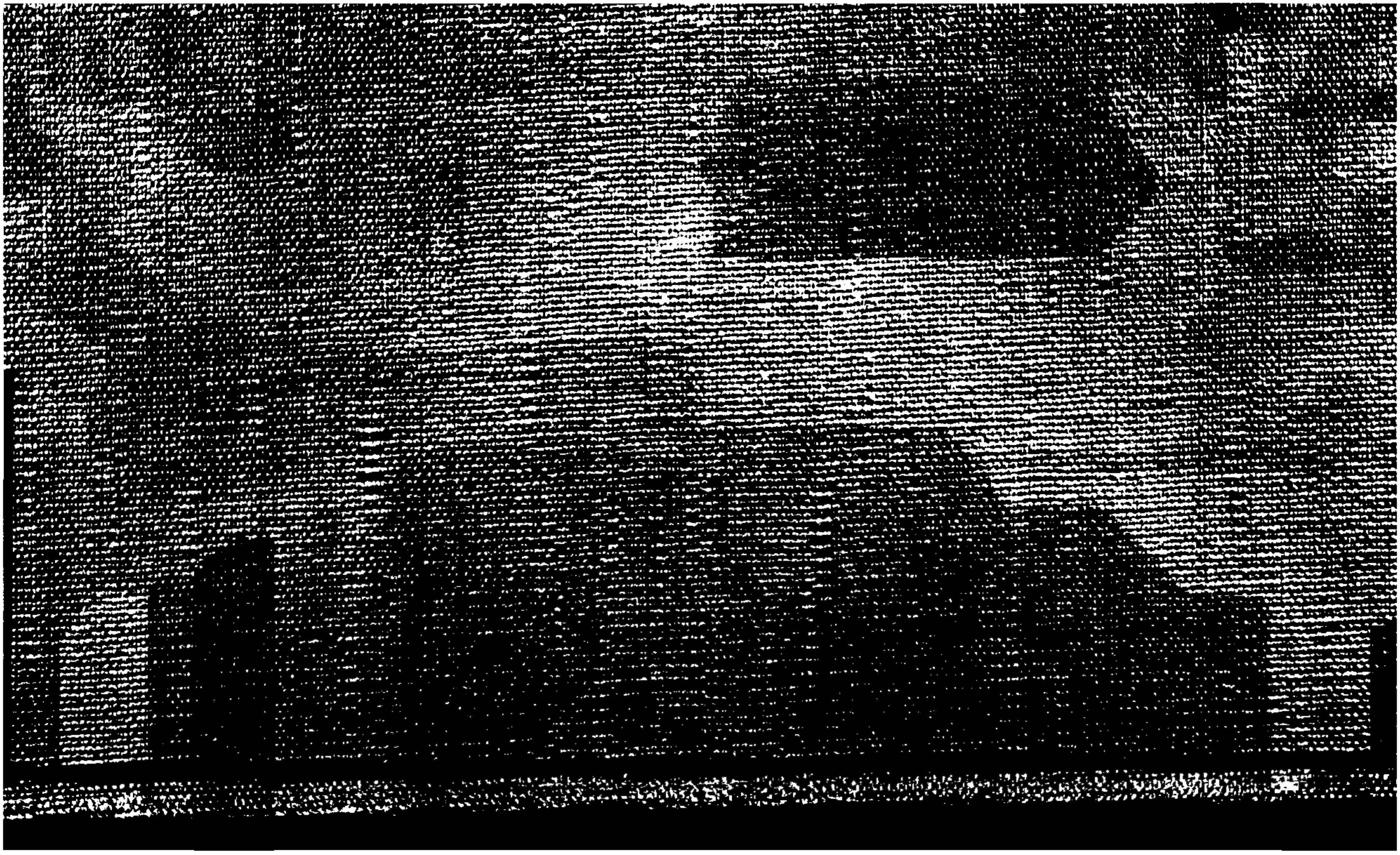

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOLUME XV, 1914

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JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

VOLUME XV

WITH 14 PLATES

1914

PUBLISHED FOR THE GARDEN

AT 41 NORTH QUEEN STREET, LANCASTER, PA.

THE NEW ERA PRINTING COMPANY

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VEGETABLE FOODS; THEIR DISTINCTIVE CHARACTERISTICS AND CLASSIFICATION*

Our vegetarian friends are quite insistent upon the immorality of destroying the lives of the lower animals for the purpose of securing our food supplies. They sometimes go so far as to declare that this constitutes murder. If they are reminded that these animals are brought into existence on an enormously increased scale for the very purpose of furnishing this food supply and that the sum total of animal happiness is thereby greatly increased, they reply that, in any case, we should be better off if we used only vegetable food.

It is not the purpose of this series of lectures to discuss questions of this kind, but it is not out of place to say here that considerations of economy will more and more compel a resort to vegetable foods. Meat products grow and will continue to grow more high-priced as population increases, and great numbers of people who can now make a free choice between animal and vegetable food, will eventually be forced to depend largely upon the latter. To a certain extent, this condition will certainly force nature, because it cannot be denied that, while we can successfully subsist upon a mixed diet, our digestive organs are better adapted to deal with animal than with vegetable foods. The anticipated change will involve the necessity for an extensive adaptation to meet it, and the human race cannot too soon

* Abstract of a lecture delivered at the New York Botanical Garden on October 4, 1913.

[JOURNAL for December, 1913 (14: 195–230) was issued January 22, 1914]

begin its study of the best method of fitting its vegetable food supply to its digestive provisions.

We must remember that only a portion of almost any food can become fitted for assimilation by our body, the remainder being rejected as waste. The portions which are thus used are called nutrients, and one of the functions of digestion is to separate them from the foods that we eat. These nutrients are of different classes. Those which are inorganic include such substances as water, iron and the lime salts. The organic nutrients are divided into those which contain nitrogen, called albuminoids, and those which do not, the latter known as carbonaceous. Some of the latter, as sugar, starch and inulin, contain two atoms of hydrogen for each atom of oxygen, as in water (H_2O) and are therefore called carbohydrates, while those not based on this formula, as the fats, are called hydrocarbons. The carbohydrates become at least partly converted into fat by the body, but this is done at the expense of considerable labor by the system, while the fat eaten calls for very little such labor. A given weight of fat in the food is therefore rated as about four and a half times as valuable, as a nutrient, as the same weight of carbohydrate. A pound of albuminoid is regarded as equally valuable with a pound of fat. We are thus enabled to readily calculate the relative nutritive values of different foods. Suppose, for example, that we have three foods with the composition given below:

	Carbohydrate	Hydrocarbon	Albuminoid
A	40	4	6
B	20	2	3
C	49	7	1

Reducing each set to carbohydrates, we get the following results:

	A	*B*	*C*
Carbohydrates	40	20	49
Hydrocarbons	$4 \times 4\frac{1}{2}$ 18	$2 \times 4\frac{1}{2}$ 9	$7 \times 4\frac{1}{2}$ 31.5
Albuminoids	$6 \times 4\frac{1}{2}$ 27	$3 \times 4\frac{1}{2}$ 13.5	$1 \times 4\frac{1}{2}$ 4.5
	85	42.5	85

The number of nutritive units in *A* and *C* is the same, so that the money value per hundredweight of these two would agree, while that of *B* would be only half as great.

The kind of effect upon the system of eating *A* and *C* would, however, be vastly different. Good health demands a definite relation between the amounts of the albuminoid and carbonaceous nutrients, the ratio differing of course with the individual, with his condition at a particular time, his environment, occupation, etc. Such ratios for the three foods above would be as follows:

$$A = 6 \text{ to } (40 + 18)\ 58, \text{ or } 1 \text{ to } 9.66;$$

$$B = 3 \text{ to } (20 + 9)\ 29, \text{ or } 1 \text{ to } 9.66;$$

$$C = 1 \text{ to } (49 + 31.5)\ 80.5, \text{ or } 1 \text{ to } 80.5.$$

This ratio is called the nutritive ratio and is consulted in order to ascertain whether a food supply is composed of the proper kinds of nutrients. *A* and *B*, although one contains twice as much nutrient as the other and is therefore twice as valuable, have the same nutritive ratio, while *C*, of equal value with *A*, has a nutritive ratio about as different as could well be imagined.

Those who have charge of providing food supplies for large numbers of animals, whether human or inferior, must, in making their selection, consider the feeding value for purposes of economy, and the nutritive ratio for purposes of sanitation. When the individual has a varied supply of food accessible, nature is quite likely, through the appetite, if this be not perverted, to create a desire for such foods as will give his diet the proper nutritive ratio.

It so happens that there are, in both animal and vegetable foods, very similar series of albuminoids and of fats, so that, so far as securing the proper nutrients is concerned, we are equally favored by both classes. As to the conditions of these nutrients, affecting their digestibility, there is a great difference between the two series. In meat, both the albuminoid and the fat are contained in little sacs or pockets, the walls of which are themselves albuminoid in nature. The stomach is peculiarly adapted for digesting these albuminoid walls, so that the contents are readily freed for prompt digestion, in either the stomach or the intestine, according to the natural conditions. The nutrients of vegetable foods, on the other hand, are contained in cells or sacs whose walls are of cellulose, which is a carbohydrate, and is with

difficulty, if at all, digested in the stomach. These walls may thus be left intact until the intestine is reached, being there digested off and the contents exposed to the digestive processes in that organ. Some of these contents may, however, be much better adapted to stomach digestion than to intestinal digestion, yet they cannot now avail themselves of such preference.

It must be remembered further that it is only the best quality of vegetable foods whose cell-walls consist of pure or nearly pure cellulose. The great majority of plant tissues have their cell walls modified in various ways, the usual result being that their digestion becomes much more difficult. Thus, the cells of wood tissue, originally of pure cellulose, become lignified by the addition to their walls of a thick coating of almost indigestible lignin. The cells of cork are invested with suberin, almost impervious to the digestive juices. The term "cork," as here used, includes all substances of the same nature as that composing the tissue of ordinary corks, such substances, or very similar ones, being exceedingly abundant in vegetable foods.

These facts are of the utmost importance for our consideration in this lecture. They prove conclusively that the human digestive organs cannot deal so effectively or generally with vegetable as with animal foods, and they prove with equal certainty that the problems of selecting vegetable foods and of preparing them for our digestive organs, are much more serious and difficult than are those relating to animal foods. It is these considerations which must occupy us in our attention to the lectures which will follow in this course. They will receive special attention in our eighth lecture, by Miss Shapleigh, on the selection and preparation of vegetable foods.

In this connection, it must be remembered that great numbers of highly nutritive vegetable products are unavailable as foods because of the presence in them, along with their nutrients, of poisonous constituents of one sort or another. Some of these poisons which originally existed in the wild products in such amounts as to wholly prevent their use as foods, have been so eliminated by cultivation and plant breeding that those substances have now become staple and valuable foods. The lima

bean and the sweet cassava might be cited as illustrations of such developed foods. In other cases, as those of the bitter yam and young pokeberry shoots, we are able to remove the poisons from vegetable foods by the process of preparation, so as to convert a deadly poison into a table delicacy.

We may note in conclusion that it frequently happens that foods in the same family exhibit a general agreement in their nutritive properties. Thus, the cabbage, cauliflower, kohl rabi, brussels sprouts, turnip, radish, horse-radish, cress and mustard belong in the Cruciferae; the bean, pea, lentil and garbanza, in the Leguminosae; all of our cereal grains in the Gramineae; the spinach, beet, swiss chard and lambs-quarters in the Chenopodiaceae, and the parsnip, carrot, celery, parsley and arracacia in the Umbelliferae.

H. H. RUSBY

THE DIGESTION OF VEGETABLE FOODS*

I. Typical "vegetable foods" vary in digestibility, in a given normal individual, with their texture and composition. In general they are readily digestible and wholesome. Mastication disintegrates the comparatively *impervious* masses, such as corn grains; and cooking, by swelling and breaking the contained starch granules, renders *more pervious* such forms as potato. Masticated corn, boiled potato and similar vegetable masses, when eaten, *expose comparatively large extents of surface to the digestive juices*, thereby facilitating solution and the *chemical changes* which characterize digestion.

The cells, fibers, grains, globules, crystals, gelatinous masses and juices of the true "vegetable *foods*" are composed collectively of the following comparatively small number of *types* of constituents:

1. *Carbohydrates* (starches, sugars, celluloses, etc.).
2. *Lipins* (fats, lecithins, etc.).
3. *Proteins* (albuminous substances).

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* Abstract of a lecture delivered at the New York Botanical Garden on October 11, 1913.

4. *Extractives* (many substances of divers nature that *occur in minute proportions*, such as pigments, and which as a *heteroeneous* group, are conveniently designated in this way).

5. *Organic acids and their salts* (malic acid, citric acid, potassium tartrate, etc.).

6. *Mineral salts, i. e.*, salines (chlorids, phosphates, etc.).

7. *Enzymes* (substances that induce important chemical changes during the life and after the death of the vegetable forms containing them).

8. *Gases* (oxygen, carbon dioxid, etc.).

9. *Water*—usually the most *abundant* constituent.

Of these types of substances, the *extractives* (4), *organic acids and their salts* (5), *mineral salts, i. e., salins* (6), and *water* (9), are easily absorbed (without essential molecular changes) from the alimentary tract—their molecular simplicity, diffusibility and comparative non-toxicity give them ready access, directly through the absorbing channels, to the blood. The *enzymes* (7) and *gases* (8) are present in very minute quantities in vegetable foods and add nothing of consequence to the *nutritive* value of such foods.

The digestible substances in vegetable foods, the *carbohydrates* (1), *lipins* (2), and *proteins* (3), are characterized, for the most part, by molecular complexity, colloidal perversity and comparative non-diffusibility. There are exceptional substances in these three groups, such as cane-sugar, which, though comparatively simple molecularly, non-colloidal in character and readily diffusible, are nevertheless *chemically* unsuited for direct assimilation—they don't seem to *fit* in the body anywhere! As in the case of the rest of the members of these groups, however, digestion changes these substances into products that are directly absorbable and readily assimilable. The representatives, in vegetable foods, of these three groups of nutrients are like large rock-masses direct from the quarry—unsuitable in form and size for constructive purposes, but suitable for such use *if properly cut and shaped.* The carbohydrates, lipins and proteins in vegetable foods are "cut and shaped" by the digestive processes into *construction units* of small molecular size, which are non-colloidal in character,

which are readily passed (absorbed) through the walls of the alimentary tract into the blood, or lymph, or both, and which *fit* in the cell structures. From the circulation these simple "construction units" are taken up and utilized by the cells in all parts of the body in the constructive operations that characterize the *extensions* of development, the *substitutions* of maintenance, the *depositions* of accumulation, and the *repairs* of self-preservation.

II. Alimentary digestion is a process of *progressive* conversion of complex compounds into comparatively simple substances. The digestive juices are the mechanical media, and the enzymes in the juices are the chemical agents, in these transformations. The digestive enzymes, which are collectively called "*hydrolases*," induce rapid reaction between the carbohydrates, lipins and proteins on one side and water on the other: *hydrolysis ensues*. The enzymes themselves are not consumed in the process; they are *agents that order things about into new relationships*. Through the influence of hydrolases, by their direction let us say, water molecules are driven into, so to speak, and break with, the molecules of the digestible substances, hydroxyl from the water passing into one part of a cloven complex molecule, hydrogen entering the other. This process continues until the large molecular blocks are chopped into very small fragments. Thus, the molecule of cane sugar ($C_{12}H_{22}O_{11}$), which may be represented by the formula $C_6H_{11}O_6—C_6H_{11}O_5$, is converted into glucose and fructose, by the enzyme *sucrase* in intestinal juice, in harmony with the cleavage indicated by the following general equation:

$$C_6H_{11}O_6—C_6H_{11}O_5 + HOH = C_6H_{12}O_6 + C_6H_{12}O_6$$

Cane sugar	Water	Glucuse ($C_6H_{11}O_6+H$)	Fructose ($C_6H_{11}O_6+OH$)

The hydrogen and hydroxyl of the water are divided, in this reaction, between the two isomeric hydrolytic products, glucose and fructose.

In similar reactions, starches, cane sugar, fats and albuminous substances (the leading representatives of the types of substances

in vegetable foods that are digested, and *require* digestion, prior to their assimilation), are converted into the products indicated in the appended summary:

$$\text{Starch} \xrightarrow{+H_2O} \text{dextrins} \xrightarrow{+H_2O} \text{maltose} \xrightarrow{+H_2O} \textit{glucose}\ \text{(monosaccharid)}$$

$$\text{Cane sugar} \xrightarrow{+H_2O} \textit{glucose}\ \text{and}\ \textit{fructose}\ \text{(monosaccharids)}$$

$$\text{Fats} \xrightarrow{+H_2O} \begin{cases} \textit{glycerol} \\ \textit{fatty acids (soaps)}' \end{cases}$$

$$\text{Proteins} \xrightarrow{+H_2O} \text{proteoses} \xrightarrow{+H_2O} \text{peptones} \xrightarrow{+H_2O} \textit{amino acids}$$

Monosaccharids (*e. g.*, glucose, fructose), *glycerol* and *fatty acids* (*soaps*), and *amino acids* are the "end products of digestion." These representatives of (derivatives from) the digestible food substances are absorbable and assimilable, whereas most of the compounds from which they are produced by digestion are neither and, without digestion, are non-nutritious.

Alimentary digestion results, in brief, in the conversion of a very large number of dissimilar complex "foreign" compounds *into a few simple "native" substances.* The digestive products in animals are comparable to the common mineral nutrients for plants—they are the *construction units* with which all the building and rebuilding in animals are accomplished.

III. The "end products of digestion," which the animal cells cannot produce from inorganic matter, are synthesized in great abundance, in plants, from carbon dioxid, water, and mineral substances such as nitrates, and then are condensed into carbohydrates, lipins, proteins and many other substances. Thus, the production of glucose in plants may be indicated by the following abbreviated equation:

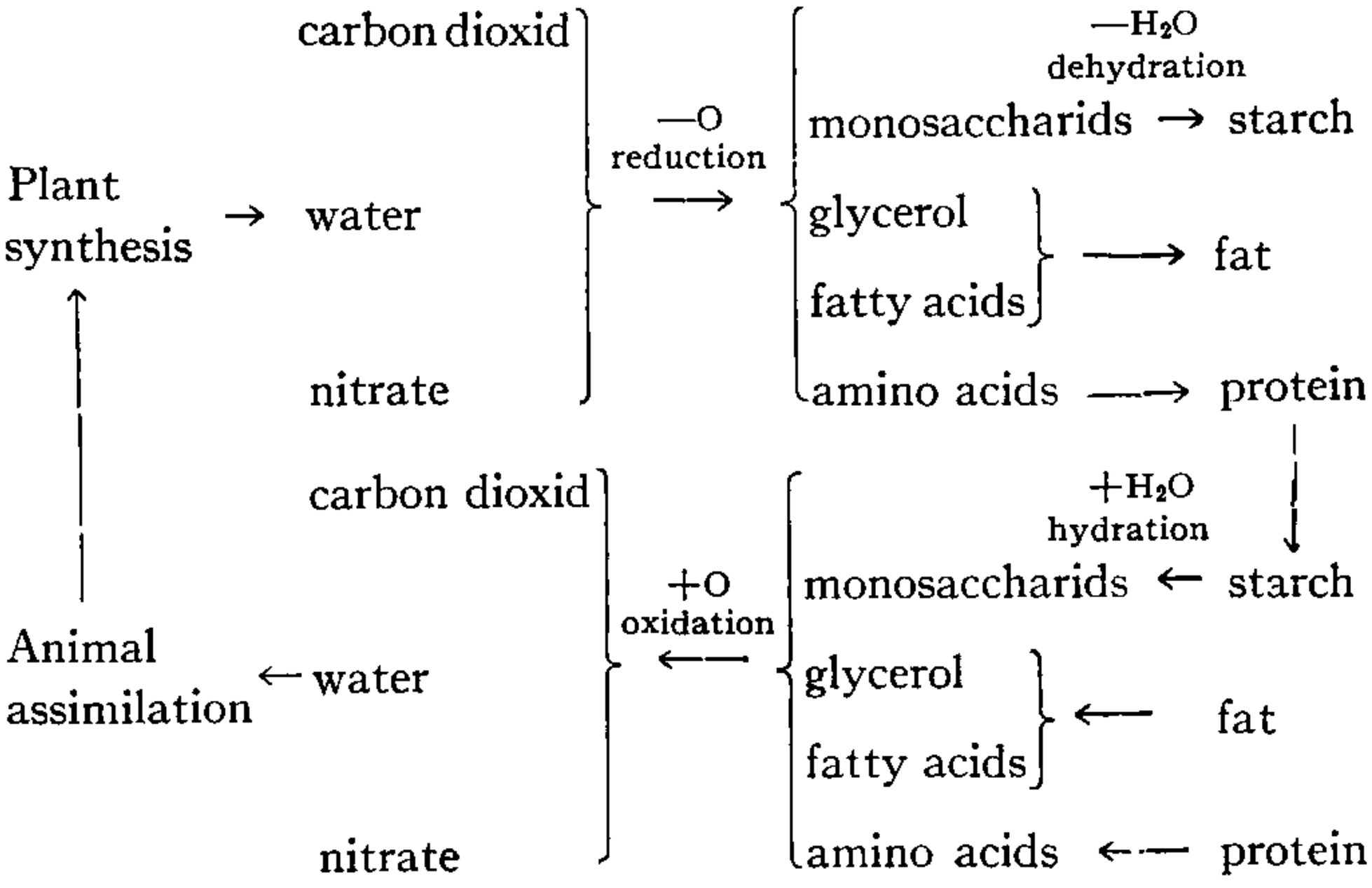
$$\underset{\text{Carbon dioxid}}{6CO_2} + \underset{\text{Water}}{6H_2O} = \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_2}$$

The condensation of glucose into starch, in plants, is suggested by the appended equation:

$$nC_6H_{12}O_6 - nH_2O = (C_6H_{10}O_5)_n.$$

Carbohydrates, lipins, and proteins are synthesized, in plants, from such simple mineral substances as carbon dioxid, water and nitrates, by processes of *reduction* and *de-hydration*. Carbohydrates, lipins, and proteins, when eaten by animals, are *hydrated* into the "end products of digestion," then absorbed into the circulation and, in their subsequent assimilation, are *oxidized* into carbon dioxid, water, amino products (*e. g.*, urea), etc., and excreted in these useless forms ("waste products"). (The excreted amino products are ultimately oxidized on and in the soil into nitrates.)

The general nature of the fundamental biological cycle of transformation which is suggested by the above remarks, is indicated more fully and graphically, though not completely, by the following arrangement:



WILLIAM J. GIES

DR. HOLLICK'S NEW POSITION

November 17, 1913.

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,
NEW YORK BOTANICAL GARDEN.

Dear Sir: I beg to advise you that at a meeting of the board

of trustees of the Staten Island Association of Arts and Sciences, held on Friday, November 14, 1913, I was tendered the position of curator-in-chief of the museum of the Association, and that I have accepted the same.

I therefore tender herewith my resignation as a member of the curatorial staff of the Garden, to take effect at your convenience, but not later than January 1, 1914, on which date it is my intention to enter upon the duties of my new position.

In thus severing my connection with the Garden, after having enjoyed the privilege of over thirteen years of service, which was especially concerned with the installation and development of the fossil plant collections, I wish to express my sincere appreciation of the encouragement with which my efforts have been received, and to add the assurance that I shall always be pleased, at any time in the future, to be called upon for any assistance which I may properly render the Garden in connection with my special line of work.

Very respectfully,

ARTHUR HOLLICK

November 20, 1913.

DR. ARTHUR HOLLICK,

NEW YORK BOTANICAL GARDEN.

Dear Sir: I am in receipt of your letter of November 17, conveying your resignation as a curator of the museums of this institution, to take effect not later than January 1, 1914, in order to accept the position of curator-in-chief of the Staten Island Association of Arts and Sciences to which you have been elected. On behalf of the board of managers of the New York Botanical Garden, I accept such resignation, to take effect at the termination of your present appointment, on December 31, 1913.

Yours very truly,

N. L. BRITTON,

Director-in-Chief.

January 2, 1914.

DR. ARTHUR HOLLICK, CURATOR-IN-CHIEF,

STATEN ISLAND ASSOCIATION OF ARTS AND SCIENCES.

Dear Sir: I have the honor to transmit the following resolutions adopted by the Scientific Directors of the New York Botanical Garden at a meeting held December 13, 1913.

"*Resolved:* That the scientific directors of the New York Botanical Garden regret the withdrawal of Dr. Arthur Hollick from the curatorial staff. His services as a curator have extended over 13 years, during which period he has discharged the duties of his position with enthusiasm and ability; his investigations and published contributions to science have been noteworthy, and highly creditable to himself and to the Garden.

"*Resolved:* That the scientific directors wish Dr. Hollick all success in his new position of usefulness, in the development of the museum of the Staten Island Association of Arts and Sciences and in the expansion of the scientific and educational work of that institution.

"*Resolved:* That subject to the approval of the trustees of the Staten Island Association of Arts and Sciences, the board of managers of the New York Botanical Garden be requested to designate Dr. Hollick honorary curator of the collection of fossil plants.

"*Resolved:* That the Director-in-Chief be and he is hereby authorized to loan the Staten Island Association of Arts and Sciences, from time to time, such specimens of fossil plants of the Garden collection as Dr. Hollick may wish to study in continuation of his investigations."

At a meeting of the Board of Managers of the New York Botanical Garden held December 18, 1913, the foregoing request by the scientific directors was granted.

Yours very truly,

N. L. BRITTON,

Secretary

The following resolutions were adopted by the Executive Committee of the Board of Trustees of the Staten Island Associa-

tion of Arts and Sciences at a meeting held on Thursday, January 8, 1914:

Resolved: That the Executive Committee of the Board of Trustees of the Staten Island Association of Arts and Sciences has learned with gratification of the designation of Dr. Arthur Hollick as Honorary Curator of the Collection of Fossil Plants in the museum of the New York Botanical Garden.

Resolved: That this Committee, on behalf of the Board of Trustees, hereby records its approval of said designation.

CONFERENCE NOTES

The December conference of the scientific staff and students of the New York Botanical Garden was held in the laboratory of the museum building on the afternoon of December 3. Summaries of the subjects presented are here given as follows:

Philippine Mosses, by Mr. R. S. WILLIAMS.

The Philippine islands extend from about 5½° to 18½° north latitude, a distance of about 900 miles, and contain mountain ranges and peaks rising to an elevation of 8,000 to 10,000 feet, so that considerable variation in temperature occurs, frosts being not unknown in some of the northern mountains.

Previous to the American occupation not much attention had been given to the moss flora. Among the first to collect these plants to any extent, I believe, was an Englishman, Hugh Cummings, who lived on the islands from 1836–40 and quite a number of his plants are in the Garden herbarium. At about this same time, the Wilkes Expedition, on its trip around the world, 1838–42, touched at both the northern and southern islands but only three species of mosses are mentioned among their collections. One of these, however, called *Neckera phyllogonioides*, seems, rather oddly, never to have been obtained since by any of the numerous collectors.

Considerably later on, 1870–71, G. Wallis spent some time on

the islands and seventeen new species are credited to him by C. Müller in *Linnaea*, 1874. The next and most extensive collection made during Spanish rule apparently was that obtained by A. Loher, chiefly in northern Luzon, who began his collecting in 1890. Mr. Loher was, and very likely is still, a druggist in Manila who made a number of trips to northern Luzon especially for ferns and mosses. His ferns, some 270 species, were named by Christ, but the mosses remained long unstudied. Dr. Brotherus finally determined some fifty species.

Since the American occupation a great many collections from various parts of the islands have been sent in to the Bureau of Science in Manila and have been determined by Dr. Brotherus. These collections embrace some 375 species, of which about 160 are said to be endemic or nearly 43 per cent.

My own collecting in the islands extended from November, 1903, to August, 1905. The principal regions visited were as follows. The Lamao river and Mt. Marivales, 3,800 feet altitude, just across the bay from Manila. Baguio and vicinity, 5,200 feet altitude, about 150 miles north of Manila, and Mt. Santo Tomas, 8,000 feet altitude, some 10 miles from Baguio. It was in Baguio, by the way, that a fire, while I was temporarily absent, burned up the hotel in which I was living and destroyed my entire collecting outfit, all the mosses of some two months' work, as well as about one half the other collections. This necessitated a trip to Manila for a new outfit, obtaining which I returned and remained in the same region to the end of the year. A short stay in Los Baños on Laguna de Bay early in 1905 ended my collecting on the island of Luzon. I next went to southern Mindanao collecting for some time in the mountains a few miles back from San Ramon, a former penal colony of the Spanish and about fifteen miles around the coast from Zamboanga. From this point, I traveled eastward some 250 miles to Davao, a town near the head of the Gulf of Davao, collecting along the coast for a distance of some fifty miles southward but chiefly at Santa Cruz and on the slopes of Mt. Apo, about Todaya, some 6,000 feet elevation, the mountain itself attaining a height of 10,000 feet. On the way back to Manila a short stop at Jolo

enabled me to add a few more species to the collection and were the last I obtained in the Philippines.

The entire collections of the trip include about 240 species of mosses. Of these apparently some 7 per cent. are undescribed. Four of the species occur in the United States. Others occur that have before only been reported from the Fiji islands and from Asia and many of the species are common to Java, Borneo and New Zealand as might be expected.

Notes on Truffles Recently Collected in the Eastern United States, presented by DR. SEAVER and DR. MURRILL.

The truffles are the most valuable of the edible fungi and are, at the same time, the most difficult to collect, since they occur buried from two to eight inches in the ground. In Europe, where these fungi are collected and sold as a commercial article, they are collected with the aid of trained animals, such as pigs and dogs. These animals are able to scent the fungi and are taught to hunt and dig them. Europeans coming to America who are familiar with the habits of these fungi in Europe and the means employed there to collect and put them on the market, are naturally interested in finding them in this country in sufficient quantity to bring financial returns. Several attempts have been made to interest the Garden in the matter, and it has been difficult to impress these various individuals with the fact that we are interested in the matter only from a scientific point of view and not as a commercial enterprise.

In October of this year, a box of truffles was sent to the Garden for our examination with a note requesting information regarding their food value. Later, the sender of this material made a visit here and stated that the truffles had been collected in the vicinity of New York through the aid of a trained dog imported from Italy. The specimens were filed away in the herbarium for later study. In November of the same year, a second package of these fungi was received which was said to have been collected in New Jersey. A microscopic examination of these plants showed them to be two different species. Later, a third collection of the plants was

sent for examination, which collection was found to contain some examples of both of the species previously sent. These plants were of especial interest to us since they represent the only two specimens of the genus *Tuber* in our collection from America.

Three species of *Tuber* have been previously reported from the eastern United States, none of which accord well, so far as we can judge from the published accounts, with the two recently collected. The identity of the two recent collections has not been determined with certainty, but the specimens are kept for further study. The indications are that this genus may be well represented in the eastern United States.

Correspondence with Messrs. Robba and Giavelli was read, and the specimens they have recently collected in New York and New Jersey exhibited.

A very brief account was given of the literature and the classification of truffles, with brief descriptions of the principal edible species of Italy and France. In the market at Trent, the following species are usually found: *Tuber aestivum*, *Tuber brumale*, *Tuber mesentericum*, *Tuber melanosporum*, and *Tuber uncinatum*. In France, from six to seven million dollars' worth of truffles are marketed annually at one to two dollars per pound. Fresh truffles shipped to New York sometimes sell as high as eight dollars per pound.

In his work on underground fungi occurring in California, Harkness reports thirteen species of *Tuber*, but all of them are so rare as to be of little economic value. Harkness did not find any of the species of truffles usually eaten in Italy, but *Tuber californica* approaches very nearly to one of these Italian species. In addition to *Tuber*, a number of other genera of underground fungi contain edible species.

NOTES, NEWS AND COMMENT

Dr. W. A. Murrill, Assistant Director, represented the Garden at the inauguration of John Huston Finley as President of the University and Commissioner of Education of the State of New York at Albany on January 2.

North American Flora, Volume 22, Part 5, was issued December 23. It comprises 92 pages (389–480), and is devoted entirely to the continuation of the treatment of Rosaceae, by Dr. Rydberg. This part does not complete the volume, as announced in the September number of the JOURNAL.

The annual meeting of the New York State Forestry Association was held at Albany, January 22, with morning and afternoon sessions, and a banquet in the evening at which Hon. James S. Whipple, the newly elected president, was toastmaster. Dr. W. A. Murrill represented the Garden and gave an illustrated address on "Trees and Children."

Dr. Marshall A. Howe was the delegate from the Garden staff to the annual meetings of the American Association for the Advancement of Science and of the Botanical Society of America, held in Atlanta, Georgia, during the Christmas holidays. In the absence of President Douglas H. Campbell of California, he acted as chairman at the meetings of the Botanical Society. After the meetings Dr. Howe devoted two weeks to field work in Georgia and Florida.

Dr. Charles Budd Robinson, of the Bureau of Science, Manila, who had been engaged for several months in the botanical exploration of Amboina, was murdered on December 5 at a spot about eight miles from Ambon, the principal town of the island, by a party of six Mohammedan natives of the island of Boeton. Five of the six were promptly captured and confessed their deed, but of course no punishment that may be meted out to them can atone for the loss they have inflicted upon American science. Dr. Robinson was a native of Nova Scotia, and a teacher for ten years in the schools of that province before devoting himself exclusively to botany as a profession. He was a graduate of Dalhousie University at Halifax, studied for two years at Cambridge University, England, and took the degree of Doctor of Philosophy from Columbia University in 1906. He was connected with the New York Botanical Garden, as student, assistant, and curator, for more than four years before his appointment

as economic botanist of the Bureau of Science in Manila. He occupied this position for four years, and after a brief visit to this country, during which he spent several months in work at the Garden, he returned to Manila in the fall of 1912. He had hosts of friends in Nova Scotia, and among the botanists of the United States. A more extended biographical sketch, now in preparation, will probably be published in the Bulletin of the Torrey Botanical Club, of which he was at one time an associate editor.

Meteorology for December.—The total precipitation for the month was 2.68 inches with traces of snow on the 10th and the 26th. Maximum temperatures recorded for each week were *62° on the 3d*, 57½° on the 15th, 55½° on the 22d, and 45° on the 30th. Minimum temperatures were 28° on the 8th, 18½° on the 12th, 28° on the 19th, and *16° on the 29th.*

Meteorology for the Year 1913.—The total precipitation at the New York Botanical Garden for the year was 41.53 inches distributed as follows: January 2.49; February 2.91; March 4.97; April 5.18; May 2.14; June 0.63; July 4.06; August 3.00; September 2.91; October 8.89; November 1.67; December 2.68.

The maximum temperature recorded was 98° on July 2. The minimum was 9° on February 13.

It is to be noted that more than one fifth of the total precipitation for the year occurred during October. A special account of the weather conditions during October was published in the November JOURNAL. Drought conditions prevailed during June. On August 10, the Garden was swept by the most destructive storm in its history, the results of which are recorded in the September JOURNAL.

ACCESSIONS

PLANTS AND SEEDS

30,750 bulbs for decorative beds.

21 plants of *Opuntia.* (By exchange with U. S. Nat. Museum, through Dr. J. N. Rose.)

60 plants for conservatories, mainly cacti. (By exchange with U. S. Nat. Museum, through Dr. J. N. Rose.)

1 plant *Opuntia Bentoni?*. (By exchange with U. S. Nat. Museum, through Dr. J. N. Rose.)

77 plants for conservatories from Laredo, Texas. (Collected by Dr. J. N. Rose.)

6 plants for conservatories from San Antonio, Texas. (Collected by Dr. J. N. Rose.)

35 plants for conservatories from Devil's River, Texas. (Collected by Dr. J. N. Rose.)

41 plants for conservatories from Sierra Blanca, Texas. (Collected by Dr. J. N. Rose.)

81 plants for conservatories from near El Paso, Texas. (Collected by Dr. J. N. Rose.)

1 plant for conservatories, from Maricao, P. E. (Collected by Bro. Hioram).

3 Cuban plants for conservatories. (By exchange with Bro. Leon.)

2 plants of *Epidendrum* from Jamaica. (Given by Miss Helen Ingersoll.)

2 plants of *Coleus*. (Given by Mr. J. A. MacDonald.)

1 plant for conservatories, from New Providence. (Given by Mr. Giorge.)

4 cacti for conservatories. (By exchange with Mr. F. Lighte.)

20 plants for conservatories. (By exchange with U. S. Dept. Agric., Bureau of Plant Industry.)

2 plants for conservatories. (Given by Mr. R. M. Harper.)

2 plants for hardy collections. (Given by Miss M. W. Bartley.)

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

1 plant *Veltheimia capensis*. (By exchange with Mr. W. L. Schultz.)

6 plants for conservatories. (By exchange with Mr. Geo. W. Perkins.)

1 plant of *Archontophoenix Cunninghamii*. (Given by Mr. John Bister.)

24 plants for conservatories. (By exchange with Missouri Botanic Garden.)

3 plants *Thymus Serpyllum*. (Given by Dr. W. Gilman Thompson.)

7 plants of hybrid *Hibiscus Hawaii*. (By exchange with Mr. W. J. MacNeil.)

267 lilac plants, derived from cuttings. (By exchange with Board of Park Commissioners, Rochester, N. Y.)

10 *Philadelphus* plants, derived from cuttings. (By exchange with Board of Park Commissioners, Rochester, N. Y.)

1 plant *Azalea nudiflora alba*, from Spring Valley, N. Y. (Given by Miss E. M. Kittredge.)

45 orchids from Mexico. (By exchange with Dr. J. C. Harvey.)

2 plants of sugar-loaf pineapple from Isle of Pines. (Given by Dr. W. A. Murrill.)

1 plant of *Citrus Limonum*. (Given by Mr. E. S. Reimier.)

46 plants derived from seeds from various sources.

394 plants derived from seed. (By exchange with Board of Park Commissioners, Rochester, N. Y.)

20 conifers for conservatory court. (Purchased.)

917 herbaceous plants for new beds at conservatories. (Purchased.)

1 plant *Juglans quercifolia*. (Purchased.)

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

3 plants of *Opuntia*. (By exchange with the U. S. Nat. Museum through Dr. J. N. Rose.)

15 plants for conservatories from Brownsville, Texas. (Collected by Dr. J. N. Rose.)

1 plant from Texas, for conservatories. (Collected by Dr. J. N. Rose.)

1 plant of *Peristeria elata*. (Given by Mr. Frank A. White.)

30 plants for conservatories. (By exchange with Buffalo Botanic Garden.)

8 palms. (Given by Mr. W. C. Conyer.)

16 seedlings of *Cocops rivalis*. (By exchange with Porto Rico Exp. Sta.)

35 herbaceous plants from vicinity. (Collected by Mr. K. R. Boynton.)

54 woody plants for hardy collections. (Purchased.)

1 packet seed. (Given by Mr. E. L. Adams.)

1 packet seed *Diospyros Lotus*. (By exchange with U. S. Dept. Agric., Bureau of Plant Industry.)

3 packets seed. (Given by Dr. H. H. Rusby.)

6 packets Jamaican seed. (By exchange with Dept. Agriculture, Jamaica.)

5 packets spores Hawaiian ferns. (By exchange with Mr. Wilbur J. MacNeil.)

1 packet seed. (Given by Dr. H. H. Rusby.)

2 packets *Copernicia* seed, from Curacao. (Collected by Dr. N. L. Britton.)

1 packet seed *Sequoia*. (Given by Mr. Alfred T. White.)

1 packet seed from Bermuda. (Collected by Dr. N. L. Britton.)

7 packets Oregon seed. (Given by Rev. George Schoener.)

3 seeds of *Macrozamia Moorei*. (Given by Mr. Clements.)

2 packets seed from Florida. (Given by Mr. H. D. Ewing.)

1 packet seed of *Prunus Besseyi*. (Given by Dr. C. E. Bessey.)

MUSEUMS AND HERBARIUM

469 specimens of flowering plants, mostly from New Mexico. (By exchange with the United States National Museum.)

96 specimens of flowering plants from Vancouver Island, British Columbia. (By exchange with the Geological Survey of Canada.)

18 specimens of flowering plants from Nevada and California. (By exchange with Dr. A. A. Heller.)

42 specimens of flowering plants for the Local Herbarium. (By exchange with Mr. Witmer Stone.)

134 specimens of flowering plants from Cuba. (By exchange with Brother Leon.)

25 specimens of flowering plants from Porto Rico. (By exchange with Brother Hioram.)

245 specimens of flowering plants from Porto Rico. (By exchange with the College of Agriculture, Porto Rico.)

12 specimens of flowering plants from Jamaica. (By exchange with Mr. William Harris.)

59 specimens of flowering plants from Porto Rico. (By exchange with the Experiment Station, Porto Rico.)

416 specimens of flowering plants and ferns from Nevada and California. (Collected by Dr. A. A. Heller.)

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

43 specimens of crude drugs. (Given by Dr. H. H. Rusby.)

2 specimens of *Boletus sphaerosporus* from Minnesota. (By exchange with Dr. Mary S Whetstone.)

2 specimens of fungi from New York. (By exchange with Mr. William E. Abbs.)

5 specimens of fungi from New York. (By exchange with Mr. Fred S. Boughton.)

2 specimens of fleshy fungi from Iowa. (By exchange with Mr. O. M. Oleson.)

3 specimens of plant rusts from New York and New Hampshire. (Given by Mr. Otto Kunkel.)

2 specimens of fungi from Colorado. (By exchange with Professor Ellsworth Bethel.)

1 specimen of fleshy fungus from New York. (By exchange with Mr. William E. Abbs.)

3 specimens of fungi from New York. (By exchange with Mr. Fred S. Boughton.)

2 specimens of fungi from New York. (By exchange with Mr. William E. Abbs.)

64 specimens of fungi "Plants of Wyoming." (Distributed by Professor Aven Nelson.)

31 specimens of fungi from North Carolina. (By exchange with Mr. Paul C. Standley.)

2 specimens of gill fungi from New York. (By exchange with Dr. F. M. Bauer.)

35 specimens of fungi "Ascomycetes" fasc. 53. (Distributed by Dr. Heinrich Rehm.)

4 specimens of fungi from Minnesota. (By exchange with Dr. S. M. Stoker.)

1 specimen of fungus from Long Island, New York. (By exchange with Mr. Leonard Barron.)

1 specimen of fungus from Texas. (By exchange with Dr. J. N. Rose.)

63 specimens of crude drugs and oils for the Perfumery exhibit. (Given by the Manufacturing Perfumers' Association.)

1 specimen of fungus from Illinois. (By exchange with Dr. C. F. Millspaugh.)

10 specimens of fungi from Japan. (By exchange with Dr. A. Yasuda.)

70 specimens of fungi from North Carolina. (By exchange with Dr. W. C. Coker.)

9 colored photographs of fungi from the Field Museum of Natural History. (By exchange with the Field Museum of Natural History.)

1 specimen of fleshy fungus from New York. (By exchange with Mr. William E. Abbs.)

9,000 specimens from the West Indies. (Collected by Dr. and Mrs. N. L. Britton, Dr. J. A. Shafer, and Miss Delia W. Marble.)

3 specimens of Ricciaceae from Massachusetts. (Given by Miss Helen E. Greenwood.)

3 specimens of *Anthoceros punctatus* from Winona, Minnesota. (Given by Professor J. M. Holzinger.)

5 specimens of Ricciaceae from Indiana and Illinois. (Given by Professor LeRoy H. Harvey.)

1 specimen of *Riccia californica* from Alberta, Canada. (Given by Mr. A. H. Brinkman.)

3 specimens of Ricciaceae from Maryland, South Carolina, and Jamacia. (Given by Professor W. C. Coker.)

1 specimen of *Riccia sorocarpa* from Pullman, Washington. (Given by Professor H. T. Darlington.)

3 specimens of *Notothylas orbicularis* from Minnesota. (Given by Professor J. M. Holzinger.)

2 specimens *Ricciocarpus natans* and *Riccia Frostii* from Indiana. (Given by Professor F. L. Pickett.)

5 photographs of type specimens of marine algae in the Agardh herbarium. (By purchase.)

2 specimens, *Riccia arvensis* and *Ricciella Sullivantii*, from New Jersey. (Given by Miss Caroline C. Haynes.)

2 specimens, *Riccia Frostii* and *Ricciella crystallina*, from Montana. (Given by Professor J. E. Kirkwood.)

5 specimens, *Riccia arvensis*, *R. sorocarpa*, *Riciella fluitans*, *R. Sullivantii*, and *Ricciocarpus natans*, from Connecticut. (Given by Miss Annie Lorenz.)

6,273 specimens from the Everglades and tropical Florida. (Collected by Dr. J. K. Small.)

2 specimens, log of *Amyris balsamifera* and bottle oil of *Amyris balsamifera*, from Venezuela. (Given by Magnus, Mabee, and Reynard.)

32 specimens of mosses from Borneo and Guam. (By exchange with the Bureau of Science, Manila.)

24 specimens from Washington. (Given by Mr. A. M. Johnson.)

31 specimens from British America. (By exchange with the Geological Survey of Canada.)

161 lichens from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

790 specimens from Nevada, Idaho, Colorado, Wyoming, and Utah. (By exchange with the University of Wyoming.)

2 specimens, fossil plants from the Cretaceous, Roslyn, New York. (Given by Mr. Howard J. Shannon.)

2 specimens, fossil plants from the Cretaceous, Glen Cove, New York. (Given by Mr. Howard J. Shannon.)

3 specimens, fossil plants from the Cretaceous, Glen Cove, New York. (Given by Mr. Howard J. Shannon.)

2 specimens, fossil plants from the Cretaceous, Glen Cove, New York. (Collected by Dr. Arthur Hollick.)

10 specimens, fossil plants from the Cretaceous, Glen Cove, New York. (Collected by Dr. Arthur Hollick.)

1 specimen fossil calcareous alga from the Cretaceous, Japan. (Given by Mr. H. Yabe.)

60 specimens, fossil plants from the Lower Carboniferous, Indiana, Kentucky, and Ohio. (Given by Dr. L. Hussakof.)

40 specimens, fossil plants from the Devonian, Canada. (Given by Dr. L. Hussakof.)

8 specimens, fossil plants from the Devonian, Ohio. (Given by Dr. L. Hussakof.)

24 specimens, plants from Great Falls, Virginia. (Collected by Dr. Arthur Hollick.)

14 specimens for the economic museum, from southern Florida. (Collected by Dr. J. K. Small.)

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for

Benefactors, Patrons, Fellows, Fellowship Members, Sustaining Members, Annual Members and Life Members.

1. Benefactors

The contribution of $25,000.00 or more to the funds of the Garden by gift or by bequest entitles the contributor to be a benefactor of the Garden.

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The contribution of $1,000.00 or more to the funds of the Garden at any one time shall entitle the contributor to be a fellow for life of the Garden.

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Fellowship members pay $100.00 or more annually and become fellows for life when their payments aggregate $1,000.00.

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Annual members pay an annual fee of $10.00.

All members are entitled to the following privileges:

1. Tickets to all lectures given under the auspices of the Board of Managers.

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A copy of all handbooks published by the Garden.

4. A copy of all annual reports and Bulletins.

5. A copy of the Monthly Journal.

7. Life Members

Annual Members may become Life Members by the payment of a fee of $250.00.

FORM OF BEQUEST

I hereby bequeath to the New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of.....

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OF

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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.] Now in its fifteenth volume.

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Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22, parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

Vol. 25, part 1, 1907; part 2, 1910; part 3, 1911. Geraniaceae—Burseraceae.

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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159. A Case of Bud-Variation in *Pelargonium*, by A. B. Stout.
160. Studies on the Rocky Mountain Flora—XXIX, by P. A. Rydberg.

NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

CONTENTS

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DR. P. A. RYDBERG, *Curator* (Flowering Plants)
DR. MARSHALL A. HOWE, *Curator* (Flowerless Plants)
DR, FRED J. SEAVER, *Curator* (Flowerless Plants)
ROBERT S. WILLIAMS, *Administrative Assistant*
PERCY WILSON, *Associate Curator*
GEORGE V. NASH, *Head Gardener*
DR. A. B. STOUT, *Director of the Laboratories*
DR. JOHN HENDLEY BARNHART, *Bibliographer*
SARAH H. HARLOW, *Librarian*
DR. H. H. RUSBY, *Honorary Curator of the Economic Collections*
ELIZABETH G. BRITTON, *Honorary Curator of Mosses*
DR. ARTHUR HOLLICK, *Honorary Curator of Fossil Plants*
DR. WILLIAM J. GIES, *Consulting Chemist*
COL. F. A. SCHILLING, *Museum Custodian*
JOHN R. BRINLEY, *Landscape Engineer*
WALTER S. GROESBECK, *Clerk and Accountant*
ARTHUR J. CORBETT, *Superintendent of Buildings and Grounds*

JOURNAL

OF

The New York Botanical Garden

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CIRCULAR OF THE ENDOWMENT FUND COMMITTEE*

THE NEW YORK BOTANICAL GARDEN: ITS ACHIEVEMENTS AND NEEDS

The New York Botanical Garden in Bronx Park has rapidly become an institution of international importance since the commencement of work on its development in 1896. Its collections of living plants, of books, and of herbarium and museum specimens are among the most important in the world. Its reservation of 250 acres in Bronx Park has been improved as a public park by the construction by means of city appropriations of some 4 miles of driveways, 8 miles of paths, the largest greenhouses in America, and the largest botanical museum building

* At the meeting of the Board of Managers of the Garden held November 14, 1912, Dr. N. L. Britton, Director-in-Chief, and Dr. W. Gilman Thompson, Chairman of the Executive Committee, were appointed a committee to obtain additional endowment for educational and scientific work. Subscriptions were solicited by means of a printed circular which is here reproduced, posted up to date, for purposes of record.

At the meeting of the Board of Managers held November 10, 1913, the committee reported over $100,000 given or subscribed, thus bringing the permanent funds to more than $500,000, and was continued. The committee desires the coöperation of all members of the Garden in further increasing the endowment to at least $1,000,000.

[JOURNAL for January, 1914 (15: 1–21) was issued February 7, 1914]

in existence; the physical work on the reservation, including drainage, grading and water supply, has been nearly completed. The institution is, thus, now in a position to take its place among the most notable of educational and research establishments, but its available funds for educational and scientific work are too limited to enable its Board of Managers to authorize such development.

The appropriations by the City are for *construction and maintenance* only. The appropriations for construction thus far aggregate $1,406,850 and have been expended for the construction of buildings, driveways, paths and bridges, and for grading, drainage and water-supply. The present annual income of the Garden from interest on permanent funds, membership dues and sales of publications is about $30,000, of which all but about $5,000 has to be expended to supplement city maintenance appropriations. An additional annual income of at least $20,000 is therefore greatly needed in order to expand its educational and scientific work along the lines which have proved so successful during the past sixteen years, despite serious financial restrictions.

The Garden is incorporated under an Act of the New York Legislature, Chapter 285, Laws of 1891, as amended by Chapter 103, Laws of 1894, for the purpose of "establishing and maintaining a botanical garden and museum and arboretum, for the collection and culture of plants, flowers, shrubs and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people." The corporation is given all such corporate powers, and may take and hold by gift, grant or devise all such real and personal property as may be necessary and proper for carrying out the purposes aforesaid, and for the endowment of the same, or any branch thereof, by adequate funds therefor.

Educational and Scientific Work

The educational and scientific work of the Garden is accomplished:

1. Through its collections of labeled living plants in the grounds and greenhouses, some 13,000 different kinds of living plants being now represented.

2. Through the labeled specimens of plants, products, photographs, drawings, paintings and models in the public museums, the number of such labeled specimens being now over 12,000.

3. Through the herbarium, which contains about 1,500,000 prepared and labeled specimens.

4. Through the library, containing over 24,000 bound volumes.

5. Through the laboratories, available for advanced students, equipped for botanical investigation in a wide range of subjects.

6. By free illustrated public lectures delivered on Saturday afternoons from spring until late autumn.

7. By lectures and demonstrations in botanical nature-study to children of the public schools, accompanied by teachers; the attendance at such lectures since 1905 has been over 110,000.

8. By docents, who guide visitors to points of special interest in the grounds and buildings.

9. By answering inquiries which come by mail relative to a great range of botanical, horticultural and agricultural subjects.

10. By supplying colleges and other institutions with plants and specimens for botanical study.

11. By the publication of both popular and technical contributions of botanical and horticultural knowledge. These publications include *Journal*, 13 volumes; *Bulletin*, 7 volumes; *Memoirs*, 4 volumes; *Contributions*, 5 volumes; *North American Flora*, 17 parts; *Mycologia*, 4 volumes.

12. By exploration expeditions to regions little known botanically. Thus far over 100 such expeditions have been equipped, and valuable and unique collections have been brought back for the greenhouses, museums and herbarium from Cuba, Haiti, Porto Rico, Jamaica, St. Kitts, Dominica, Montserrat, the Bahamas, Bermuda, Mexico, Panama, Costa Rica, Lower

California, South Florida, California, the Rocky Mountains and elsewhere.

The permanent interest-yielding funds now held by the corporation are as follows:

Endowment Fund (including previous subscriptions and life membership fees)	$304,510.00
Bequest of Charles P. Daly (David Lydig Fund)	34,149.86
Bequest of Darius Ogden Mills (Darius Ogden Mills Fund)	50,000.00
Bequest of William R. Sands (William R. Sands Fund)	10,000.00
Olivia and Caroline Phelps Stokes (Fund for the Preservation of Native Plants)	3,000.00
Students Research Fund (Fees of Special Students, accumulated to aid Students' Research)	3,317.00
Total	$404,976.86

It is desired to increase this endowment to not less than $1,000,000

The following contributions have been received, and subscriptions made, in part conditional upon not less than $100,000 being given or subscribed during 1913:

Bequest of the late President Addison Brown, income for illustration of publication (Addison Brown Fund), about	$21,850
Mrs. John Innes Kane, income for the purchase of plants for the grounds and greenhouses (John Innes Kane Fund)	10,000
Bequest of the late Henry Iden, income for resident research scholarships (Henry Iden Fund)	10,000
W. K. Vanderbilt	5,000
Edward S. Harkness	5,000
James B. Ford	5,000
J. Pierpont Morgan	5,000
Mrs. Frederick F. Thompson	5,000
Andrew Carnegie	5,000
N. L. Britton	5,000
Archer M. Huntington	5,000
Miss Catherine A. Bliss	5,000
Mrs. D. Willis James	2,000
Francis Lynde Stetson	1,000
Dr. and Mrs. Frederic S. Lee	1,000
James A. Scrymser	1,000
Robert W. de Forest	1,000
Thos. H. Hubbard	1,000
John D. Archbold	1,000
Edward D. Adams	1,000
Miss Elizabeth Billings	1,000

Samuel Thorne	1,000
H. C. Fahnestock	1,000
Geo. S. Bowdoin	1,000
Daniel Guggenheim	1,000
Mortimer L. Schiff	1,000
Edward V. Z. Lane	1,000
Geo. W. Perkins	1,000
Geo. F. Baker	1,000
Mrs. W. Bayard Cutting	1,000
Estate of Edward Russ	1,000
James McLean	1,000
Mrs. Morris K. Jesup	1,000
Mrs. John Stewart Kennedy	1,000
Ogden Mills	1,000
Cleveland H. Dodge	1,000
Louis C. Tiffany	1,000
Chas. G. Thompson	1,000
Walter B. Jennings	500
Mrs. H. L. Satterlee	500
W. D. Sloane	500
Samuel P. Avery	100
Jno. E. Parsons	100
Charles Baird	100
Geo. Peabody Wetmore	100
James Douglas	100
Geo. D. Barron	100
Chas. J. Harrah	100
J. H. Schiff	100
A. R. Shattuck	100
M. D. Howell	100
W. Gilman Thompson	100
W. J. Matheson	100
Mrs. Samuel Lawrence	50
Henry F. Osborn	50
David Lydig	50
H. M. Baldwin	25
Miss E. Richard	25
Banyer Clarkson	25
Oakes Ames	25
M. C. Lefferts	25
John W. Frothingham	25
Miss Josephine H. Dill	25
Paul J. Sachs	25
Pierre J. Smith	25
Miss Harriet Louise Britton	25
Richard H. Britton	25
Conrad Hubert	25
William J. Gies	25

William Shillaber	25
E. P. Bicknell	25
R. A. Harper	25
F. R. Newbold	25
Henry H. Rusby	25
H. A. Siebrecht	25
Alfred Tuckerman	10
Walter Scott	10
Loyall Farragut	10
Thomas J. Byrne	10
Miss Lydia F. Emmet	10
Mrs. S. Neustadt	10
Mrs. I. T. Williams	10
James F. Kemp	10
Reginald H. Sayre	10
Miss Juliet Turner	10
Jno. I. D. Bristol	5
Charles Zoller	5
Aurel Batonyi	5
Miss Mary Taber	5
Total	$117,295

Subscriptions may be made for definite purposes if preferred, as for (1) Botanical Exploration and Collecting; (2) Botanical Investigation; (3) Horticultural Investigation; (4) Purchase of Plants for Grounds and Greenhouses; (5) Purchase of Herbarium Specimens; (6) Public Lectures; (7) Illustration of Publications; (8) Research Scholarships; (9) Laboratory Purposes; (10) Library Purposes; (11) Botanical Prizes; (12) Horticultural Prizes.

We ask if you will make or obtain a contribution or a subscription

The committee will be pleased to call upon you and give further information if you so desire.

The New York Botanical Garden, Bronx Park, New York, Jan. 31, 1914.

N. L. Britton, Sc.D.,
Director-in-Chief,
W. Gilman Thompson, M.D.,
Chairman of the Executive Committee,
Committee on Endowment

Members of the Corporation

Fritz Achelis,
Edward D. Adams,
Charles B. Alexander,
John D. Archbold,
George F. Baker,
Eugene P. Bicknell,
Prof. N. L. Britton,
Prof. Edw. S. Burgess,
Dr. Nicholas M. Butler,
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Albert R. Shattuck,
Henry A. Siebrecht,
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Nelson Smith,
Valentine P. Snyder,
James Speyer,
Francis L. Stetson,
Charles G. Thompson,
Dr. W. Gilman Thompson,
Samuel Thorne,
Myles Tierney,
Louis C. Tiffany,
George W. Vanderbilt,
W. K. Vanderbilt.

FORM OF BEQUEST

I hereby bequeath to the New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of.....

TOTAL OF PERMANENT FUNDS

1. As above stated.....	$404,976.86
2. Given or subscribed since November 14, 1912.....	117,295.00
	$522,271.86

CEREAL FOODS*

The Century Dictionary defines the word cereal as pertaining or relating to edible grain, or any graminaceous plant cultivated for the use of its farinaceous food; any one of the annual grain plants, as wheat, rye, barley, oats, rice, millet, and maize. This definition would indicate that the word cereal can be properly applied only to the fruits of grasses. This word was derived from the Roman goddess Ceres, in whose honor was celebrated the festival of the Cerealia.

The principal cereals of temperate climes are wheat, rye, oats, and barley; of warm temperate and tropical regions, rice and Indian corn or maize.

Do we fully realize what it would mean to mankind to have the cereals destroyed? Think of the bread we eat and of the many breakfast foods, such as oatmeal, cornmeal, wheatlet, hominy, and many others, if we wish to have a realizing sense of what it would mean to be deprived of the cereals.

Of the temperate cereals, wheat is the most valuable. Its origin is veiled in uncertainty, but probably traceable to Egypt. It is found in old Egyptian monuments, and grains of it were discovered in the bricks of a pyramid dating back to 3359 B. C. It was cultivated by the lake dwellers of western Switzerland, and was known to cultivation in China 2700 B. C.

It is the principal bread-stuff among civilized nations, being chiefly converted into flour. The proteids in wheat, which feed the nerves and brain, reside, together with the fat and mineral elements, in the outer layers which are all removed in the manufacture of white flour. These elements thus removed are essential to the welfare of the human body, and so the great value of whole wheat flour may be appreciated. The ordinary white flour of commerce practically contains nothing but starch.

The production of wheat is enormous. As an example, the wheat crop in the United States for 1910 was 635,121,000 bushels, the product of 45,681,000 acres; while the world crop for the same year was 3,572,084,000 bushels. Oats, while extensively used

* Abstract of a lecture delivered at the New York Botanical Garden on October 18, 1913.

for food for beasts in this country, are also largely employed for food for man in the shape of oatmeal. The area in the United States devoted to this cereal in 1910 was 37,548,000 acres, upon which were produced 1,186,341,000 bushels. The world crop for the same year was 4,214,727,000 bushels. Rye is not of such great antiquity as wheat, being unknown in cultivation before the Christian era. It was not known to the ancient Greeks, and probably originated in the countries north of the Danube. It was first mentioned in the Roman Empire by Pliny. It is extensively grown in central and northern Europe, and is almost the exclusive bread-stuff there. It is less nutritious than wheat, although next to it in this respect. The amount of this grain produced in the United States in 1910 was only about one eighth that of wheat, about 34,897,000 bushels, while the world crop was 1,668,937,000 bushels in the same year. Barley is found wild in western Asia, in Arabia, and to the south of the Caucasus. In ancient times it was a very important article of food. It was cultivated by the lake dwellers in eastern Switzerland, was mentioned by Greek authors, and is found in the earliest Egyptian monuments. Of all the cereals, this is suited to the greatest range of climate. It is cultivated in Lapland, Norway and Iceland at 65° to 70° N. Lat., and in the Andes and Himalayas at 11,000 feet altitude. In the United States the barley crop in 1910 was 173,832,000 bushels, while the crop in the world was 1,383,192,000 bushels. Much of the supply is used for feeding animals, its chief use, however, being in the manufacture of fermented liquors, such as ale, beer, and porter.

Corn, as it is commonly called in this country, but more properly Indian corn or maize, is of tropical American origin, perhaps a native of Colombia or Mexico. It is unknown in a wild state. As it is an annual plant, intolerant of shade, it must have come from some open mountainous region. The early discoverers in this country found it almost universally cultivated by the Indians from the La Plata valley to the United States. It is found in the burial mounds and tombs of the Incas and in the catacombs of Peru. Its great antiquity is shown in its association with religious rites. In Mexico the

first fruits of the maize harvest were offered to the goddess Cinteutl, equivalent to the Ceres of the Romans. In Peru the virgins of the sun offered sacrifices of maize bread. Next to rice, it is said to furnish food for a greater part of mankind than any other cereal. The output in the United States in 1910 was 2,886,260,000 bushels, cultivated on 104,035,000 acres, the United States producing about 71% of the world crop of this cereal for that year. The above acreage would equal about 162,554 square miles, an area equivalent to the whole of New England, New York, New Jersey and Delaware. The crop in this country was valued at over one and a third billions of dollars. Illinois is the largest producer of corn, with a yield in 1910 of 10,250,000 bushels. Remember that a large part of the corn crop is used as food for beasts, and another large part in the production of whisky.

We now come to rice, the most important of all cereals, as it furnishes food for the greatest number of people. It is of great antiquity, its cultivation being fully established in the Euphrates valley in the time of Alexander, 400 B. C. It forms almost the exclusive diet in India, China, and Malaysia. In addition to these countries, it is also cultivated largely in Japan, the Philippines, Brazil, the southern United States, and to some extent in Italy and Spain. It was introduced into cultivation in the United States in 1694, and is now cultivated in the South Atlantic and Gulf States. In 1910 the yield in this country was about 11,347,000 bushels, which was about one two-hundredth of the world's crop for that year. This cereal, unlike the others considered here, needs wet or flooded land for its development. This makes its cultivation quite different.

The rice as it comes from the thresher consists of the grain proper with its close-fitting cuticle in the stiff hard husk. In this condition it is known as "paddy" or rough rice. It is then milled, the object being to remove the husk and cuticle and polish the grain. It is the polishing process which gives to the commercial product its pearly luster, but at the expense of some of its most essential food elements. This polishing removes nearly all the fats which reside in the outer parts of the rice

grain. For instance, in 100 lbs. of rice flour, removed by the process of polishing, there are 7.2 lbs. of fat, while in 100 lbs. of polished rice there is only 0.4 of a pound. Rice is very nutritious, especially in its unpolished state, and easily digested, boiled rice being digestible in one hour. The grain should be at least three months old before comsumption. In rice-producing countries it is used as a substitute for bread and potatoes. One of the more recent cereals is that known as "puffed rice," the "food shot from guns." The process of manufacture of this was discovered at the New York Botanical Garden by Dr. Alex. P. Anderson, and first published by him in the *Journal* of that institution in May, 1902. The same process is also employed in the manufacture of "puffed wheat." In both of these the entire grain is used.

To impress upon you the value of the cereals for food, and what it would mean to be deprived of them, I give below the world production and value in United States prices, of the six principal cereals for the year 1910:

	Yield, Bushels	Value per Bushel in U. S.	Total Value at Prices in U. S.
Oats	4,214,727,000	$0.34	$1,433,007,180
Corn	4,026,967,000	.48	1,932,944,160
Wheat	3,572,084,000	.88	3,143,436,920
Rice	2,241,933,000	.67	1,502,135,310
Rye	1,668,937,000	.71	829,945,270
Barley	1,383,192,000	.57	788,419,440
			$9,629,888,280

GEORGE V. NASH.

STARCHY AND SUGARY FOODS*

The formation of sugars and starches is generally considered the basic process of food synthesis for both animals and plants. The familiar so-called "food cycle" which emphasizes the dependence of animals on plants takes its starting point in the assimilation of mineral substances by the common green plants

* Abstract of a lecture delivered at the New York Botanical Garden on October 25, 1913.

which results in the formation of starch or sugars. Our commercial sources of starch are the storage organs of plants such as seeds, thickened fleshy stems and roots and even the pith of woody trunks. Agricultural plants can be roughly classed as those which store starch, such as the cereal grains, corn, rice, the potato, etc., and those which store sugar, such as sugar cane, the sugar beet, sorghum, etc. Starches are more commonly stored by the plant for use in its own future growth periods. Sugars may serve in the same way, but also are not infrequently found associated with other attractively flavored food elements in fruits, nectaries, etc., where they serve as baits to attract insects and other animals whose agency is needed for cross fertilizing, distributing seeds, etc. It is a commonplace that over half of all our foods have a sweetish taste. The number of sugars is very great and their food values vary within wide limits. The chemistry of the starches is less well understood but their general properties vary to a considerable degree according to the type of plant from which they are obtained.

Chemically considered the starches and sugars are types of the great group of the carbohydrates. The chemical characteristics of the carbohydrates are largely determined by the qualities of the element carbon and Van't Hoff was willing to assert that life itself is but the vast and complex expression of the chemical properties of carbon compounds,—under the present temperature conditions of the earth. Such a statement is to be taken as the extreme viewpoint of the chemist, though the importance of carbon as a building material is very great. In the case of both plants and animals the carbohydrates are transported and taken up in growth processes in the form of sugar, starch representing a compact storage substance which appears in the plant tissues when there is an excess of food, much as fat is produced in the animal tissues. So far as known a remarkable similarity has been found between the processes by which starches are converted into sugars and thus utilized in both plants and animals. The digestive juices of a seedling are quite comparable to those of an animal and plant enzymes may be used as a substitute by the animal in case of a deficiency.

From the standpoint of human development, the history of the starch plants is simply that of the development of the great crop plants of agriculture and most of these were essentially what they are now before the appearance of written records. The bulkiness of starch crops made them largely in early times products for local consumption. The sugars, because of their attractive tastes, concentrated form and more localized production, early became objects of traffic between widely separated peoples and they have played a much more conspicuous rôle in the development of commerce and manufacture. Doubtless one of the very earliest manufacturing processes was the condensation of plant juices into syrups and crude sugars, antedated only by the primitive processes of milling by which the starches of the cereal grains were made more available for food. Cane sugar was originally brought from India and its use there as syrupy extracts of cane plainly antedates the earliest historical records. Indian sugar was first brought to Europe in the time of Alexander and it was one of the stimuli to the development of commercial intercourse between east and west. Cane growing was introduced into the Mediterranean islands and countries by the Arabs in the seventh century. The crusades spread the use of sugar more widely in western Europe and the increasing demand for it was one of the stimuli to the discovery of the sea route to the East Indies. Columbus introduced sugar cane in San Domingo on his second voyage. The West Indies afforded a more favorable soil and climate for it than had before been found and within the first century after the discovery of the New World sugar became one of the most important and highly prized exports. The development of the sugar beet industry in France and Germany as a result of the Napoleonic blockade which cut off Europe from her source of supplies in America is the latest of the long series of revolutions in world commerce and manufacture in which sugar played a prominent part. The history of sugar prices from the middle of the thirteenth century to the present shows a reduction from something like $2.00 a pound to the current value of a few cents per pound.

We depend for our most concentrated foods on the excess

produced and stored by the plant for its own use and that of the embryos and seedlings it produces and it is a commonplace of evolutionary theory that the highly specialized animals with their strongly developed muscular and nervous systems would not be possible except for the concentrated food stuffs of the plant seed. A prerequisite for the evolution of the highly perfected animal types of the present day was the development of the seed habit in plants with its concomitant forehanded storage of concentrated foods intended for the seedling but which can be diverted to the use of the predatory animal. Before seeds were available as foods herbivorous animals were dependent largely on what we characterize as fodder or roughage, demanding excessively developed digestive tracts and foraging capacity.

Looked at from the standpoint of economics, the work of the farmer is to a large degree the production of carbohydrates by the use of the plant mechanism. Carbohydrate formation is known as light assimilation, or photosynthesis. The organs of light assimilation are the green leaves. The raw materials for carbohydrate synthesis are carbonic acid gas from the air and water largely from the soil. The energy necessary to bring about the chemical synthesis is furnished by sunlight. It is of interest that the supply of raw materials for carbohydrate formation and the necessary energy available in the form of sunlight are both practically inexhaustible and the farmer need not concern himself with problems of the conservation of raw materials or energy in this immediate connection.

The chemistry of the synthetic process has been one of the most constantly studied problems in the whole domain of plant physiology, and there is still no agreement as to the fundamental processes involved. Two widely divergent views have been held. According to the one, starch is a dissociation product of more complex nitrogenous compounds which are first formed. According to the other view, the carbonic acid gas and water are more directly built up into sugars and then starch. Even the rate of this most important process in the manufacture of foods under standard conditions of temperature, light, carbonic acid gas supply, etc., has never been adequately determined, but it is

fairly well established that with a higher per cent. of crude material available in the form of CO_2 in the air the plant can work more rapidly, while on the other hand the optimum light intensity is easily and commonly exceeded under ordinary conditions of sunlight. Some recent work indicates that the plant is active in starch formation only in the earlier part of the day. The limit to the more complete utilization of the inexhaustible supplies of CO_2 water and energy of the sunlight is practically set in many cases by the lack in the soil of other elements necessary to plant growth, such as nitrogen, potash, phosphorus, etc. The present average production of plant growth is estimated at 2½ tons per hectare.

The attempt to replace the agency of the plant in the production of these important food stuffs has been a common problem with the organic chemists. Sugars have been produced synthetically in the laboratory, but not at all on a commercial scale, and for this it is in a large degree a problem of finding a form of energy available for the production of the complex syntheses involved which can compare in availability with the sunlight used by the plant. In saccharin, the chemist has produced a compound vastly more concentrated than the common sugars, but the physiologists have found it so deleterious that its use is forbidden by law. It is not likely that chemical methods will be able to surpass those of the farmer with the common crop plants, for the more fertile areas of the earth, but the chemist Ciamician at least dreams of the utilization of the sunlight of the great desert regions as a possible source of energy for the synthesis of the food products of the future.

R. A. HARPER.

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——— *Sphagnales.* N. Am. Fl. **15**: 1. 14 Je 1913.
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Banker, H. J. Type studies in the *Hydnaceae*—III. The genus *Sarcodon.* Mycologia **5**: 12–17. Ja 1913;—IV. The genus *Phellodon.* Mycologia **5**: 62–66. 10 Mr 1913;—V. The genus *Hydnellum.* Mycologia **5**: 194–205. Jl 1913.
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——— *Pinguiculaceae.* In Small, Flora of Miami. New York. 169–171. 26 Ap 1913.
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ROBERT S. WILLIAMS.

NOTES, NEWS AND COMMENT

The January conference of the scientific staff and registered students of the GARDEN was held in the laboratory of the museum building, January 7. Dr. John K. Small reported on his recent botanical explorations in Florida, the official report of which will appear in a future issue of the JOURNAL.

Miss Winifred J. Robinson, Ph.D., has resigned from the position of assistant professor of botany at Vassar College to become dean of women in the State College of Delaware. After March 1, Miss Robinson's address will be Newark, Delaware.

Dr. John K. Small spent part of the last week of January in Washington, D. C. in the examination of specimens in the National Herbarium in connection with work on North American Flora.

Dr. Britton, accompanied by Mrs. Britton, Mr. John F. Cowell, Director of the Buffalo Botanical Garden and Mr. Frank E. Lutz of the American Museum of Natural History, sailed for Porto Rico on February 7 for continuing studies of the botany and zoölogy of that island in coöperation with the New York Academy of Sciences. The party will make Mayagüez a base of operations for explorations in western Porto Rico, and the islands of the Mona Passage, planning to return to New York about March 16.

Dr. George E. Nichols, of Yale University, will deliver the regular public lecture at the Garden on Saturday afternoon, April 4, at 4 P.M. The subject of the lecture is the twelve thousand mile excursion made by the international plant geographers last summer through some of the most interesting regions of the United States. Dr. Nichols obtained a series of excellent photographs, which will be used for illustration in the form of lantern slides.

Dr. C. H. Kauffman, assistant professor of botany in the University of Michigan, spent part of February at the Garden on a scholarship grant for the study of the genus *Cortinarius*.

Dr. F. D. Heald of the Bureau of Plant Industry recently spent several days at the Garden in the study of herbarium material relating to the chestnut tree blight.

Meteorology for January.—The total precipitation for the month was 4.43 inches of which 0.375 (3.75 inches of snow reduced to rain-fall) inches fell as snow. The maximum temperatures for each week were 43° on the 9th, and the 16th, 49° on the 24th, and *60° on the 28th.* The minimum temperatures were 16° on the 6th, *3° on the 14th*, 12° on the 23d, and 25° on the 26th.

ACCESSIONS

MUSEUMS AND HERBARIUM

81 specimens of orchids from the Philippine Islands. (By exchange with Mr. Oakes Ames.)

112 specimens of ferns from Trinidad. (By exchange with the New York State Museum.)

27 specimens of flowering plants from Asia and America. (By exchange with the Royal Gardens, Kew, England.)

4 specimens of *Hyacinthus* from Louisiana. (By exchange with Mr. Mugo Wurzlow.)

7 specimens of flowering plants from the Island of South Georgia. (By exchange with the Brooklyn Botanic Garden.)

2 specimens of fungi from New York. (Given by Mr. E. W. Humphrey.)

25 specimens of fleshy fungi from New York. (By exchange with the New York State Museum.)

2 specimens of woody fungi from the West Indies. (By exchange with Dr. J. N. Rose.)

25 specimens, "Ustilagineen," fascicle 12. (Distributed by Professor P. Sydow.)

25 specimens, "Phycomyceten et Protomyceten," fascicle 8. (Distributed by Professor P. Sydow.)

50 specimens, "Uredineen," fascicle 51. (Distributed by Professor P. Sydow.)

200 specimens, "Fungi Columbiani," fascicles 41 and 42. (Distributed by Mr. Elam Bartholomew.)

127 specimens, "Kryptogamae Exsiccatae," fascicles 78–81. (Distributed by the Royal Natural History Museum, Vienna.)

1 specimen of *Geoglossum* from Canada. (Given by Professor R. A. Harper.)

21 specimens of fungi from California. (By exchange with Professor W. A. Setchell.)

1 specimen of fungus from Nevada. (By exchange with Professor W. A. Setchell.)

24 specimens, "Fungi Dakotenses," fascicle X. (Distributed by Dr. J. F. Brenckle.)

7 specimens of fungi from California. (Given by Dr. E. P. Meinecke.)

5 specimens of woody fungi from Florida. (By exchange with Mr. W. H. Long.)

1 specimen of fungus from Cuba. (By exchange with Dr. Eugenio Cuesta.)

37 specimens of fungi from New York. (By exchange with the New York State Museum.)

1 specimen of *Polyporus candicinus* from China. (By exchange with Mr. F. N. Meyer.)

1 specimen of *Marasmius* from Colorado. (By exchange with Mr. L. O. Overholts.)

3 specimens of *Marasmius tomentosipes* Peck from New York. (By exchange with Mr. Stewart H. Burnham.)

17 specimens of miscellaneous fungi from various localities in the United States. (By exchange with Mr. Elam Bartholomew.)

1 specimen of woody fungus from Bolivia. (Given by Dr. H. H. Rusby.)

10 specimens of fungi from New York and Vermont. (By exchange with Mr. Stewart H. Burnham.)

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Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22, parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

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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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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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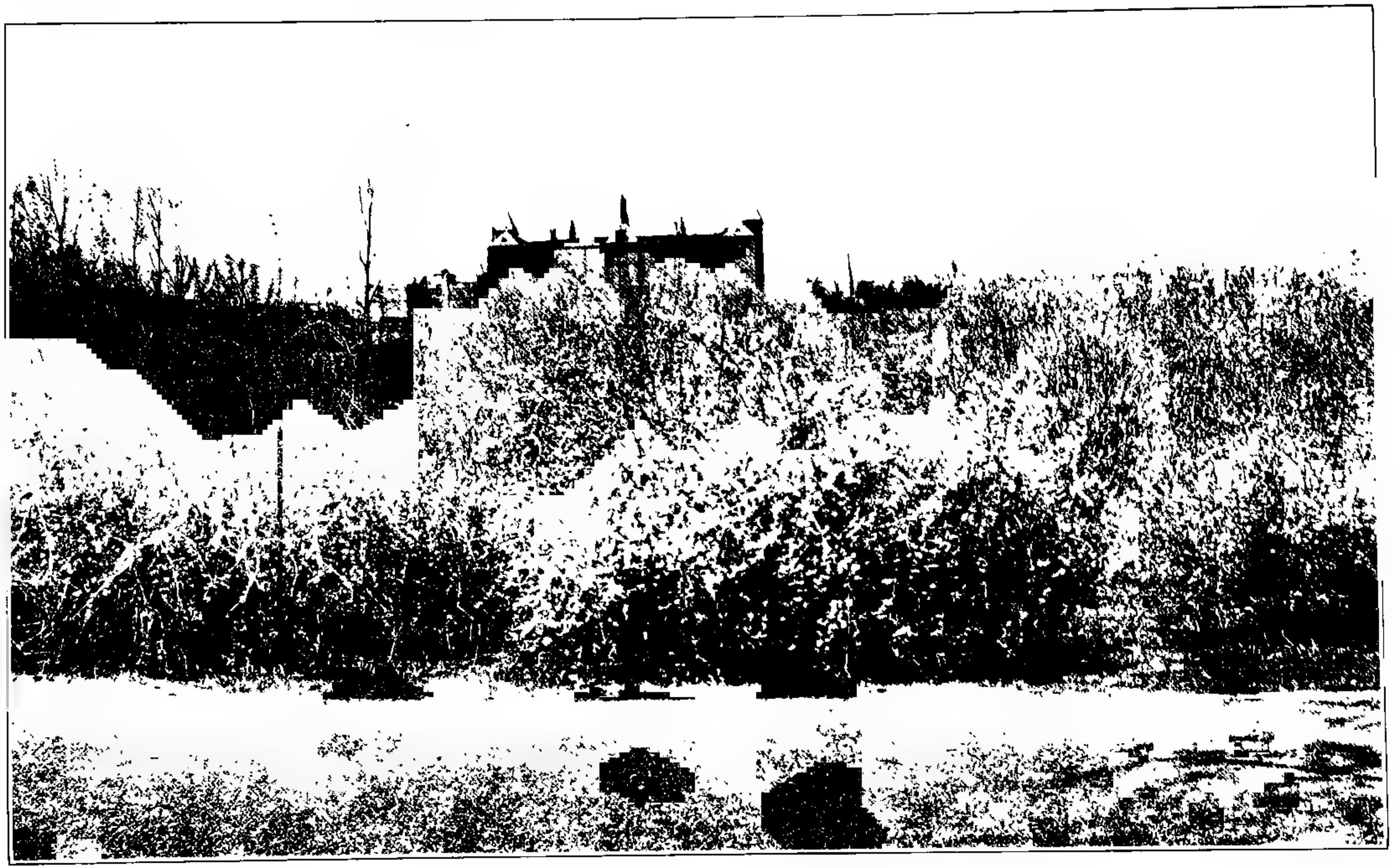

Forsythias or Golden Bells, near plaza at Harlem Railroad depot. *Forsythia Fortunei* to left, *F. intermedia* in middle, and *F. viridissima* to right.

JOURNAL

OF

The New York Botanical Garden

VOL. XV March, 1914 No. 171

FORSYTHIAS OR GOLDEN BELLS

(WITH PLATE CXXVIII)

The forsythias or golden bells are among the showiest of our spring flowers, in the latitude of New York clothing themselves late in April or early May with a profusion of bright yellow blossoms. These appear before the leaves, so the effect is one of a color mass of yellow, almost dazzling in its brilliancy in the bright sunlight. They are by far the most attractive shrubs of that season of the year, and groups of them stand out in the landscape as striking masses of color. They are of easy culture and should form a part of the decorative features wherever space will permit.

The genus contains four or five species, distributed, with one exception, in the central, northern, and eastern parts of China. This one exception, *F. europaea*, related to *F. viridissima*, occurs in Albania, far removed from the home of the other species. The first species discovered, *F. suspensa*, was found in Japan by Thunberg, and described by him in 1788 as *Syringa suspensa*, afterward forming the type of the genus *Forsythia* described by Vahl. It is now held, however, that the presence of this species in Japan was purely through the channels of horticulture, and that it is really a native of northern and central China.

[JOURNAL for February, 1914 (15: 23–45) was issued March 10, 1914]

There are three species in general cultivation in this country, viz.: *F. viridissima*, *F. suspensa*, and *F. Fortunei*, the last sometimes being considered a variety of the second.

Of these, *F. viridissima* is the least desirable, from a horticultural point of view. It is a low shrub, not as hardy as the others, with stiff upright branches. The undivided leaves are narrowly elliptic, of similar shape at both ends, rarely exceeding one third as broad as long, with the apex acute, and the margins sharply saw-toothed from about the middle upwards, or rarely the whole margins entire. In the fall they assume usually a beautiful bronze-green, a characteristic not so marked in the other species. The flowers are borne in great profusion in a crowded manner.

F. suspensa is the other extreme in habit, as compared with the above. Its stems are long and slender, drooping and pendant at the ends, and forming a fountain-like effect. On account of its habit it makes an excellent porch or wall plant, lending itself readily to the festooning and decorating of columns or pillars. The leaves are broadly ovate, more than one half as broad as long, acute, sharply saw-toothed, excepting at the base, and frequently, especially on the more vigorous shoots, deeply three-parted, the basal lobes much smaller than the terminal one. The flowers are not borne so profusely as in *F. viridissima*, and they are pendant on long slender pedicels which give them a very graceful and airy appearance. The form known as *F. Sieboldii* is also this plant.

The third species in cultivation is *F. Fortunei*. This is often considered a variety of the preceding. It is a stouter, more vigorous shrub, with more rigid branches, the ends of which are somewhat drooping or hanging, but to nowhere near the extent as those of *F. suspensa*. The ends of the branches are also often flexuous or wand-like, giving it a rather straggling appearance. The leaves also resemble those of *F. suspensa*, but are usually larger and more vigorous, being frequently lobed in a similar manner. The flowers are even more scattered than in *F. suspensa*, on much shorter pedicels, thus losing the pendulous effect. The lobes of the corolla are also narrower and more twisted.

In addition to the above there is one other form in cultivation, this bearing the name of *F. intermedia*. This name was given by Zabel, and the plant so named was considered by him to be a hybrid between *F. suspensa* and *F. viridissima*, his conception of the former species, however, being that of the plant here considered as *F. Fortunei*. In habit this hybrid is intermediate between its two parents, as well shown in the accompanying illustration, in which the plant to the left is *F. Fortunei*, that to the right *F. viridissima*, while the central one is *F. intermedia*. It will be seen that the loose straggling habit of *F. Fortunei* has been considerably modified by the more compact upright habit of *F viridissima*, producing a more graceful appearance, with none of the stiffness of the latter species. In leaf-form it is intermediate, the leaves being broader in proportion to their length than in *F. viridissima*, and often broadest below the middle, as in *F. Fortunei*, being rarely lobed or parted. Its flowers are borne in the great profusion of *F. viridissima*, but on account of the more graceful and open habit they are more effective.

F. intermedia is by all odds the best variety in cultivation. It combines the more open airy habit of *F. Fortunei*, but without its straggling unkept look, being more compact, and it avoids the stiff dwarf character of its other parent, inheriting from it, however, its ability to produce a great profusion of flowers. Its blooming period is also intermediate, coming a little later than *F. Fortunei*, but earlier than *F. viridissima*.

There are many groups of this charming shrub at the Garden, and a visit at the blooming period, the end of April or early May, is well repaid. Masses of it will be found in the west and south borders, and in the fruticetum in the area devoted to the olive family, to which this plant belongs. As one enters from the terminus of the elevated railroad, on the left of the approach, there is a group of *F. Fortunei*. Immediately opposite the approach entrance, across the road, is a large group of the hybrid, *F. intermedia*. Come upon this in a bright sunshiny day, and the effect is almost dazzling, so luminous is the color. Further on, on the way to the Museum, to the left of the path and in the neighborhood of the Harlem railroad depot, is a large planting

of this shrub, including specimens of *F. Fortunei*, *F. viridissima*, and the hybrid, *F. intermedia*. The accompanying illustration depicts a part of this group. Here the three kinds may be studied, and a comparison made of their resemblances and differences.

GEORGE V. NASH

VEGETABLE FOODS OF THE AMERICAN INDIANS*

The name "American Indians" is a collective term applied since the time of the discovery of America to the various native tribes inhabiting North and South America and to their descendants.

A glance at a map of the world reminds us that the area inhabited by the Indian was extensive. In some regions the population was sparse, in others it was dense. The population numbered at the time of the discovery about 25,000,000.

The vegetable foods of these people taken collectively were as diverse in respect to the particular plants used as is the flora of the two continents. In the northern parts of North America, food plants are rare and the Esquimo was compelled to subsist largely on animal food. We may say that the food of the Indians inhabiting the northern half of North America was three quarters animal. On the other hand, the food of the Indians of southern United States was three quarters vegetable.

Through the tropics and especially in the uplands of Mexico and Peru the food was principally from vegetable sources. Food products were obtained from cultivated plants and from wild plants. The cultivation of plants for food reached the highest stage of development in the highlands of Peru and Mexico and the principal cultivated plants native of the New World originated in these regions.

The most important cultivated plant was maize. The Spaniards found the various tribes in the uplands of Mexico and South America cultivating this plant on a considerable scale. The

* Abstract of a lecture delivered at the New York Botanical Garden on November 1, 1913.

plant was probably indigenous to the highlands of Mexico. Its use spread northward into the Mississippi valley and along the Atlantic coast until at the time of the landing of Columbus it was the principal and most common crop of all the agricultural tribes of this region.

The growing crop on an Indian cornfield looked much like our fields of today, except that the corns hills were not arranged in definite rows. The extent and character of these cornfields are shown by those fields that have remained undisturbed since the Indians raised the last crop upon them. At the present time the individual hills in these cornfields are sod-covered mounds of dirt one to one and one-half feet high and several feet across.

There are at Lake Koshkonong, Wisconsin, single fields of these corn hills comprising 40–60 acres. Along the Wisconsin River in Wisconsin and Illinois, there were continuous fields of these hills covering several hundred acres. The same was also true of Ohio, New York and other neighboring states. Most of these cornfields have, however, been effaced by the white man's cultivation.

While the crop has been improved both in yield and quality by the 300 years of our cultivation, there is no evidence that any distinctly new types have been developed. The flint, dent, soft, sweet and pop corns were all known to the Indians. Indian corn is, without doubt, the greatest contribution which the Indian has made to the civilization and progress of the world.

No discussion of the food plants of American Indians is complete without mention of the group of plants known as century plants, agaves, or magueys. They have, as a rule, thick, fleshy, rigid leaves which arise from a short, thickened, fleshy, basal stem. On account of its striking features, the plant is utilized in north temperate regions as an ornamental plant.

From the sap of certain species of agave a beverage called pulque has been prepared from the time of ancient Mexican Indians. In the period of Spanish exploitation following the invasion of Cortez, the pulque industry was greatly extended. Various agaves have a food value which was utilized by the ancient Indians. The fleshy bases of the plants when roasted

made a sweet, juicy and nutritious food. The food value of the agave together with that of maize made possible the dense population and the stage of civilization which developed on the high plateaus of Mexico.

Next to corn the beans comprised the most important crop raised by Indian tribes of eastern United States. It seems quite certain that the kidney bean, *Phaseolus vulgaris*, is a plant of South American origin and that its culture spread through Mexico and eastern United States into Canada. The lima bean, *Phaseolus lunatus*, is a native of South America. Seeds of this species have been found buried in prehistoric Indian tombs of Peru. The appearance of these beans is quite like that of the lima beans grown in our markets today. Columbus saw fields of beans which the Indians of Cuba were cultivating. He called them *Fabas*, the name of the bean which he knew in Italy, but he states that they differed from the beans of Europe.

There is much confusion in the literature regarding the plants which we known as the pumpkin, the gourd, and the squash. These names are applied rather loosely and even botanists have considerable difficulty in distinguishing the species to which many of the varieties belong. The field pumpkin is a familiar plant in the United States, yielding the substance for the famous pumpkin pie of the New England Thanksgiving. There are, however, many varieties of the pumpkin exhibiting various shapes, colors and amounts of fleshy substance. It seems more probable that the pumpkins cultivated by the Indians of North America resembled the gourd pumpkins more than the present field pumpkins. It seems certain that the pumpkin and its derivatives, the pumpkin-gourds, are American plants native to South or Central America. There is more uncertainty regarding the origin of the true squash. If it is not native, it was introduced by the early explorers and found favor with the Indians of eastern North America with whom it was a plant of considerable importance.

Beans, pumpkins, tobacco, sunflowers and artichokes were sometimes grown along with the corn, but were often grown in gardens laid out in long narrow beds with paths between them.

Previous to the discovery of America the potato was not known to the Indians of the Mississippi valley. They found, however, a good substitute for such a tuberous food in a native sunflower, a plant now known as the Jerusalem Artichoke. The fleshy underground tubers of this plant are rich in stored food. The plant is hardy, perennial and prolific, qualities which made it one of the valuable cultivated plants of the Indians. Its use spread from the valleys of the Ohio and Mississippi, where it was native, to Canada and the Atlantic coast.

The common sunflower, *Helianthus annuus*, is an American plant growing wild over a considerable area of the prairies and plain regions of the West. It was commonly cultivated by Indians from Canada to Mexico, both east and west of the Mississippi River. It was grown solely for its seeds, which are produced in large numbers.

The ground nut, *Apios Apios*, is a wild plant over a considerable part of eastern United States. Underground stems possess at intervals round edible tubers sometimes as large as a hen's egg. When cooked they are wholesome and nutritious. Several Indian tribes cultivated this plant both for its tubers and for the seeds which are quite like that of our garden pea. Asa Gray once said that if civilization had developed in eastern United States the ground nut would have been the first developed tuber. However, experiments to improve the tuber by cultivation have failed to increase the size or number of the tubers.

The Indians living in the high altitudes of Peru and Chili found it necessary to grow some crop that was adapted to poor mountain soil and the short growing season of the high altitudes. Corn, of course, would not do well, and they were without any of the quick-growing cereals which we have today. They developed as their staple food the plant known as *Chenopodium quinoa*. This is a rank, quick-growing weed that does well in very poor soil. The seeds were boiled in water as we do rice or oatmeal, making a nutritious gruel, or they were roasted and then boiled and strained somewhat as we prepare coffee. The value of this plant to the Peruvians was noted by the early explorers and it was introduced into Europe. The seeds are not

very palatable and the plant has not been able to compete successfully with wheat, rye and oats of the Old World. It is grown to some extent in England and Scotland at the present time, where the seed is fed to fowls and the leaves of the tender young plants are used as greens.

The probable progenitor of the potato is still found wild in Chili and Peru. The Indians cultivated the potato on the uplands of South America, but its use did not spread to the Mexican region. It is distinctly an American plant and should perhaps be called the Indian potato instead of the Irish potato. The plant was introduced into Europe in 1565, but its value as a food product was slow to be recognized. In fact, it was only about 60 years ago that it was cultivated to any extent. Recently its use has spread rapidly and many new varieties have been developed.

The original home of the sweet potato is not known. This plant was cultivated at an early date in both Asia and America. It was a favorite food of many Indian tribes of tropical America and was grown, it is claimed, in North America as far north as Virginia.

With the exception of the various tropical fruits and tuber-producing plants used as food which will be treated in other lectures in this course, we have now considered the principal food plants cultivated by the various groups of American Indians.

The common arrow-head (*Sagittaria latifolia*) is a rather variable and widely distributed plant throughout the whole of the United States and is often very abundant in the shallow water along streams and lakes and in marshes or swamps. The plant produces underground rootstocks bearing tubers often as large as a hen's egg. These tubers were gathered and boiled, or roasted by all Indian tribes of United States. It is never out of season. This plant was known as "Katuis" by the Indians in the vicinity of New York. It is the "Wappatoo" of the Columbia River Indians, frequently referred to in Lewis and Clark's Journal.

The arrow arum (*Peltandra virginica*) is a plant common in swamps and shallow water throughout eastern United States.

Its leaves appear somewhat like those of the arrow-head, but the flowers are quite different, being small and arranged in a dense cluster with a spathe enclosing them. This plant produces a short, thick, corm-like root or rootstock, often weighing 5 or 6 lbs., which was utilized as food.

In southern Florida there grows a plant (*Zamia floridana*) belonging to the cycads. It has a thick fleshy root joined to a thick short stem, above which are borne leaves and fruiting cones. The stem and root are richly stored with starch. The roots were mashed in mortars, passed through strainers, washed and the separated starch dried on palmetto leaves. This dried flour, which would keep indefinitely when properly stored, was used in the making of a palatable as well as highly nutritious bread. This plant supplied the chief food of the Seminole Indians in their long war with the whites. At the present time, the wild plant is utilized to some extent by the white race. Several small mills make flour. The entire product of one mill is shipped to the National Biscuit Company and is used in the manufacture of the so-called arrowroot biscuits.

In the lily family there are a large number of species whose bulbs were included in the diet of the Indians. Perhaps the most important of these is the camas or quamash (*Camassia esculenta*), a plant with bright blue flowers, abundant in the region west of the Rocky Mountains. The bulb resembles a small onion. Raw it is mucilaginous and rather of insipid taste. When baked it acquires the flavor of a roasted chestnut. These bulbs were gathered in great quantities in the spring and stored for future use. The bulbs were roasted in pits and eaten entire, they were boiled in a soup, and they were made into a sort of bread-cake. Several species closely related to this plant, as well as various wild onions or wild leeks, species of smilax and other plants of the lily family yielded root products.

If we turn now to the fleshy fruits, we may say that the Indians ate all the native fruits which we eat and have in some cases improved, and also many others which we do not consider worth eating.

To the Indians of the southwest the fruits of various species of

cacti were important. One species known as the tuna was cultivated on a considerable scale. The giant cactus, one of the vegetable wonders of the world, produces in considerable quantity fruits with a rich crimson pulp which were considered a delicacy by the Indians of Arizona. One method of preparation was to make a light-brown sugary syrup from the pulp, a syrup which was a substitute for sugar. The seed of many cacti were also parched and pulverized into a meal which was used in making gruel, cakes, or bread.

The Virginia or scarlet strawberry is quite abundant on dry meadows over the greater portion of eastern United States. The Indians and the early white settlers as well gathered the delicious fruits of this species. The familiar strawberry in cultivation today originated not from this plant but from a species found wild in South America.

Two species of cranberries are wild in North America. The Indians of northern and eastern United States were very fond of the fruits of these.

The persimmon is a well-known tree over a large part of eastern United States. The fruit is somewhat like a yellow plum in appearance. They are strongly astringent when green, but of sweet and agreeable taste when ripe. The fruits were much esteemed by Indians and were preserved by drying.

Among the various other plants yielding fruits there should be mentioned wild plums, blackberries, raspberries, blueberries, and huckleberries, all of which were gathered in considerable quantities when in season.

Of the dry fruits, seeds, and nuts, there were many species that were of great importance to various Indian tribes. One of these is wild rice, an annual grass growing in shallow sluggish water of lakes and streams over a wide area of United States and Canada. When conditions are favorable, it grows rapidly and causes shallow bodies of water to appear like extensive grassy meadows. The seed is somewhat longer and more cylindrical than an oat or a wheat seed. Wild rice reaches its best development in Wisconsin and Minnesota, where it has always been an important food with several Indian tribes. It is probable that

no less than 30,000 Indians, chiefly of the Winnebago and Ojibway tribes, still use wild rice.

In northwestern United States there grows a large yellow water lily (*Nymphaea polysepala*), somewhat similar in appearance to the yellow water lily common in the region about New York City. The pods produced by the plant are somewhat larger than a hen's egg and contain numerous seeds that are well flavored and nutritious. On the Klamath Indian Reservation in Oregon, there are 10,000 acres of this lily, known to the Indians as "Wokas," in one marsh. During the months of July and August the Indians are busy gathering the pods from which the seeds are extracted and stored for use during the year. Enormous quantities of seeds are collected which provide the principal vegetable food of the Klamath Indians. The seeds are commonly roasted in open baskets over coals when they swell and crack open somewhat like pop corn. When thus roasted they may be eaten dry or ground into a meal, from which porridge or bread is made.

The American lotus is a plant of eastern United States belonging to the same family as the wokas. This plant produces nut-like fruits set in the swollen receptacle. The nuts are about three quarters of an inch in length, look like acorns and are rich in nutritious food substances. These nuts were gathered, stored, and used in various ways. Not only seeds, but the large fleshy rootstocks of various water lilies were important sources of food.

Various nut-bearing trees such as the hickory nut, walnut and pecan furnished nuts which were gathered in season and stored for use when needed. The Indians had groves of pecans, walnuts and hickory trees of which they took considerable care.

Various species of oak bear acorns that are highly nutritious and which formed the bulk of the food of various Indian tribes. This was especially true of various tribes in California. The acorns were gathered when ripe, as much as 500–1,000 lbs. by a family, and carefully stored. The kernels were ground into a fine meal. Some species produce acorns which contain considerable amounts of tannin together with bitter substances that are injurious to the health. The Indians developed rather ingenious

methods to rid the acorn meal of these injurious substances. This was accomplished by a method of filtration—finely ground meal was placed in porous baskets and set in sand. Water forced into the meal gradually soaked through into the sand filtering out the injurious substances. Certain sweet acorns do not need this special treatment. Acorn meal was used in making soups or in baking bread.

The chestnut is one of the stately trees of eastern United States, forming almost pure forests over areas of considerable size. With the Indians the nuts formed an important article of food and were gathered in large quantities.

The beech tree is also abundant over the greater portion of eastern United States. The burs which it produces are somewhat like those of the chestnut, but the nuts are much smaller. They were, however, gathered as an article of food. The various oaks, the chestnut and the beech are members of the same family.

The mesquite (*Prosopis glandulosa*) is a small tree or often a mere shrub abundant in the dry desert regions of the southwest. The large tap root of the plant often extends to a remarkable depth in search of water, a habit which enables the plant to live in desert regions. Pods are produced by this plant. The seeds of the pods are enclosed in a sweet pulp so that the ripe pods form an important article of food.

The maple sugar industry is of Indian origin. The earliest extended notice of maple sugar is "An Account of a Sort of Sugar Made of the Juice of the Maple in Canada," published by the Philosophical Transactions of the Royal Society for 1684–85. In this article it states that the savages had practiced the art longer than any now living among them can remember. The methods of tapping trees, collecting the sap and preparing the sugar are the same in principle today as in early times. In the southwest regions, sugar was obtained from the juices of the willow, the agave and from the pulpy fruits of certain cacti.

Bark of trees furnished food for many tribes especially in spring, when there was often a period of great need. The name Adirondack means "they eat trees" and was applied to certain tribes of the Algonquin Indians because of their custom of eating

bark. Cakes were made from the soft and nutritious inner bark of the hemlock, the willow, slippery elm, and the pine. Especially with the northwest Indians this sort of food was an important item of diet.

A few words should perhaps be said concerning the storage of food products. Some fruits and tubers were gathered for immediate consumption, but whenever the nature of the food product was suitable, and the quantity available was sufficient, storage for future use was the rule. When properly dried and stored various seeds, nuts, tubers, and even fruits keep from season to season. In fact, storage was not a serious problem with the Indians. Thatched huts or cribs were used especially for corn. Attics in their houses were utilized. Many tribes dug caches or cistern-like cavities in the ground in suitable localities about the village sites in which food supplies were stored. Often these caches are found today with remains of such less perishable foods as nuts and seeds. In both the preparation and the cooking of such foods the Indians were seriously handicapped. With them grinding was a laborious task, accomplished by hand with the aid of mortars and stone grinding stones.

Contrary to popular belief the Indians as a rule preferred cooked food. Nearly all the more staple vegetable foods require cooking. Parching and roasting were processes easily carried on by the use of open baskets and flat stones. Baking was also a rather simple process. Boiling was a difficult procedure, as the Indian was without iron, tin, or even glazed earthenware. "Stone boiling" was practiced. In this method hot stones were placed in the baskets along with the food to be boiled. Considering all these difficulties many tribes reached a remarkable degree of proficiency in the art of cooking.

At the time of the discovery of America, the Indians as a whole were probably slowly increasing in numbers. Since their contact with whites most tribes have gradually diminished in numbers. A few tribes have made a steady gain—Navajo tribes for example. Recently several tribes have shown slight increase. The most common disorders of health now experienced by Indians are those of the gastro-intestinal tract, due chiefly to

improper feeding in infancy, the consumption of food not properly cooked, a misuse of inferior baking powders and an excessive use of coffee and alcoholic liquors.

The various plants mentioned in this rather brief survey of the vegetable foods of American Indians indicate the kinds of plants useful to the Indians as food. Necessity compelled the Indian to utilize every plant that could supply food. Yet the Indian was making progress in the art of agriculture, in fact in the highlands of Mexico and South America the art was rather definite and specialized. In the domestication of various plants, especially corn, agave, and beans, the Indian has perhaps contributed more to the civilization of the world than he has thus far received from it.

A. B. STOUT

REPORT ON A COLLECTING TRIP TO GEORGIA AND FLORIDA*

The visit to the south was undertaken in part for the purpose of attending the annual meetings of the American Association for the Advancement of Science and the Botanical Society of America, which were held in Atlanta, Georgia, December 29, 1913, to January 1, 1914. After the close of these meetings I remained in the south for two weeks for a little botanical exploring in Georgia and Florida, going first to Gainesville, Georgia, which is about fifty miles northeast of Atlanta, and thence to Jefferson, Athens, and Augusta, in Georgia, and finally to Cedar Keys, in Florida. Since undertaking to write an account of the Ricciaceae for the "North American Flora," the region between Jefferson and Gainesville has had peculiar attractions as the type locality of *Riccia Beyrichiana*, a species collected in August, 1833, by a German botanical traveler, Heinrich Karl Beyrich, between Jefferson and Gainesville, "North America." The species was published in 1838 by Lehmann and Lindenberg, who adopted a manuscript name of Hampe's, and since that time the species

* Presented at the conference of the students and staff of the New York Botanical Garden, February 4, 1914.

has been known only from literature and from Beyrich's original material, most, if not all, of which appears to have been preserved in the Lindenberg herbarium of the Naturhistorisches Hofmuseum at Vienna. From what is known of Beyrich's travels and of North American geography, it is evident that the Jefferson and Gainesville in question are in northern Georgia, where these two towns are county-seats about twenty miles apart. However, Sullivant, who prepared the treatment of the Hepaticae for the second edition of Gray's Manual, in some unaccountable way, attributed the species to Tennessee and to Tennessee only. The late Professor Underwood, in some critical notes on the American species of *Riccia*, published in the Botanical Gazette in 1894, omitted *Riccia Beyrichiana* on the ground that there was no recent evidence that it was a member of the North American flora. In 1901, for the sake of comparison with a peculiar *Riccia* collected at Athens, Georgia, by Dr. Roland M. Harper, which I at first thought might prove to be the long lost species, I secured, through the courtesy of the officials of the Naturhistorisches Hofmuseum at Vienna a loan of Lindenberg's authentic specimen of *Riccia Beyrichiana*. As described in a previous paper* on the subject, an examination of this indicated that it differed amply from Dr. Harper's plant, which was then described as new under the name *R. dictyospora*. The opinion was expressed that *Riccia Beyrichiana* was a valid species and that it was still, to all appearances, unknown except from the specimens collected by Beyrich, August 13, 1833, between Jefferson and Gainesville, North America. The hope was expressed that botanists resident in the south or those traveling in that region would consider its rediscovery a problem worthy of their attention. The possibility of finding this small *Riccia* was the motive that led to my visit to Gainesville and to Jefferson.

During the day that I spent at Gainesville, the ground was covered with two inches of snow, which interfered with the finding of such plants as the small terrestrial Riccias. Beside a shaded rocky stream several well-known northern Hepaticae were met with, such as *Conocephalum conicum* and *Pellia epi-*

* Bull. Torrey Club, **28**: 161–165. 27 Mr 1901.

phylla, here near the southern limit of their ranges. At Jefferson, I followed for several miles the old stage road towards Gainesville—probably the road that Beyrich had traveled eighty years earlier. I found one small *Riccia* here, but it was not *R. Beyrichiana*. At Athens, the seat of the University of Georgia, about eighteen miles from Jefferson, I had the assistance of a sketch made by Dr. R. M. Harper, indicating the type locality of *Riccia dictyospora*, a species discovered by him in 1900. With the aid of this map I was able to find on the university grounds three species of *Riccia*, which proved to be *R. dictyospora*, *R. Austini*, and the long lost *R. Beyrichiana*. The first and the last grew on the upper margins of granite ledges, in places that were, at the time, thoroughly moistened by water seeping down from above, a habitat of a rather different character from those in which I had found species of *Riccia* in California and New York. I am informed, however, that these ledges are more or less arid during a good part of the summer.

The chief motive for my stop at Augusta, where one day was spent, was to rediscover, if possible, a minute moss, *Erpodium biseriatum*, a species whose history has been somewhat similar to that of *Riccia Beyrichiana*. This plant was collected at or near Augusta by the distinguished American bryologist Sullivant in 1845, though the plant was so minute and there was so little of it that he apparently did not know at the time that he was collecting it. A considerable number of years later Mr. C. F. Austin, in studying some of the foliose Hepaticae of the *Lejeunea* tribe, collected by Sullivant at Augusta, picked out a few sterile stems of a minute plant which he considered to be a foliose hepatic and which he described as a new species under the name *Lejeunea biseriata*. A little later Austin perceived that the plant was a true moss, whereupon he transferred it to the genus *Erpodium*, a chiefly tropical genus, not otherwise known from the United States.* This *Erpodium biseriatum* has, to all appearances, never been met with again, and I was not so fortunate as to rediscover it in the rather brief time that I was enabled to devote

* See Britton, E. G., A long lost genus to the United States—*Erpodium* (Brid.) C. M. Bryologist **8**: 71. 1905.

to the search for it. The species is represented in the herbarium of Columbia University by Austin's notes and sketches and by a single plant or fragment of a plant, which is about one centimeter long and less than one millimeter wide.

The town of Cedar Keys, Florida, is situated on the west coast of the peninsula, a little north of the 29th parallel of latitude and nearly one hundred miles north of Tampa. The second week of January was spent here with the purpose of obtaining some information as to nature of the marine flora at this point in the winter season. My previous visits to Florida in quest of marine algae had been in the spring and autumn. The water is shallow for many miles about Cedar Keys, with many reefs, shoals, and small islands and with considerable variety in the nature of the sea-bottom. The physical conditions would seem to favor an abundant and diversified seaweed flora, but, at the time of my visit, at least, the marine algae did not appear particularly numerous, either as to species or individuals. About forty species, perhaps, were observed and collected. On three days, dredging operations, mostly in from one to three fathoms of water, were carried on. Among the Siphonaceous green seaweeds about the only distinctively tropical or subtropical species secured was *Caulerpa prolifera*. It is probable that more of the tropical species might have been found on the reefs and shoals where the collection of sponges is carried on, but these sponge reefs are said to be fifteen miles or more to the seaward of Cedar Keys and I was disappointed in my efforts to reach them. It may be remarked that a common and conspicuous seaweed of the Cedar Keys region in the first half of January appears to be *Agardhiella tenera*, a species that is common in Long Island Sound and about New York in summer and autumn, though very rarely met with in the winter. A visit to Cedar Keys at other seasons of the year would doubtless lead to finding a greater number of marine algae and to securing data of interest as to their seasonal occurrence.

MARSHALL A. HOWE

SPRING LECTURES, 1914

Lectures will 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 4. "An Excursion through the United States with Distinguished Foreign Botanists," by Dr. G. E. Nichols.

April 11. "The Occurrence and Significance of Variation in Plants," by Dr. A. B. Stout.

April 18. "The Seaweeds of New York City and Vicinity," by Dr. M. A. Howe.

April 25. "The Petrified Forest of Arizona," by Dr. Arthur Hollick.

May 2. "Some Interesting Trees Seen on My Travels," by Dr. W. A. Murrill.

May 9. "Wild Flowers of Spring," by Dr. N. L. Britton.

May 16. "American Orchids," by Mr. G. V. Nash.

May 23. "The Protection of Shade Trees against Insect and Fungous Enemies," by Dr. F. J. Seaver.

May 30. "Some Plants of Our Swamps," by Dr. J. H. Barnhart.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for crosstown trolley, transferring north at Third Avenue.

NOTES, NEWS AND COMMENT

Dr. M. Miyoshi, professor of botany in the Imperial University of Tokyo, visited the Garden on February 20, on his way to Florida, Louisiana, and the Pacific coast.

Professor Harvey M. Hall of the department of botany, University of California, spent the month of March at the Garden in the study of American Compositae. Dr. Hall is taking a half-year leave of absence from his university duties and will spend several months in the East, returning to California in August.

Meteorology for February.—The total precipitation for the month was 2.21 inches of which 1.05 (10.5 inches of snow reduced to rain-fall) inches fell as snow. The maximum temperatures for each week were *58° on the 4th*, 37° on the 11th, 36° on the 23d, and 52° on the 27th. The minimum temperatures were 13° on the 9th, *—1° on the 13th*, 6½° on the 22d, and 0° on the 25th.

ACCESSIONS

MUSEUMS AND HERBARIUM

200 specimens of hepaticae, algae, and fungi from Georgia and Florida. (Collected by Dr. Marshall A. Howe.)

36 specimens of marine algae from Alaska. (By exchange with the U. S. National Museum.)

6 specimens of marine algae from Guaymas, Mexico. (By exchange with the U. S. National Museum.)

9 specimens of Ricciaceae and other hepaticae from College Station, Texas. (Given by Dr. F. H. Blodgett.)

5 specimens of Ricciaceae and other hepaticae from Austin, Texas. (Given by Dr. M. S. Young.)

21 specimens of marine algae from Orient, New York. (Given by Mr. Roy Latham.)

61 specimens of flowering plants and ferns from Porto Rico. (By exchange with the Experiment Station, Rio Piedras, Porto Rico.)

200 specimens, "American Grasses." (By exchange with the United States National Museum.)

250 specimens of flowering plants from Indo China, Guam, Hawaii, Burma and Borneo. (By exchange with the Bureau of Science, Manila.)

1423 specimens of flowering plants and ferns from eastern North America. (By exchange with the Missouri Botanical Garden.)

497 plates and drawings mostly from the "Flora Brasiliensis." (By exchange with Professor Ignatius Urban.)

10 specimens of sedges from Canada. (By exchange with Brother Leon.)

12 specimens of flowering plants from the eastern United States. (Given by Mr. E. P. Bicknell.)

324 specimens of hepatics from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

3 specimens of *Halophila* from Cedar Keys, Florida. (Collected by Dr. M. A. Howe.)

60 specimens of marine algae, chiefly calcareous. (By exchange with the Royal Botanic Garden, Berlin.)

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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Creek at the southeastern end of Lake Okeechobee. Water-plants in the foreground. Pond-apple or custard-apple hammocks on the banks.

Bay at the southeastern end of Lake Okeechobee. Spatter-dock or yellow pond-lily and other water-plants in the foreground. Everglades in the distance.

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EXPLORATION IN THE EVERGLADES AND ON THE FLORIDA KEYS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Sir: The active work which has been in progress for several years, preliminary to draining the Everglades, suggested to the writer the desirability of observing the natural flora and of getting together a representative collection of the vegetation of that isolated plant-region in advance of the inevitable colonization and cultivation of its lands, and the consequent modification and perhaps the ultimate destruction of the original plant-covering. In the early part of the last decade a similar idea prompted us to undertake the exploration of the Miami Limestone Region or the Everglade Keys. Most of this relatively small area was then difficult of access, but the wisdom of exploring it was evident long before we had covered half the ground, and as exploration advanced it was astonishing to note the many kinds of plants it yielded either new to science or new to the flora of the United States.

Heretofore, much information about the southern portion of the Everglades, particularly that adjacent to the Miami Limestone Region, was obtained during the progress of the exploration just referred to, but much remains to be ascertained in what is perhaps the most interesting section lying between the larger islands of the Everglade Keys near the eastern coast and

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and the Ten Thousand Islands on the western coast of southern peninsular Florida.

With your permission I left New York on the first day of November of last year equipped for exploration in the Everglades and contiguous territory. I was accompanied by my family who as a whole or in part participated in all the work, both in the field and at headquarters, and they added materially to the results. We proceeded direct to Miami, and there upon the invitation of Mr. Edward Simmonds established our exploration headquarters in the laboratory building at the Plant Introduction Garden of the United States Department of Agriculture. All phases of our undertaking were furthered by the interest and the generosity of Mr. C. F. Sulzner and family. While at Miami we made our headquarters at the residence of Mr. Sulzner, and his manifold facilities were generously placed at our disposal. The cruiser "Lida" owned by Mr. Sulzner, was kindly put into commission as a house-boat for our proposed expedition through the Everglades and Lake Okeechobee, and later Mr. Sulzner fitted out his small motor-boat "Scooter," for local work about Bay Biscayne and in the Everglades about the head of the Miami River. I also wish to thank Mr. E. H. Lyon for the use of his small motor-boat of shallow draught. This craft was of much use in exploring certain portions of the shores of Bay Biscayne.

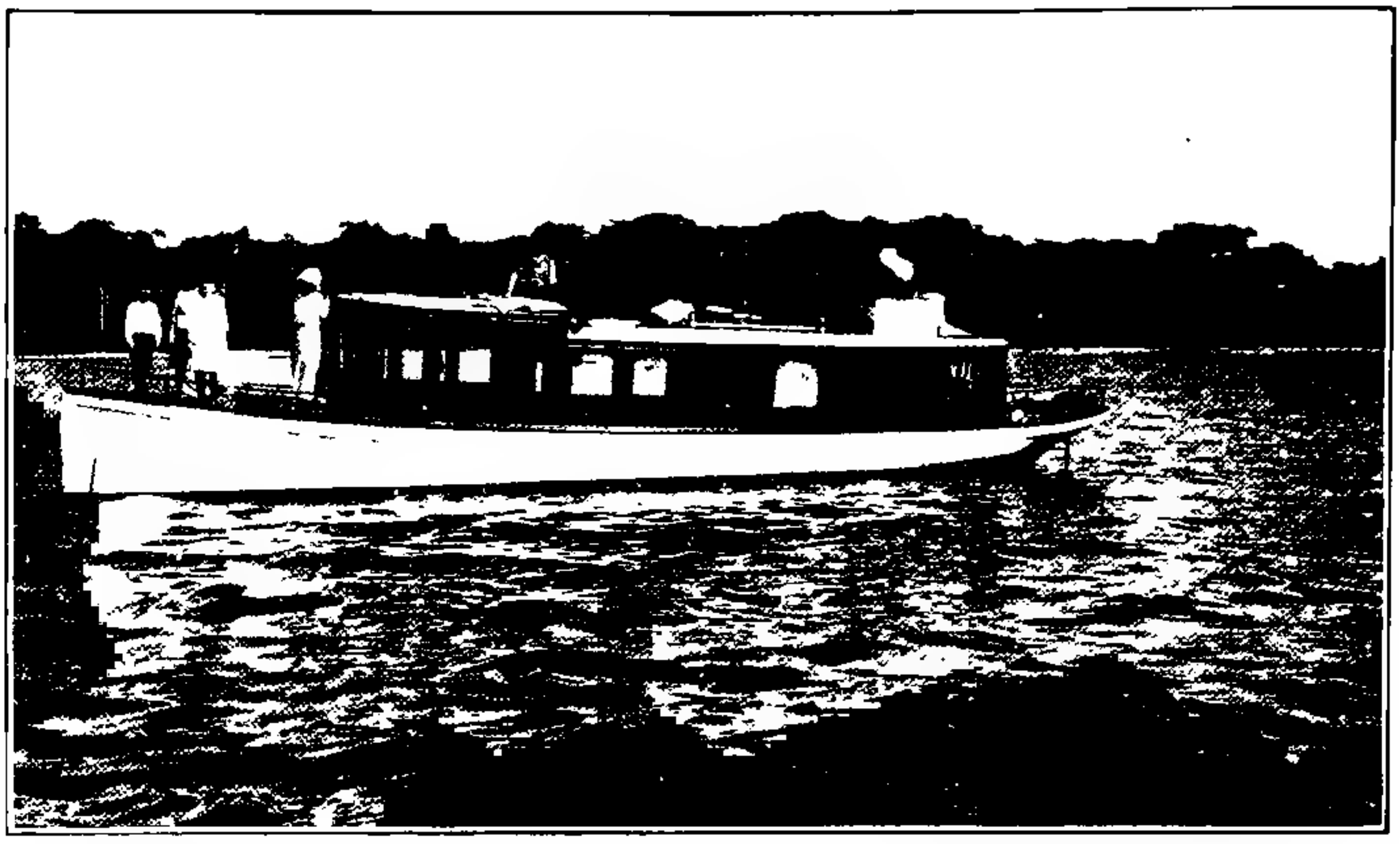
For a period of nearly two weeks only sporadic field work could be accomplished on account of an unseasonable spell of very rainy weather. However, the time not spent in the field was put to good advantage in fitting out and provisioning the "Lida" for our proposed Everglade expedition. By removing the engine from the "Lida" we gained a commodious work-room in the stern of the boat which could not have been more suited to the waters of the region we traversed and to the character of our work. In addition to the converted engine-room, she had a galley, a saloon, and a spacious pilot-house. After securing the services of Captain Ball with his motor-boat "Highball" to tow the "Lida," we awaited a favorable change in the weather. With the advent of the first clear day we started down the Miami

River bound for Fort Lauderdale, which course we were forced to take both on account of an impassable point in the Miami Branch canal just beyond the source of the Miami River and some shallows in the South New River canal near Lake Okeechobee. Our party made an admirable crew for the "Lida," and all members had plenty of work to do from start to finish. After some delays on sand-bars and oyster-banks in Bay Biscayne, we entered the Coastwise Canal at the head of the bay, and passing through Dumbfoundling Bay, New River Sound, and Lake Mable, we entered the mouth of the New River just after dark, and proceeded slowly up the channel to Fort Lauderdale where we tied up at the public dock for the night. As at this point all traces of civilization would be left behind, we spent the evening partaking of the kinds of civilization especially appreciated by the younger members of the party, particularly ice-cream and moving-picture shows, both of which were of a primitive type, nevertheless they were appreciated. Early the next morning, after making repairs to the engine of the "Highball" in the hope of increasing her speed, we started up New River for the Everglades. In saying up, I merely mean against the current for the New River passes through a tortuous channel which covers all points of the compass within short distances. Its banks are lined with a succession of pinelands, hammocks, and wierd cypress-swamps.

That the Everglades are considerably above the level of the sea is at once realized by the rapidity of the current that flows through each canal. The outlook on the Everglades cannot be called picturesque, except in the vicinity of Lake Okeechobee. The view, however, is impressive, but only so by the extreme simplicity of the contours and the monotony of the plant-formation. In the outer portion the landscape consists of water, saw-grass, and low, mostly scattered, usually remote, hammock islands. The inner part consists of a monotonous expanse of water and saw-grass extending to the horizon in all directions; in dry seasons the visible water is more or less eliminated, except in depressions; then nothing is in sight but saw-grass.

Two days' travelling against a strong current, with occasional

stops for collecting along the way, brought us at sundown to the most southern portion of Lake Okeechobee, called South bay. As we approached the lake a gradual elevation of the land was noticeable. This higher land supported dense hammocks, consisting chiefly of pond-apple or custard-apple (*Anona glabra*), while the most conspicuous and everblooming shrub there is the southern-elder (*Sambucus intermedia*). However, by far the commonest plant of all is a high-climbing vine, known in cultivation as the moon-flower (*Calonyction aculeatum*). There it is ubiquitous, and in many hammocks it covers everything and every place. This vine runs over the herbaceous vegetation and shrubs and climbs to the tops of the highest trees, and where there is no vegetation it covers the ground. We were favored by bright moonlight during most of the nights spent on the lake and in the Everglades. The sight of acres, if not of miles, of moon-vine with its deep-green leaves and thousands of large white flowers throughout the night and in the early morning was more beautiful than words can describe. At day-break on the morning following our arrival at South bay we made our way through a channel between the patches of pondweed (*Potamogeton*) to Torry island which is the southernmost and largest of the four islands of the lake. The morning was devoted to exploring Torry island and making collections of the plants observed there. Access to the hammocks of this island is often difficult chiefly on account of mud-flats which extend far from the shore. These expanses consist of the most non-resistant liquid mud I ever experienced. They support a growth of maiden-cane (*Panicum hemitomon*), bulrushes (*Scirpus validus*), water-hyacinth (*Piaropus crassipes*), water-lettuce (*Pistia Stratiotes*) and pennywort (*Hydrocotyle umbellata*), but any one who sets foot thereon sinks in the mud to an indefinite depth about as readily as in pure water. Behind these mud flats one meets with a very dense line of pond-apple or custard-apple trees with curiously buttressed or branched trunks. These trees often form hammocks acres in extent to the exclusion of all other kinds. In these groves, other vegetation is scant. Various vines struggle to the tops of the trees for sunlight, those more conspicuous are,



Cruiser "Lida" at anchor off the eastern shore of Lake Okeechobee. Sand-ridge covered with a dense hammock made up mostly of bald-cypress and cabbage-palm or palmetto trees in the background. Behind the ridge and hammock lies a cypress swamp.

Eastern shore of Lake Okeechobee. Beach of white sand in the foreground. Ridge with hammock behind. The trees along the shore-line are accustomed to thrive both in and out of the water. At the high-water mark the larger tree trunks usually support an assemblage of plants not usually epiphytic, such as the Carolina-aster, a tropical climbing-hempweed, and other herbaceous plants, and vines.

a kind of gourd, and still more surprising, a high-climbing dew-flower (*Commelina*). This plant with its stout fleshy stems and branches climbs all over the limbs of the pond-apple trees, often reaching to the highest branches. Air-plants were represented by both orchids and bromeliads.

About noon we passed between Torry and Kreamer islands and went into Pelican harbor where we dropped anchor. As soon as the "Lida" was made secure we boarded the "Highball" and hurried over to the northern end of Kreamer island several miles to the westward and spent the afternoon in making a large collection in the hammocks. The vegetation for the most part was similar to that of Torry island but apparently rather more varied. Returning to the "Lida" we weighed anchor and moved up into the sound which connects Pelican harbor with Pelican Lake, just as the sun was going down. The scenery there was enchanting, and the birds of various kinds were congregating in their respective rookeries which were the largest and most fantastic I have seen in southern Florida. As the moon was rising we anchored in this sound surrounded by floating islands of water-hyacinth and water-lettuce. These floating islands, varying in size from a few rods to acres in extent, are at times blown about by the wind with almost incredible swiftness. Sometimes the outlook would be perfectly clear, then in a few moments our boats would be surrounded by masses of these plants. How this South American plant got into Lake Okeechobee I do not know, nor how long it has been there will probably never be known. It may have been brought by birds coming from the south or it may have floated down the Kissimmee River, for the distance of several hundred miles after it was introduced into northern Florida. The lake and some of its branches have proved very congenial to the water-hyacinth and I doubt if it grows more luxuriantly in its native countries. Curiously enough it does not prove much of an impediment to navigation. We successfully made our way through formidable looking masses acres in extent almost at full speed; but not so in the case of the inconspicuous pondweed. Progress through a growth of this plant is well nigh impossible, except with a weedless propeller.

With the ordinary style of propeller, a few rods' progress through a patch of the "weeds" is sufficient to stop the engine.

Soon after daybreak next morning we pushed up into Pelican Lake and collected along its wooded shores. We found a creek on the western side of the lake through which we were able to pole our rowboat nearly into Lake Okeechobee. A slight extension of this channel, and it may exist at times of high water, would add a fifth island to the group now in the lake.

After devoting as much time to Pelican Lake as our schedule allowed, we returned to Pelican harbor and passed outside, where we began our course northward along the eastern shore of Lake Okeechobee. Landings were made from time to time as inviting localities appeared along the shore. Just above Pelican harbor and northward from it both the land and the vegetation undergoes an abrupt and a conspicuous change. A ridge of fine white siliceous sand runs parallel with the shore of the lake. This ridge is several feet high and varies, as far as we observed, from about twenty-five feet to two hundred feet in width. Behind this ridge lies a dense cypress swamp. Along the lake-side the shore is open and of clean sand, and not of mud as it is a little further south. There the water-hyacinth and water-lettuce so common and luxuriant a few miles south cannot gain a foothold, and exist, if they are to be found at all, as stunted and insignificant plants hardly noticeable after an experience about Pelican Lake. Consequently the shore-line is devoid of vegetation, except for some small grasses and sedges. Thus a complete change of scenery takes place. The low muddy and irregular shore with its dense growth of pond-apple gives place to a ridge clothed for the most part with a remarkable growth of bald-cypress (*Taxodium distichum*) and palmetto (*Sabal Palmetto*). In appearance this ridge seems to be a series of ancient sand-dunes and the discovery there of several coastwise plants seems to indicate that it was once a sea-coast. These sand-dunes support a very dense growth of the two above-mentioned trees. The growth is almost impenetrable in many places. Scattered with the cypress and palmetto are trees of the red-maple (*Acer carolinianum*), holly (*Ilex Cassine*), ash (*Fraxinus caroliniana*),

also many shrubs and herbaceous plants. In the swamp behind the ridge we found black muck instead of sand. Here in most places the cypress grows to the exclusion of other trees, and ferns of various kinds cover the swampy ground.

Passing northward we found this ridge continuous nearly up to the head of the lake, except where several small creeks connect the lake with the cypress-swamp. We finally reached the northern end of the lake, and anchored off the mouth of Taylor Creek. Here we left the "Lida" at anchor, and going aboard the "Highball," found a channel through the bar at the mouth of the creek and proceeded up the very tortuous channel to a settlement called Tantie. This creek is favorable to the growth of water-hyacinth, and it is often completely choked from shore to shore. Time and again we had to plough our way through hundreds of feet of a dense growth of the plants. The banks of the creek, after passing the line of cypress near the mouth, are clothed with hammocks of shrubs and trees different from the kinds growing at the southern end of the lake. These hammocks resemble more closely those of peninsular Florida farther north. Four miles up the creek we emerged into the pinelands at a point where it is planned to build Okeechobee City. We had now reached the northern extremity of the lake and of the Everglades, and our next move was down the western side of the lake a few miles to Eagle bay, and after collections were made on its shores, the next stage in our journey brought us to the mouth of the Kissimmee River. Further progress along the western shore of the lake was impossible not only on account of the naturally shallow waters of the western side of the lake, but also on account of a remarkably low level of the water brought about by a long drought prevalent in the peninsula north of the lake.

The mouth of the Kissimmee as it exists is very different from that shown on maps. Instead of a bay, it is a delta, and the main channel of the river is very obscure, and evidently very tortuous further up, as a fisherman we met in the delta told us that if we attempted to ascend the river with a boat over twelve feet in length, the boat would have to be hinged in the middle so as to be able to get around the bends in the river.

We now began to retrace our course, and after making several landings on the sand-ridge south of Chancey bay we headed straight for the southern end of the lake and made our first stop for collecting at Observation island.

From the time we left Pelican Lake until we got back into the South New River canal we did not seek the shelter of a harbor but anchored from sunset to sunrise on the open lake. We could not have been favored with better weather for our undertaking.

Observation island is quite flat, and aside from some sandy beaches, at least at periods of low-water, it consists mostly of pond-apple hammocks. The following day found us off the mouth of the South New River canal. There we again left the "Lida" and in the "Highball" made a collecting trip some miles southward into the Everglades.

After leaving the South New River canal we crossed to Rita island, the fourth island of the lake, and the one remaining to be explored. Rita is the smallest of the islands, and apparently has less variety of vegetation than the other three.

The surface of the lake is uninterrupted except by the four islands already mentioned. Several limestone rocks have been reported between Rita and Observation islands. We kept a lookout for these obstructions, and although the water was unusually low, we did not observe them. After leaving Rita island we sailed direct for the mouth of the North New River canal and anchored along the channel where we entered the lake about ten days previous. There we explored a creek lying between the mouths of the North New River canal and the Hillsborough canal. This creek with its growth of water-lettuce, water-hyacinth, pond-lilies, and yellow and white water-lilies on the one hand and the large pond-apple and wild-rubber trees on the other presented one series of pictures after another of indescribable beauty.

Lake Okeechobee may be described as an irregular body of water nearly forty miles in diameter. Its broad expanse is broken only by the four islands near the southern end. Summing up what has been said, the eastern side consists of deep water bordered by a sand ridge with a remarkable growth of bald-cypress

Motor-boat "Highball" towing the "Lida" through Pelican sound. Floating islands of water-hyacinth and water-lettuce in the foreground. Pond-apple hammocks on the shores. Entrance to Pelican Lake in the distance.

Shore of Pelican Lake. Luxuriant growth of water-hyacinth in the foreground. Dense pond-apple hammock in the background. On the muddy shore alligators are plentiful. The hammock is the home of the otter and the racoon, and other mammals. The pond-apple trees furnish rookeries for various kinds of birds.

and palmetto. This ridge gradually passes into the deltas of several creeks and into that of the Kissimmee River at the north. The western side of the lake is shallow and mostly filled with pondweed. Its border consists of Everglade formation. The southern shore is a high ridge of peat or peaty soil which supports a dense hammock and gradually tapers off into the Everglades. South bay is also pretty well filled with pondweed and lined with muddy shores which support exceedingly luxuriant vegetation and remarkable pond-apple hammocks.

To the animal life of the Everglades we paid little attention, except such as was forced upon us. We noticed many kinds of birds. These because of protection throughout the state of Florida have become remarkably numerous and tame. Mammals were represented most conspicuously by otters and racoons. Of course, bear, deer, and wild-cats are plentiful, but they keep themselves out of sight. Reptiles were well represented by alligators, crocodiles, water-moccasins, and rattlesnakes. However, all these animals seemed insignificant after we reached the home of the mosquito and the blind-mosquito. The mosquito did not trouble us at all in the Everglades proper, but when we entered Pelican sound, we found the mosquito and the mosquito found us; but the greatest surprise awaited us as we started up the eastern shore of the lake. There we made the acquaintance of the blind-mosquito. These animals are about the size of the common mosquitoes, but they do not bite. However, their attack which is vicious, persistent, and irritating, is pure bluff, and their numbers are incredible. They live on the vegetation along the shore, and at night they are attracted to a light-colored object or to the lights of a boat. They were so numerous that they actually buried the lantern on the upper deck of our boat and accumulated in a mass to the depth of a foot on the lower deck. The only way in which we could escape the plague was to shut up the cabin at sunset, put out all lights and go to bed, but in spite of all we could do, thousands would find their way inside.

Having put in all the time at our disposal on the lake we started for Fort Lauderdale by the same course as we came to the

lake. However, upon reaching the junction of the two forks of the New River, we went up the South fork and through the South New River canal into the Everglades. After the desired observations and collections were made there, we proceeded back to Fort Lauderdale. There we replenished the supply of gasoline which the almost constant use of the engine had exhausted and the supply of food which ravenous appetites had reduced to the quantity of about a meal, and then made our way to the mouth of the New River, and through Lake Mable to New River Sound. We cast anchor in the southern part of the sound and spent the day on the sand-dunes between the ocean and the sound where there is always much of botanical interest to occupy one. The brilliant coloring of the vegetation, particularly the many shades of green exhibited by the trees and shrubs surrounding the sound is remarkable. Early the next morning we weighed anchor and started on the last stage of our lake trip, and reached Miami late in the afternoon.

After our return to Miami collecting was continued in the Everglades about the head of the Miami River and further up along the Miami Branch canal. Also while caring for the specimens, incidental exploration was carried on along the shore of Bay Biscayne, on the sand-dunes opposite Miami, and in the large hammocks south of Miami.

Several days in the first and third weeks of December were spent in making collections on Key West, Boca Chica Key, and Big Pine Key. The first visit to Key West was made primarily to explore Rock Key, which is said to lie to the westward of Key West, and where Dr. Blodgett collected a very rare plant many years ago. The only Rock Key on the charts, and also the only one known to the inhabitants of Key West, was washed away during recent storms, and thus if the Rock Key referred to above be the same one that Dr. Blodgett collected on, the plants that grew there are exterminated, providing they do not exist on other keys.

After locating the former position of this Rock Key by means of its remains now completely submerged, we turned our attention to Boca Chica Key and Key West. The latter named key

was searched for its botanical treasures, particularly for plants found there early in the last century and not recently collected, nor rediscovered there. A shrub and several kinds of trees still remain to be rediscovered, and unless they are found at an early date, they will never be found, for they will have gone forever together with the little that remains of the original hammock where they evidently once grew. In fact, it will not be very long until the only vegetation of Key West will consist of way-side and backyard weeds. The native vegetation of many other of the Florida Keys is also doomed. The hammocks of Big Pine Key will not survive very long. We devoted as much time as possible to these, and walked the whole length of the key in search of two shrubs or trees collected there many years ago by Dr. Blodgett. Our search for these was unsuccessful, but much else of botanical interest was secured. This key and all the others supporting pinelands in addition to hammocks, should be explored almost every month of the year, if we expect to get a complete collection of their interesting vegetation.

Our party returned to New York without an accident and with a collection of museum specimens and about 6,000 herbarium specimens of flowering plants.

Respectfully submitted,

J. K. SMALL,

Head Curator of the Museums and Herbarium.

FLOWERS FOR THE SPRING GARDEN

Perhaps there is no side of the garden which appeals more eloquently to us than do the flowers of spring. After the long hard winter and the confinement indoors are about to end, we hail with peculiar delight the arrival of the first warm days, for they sound the knell of winter, and tell us that the earth is about to awake and clothe herself with all the wealth and beauty of the flower world. And from this awakening in spring to the frosts of fall we can have a succession of flowers, if we but plan our garden aright, so that at all times there will be something of beauty or interest to which we can turn our attention.

This planning is especially necessary if we desire any of the bulbous plants, for these must be placed in the fall. It is upon the bulbs that we must rely for our great show of color in the spring. These are not expensive, and the return upon a small investment is great. Snowdrops, glory-of-the-snow, squills, narcissi, daffodils, spring and summer snowflake, all these are valuable for our spring garden. We can look in early March for the first signs of spring in the little snowdrop, with its dainty nodding blossoms. What can be more appealing than these shy little flowers as they peep out of the ground. In some sunny sheltered spot on the south side of a house, near the cellar wall, where the warmth from the house adds its stimulus, we may look for this in February. They may be nipped by a following cold spell, but they have done their best to show us they are willing. Glory-of-the-snow and Siberian squills follow in quick succession, these preceding but a short time the crocuses, yellow and purple and white. Then come the tulips, the daffodils and the narcissi. Other perennial plants, some of which will be considered below, may accompany these, adding another touch to the spring garden.

In the large collections at the Garden there are many plants which may be used in the spring garden. Below I have selected some of these as suggestions. I give the bulbous plants first, following with the miscellaneous perennials. Many will doubtless desire to visit the collections and see these plants for themselves, and that they may do this I have indicated with abbreviations the location in the various collections of the plants considered. These abbreviations follow: C. B., conservatory beds, located to the north and west of conservatory range 1, the accompanying numeral indicating the particular bed in the series; C. C., conservatory court, the area enclosed by conservatory range 1; C. P., conservatory plaza, to the south of conservatory range 1; L. B., border paralleling the elevated railroad approach; L. C., beds along path from elevated railroad to conservatory range 1; W. B. S., west border south of Harlem railroad depot plaza; W. B. N., west border north of same plaza; F., fountain at foot of Museum approach; H. G., herbaceous grounds, located in the little valley to the eastward of conservatory range 1.

The flowering period of all bulbs is short, many of them having a long resting time. The leaves gradually turn yellow and wither, finally disappearing, leaving vacant spaces in the garden. These are unsightly and may be obviated by sowing seeds of annual plants, or using tender plants which have been propagated by cuttings. This does not really come within the scope of a discussion of spring flowers, only to the extent that objection might be made to the use of bulbs in the spring garden on this account. It is alluded to here for that reason.

Some bulbs must be replaced from time to time, the stock becoming weak or dying out. This is true of some of the tulips. These bulbs can be taken up each year if desired and kept in a dry place during the summer, replanting in the fall. Narcissus and daffodil bulbs are much more permanent than tulips, the clumps increasing with age. It is usually necessary to replace from time to time the bulbs of *Galanthus*, *Chionodoxa*, and *Scilla*. Crocus bulbs are much like those of narcissus, increasing from year to year, although it is sometimes necessary to replace.

Bulbs

Miscellaneous

The smaller bulbs, such as *Galanthus*, *Chionodòxa*, and *Scilla sibirica* should be planted from 2 to 3 inches apart, or from 16 to 35 to the square foot. *Muscari* should be 6 to 8 inches apart, or 2 to 3 to the square foot; and *Leucojum*, *Scilla hispanica*, and *Ornithogalum* 5 to 6 inches, or 4 to 6 to the square foot.

The snowdrops, the first to appear, belong to the genus *Galanthus*. There are two of these commonly cultivated, *G. nivalis* (C. B. 3, 5), the common snowdrop, and *G. Elwesii* (C. B. 5, 7, 8, 10; L. C.; W. B. N.), known as the giant snowdrop. The latter has broader leaves and larger, more globular flowers. Glory-of-the-snow, *Chionodoxa Luciliae* (C. B. 3, 5, 10), comes shortly after the snowdrop, with its beautiful purple-blue flowers. Another, known as *C. Luciliae gigantea* (C. B. 3, 5), has larger flowers. Of a beautiful sky-blue is *Scilla sibirica* (C. B. 1, 3, 5, 10), arriving with the glory-of-the-snow. These may be planted together, and if in a bright sunshiny sheltered spot, the flowers

will appear very early. The white of the snowdrop will harmonize the different shades of blue. All the above may be planted among the grape hyacinths, referred to below, as they flower much earlier, the grape hyacinths thus extending the period of flowers. Seed of some annual, such as sweet alyssum, may be sown among these early in spring, giving a beautiful mass of white way up to frost time. Thus a continuous display of flowers may be had in a small space from earliest spring to latest fall.

The snowflakes, *Leucojum*, are also among the early bulbs. As the common name indicates, the flowers are white. The spring snowflake, *L. vernum* (C. B. 3, 5), appears in March, while *L. aestivum* (L. B.), the summer snowflake, makes its appearance in April and May. The Star-of-Bethlehem, *Ornithogalum umbellatum* (W. B. S.), with its beautiful starry white blossoms comes in May. The grape hyacinth, *Muscari botryoides* (W. B. N.), opens its deep blue flowers in late April or May. *Scilla hispanica* (L. B.), the Spanish bluebells, is a May visitant.

Crocus

Crocus bulbs should be planted 2 to 3 inches apart, or 16 to 35 to the square foot, when a part of the regular garden. If for the lawn, place them in a shovel or other receptacle and scatter them, planting where they drop. This avoids the set stiff effect which is apt to follow other methods of planting.

The earliest crocus is a yellow one, *C. Susianus* (L. B.; C. B. 6, 8, 9, 11), known as cloth-of-gold, appearing from the middle to the end of March. There is another yellow crocus, coming later, known as the dutch crocus and the golden yellow and mammoth golden yellow, *C. Moesiacus* (W. B. S.; C. B. 2, 6, 9). The white and purple crocuses in cultivation belong to *C. vernus*. Caroline Chisholm (L. B.), Mont Blanc (C. B. 2, 8, 10; W. B. S.), King of the Whites (C. B. 6; W. B. S.), Queen of the Netherlands (L. C.), are all white forms. Purple forms are known as Baron von Brunow (C. B. 6, 10), David Rizzio (L. C.), *purpurea grandiflora* (C. B. 6; L. B.). White striped with violet are represented by Sir Walter Scott (W. B. S.) and La Majesteuse (L. C.; C. B. 9, 11). White striped with lavender is Mme. Mina (W. B. S.).

Tulips

Early—late April and early May.

	Color	Location
Artus	Bright deep scarlet,	C. B. 8.
Belle Alliance	Brilliant scarlet,	C. B. 11.
Bizard Verdict	Bright red, marked with bright yellow,	L. C.
Cardinal's Hat	Dark brownish red,	L. B.; C. B. 3, 7.
Chrysolora	Yellow,	W. B. S.; L. B.; C. C.; C. B. 3, 5; F.
Cottage Maid	White, broadly bordered with bright pink,	L. C.; L. B.; C. B. 5, 7, 8.
Canary Bird	Yellow,	L. B.
Couleur Ponceau	Bright cherry, marked white at base,	C. B. 9; W. B. S.
Cramoisie Brilliant	Brilliant scarlet,	C. B. 3; F.
Crimson King	Brilliant crimson-scarlet,	L. C.; C. C.; C. B. 11.
Duchesse de Parma	Orange-red, yellow edge,	C. B. 1, 3.
Duc von Tholl, rose	Rich rose-pink,	C. B. 8.
Duc von Tholl, scarlet	Intense scarlet,	C. B. 8, 9.
Kaiserkroon	Red, heavily bordered yellow,	L. C.; C. P.; W. B. S.; C. B. 3; L. B.
La Reine	White with a slight flush of pink,	C. B. 5, 8; C. C.; L. B.
Mon Tresor	Yellow,	W. B. S.; L. C.; C. B.
Pottebakker White	White,	L. C.; C. B.; L. B.
President Lincoln	Violet,	C. B. 8.
Prince of Austria	Orange-scarlet,	W. B. N.; L. C.
Proserpine	Violet-rose,	C. B. 5, 10.
Rosamundi Huykman	Rose-pink, white-striped,	L. C.
Rose Grisdelin	Delicate pink,	C. C.; C. B. 5, 11; W. B. S.; L. B.
Thomas Moore	Orange,	W. B. S.
Titian, double	Red, bordered yellow,	C. B. 8.
Vermilion Brilliant	Scarlet,	L. C.
Wouverman	Purple-violet,	C. B. 8.
Yellow Prince	Yellow,	L. C.

May-flowering or Cottage—middle to late May.

	Color	Location
Bizards	Yellow, marked with various colors,	L. C.
Bouton d'Or	Yellow,	W. B. S.; C. B. 4, 7.
Byblooms	White, marked with various colors,	W. B. S.; C. B. 7; L. B.
Golden Crown	Yellow, edged scarlet,	L. C.; C. B. 6, 7.

Isabella	Carmine-pink, white at center,	C. B. 11.
Inglescombe Pink	Violet-rose,	C. B. 5, 9.
La Merveille	Salmon-rose, suffused with orange-red,	C. B. 8.
Orange Beauty	Dark red, bordered with orange,	C. B. 8.
Parisian Yellow	Golden yellow, buff outside,	C. B. 9.
Picotee, or Maiden's Blush White,	delicately edged rose,	C. B. 6. 11.
Summer Beauty	Carmine-rose, feathered white,	C. B. 10.

Darwin—middle to end of May.

Barronne de la Tonnaye	Bright rose,	L. C.
Bartigon	Bright red, shaded rose,	C. B. 9.
Clara Butt	Clear salmon-pink,	L. C.
Dream	Dark lilac-lavender,	C. B. 9.
Europe	Salmon-scarlet, shaded carmine outside,	C. B. 10.
Flambeau	Dark carmine-rose,	W. B. N.
Gretchen	Silvery pink,	W. B. N.
May Queen	Soft rose,	C. B. 10.
Mixed	All colors,	W. B. N.; C. B. 7, 10.
President Roosevelt	Bright crimson-scarlet,	C. B. 10; W. B. N.
Salmon King	Rosy scarlet,	C. B. 8.
The Sultan	Blackish maroon,	L. C.

Parrot.

Admiral of Constantinople	Orange-scarlet,	L. C.
Perfecta	Yellow, striped scarlet,	C. B. 3.
Markgraff von Baden	Orange-yellow, outside striped scarlet,	W. B. S.; C. B. 5, 8.

Selections from these will give a succession of flowers from late in April to late May or early June. The Darwin tulips are especially fine for cut flowers, the petals being thick and fleshy, giving the flowers long-lasting qualities. The soft colors are especially attractive. The parrot tulips are odd, rather than beautiful.

Narcissus

Here are included also the daffodils. There are many of the large trumpet-daffodils from which to select. One of the best of these is Emperor, the trumpet yellow, the perianth primrose (C. B. 3, 5). Another is Golden Spur, a deep golden yellow

(C. B. 9, 11; W. B. N.). Empress has a pure white perianth with a yellow trumpet, and is one of the best bicolored forms (C. B. 3, 5). Grandee is similar to Empress, but later (C. B. 8). Henry Irving has a deep yellow perianth and golden yellow trumpet (C. B. 2). Victoria has the perianth creamy white, the trumpet yellow (C. B. 10; L. C.). Mme. de Graaff has a pure white flower (C. B. 8). Von Sion, single, a rich yellow (L. C.). Princeps, the trumpet a light sulphur-yellow, the perianth paler (L. C.). Von Sion, double flowers, yellow (C. B. 10, 11). Silver Phoenix, double flowers, yellowish white (C. B. 9, 11).

Those forms with the trumpet much reduced in size are known as the chalice-cup or star. *Barrii conspicuus* has the perianth a soft yellow, the cup marked with orange (L. C.; C. B. 3, 5, 10). *Incomparabilis Lucifer* has the perianth pure white, the cup orange (C. B. 8). In *Incomparabilis Sir Watkin* the perianth is sulphur-yellow, the cup tinged with orange (C. B. 6; W. B. S.). *Leedsii Mrs. Langtry* has a pure white perianth and the cup primrose (C. B. 6, 9).

In another group the trumpet is reduced to a mere shallow cup or saucer. This is represented in the poet's narcissus, *N. poeticus* (L. C.). A fine variety of this is *ornatus*, with larger flowers than in the type, appearing earlier (L. C.; C. B. 3, 5, 9). *Biflorus* has the perianth white, the saucer pale yellow, the flowers usually in pairs (C. B. 8). The jonquil, *N. Jonquilla*, with its rush-like leaves and yellow fragrant flowers is very desirable (W. B. N.; C. B. 3, 5).

Miscellaneous Perennials

The following are some of the perennial plants, other than bulbs, which may be used in the spring garden. These may be planted in the fall, preferably the early part, or in the spring. The fall planting will, of course, give a better showing the first year than plants set out in the spring. For convenience these are arranged according to the month in which they first appear.

March

Winter is makings its last protest, and few flowers, other than the bulbs, venture to appear. *Eranthis hyemalis* (H. G.), the

winter aconite, comes in this windy blustery month. The Christmas rose, *Helleborus niger*, with white flowers, or the variety *atrorubens* with purple flowers, also braves the unfavorable conditions and sends forth its flowers. So we must look to the snowdrops, the glory-of-the-snow, the Siberian squills, and the early crocuses for our material for this season of the year.

April

Now we have more material at our disposal, for spring has a firmer grasp. Flowers, which in the greater abundance of more showy things of the later season, would not attract, are now most welcome. Let us consider some of these, grouping them by color. First the whites. Among these, for a partially shaded place, is the dainty little wind anemone, *Anemone quinquefolia*, the flowers sometimes with a rosy blush. For similar situations we have the rue anemone, *Syndesmon thalictroides* (H. G.). *Bicuculla Cucullaria*, Dutchman's breeches, is another with the curiously shaped flowers which have suggested its common name. To these we may add the spring beauty, *Claytonia virginica*, H. G., the flowers delicately penciled with pink. Another is the nodding wake robin, *Trillium cernuum*. The blood-root, *Sanguinaria canadensis* (H. G.), also comes in here, with its starry flowers, appearing before the leaves are fully expanded. The shy little liverleaf, *Hepatica* (H. G.), in its white-flowered forms, may also be used. These are delightful little things for the woodsy garden, requiring partial shade. For a sunny situation there is nothing better than the rock cress, *Arabis alpina*. This has a luxuriant growth, and is a mass of the purest white flowers. It comes in both a single (H. G.; C. B. 3, 5, 6) and a double (C. B. 9) form, the latter being more lasting. During the summer it is attractive in its gray-green foliage.

Among the red or pink flowers for this month we have our common wild columbine, *Aquilegia canadensis* (H. G.), thriving in either sun or shade. For sunny situations are the wild pink, *Silene caroliniana* and *Saxifraga crassifolia* (H. G.), the latter with ample fleshy leaves and large masses of pink blossoms, the foliage remaining in good condition throughout the summer.

The spotted dead nettle, *Lamium maculatum* (H. G.) is another of our pink April flowers, continuing along into May, with white-spotted leaves. *Pulmonaria saccharata* (H. G.; C. B. 3), with its white-blotched leaves, should not be forgotten.

A good yellow flower for this month is the leopard's-bane, *Doronicum austriacum* (C. B. 8). *Capnoides nobilis* (W. B. S.), with pale yellow flowers and finely cut foliage, is another. These do well in sunny places, while *Viola pubescens*, a wood violet, may be used in our shade bed.

Blue flowers for this month are scarce. For a shaded situation we can use *Hepatica* (H. G.) the liverleaf, and *Viola palmata*. For a sunny place, bluets or innocents, *Houstonia coerulea*, may be tried. It is rather difficult to hold, however, and has but a short flowering season.

Purple may be brought into the shade garden with the purple wake robin, *Trillium erectum*, and into the sunny places by *Aubretia Hendersoni*, the false wall-cress.

May

As the season advances, our selection grows. In this last month of spring, in addition to the color we get from tulips and daffodils, many other plants present themselves for our consideration.

Among the blue or purple flowers the forget-me-not, *Myosotis palustris* (C. B. 1), does best in a shaded situation. A number of the irises come in this month. The stately German iris, *Iris germanica* (W. B. S.; C. B. 2), is one of the best of these, with its rich purple flowers. *Iris sanguinea* (C. B. 2, 3, 5, 6; W. B. N.), with its crimson bracts from which the purple flowers spring, is effective in its erect tall, habit, and is useful to carry upright lines into the planting. Quite in contrast with this, also with purple flowers, is the dwarf iris, *Iris pumila* (C. B. 2, 6, 8), one of the first to appear. Another dwarf iris is *I. cristata* (W. B. N.; L. C.), with dainty blue flowers. With taller stems and larger flowers, also blue, is *Iris tectorum* (C. B. 3.; W. B. S.), the roof iris of Japan, a fine plant. Still another is *Iris versicolor* (C. B. 3, 5), our native wild flag, and its rosy colored form, var. *rosea* (C. B. 3).

The common spiderwort, *Tradescantia virginiana* (C. B. 5, 6; H. G.), grows easily, forming large masses. *Aquilegia coerulea* (C. B. 11), with its charming blue flowers, is valuable. The gentian-like speedwell, *Veronica gentianoides* (H. G.; C. B. 2, 3, 5, 6), bears its flowers in long slender racemes, opening successively, thus giving it a long flowering period. Another speedwell is *Veronica Chamaedrys* (H. G.). *Phlox Brittonii* (H. G.; C. B. 5) is an excellent plant, with bright starry flowers, forming dense mats. Jacob's-ladder, *Polemonium coeruleum* (H. G.), is of erect habit, its blue flowers borne in terminal clusters; while its relative, *P. reptans* (H. G.), forms large mats. The common garden columbine, *Aquilegia vulgaris*, (H. G.; L. C.; C. B. 3) is found in a variety of colors besides blue, including pink and white.

Among the whites, for our shade garden, we have the lily-of-the-valley, *Convallaria majalis* (H. G.; C. B. 2). The false Solomon's-seal, *Vagnera racemosa* (H. G.), the white wake robin, *Trillium grandiflorum*, the wood violet, *Viola canadensis*, all prefer shaded situations, and come in well for the shade garden. Among the irises are *Iris florentina* (W. B. N.), the flowers white flushed with lavender, *I. Statelliae* (C. B. 3, 5), with creamy flowers, and the white varieties of *Iris pumila*, all for the open border. *Aquilegia nivea grandiflora* (C. B. 9), *Cerastium tomentosum* (W. B. S.); *Iberis sempervirens* (W. B. N.; C. B. 3), *Anemone pennsylvanica* (W. B. S.), and *Phlox subulata alba* (C. B. 2), are of use under ordinary garden conditions.

The pink or red forms. An old time favorite is the bleeding heart, *Bicuculla spectabilis* (L. C.; W. B. N.), good for either sun or shade. A shade-loving plant is *Geranium maculatum* (H. G.), of our own woodlands. For ordinary garden conditions the following do well: the common garden pink, many of the forms with white flowers, *Dianthus plumarius* (C. B. 3, 5; W. B. N.; H. G.), its spicy fragrance adding to its attractiveness; *Lychnis dioica* (H. G.); *Geum coccineum* (C. B. 9), with scarlet flowers; *Phlox amoena* (C. B. 5); *Phlox subulata* (C. B. 3); *Phlox divaricata* (C. B. 11), with lavender flowers; sweet William, *Dianthus barbatus* (C. B. 2, 3, 5, 6).

For yellows we may use: *Ranunculus lanuginosus fl. pl.*, the

double-flowered woolly buttercup (C. B. 3, 5); *Doronicum excelsum* (C. B. 9); the primrose, *Primula vulgaris* and *P. polyantha* (C. B. 3, 5; H. G.); *Trollius europaeus*, the common globe flower (H. G.); *Trollius asiaticus* (H. G.); *Aquilegia chrysantha* (C. B. 8); and *Alyssum saxatile compactum* (H. G.; C. B. 8), forming dense masses, one of the best of the yellows.

We must not forget the peony, for while primarily a flower of June, some of its many forms come late in May. It comes in white, pink, rose, red, crimson, and other shades. It requires a deep rich soil, and does not like to be disturbed. Year after year it produces its flowers, and its rich foliage serves as an effective background for other flowers later in the season.

GEORGE V. NASH.

DISPLAY OF TULIPS

The beds in the court of conservatory range 1, which are such an attractive feature during the summer months with their large collections of desert plants, present a bare appearance at other times. To obviate this and make them also attractive features in the spring, it was decided last fall to make a display of spring color here by planting large numbers of tulips. These will be all over when the time comes, about the end of May, for the installation of the desert plants.

There are seven of these beds, three large central ones paralleling each other, with two others on each side flanking them. A pink and white effect is planned for the central beds. The middle one of these has 2,800 of the pink and white tulip, Cottage Maid, in the center, with a three and a half foot border, containing 2,300 bulbs of La Reine, a white tulip faintly shaded with pink. The bed paralleling this on each side has 2,400 of the pink tulip, Rose Grisdelin. The flanking beds are given over to a yellow and red color scheme. The beds placed transversely to the central beds contain each 1,150 bulbs of Crimson King, while the remaining beds have each 575 of the yellow tulip *Chrysolora*.

The top-dressing has now, at the end of March, been removed, revealing the leaves just appearing above the ground. At the

end of April or early in May there should be a fine display of tulips, one well worth a visit. Many other bulbous plants in other decorative plantations may be seen at the same time. Among these, in addition to many other kinds of tulips, are narcissi and daffodils. Then too there are numerous other attractive perennial plants in the decorative collections, furnishing many suggestions for desirable hardy perennial plants for the spring garden. In the neighborhood of conservatory range I these may be found in the beds at the foot of the terrace and along the path leading to the elevated approach. There is also a border at the elevated approach, and others along the west line of the grounds, paralleling the Harlem railroad. Also in the herbaceous grounds, in the little valley to the eastward of conservatory range I, will be found many other plants which may be used to make our spring gardens attractive.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT

Dr. C. L. Shear of the United States Department of Agriculture spent several days at the Garden recently in the examination of herbarium material pertaining to *Endothia* and other Pyrenomycetes.

Dr. Arthur Hollick went to Washington, D. C., the first of April, for six weeks of study on the fossil flora of Alaska in connection with the United States Geological Survey.

Dr. Zentaro Kawase, professor of forestry in the University of Tokio, Japan, was at the Garden recently. Dr. Kawase is in America to make observations in original forest areas, especially those in the southern Appalachian Mountains.

Professor George F. Atkinson, of Cornell University, spent April 6 in the herbarium of the Garden, examining the collections of *Lemanea*, a genus of red algae inhabiting fresh-water streams.

Dr. E. L. Ekman, assistant in the botanical department of the "Riksmuseum" (National Museum) at Stockholm, recently visited the Garden for nearly two weeks. Dr. Ekman took his degree of Ph.D. at the University of Lund and made a botanical exploration of the Province of Misiones, Argentina, in 1907–8. He is now on his way on a second exploration for two years to the West Indies, especially Santo Domingo and the State of Pernambuco, Brazil. The expenses are defrayed by a Regnellian Stipend, instituted by Dr. A. F. Regnell, who lived from 1840–1884 in Brazil. Dr. Ekman is especially interested in the genus *Vernonia* and has studied this large genus of the world. He examined the American collection in the Garden herbarium, affixing his determination to many of the sheets.

Mr. Paul B. Popenoe, of Washington, D. C., spent a day at the Garden recently. He reports a steady increase in the subscription list of the *Journal of Heredity*, of which he is the editor.

Meteorology for March.—The total precipitation for the month was 2.39 inches of which 1.125 inches (11.25 inches of snow reduced to rainfall) fell as snow. Maximum temperatures for each week were as follows: 51° on the 5th, 59° on the 15th, 56° on the 17th, and *73° on the 27th.* Minimum temperatures were 20° on the 9th, 15° on the 13th, *14° on the 21st*, and 26° on the 25th.

ACCESSIONS

MUSEUMS AND HERBARIUM

900 specimens of flowering plants and ferns from Porto Rico. (By exchange with the College of Agriculture, Porto Rico.)

35 specimens of marine algae from Orient, New York. (By exchange with Mr. Roy Latham.)

6 specimens of hepatics and mosses from Austin, Texas. (Given by Dr. M. S. Young.)

15 specimens of grasses from Cuba. (By exchange with Brother Leon.)

7 specimens of flowering plants from western North America and Central America. (Given by Professor T. D. A. Cockerell.)

190 specimens of ferns and flowering plants from Lower Canada. (By exchange with Brother Victorin.)

15 specimens of hepatics from the Philippine Islands. (Collected by Dr. A. D. E. Elmer.)

5 specimens of mosses from northwestern Canada. (By exchange with Mr. J. M. Macoun.)

1 specimen of *Pogonatum brachyphyllum* from Orient, New York. (By exchange with Dr. George E. Nichols.)

4 specimens of mosses from Texas and New Mexico. (By exchange with Dr. J. N. Rose.)

18 specimens of mosses from Central America. (By exchange with the Royal Botanic Garden, Berlin.)

7 specimens of mosses from Mexico. (By exchange with Mr. Jules Cardot.)

PLANTS AND SEEDS

1 plant of *Hibiscus sinensis* for conservatory. (By exchange with the Department of Parks, Bronx.)

10 cacti. (By exchange with Mr. S. S. Hordes.)

4 plants for conservatory. (Collected by Professor F. L. Stevens.)

1 orchid for conservatory. (Collected by Professor F. L. Stevens.)

1 plant of *Pedilanthus* from Cuba. (Collected by Brother Leon.)

3 plants for conservatory. (By exchange with the Bureau of Plant Industry, Washington, D. C.)

5 plants of *Abutilon*. (By exchange with the Botanic Gardens, Washington, D. C.)

6 plants for conservatory. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

2 plants of *Abutilon Thompsonii*. (By exchange with the Department of Parks, The Bronx, New York.)

15 orchids. (Given by Dr. R. C. Blanchard.)

11 West Indian Opuntias. (Collected by Mr. Henry Tryon.)

2 plants of *Asparagus Duchesni*. (By exchange with the Bureau of Plant Industry, Washington, D. C.)

1 *Harrisia* from Florida. (Collected by Dr. H. H. Rusby.)

11 plants for conservatory, from Porto Rico. (Collected by Dr. N. L. Britton.)

25 plants of *Hyacinthus* and 2 plants of *Atamosco*, from Louisiana. (Given by Mr. E. C. Wurzlow.)

1 plant, *Persea americana*. (By exchange with the Bureau of Plant Industry, Washington, D. C.)

3 plants from China. (Given by Mr. S. E. Taylor.)

23 plants from Santa Marta, Colombia. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

1 *Opuntia humifusa*, for cactus nursery. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

228 plants from Porto Rico, for conservatory. (Collected by Dr. N. L. Britton and Professor J. F. Cowell.)

19 plants from Vieques Island, Porto Rico. (Collected by Dr. J. A. Shafer.)

3 bulbs of *Crinum* from Florida. (Collected by Dr. J. K. Small.)

19 plants derived from seeds from various sources.

1 packet of seed of *Brassica nigra.* (Given by Dr. H. H. Rusby.)

1 packet of gourd seed from Florida. (Collected by Dr. J. K. Small.)

3 packets of seed. (Given by Dr. H. H. Rusby.)

1 packet of seed of *Prunus Besseyi.* (Given by Professor C. E. Bessey.)

1 packet, seed of red melon, from Porto Rico. (Collected by Dr. N. L. Britton and Professor J. F. Cowell.)

382 packets of seeds of herbaceous plants. (Purchased.)

81 packets of seed. (By exchange with the Botanic Garden, Prague.)

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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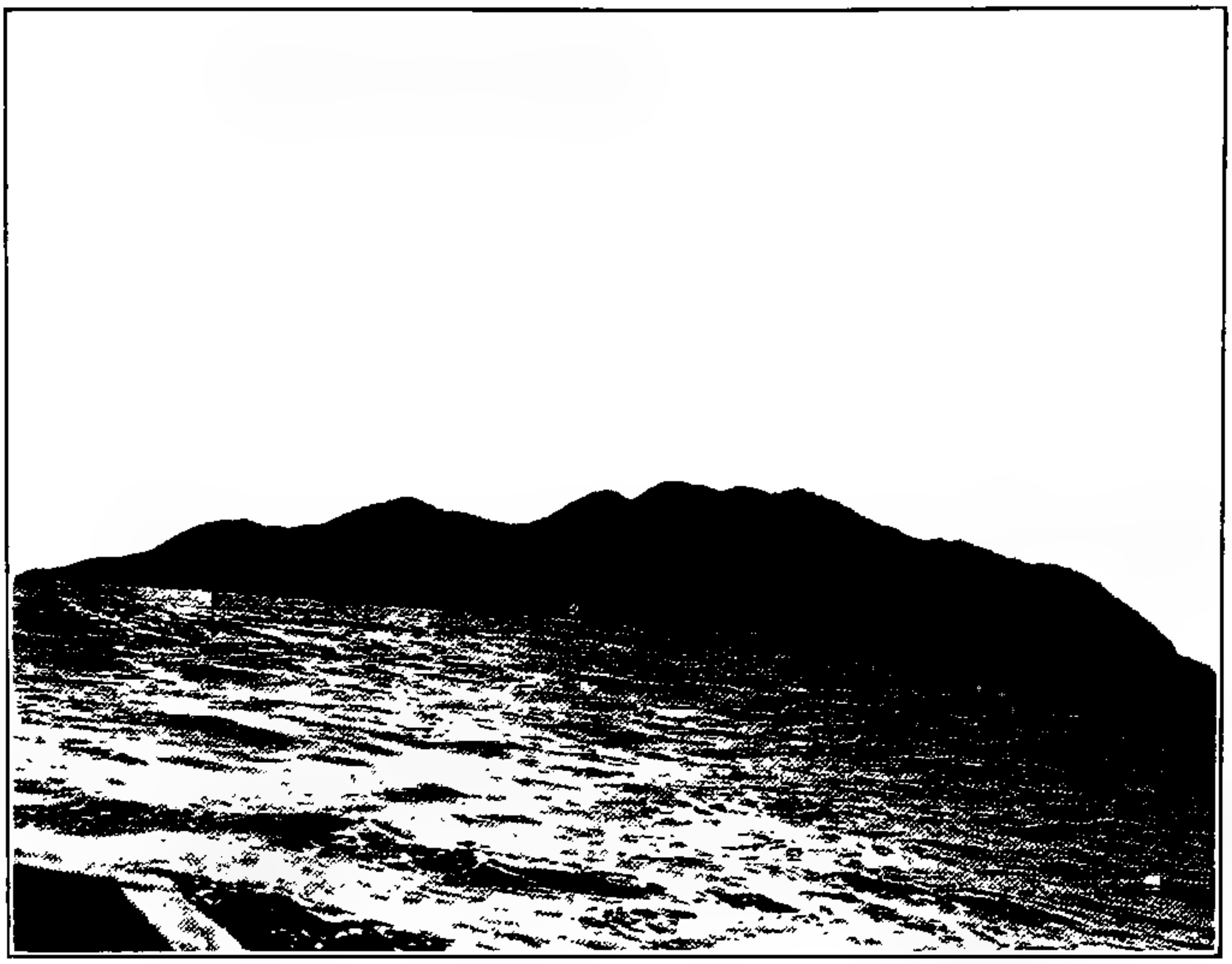
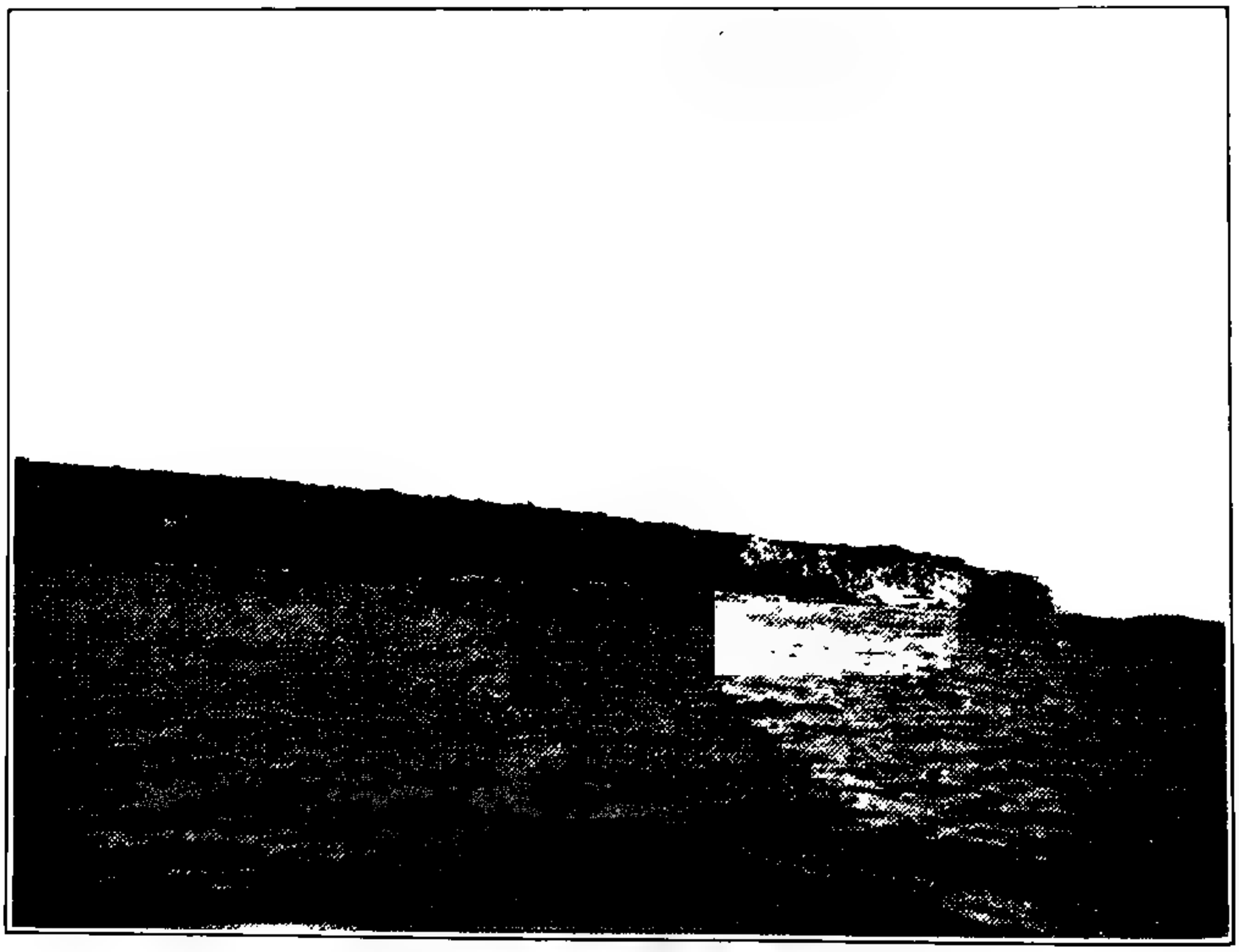


Desecheo Island, Mona Passage.



Mona Island, showing part of escarpment and limestone plateau.

JOURNAL

OF

The New York Botanical Garden

VOL. XV May, 1914 No. 173

BOTANICAL EXPLORATION IN PORTO RICO AND ISLANDS ADJACENT

WITH PLATES CXXXII, CXXXIII AND CXXXIV

TO THE SCIENTIFIC DIRECTORS.

Gentlemen: Botanical exploration in the West Indies has been continued this winter by work in Porto Rico, and especially on the small islands of that colony adjacent. Dr. J. A. Shafer was commissioned at the middle of January for two months' work, mostly on Vieques or Crab Island, east of Porto Rico; the flora of Vieques was heretofore known, almost only from a few specimens collected early in the last century and preserved in the Botanical Museum at Copenhagen; Dr. Shafer obtained over 700 field numbers, which doubtless represent very nearly all the species of land plants existing there, with the exception of the smaller fungi, the collecting of which requires the services of a specialist. Dr. Shafer's account of his work is appended to this report.

On February 7, I proceeded to Porto Rico with Mrs. Britton; we were accompanied by Mr. John F. Cowell, director of the Buffalo Botanic Garden, who had visited Porto Rico with us in 1906,* and Dr. Frank E. Lutz, assistant curator of invertebrate zoölogy in the American Museum of Natural History. Mr.

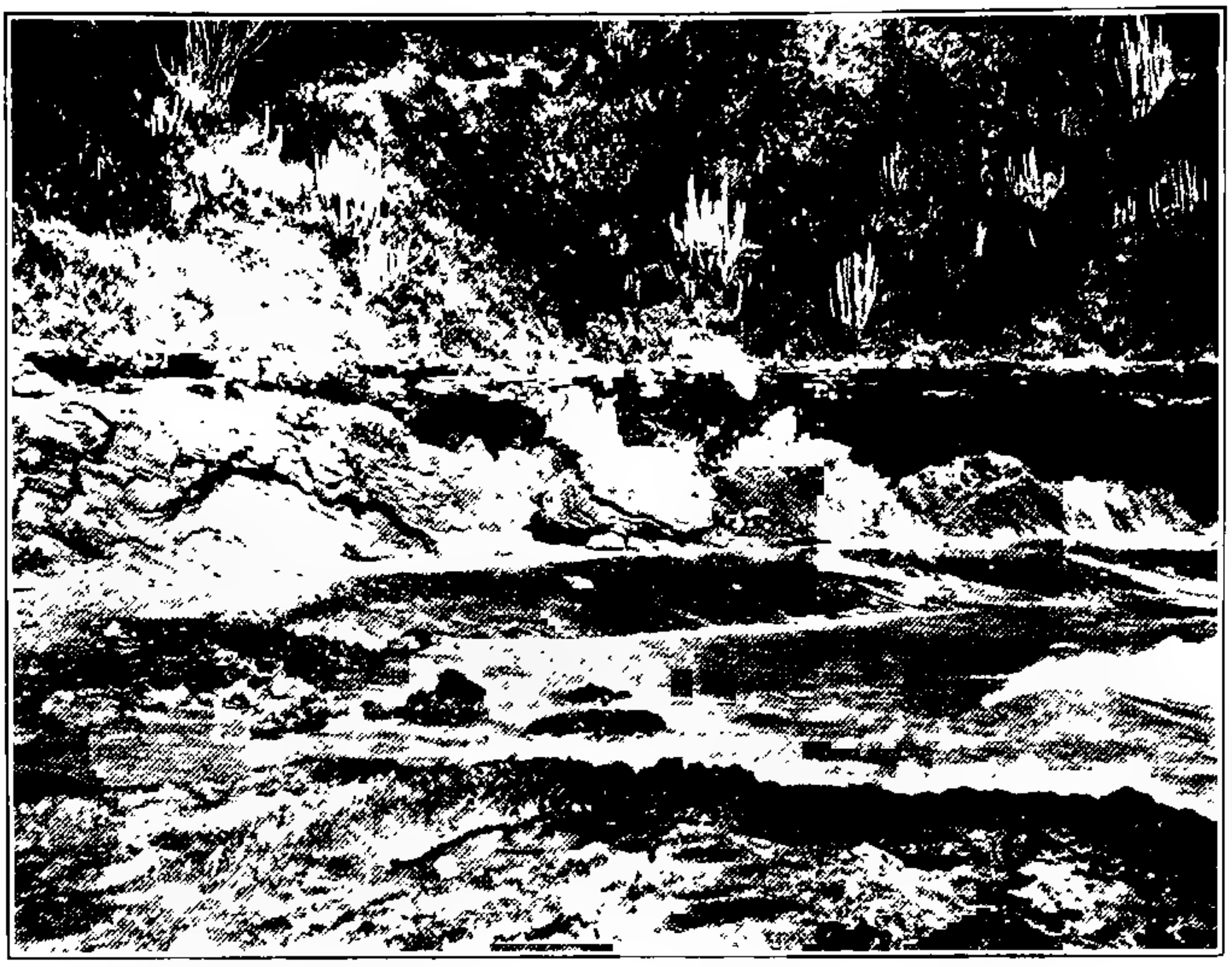
* See JOURNAL NEW YORK BOTANICAL GARDEN, 7: 125–139.

[Journal for April, 1914 (15: 69–93) was issued May 4, 1914]

Cowell paid special attention to obtaining living plants and seeds; Dr. Lutz obtained a large collection of insects, arachnids, land mollusks, and some vertebrates, which enrich the West Indian collections of the Museum of Natural History, and studied the interrelations of the insects and plants; he also secured many photographs, five of them are reproduced herewith; it fell to Mrs. Britton to care for and preserve a large part of the botanical collections.

Arriving at San Juan on February 11, we were met on the wharf by Major Basil Hicks Dutcher, M.D. U.S.A., now stationed in San Juan, and to his aid much of the success of the expedition is due; Major Dutcher's noteworthy previous field work in mammalogy in various parts of the United States and his participation in the exploration of Death Valley made him thoroughly acquainted with the needs of a natural history expedition and we were most fortunate in having his coöperation. Three days were spent in San Juan and vicinity and collections were made at Santurce, Martin Peña, Dorado, Candelaria, and Cataño. In shallow water on the borders of a marsh between Santurce and Martin Peña, we found the Porto Rican species of the interesting fern-relative *Marsilia*, bearing ripe sporocarps, and these specimens have made possible the determination of its true biological relationship, which has been in doubt. A small yellow-flowered bladderwort (*Utricularia obtusa*) and a number of other plants of interest inhabit this marsh.

Proceeding to Mayaguez by railroad February 15, we were met by Mr. W. E. Hess, plant propagator of the Porto Rico Agricultural Experiment Station. One of the principal objects of the trip was the exploration of the botanically and entomologically little-known Porto Rican islands Desecheo and Mona, situated in the Mona Passage between Porto Rico and Santo Domingo; Mr. Hess had secured the sloop "Dama" with a crew of six for this purpose, and, after outfitting, some collecting, and a visit to the plantations of the Experiment Station, including a call on Mr. D. W. May, director, the party, reinforced by Mr. Hess, through the kind permission of Mr. May, and with the exception of Mrs. Britton, who stayed in Mayaguez to preserve



Landing place Desecheo Island, showing *Cephalocereus Royeni*.

Melon cactus and Snowy cactus, on limestone plateau, Mona Island.

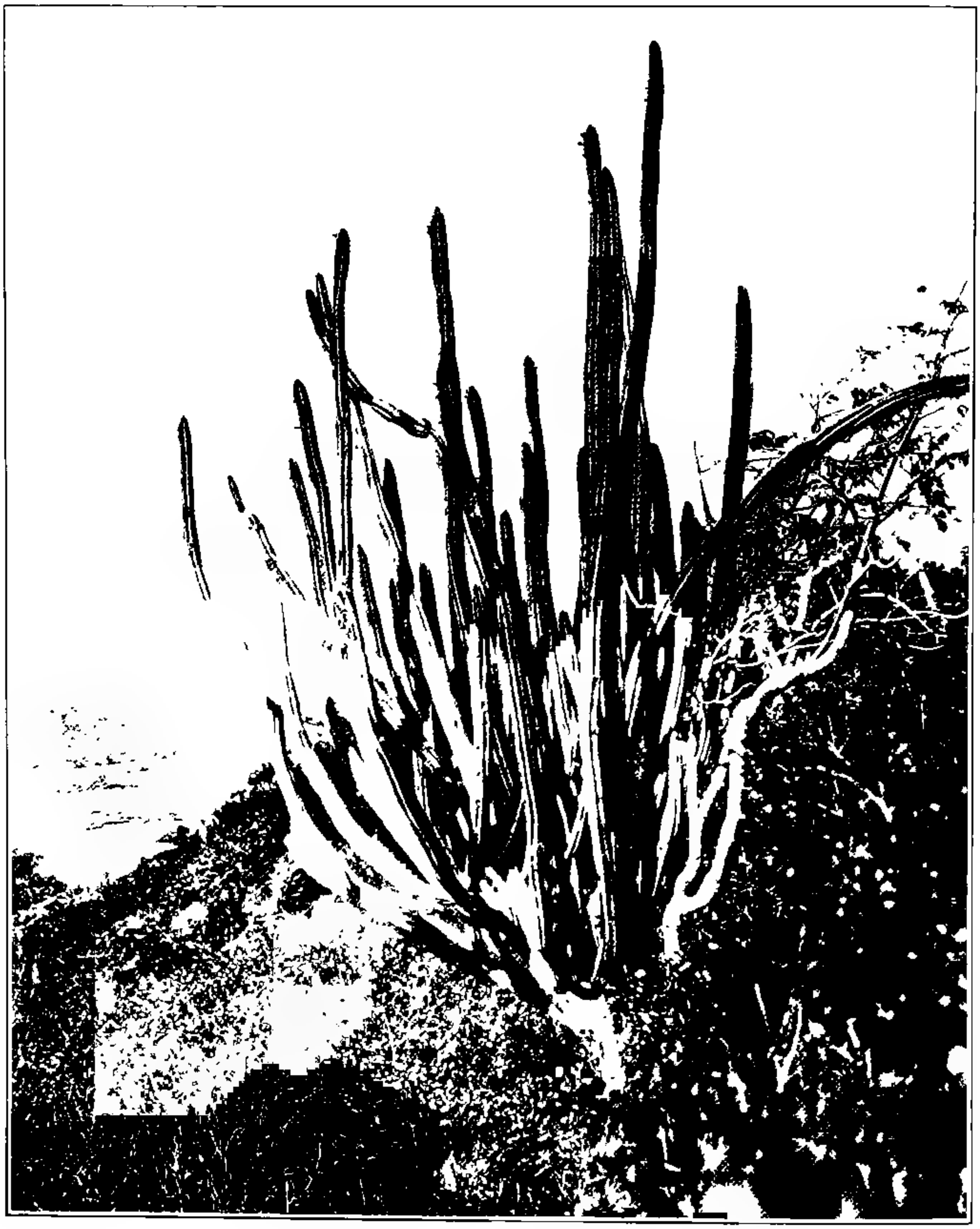
the collections already made, and for studies of mosses in the vicinity, sailed from Mayaguez on the afternoon of February 17, and arrived at Desecheo, about 18 miles northwest, at sunrise the next morning.

Desecheo has an area of somewhat more than 1 square mile, and is almost wholly bordered by rocky coasts. It rises abruptly into several hills, the highest of them probably about 400 feet in altitude; its rocks are partly eruptive, but there are stratified tilted series at the water-level on its western side, and also an old raised beech, elevated about 20 feet, composed of several kinds of rocks and pebbles. The soil, at least in the valleys, is quite deep and the vegetation dense, despite the low rainfall, which is evidenced by the great abundance of eight species of native cacti. The largest tree is the so-called West Indian birch (*Elaphrium Simaruba*), with trunks up to a foot in diameter. Mr. Hess had accompanied Professor F. L. Stevens to Desecheo at the end of May, 1913, at which time they spent parts of two days in the first botanical collecting accomplished there; I had studied a set of these collections, sent by them to the Garden, and we, therefore, collected for the most part only species not obtained by them; the two expeditions visited nearly all parts of the island and, presumably, collected specimens of nearly all of the land plants existing there, Professor Stevens having given special attention to the parasitic fungi; it is probable that few marine algae could be had, for the island is in deep water and the ocean swells break heavily upon it, even on the western, leeward side, and we saw no evidence of reefs. A single species of land alga was found on a decaying log in a slightly moist valley. Lichens are abundant on rocks and trees; some twenty-five species were obtained, and there are probably more. We collected a few kinds of the larger fungi growing on decayed wood, and others probably exist; two species of toadstools were found and lost. Two species of hepatics were obtained on trees and rocks in the same valley where the land alga was found, and four kinds of mosses were seen. The only fern noticed is the xerophytic *Cheilanthes microphylla*, quite abundant on some of the hillsides. The total number of kinds of flowering plants ob-

tained by the two expeditions is about 90. The total land flora of Desecheo is thus, presumably, not over 200 species; all but four or five are there naturally, there having been no cultivation on this island, which is ordinarliy visited only by fishermen.

Desecheo is a national bird preserve, and several kinds of water-birds nest there in large numbers. We had to pick our way over much of the island to avoid stepping on eggs. The only available landing place under ordinary conditions of wind and sea is on the southwestern side, a small harbor with rock sides and a gravel beach, where we landed from the small boat of the sloop, and where we were trapped for a day and a night, the heavy seas preventing a return to the vessel. Luckily, we had plenty of water and our gunny-sacks filled with hay, on which we slept under overhanging ledges, after becoming accustomed to the loud music of the breakers on the little beach. Most of the flowering plants of Desecheo are found also on the southern, dry side of the Porto Rican mainland, but the snowy cactus (*Mamillaria nivosa*) and *Morisonia americana*, a small tree of the Caper Family, have not yet been found there, although both occur on Culebra Island, just east of Porto Rico. The low rainfall of Desecheo and its steep configuration render it unavailable for agricultural work. It might come into use for forestation, but it is probably more valuable as a bird preserve than any other purpose. The island is not inhabited.

At 8 o'clock in the morning, February 20, we set sail for Mona Island, about 30 miles to the southwest, and lying almost exactly midway between Porto Rico and Santo Domingo, casting anchor at Sardiñera at 5 in the afternoon. Through the kind permission of the Mona Island Fertilizer Company, we made camp in one of their buildings at this point; to Mr. Marc Lejeune, manager of this company at Mayaguez, we are grateful for aid and advice. Mona has an area of perhaps 20 square miles; most of it is a limestone plateau, elevated at its highest point about 175 feet above the ocean, and nearly level, there being no hills; the surface of this plateau is rough and rocky, with scarcely any soil, though densely clothed with shrubs and small trees of a number of species; what soil there is occupies small pockets in the uneven



Cephalocereus Royeni on Desecheo Island.

surface, and, like that of other limestone islands of recent geologic age, is red, owing to the concentration of the ferruginous elements of the stone through the leaching of those more soluble. This limestone plateau is honeycombed by caves and caverns, some of them of large dimensions, and contain stalactites and stalagmites; in the caves are found the deposits of phosphate of lime, which have been extensively mined at intervals in the past, the workings being now idle; these phosphates appear to be the result of the leaching of the limestone by water percolating from the plateau, which has made the caves and caverns, leaving the phosphates as the least soluble constituents of the rock; the rainfall of Mona is evidently quite high. This limestone plateau is bounded nearly all around by steep escarpments, but may be reached at many points on the western and southern sides over the talus of large masses of rock which have fallen, although for long distances the cliffs are unscaleable; this talus, along the southwestern side, provides a home for several kinds of large trees; the manchioneel (*Hippomane Mancinella*) and one of the wild figs (*Ficus laevigata*) are here represented by trees up to at least 60 feet high, and are the largest trees of Mona. The shade afforded by these trees permits the growth of two species of ferns, one of them (*Cyclopeltis semicordata*) forming as fine a colony as may be seen anywhere, the other is a maidenhair (*Adiantum fragile*). Several kinds of mosses and hepatics have found here a suitable home on rocks and trees; several of the larger fungi are abundant on decaying logs. Many kinds of lichens grow on rocks and trees.

Along the western and southwestern sides of Mona a low plain extends for several miles, about half a mile wide at its broadest part, underlain by coarse coral-limestone, some of the coral masses being several feet across; this is, evidently, at least in part, an uplifted coral-reef, averaging, perhaps, 15 feet above sea-level, bordered for most of its length by coral-sand beaches, which, at Sardiñera, project into a sandy point; there are several small *playas* at other points on the coast. The soil of this low plain is much more abundant than that of the plateau and provides opportunity for agricultural operations. The present

inhabitants are said to number about 40; cotton grows there exceedingly well and considerable is produced; cassava, bananas, and a variety of garden vegetables are cultivated; but the principal industry at present is charcoal-burning, and the low dense natural forest of the plain is rapidly disappearing under the machete. This forest is of great interest, being composed of a large number of kinds of trees, averaging about 25 feet high, and is inhabited by two rare orchids and by many species of low plants. The butterfly orchid (*Epidendrum papilionaceum*) is very abundant, and its purplish flowers clustered at the end of long stalks were the floral feature at the time of our visit. The island is wholly United States Insular Government property, and it would be well if the remainder of this forest could be preserved. It evidently extended originally all over the plain; the part nearest Sardiñera and other areas were long ago cut off by a German colony, who worked the phosphate mines, and evidences of this occupation are to be seen in massive concrete tanks and ruins of other structures; the departure of these residents is said to be due to differences of opinion between the German and Spanish Governments.

Professor F. L. Stevens visited Mona on December 20 and 21, 1913, and was evidently diligent in botanical collecting, for, in addition to his special errand for studying the parasitic fungi, he brought specimens of about 150 species of flowering plants to the Agricultural College at Mayaguez, and sent them to me for study; we mostly collected only species not observed by him. The two collections indicate a total flora of flowering plants of about 230 species, and it is improbable that many others exist there. The land cryptograms probably outnumber the flowering plants, so that the total land flora of Mona is apparently as high as 500 species; a number of the flowering plants are, however, introduced as weeds of cultivation and are not a part of the original flora. Marine algae are abundant on the fringing reefs along the western coast, but a "norther," which blew strong for several days and caused the "Dama" to flee for safer anchorage, prevented any sea work during our stay. On February 25, we moved camp southward to Ubero, and established it in our large

tent on a sand-dune between two sea-grape trees. From this point we traversed the plateau nearly to the lighthouse on the eastern side, and, at another time, Mr. Hess went by rowboat around the cliffs to the lighthouse itself, while the others of the party studied the talus. Several species of cacti were observed on Mona; they are mostly on the plateau, and locally very plenty, especially the snowy cactus (*Mamillaria nivosa*), which exists there in countless numbers, being more abundant than on any other island we have visited. We sailed from Ubero at 6:30 on the evening of February 26, and, after cruising eastward under light variable winds, we reached Mayaguez at 10 o'clock the following evening, well satisfied with the results of our Mona Passage voyage, which yielded 313 field numbers of plants, among them over 500 lbs. of living cacti, and the first comprehensive knowledge of the land invertebrates of Desecheo and of Mona.

Our next collecting base was Arecibo, on the north coast of Porto Rico, where we proceeded by rail on March 1, Mr. Hess remaining at Mayaguez. Collections were made on that day on low limestone hills near the lighthouse, where a desirable museum accession was made in the fruits of *Hyperbaena*, a vine of the Moonseed Family. On March 2. we went by carriages to Hatillo and Quebradillas, and studied coastal thickets and limestone hills and ravines; our special object was to see the small palm which here clothes the coastal cliffs. It is a beautiful plant, the largest one observed, with a trunk only about 6 feet high, its leaves shining above, whitish beneath; we hoped to obtain its seeds for germination, but none could be had at this time of the year. With it grows a vine of the Morning-glory Family with bright red flowers, also desirable for cultivation. A small pond near Hatillo is beautified by a growth of *Neptunia*, with bright yellow flowers in globose heads, its leaves sensitive to the touch; plenty of seeds of this unusual sensitive-plant were obtained. March 3 was given to work on the limestone hills at Hato Arriba, on the road toward Lares, where a rich flora was found and specimens of 70 species obtained, among them many beautiful ferns and mosses. Many orchids and bromeliads were here collected

for growing. On March 4, we visited the limestone hills and cliffs on the road toward Utuado; here high vertical cliffs support another Porto Rican palm, almost all of which is inaccessible, at least from below, but two active boys finally succeeded in reaching one for us, but it proved to be barren; an *Agave* grows sparingly on these cliffs and three young plants were obtained. Many kinds of ferns and mosses were collected in wet woods and on rocks, and the growth here of the small red-flowered *Gesneria cuneifolia*, endemic in Porto Rico, is noteworthy. March 5 was occupied in packing and care of collections, and in a visit to limestone hills of Manati, where the most abundant growth of the cycad *Zamia integrifolia* ever seen by us was observed.

Reaching San Juan by railroad in the afternoon, we found that through the coöperation of Mr. John R. Johnston, plant pathologist of the Sugar Experiment Station at Rio Piedras, a trip had been organized to the Sierra de Naguabo, high mountains in the southeastern part of Porto Rico. On the following day, we went to Naguabo by motor car, where the party was hospitably entertained by Messrs. Alexander R. O'Neill and B. B. DeWitt at the San Cristobal Sugar Mill, and by Mr. Harold I. Sewall at his residence; the kindness and coöperation of these gentlemen is gratefully acknowledged. On March 7, we climbed about 7 miles over foothills of the Sierra and made camp at 1,600 feet elevation in a deserted shack built mostly of the leaf sheaths of the mountain palm, *Acrista monticola*, and in our tent pitched alongside of it. Reinforced by Major Dutcher, Mr. Johnston and his assistant, Mr. Stevenson, Mr. T. H. Jones, entomologist of the Sugar Experiment Station, Dr. Shafer, who had come over from Vieques, and by Mr. Hess, who had meanwhile rejoined us, we had nine collectors assembled, and for three days the mountains were searched for plants and invertebrate animals, Mrs. Britton remaining at the lower elevations most of the time for the care of the collections, which were sent down by bearers at frequent intervals. The southern slopes, ravines, and summits of the Sierra yielded us specimens of over 200 species of plants, some of them of much interest, including many ferns and bromeliads taken for growing under glass, and herbarium material of

several rare trees. In order to cover as much territory as possible during our limited time, the party divided, some visiting the higher crests, including the summit of "El Duque," said to be about 3,700 feet, although our aneroid indicated 3,560, while others explored the ravines and ridges from the camp level up to 2,900 feet; at the higher elevations we were within the southern limits of the National Forest Reservation. Tree-ferns commence at about 1,200 feet, and form beautiful masses of foliage on slopes and in ravines; the mountain forest is dense and luxuriant; at the summit the vegetation is a very compact growth of a few kinds of shrubs and small trees, almost firm enough to walk upon, and very difficult to penetrate. Orchids, except a few terrestrial species, are rare on the southern slopes. Mosses and hepatics were very abundant, densely covering trees and rocks, and several kinds of delicate filmy-ferns abound.

We broke camp on the afternoon of March 9, reached San Juan the following afternoon, and sailed for New York at 5 P.M. on March 11, reaching the Garden on March 16. The large collection made in the mountains took up much of our time on the voyage for its preservation, but everything collected was made safe, and we were fortunate in reaching New York on a warm day, the living plants being taken from the dock to the Garden without injury from cold. All together, the Porto Rico expedition of this winter brought home over 1,600 field numbers of plants, including some 6,000 specimens; these collections materially improve our representation of the West Indian flora, and the duplicates will be valuable for exchanges with other institutions.

Respectfully submitted,

N. L. BRITTON,

Director-in-Chief.

BOTANICAL EXPLORATION ON THE ISLAND OF VIEQUES, PORTO RICO

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Sir: Pursuant to a commission as collector for the New York Botanical Garden for a period of two months, I sailed from New York on the S. S. "Brazos," January 17, and arrived at San Juan,

Porto Rico, the following Wednesday, where by making close connections with the S. S. "Ramos," I reached the Island of Vieques at noon of January 23. Accommodations were obtained in the town of Isabel Segunda, where I made my headquarters during the time I spent upon the island

The island of Vieques lies southeast of Porto Rico, of which it is politically a part, and is about nineteen miles long and from three to five miles wide. The greater part of the island is made up of a soft brown eruptive rock with occasional outcroppings of a harder bluish rock, very similar to the formation of the Virgin Islands lying to the eastward. At the western end there are large boulders of a hard, light-gray rock, probably syenite. Some of the larger peninsulas projecting from the south side and all that portion of the eastern end of the island that is separated from the main body by bays and salinas, are composed of a soft fossiliferous limestone, as is also the small island, Cayo Puerto Real. Several of the short points on the northeastern shore are tipped with a very hard bluish limestone. The surface is very hilly, often steep, but seldom precipitous. Few of the hills attain an altitude of over five hundred feet, the highest being Cerro Ventana on the southwestern end, where a height of one thousand one hundred and twenty-five feet was recorded by the aneroid barometer. The summits of these hills are rocky and covered for the most part with trees and shrubs; the sides are usually of good soil and under cultivation, or used for pasturing. Vieques is essentially a cultivated island, having been pastured for a long time. The cultivation of sugar cane has recently been carried on very extensively, so that at the present time the western two thirds of the island is practically all in cane from the seacoast to the rocky tops of the low hills. A crop of Indian corn is usually grown between the rows of newly planted cane on the more easily worked tracts, while on the hillsides "cinnamon trees," that may have stood in the original forest, have been preserved, and a crop of leaves is annually gathered from them. These are shipped to Porto Rico where they are distilled for the essential oil of bay, from which the popular toilet article bay rum is made.

The eastern portion of the island is given over to pasturage,

but most of it is at present being neglected and is growing into brush and thickets. This part is also much drier and more rocky and is densely wooded with small trees, very similar to those of the Virgin Islands. A characteristic feature of these forests is the great abundance of a tall cactus, a species of *Cephalocereus*, which takes the form of a tree with a definite trunk up to ten inches in diameter, and eight to twelve feet high before branching. The entire tree often attains a height of thirty feet and in this form it is seldom seen isolated, but occurs with the hardwood trees, forming about one fourth of the forest. A species of *Agave* was seen on one dry hillside only. On this end of the island the red-headed melon-cactus was profusedly abundant on coastal cliffs of the southern shore.

Throughout the island there is little growth underneath the trees in the rocky forests, the most abundant herb being a broad-leaved creeper, a species of *Pilea*. An orchid, *Epidendrum ciliare*, is very abundant from the tops of the highest hills down to the sea cliffs, where it grows within a few feet of the salt water, the large clumps sometimes forming a striking feature. This orchid seems to be entirely absent, however, on the eastern portion of the island, where it is replaced by another member of the genus, with flower-stalks four to six feet long, supporting a few beautiful light-purple flowers; the same species occurs on the drier parts of the Virgin Islands. Only twelve species of ferns were observed.

I remained here until March 2, visiting all parts of the island and examining probably every kind of plant environment. A very fair representation of its flora was secured comprising over seven hundred field numbers and probably more than six hundred and fifty species. No doubt an examination of the same region at a different season of the year would reveal other plants.

Owing to the failure of the S. S. "Ramos" to sail as scheduled, I was obliged to return to San Juan by a more tedious route, taking a small boat to Fajardo, and proceeding overland to San Juan, where I joined your party on March 5, and had the satisfaction of ascending Monte El Duque, perhaps the highest point on Porto Rico.

Respectfully submitted,

J. A. SHAFER.

CHARLES BUDD ROBINSON

Dr. Charles Budd Robinson, formerly a member of the scientific staff of the New York Botanical Garden, was murdered December 5, 1913, by a band of ignorant fanatics at a small Boetonese settlement on the island of Amboina in the Dutch East Indies, while engaged in botanical exploration for the Philippine Bureau of Science. The authorities in Amboina reported his death as due to a superstitious fear caused by his sudden, unexplained appearance alone, dressed in a strange garb and armed with a strange collecting knife.

Dr. Robinson was born in Pictou, Nova Scotia, October 26, 1871; was educated at Dalhousie College, Cambridge University, Columbia University, and the New York Botanical Garden; and served the Garden as assistant curator from July, 1906, to January, 1908, and from January to September, 1912. He was an enthusiastic botanist and contributed valuable papers on the flora of Nova Scotia, the Characeae of North America, and the seed-bearing plants of the Philippine Islands. It was with the hope of connecting certain elements of the Amboina flora with that of the Philippines that Dr. Robinson undertook the explorations which led to his death.

Resolved: That the scientific directors of the New York Botanical Garden deplore the death of Charles Budd Robinson, and appreciate the value of his services to botanical science.

Resolved: That the board of managers be requested to accept and invest a fund, contributed by friends and associates, to be designated "The Charles Budd Robinson Memorial Fund," the income to be available, at intervals, for aiding botanical exploration.

Resolved: That the foregoing preamble and resolutions be entered on the minutes, and a copy sent to his bereaved family.

Adopted by the Scientific Directors April 11, 1914.

At the meeting of the Board of Managers held April 16, 1914, the foregoing request of the Scientific Directors was granted.

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

TROPICAL VEGETABLE FOODS*

It may be noted that the term "tropical," as used in this lecture, relates rather to climate than to latitude. When it is remembered that rising 200 feet in altitude has about the same effect on temperature as proceeding one degree toward the north or south pole, it becomes apparent that every climatic condition may be encountered in climbing the high mountains of Ecuador, directly under the equator. Millions of people there subsist chiefly upon vegetable products which can grow only in a cool-temperate or frigid region and which could not properly be classed as tropical foods, although their growth and use is principally within the geographical tropics. For example, most people on learning that a majority of the people of Ecuador, Peru and Bolivia subsist largely upon quinoa, would at once class this as an important tropical food, yet there is scarcely any other crop that requires so cool a climate. It is frequently partly covered with snow during the growing season, and its favorite climate is one too cold to permit barley-grains to develop upon their stalks. Potatoes, also, are very largely grown at these high altitudes, within the tropics, yet it is well known that potatoes can neither be grown nor successfully transported in tropical regions.

As a general thing, dwellers in the tropics eat rather sparingly of meat, and such meat is, like the people themselves, mostly lean. From this it might be assumed that the tendency is to avoid a carbonaceous diet, yet the reverse is true. Starchy foods and sugary fruits are mostly in demand. These foods are rather freely eaten and it is not easy to understand what becomes of the carbon, since the people are rarely fleshy and heat-radiation is at a minimum. As might be expected from the fermentation of such foods, intestinal diseases are very common and constitute, in fact, the chief cause of death.

Among grains, Indian millet, Kaffir corn or dhouro probably ranks first in extent of consumption in the tropics. First place is usually accorded to rice, but this is far too expensive an article

* Abstract of a lecture delivered at the New York Botanical Garden on November 8, 1913.

for the poorer people, who sell it largely for export, and consume the cheaper and coarser millet. It is noteworthy that this grain is the seed of one variety of the same plant that yields our broom-corn and our sorghum sugar-cane. It is a more nutritious food than rice, which, contrary to popular lore, is of very low dietetic value. When eaten in the unpolished state, rice is much more nutritious, since its richest layer is just under the surface, and is removed in the polishing. Very often, however, insect eggs exist in this outer layer, and unpolished rice thus becomes subject to the attack of the weevil. Rice is more largely eaten in China and Japan, dhouro among the poorer classes of India and Africa. In the American tropics, maize or Indian corn is the chief grain. Travellers in Mexico always marvel at the vastness of the areas that they see planted with this crop. For miles upon miles the trains pass through fields of maize which reach as far as one can see in each direction. At short distances are little shelter boxes on stilts fifteen or twenty feet high, in which a watcher with a gun may be concealed and ready to shoot marauding trespassers. This corn, prepared in various ways, but mostly in tortillas, constitutes the staple food of the Mexican peon, and he certainly preserves a remarkable strength by its use. All through the South American tropics it is one of the staples and is, in the parched state, the chief reliance upon long foot-journeys. In the more luxuriant regions, storage is not necessary, since it may be planted, and at the same time a crop harvested, upon any day of the year. It has numerous and destructive enemies, vegetable and animal, which attack both stalk and grain. The grain is specially liable to the attacks of worms, the larvae from eggs deposited in the young grains. In many sections, especially in the Orinoco Valley, a natural breeding process has developed varieties with an extremely horny epidermis to the grains, which resists the efforts of the egg depositor.

Among edible seeds and nuts, the bean probably holds the first place, if we include all of its numerous genera, species and varieties. Otherwise, this place must be accorded to the peanut, for probably no one kind of bean is so largely used in the tropics proper. Although the peanut is largely consumed in the East

Indies and British India, China doubtless uses more than any other country. In tropical America also, it is a staple food upon the table, and is introduced to a great variety of dishes. A sort of beer or fermented liquor is also made from it.

Throughout the Amazon Valley, the Brazil nut (*Bertholetia*), and to a less extent the monkey-cup nut (*Lecythis*), are similarly employed. These nuts, here known only as a table delicacy, constitute one of the staple foods of the aborigines and are similarly used by the settlers. They are boiled, roasted, used as stuffing in fowls, in soups, hashed up with meat, and used in numerous other ways.

What maize is to the Mexican, rice to the Chinaman and dhouro to the Kaffir, such is the coconut to the South Sea Islander. Not only does he cook it in a great variety of ways, but it yields butter for his cassava bread, fat for his cooking purposes and even plain, fermented and distilled beverages. The surplus, chiefly in the form of "copra," sold for export, yields a large part of his revenue.

Fats employed as butter-substitutes are yielded by many nuts and seeds of the old world tropics, a number of them belonging in the palm family. The cashew or caju nut, in the sumac family, is one of the most delicious tropical products of its class. The entire fruit, when ripe, might be compared to a good-sized very juicy pear, with a single lima-bean, in a thick and hard pod, adhering to the end. The "pear" portion consists of the flower-stem, enlarged and fleshy, while the "bean" portion is the ripened ovary. The juice of the pulp, though very astringent, has excellent thirst-quenching properties and is used in making a wine that closely resembles Madeira. The "bean" is shelled out, roasted and salted, and used like salted almonds, but is very much better than the latter. It is now to be purchased at many of our first-class grocery stores.

The variety of beans, "pulse" of the Scriptures, cultivated in tropical countries, is quite bewildering, and the exact botanical origin of some of them is still in doubt. In Mexico the common red bean or "frijole" is most used, although a small black bean is largely consumed. Both are true beans (*Phaseoli*), but the

garbanzo, almost as commonly served as the frijole, is *Cicer arietinum* L. In the subtropics, *Faba vulgaris*, the French, broad or horse bean, is largely grown. It is a large bean, shaped like the lima, and is often roasted and salted for the table, or to be eaten out of hand, as our children eat peanuts. The lentil (*Ervum lens*) is one of the most ancient of foods and is a great staple in the Orient, especially in Egypt. In southwestern Asia and northern Africa, the related plant *Trigonella* yields a bean-like seed that is different from all others in the family. It is not only richly albuminous, but contains an alkaloid that gives it a bitterish taste, and renders it stomachic and tonic. The pigeon-pea, *Cajanus Indicus*, is another small bean that is delicious, as well as very nutritious and wholesome. It is largely grown in the West, as well as in the East Indies. In China, the Soy bean (*Soja*) is a very important product. It requires an experienced cook to make it palatable, but the Chinaman produces with it some remarkably savory dishes. It contains a disagreeably smelling and tasting fatty oil. This is removed and used for technical purposes. The remainder, being free from starch, is much eaten by diabetic patients.

Of tropical root-crops, among which are included tubers, bulbs and corms, as well as true roots, the most important are the several species of yams, the sweet potato, the Cassava and Taro. The white or Irish potato cannot be grown with advantage, even where it is able to exist. Its tubers become watery and sweetish and it decays within a few days after being dug, or even transported into a tropical climate. The Andean mountaineers have a way of freezing the water out of potatoes, after which they exhibit a corky dryness and will keep indefinitely. In this condition they are easily carried into tropical regions. I have some samples of this "Chunya," made in 1884, which are in perfect edible condition.

The sweet potato, a plant in the morning-glory family, is too well known to require description. Its cultivation is world-wide in the tropics. The yam, of very similar appearance, is yielded by a number of species of *Dioscorea*. Some of these varieties give off prussic acid and are fatally poisonous, with almost in-

stantaneous effects, if eaten before this poison has been dissipated, which is usually done by exposing the roots in thin slices to the action of running water for some hours.

The same poison is produced in the bitter cassava or manihot, the cultivation of which is general in tropical America and common in other tropical regions. For this reason it is rarely eaten. Its starch is extracted and forms the tapioca of commerce. Sweet cassava, from another species of Manihot, is very largely eaten, as well as used for the extraction of tapioca. It is a large fusiform root like a very large dahlia root. It is the great root-crop of tropical America, and is eaten boiled, baked and roasted in the ashes, and is also ground up into a flour from which cassava bread is made. This bread is noted for its keeping qualities. It may be carried about by travellers for months, or even years, if some care is taken with its storage. Sago is a very similar starch to tapioca, but is made in the East Indies from the soft inner portions of the trunks of a number of palms. Most of the article sold for sago in this country is really tapioca. True sago is of a reddish color. The flavor of the two is very similar. Arrow-root is a very expensive starch, made from the rootstock of *Maranta* and mostly produced in the West Indies. It is popularly supposed to have special nutritive, or even curative properties, but differs not from other starches in those particulars. A spurious arrow-root starch is made in the West Indies and Florida from one or more species of *Zamia*. It is mostly used in making so-called arrow-root crackers of American manufacture.

Of all the tropical vegetable foods, and indeed most important of all vegetable foods, is the banana, destined to become eventually the chief food of the poorer classes of the entire world. The ripe banana, while a delicious dessert fruit, is not adapted to use as a common food, by virtue of its strong and sweet flavor and also its relative indigestibility. The same fruit, however, boiled, baked, or roasted when about three-fourths grown, has very much the flavor of a baked potato, with scarcely any sweetness, and is nutritious, non-cloying and perfectly digestible. The amount of this food that can be grown on an acre per year is so much in excess of any other as to make any comparison rather ridiculous.

The importance as foods of the bread-fruit and Jack-fruit, in eastern countries, is very generally known. They are produced by species of *Artocarpus*, in the mulberry family. Like the green banana, they owe their staple value largely to their freedom from sweetness or other pronounced flavor, so that one does not tire of them when continuously eaten.

Many tropical fruits which are really sugary, like figs and dates, are so generally and extensively eaten that they may be properly regarded as foods proper, rather than as dessert fruits. The subject of tropical fruits is so extensive that it should be treated as a separate lecture, but brief reference to the more important of them may be here made.

The lecturer then exhibited slides and briefly discussed the more important dessert fruits of the old and new world tropics.

H. H. RUSBY,
Chairman of the Scientific Directors.

THE WOMEN'S AUXILIARY

At the meeting of the Board of Managers held December 18, 1913, the President was requested to act under previous authorization and appoint an auxiliary body of women, to cooperate with the Board of Managers.

After consultation with a number of women, the following have been appointed and have accepted this duty:

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. James L. Breese,
Mrs. Delancey Kane,
Mrs. A. A. Low,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Archibald D. Russell,
Mrs. Benson B. Sloan,
Mrs. Henry O. Taylor.

A meeting for organization was held on February 3 at the residence of the President, and a second meeting was held at the same place on April 22. Mrs. Marquand has been elected Chairman of the Auxiliary and Miss Billings Secretary.

SPRING INSPECTION OF GROUNDS, BUILDINGS AND COLLECTIONS

Members of the Garden and their friends were invited by the Women's Auxiliary and a committee of the Board of Managers to be present on the afternoon of May 7 to inspect the grounds, buildings and collections. Weather conditions proved to be ideal, and about three hundred members and their guests in fifty or more motor-cars assembled, with the banner car bearing a Garden flag at the head of the procession.

After the plants in the Main Conservatory Range and the flower gardens adjoining had been inspected under the guidance of members of the Garden staff, Dr. W. Gilman Thompson, President of the Board of Managers, made an address of welcome and then introduced Dr. N. L. Britton, Director-in-Chief, who briefly outlined the development of the Garden reservation of two hundred and fifty acres of land in Bronx Park.

The procession left the Main Conservatory Range at four o'clock for an inspection of the Herbaceous Garden Valley, the Gorge of the Bronx, the Hemlock Forest, and the Water Gardens and Lakes, spending part of the time in the cars and part on foot.

Tea was served at five o'clock in the Museum Building, in the Gallery of the old Chinese paintings of tea presented by Dr. Reginald H. Sayre, who was present and gave an interesting account of the paintings. A living tea plant was also exhibited, and various questions were answered regarding the origin and preparation of different kinds of tea.

The guests were afterwards guided through the museums, library, and herbarium. A large collection of paintings of cactuses in flower recently made by Miss Mary E. Eaton were on exhibition in the herbarium.

THE PRESERVATION OF OUR NATIVE PLANTS

Early in February a circular letter was sent to all the principals of the public schools and high schools of the Bronx asking for their coöperation and requesting that the classes from the 4th

to the 8th grades be allowed to write compositions on "The Preservation of Our Native Plants" particularly in the parks and the vicinity of Greater New York. A list of topics on trees, shrubs, wild flowers and ferns was also sent for the use of the teachers and separates from the JOURNAL OF THE NEW YORK BOTANICAL GARDEN of the articles on "Wild Flowers Needing Protection" illustrated with colored plates, were also sent to each school. Eight of these colored plates have been framed, using the income of the fund presented some years ago by the Misses Olivia E. and Caroline Phelps Stokes, and one set has been given on Arbor Day, May 8, to each of the schools that entered the competition. The plates selected were those of the Jack-in-the-pulpit, spring beauty, wild columbine, bird's foot violet. wild pink, wild azalea, pink moccasin flower and the American or mountain laurel. A selection will be made from these compositions, known as the "Stokes Prize Essays" for publication in the JOURNAL.

ELIZABETH G. BRITTON.

SUMMER LECTURES, 1914

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

June 6. "The Soil, the Basis of Success in Gardening and in Other Lines of Productive Work," by Mr. George T. Powell.

June 13. "Diseases of Potatoes," by Dr. Mel T. Cook.

June 20. "Floral and Scenic Features of Porto Rico," by Dr. M. A. Howe.

June 27. "Haïti, the Negro Republic," by Mr. G. V. Nash.

July 4. "The Secret of the Heather," by Mr. F. V. Coville.

July 11. "Explorations in Mexico," by Dr. W. A. Murrill.

July 18. "Arctic and Alpine Plants," by Dr. P. A. Rydberg.

July 25. "Wild and Cultivated Plants of Bermuda," by Dr. N. L. Britton.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for crosstown trolley, transferring north at Third Avenue.

NOTES, NEWS AND COMMENT

Mr. Russell T. Gheen of the College of Forestry, Syracuse University, recently spent a week at the Garden studying the geographical distribution of the forest trees of the State of New York.

Dr. Francis W. Pennell of the Department of Botany of the University of Pennsylvania, who is monographing the subtribe Agalinanae of the family Rhinanthaceae, was at the Garden during the first week in May studying the herbarium specimens of the groups in which he is particularly interested.

The Council of the Bronx Society of Arts and Sciences met on May 9th, at three o'clock in the Director's office on the main floor of the museum building.

A field meeting of the department of botany of the Brooklyn Institute of Arts and Sciences was held at the New York Botanical Garden on the afternoon of May 16, fifteen persons being present. After a tour of inspection of the conservatories, plantations, and hemlock grove under the guidance of Dr. Murrill and Mr. Wilson, the visitors attended a lecture on "American Orchids" by Mr. Nash in the lecture hall of the museum building.

Meteorology for April.—The total precipitation for the month was 2.62 inches. Maximum temperatures for each week were 53° on the 2nd, 65° on the 12th, *83° on the 19th*, and 68° on the 24th. Minimum temperatures were *24° on the 4th*, 28° on the 10th, 27° on the 14th, and 33° on the 24th.

An exhibition of plants and flowers was given by The Horticultural Society, in cooperation with the Garden, in the museum building, on Saturday and Sunday, May 9 and 10. The prizes were offered by the New York Botanical Garden, to be awarded by the exhibition committee of the council of the Horticultural Society of New York. Premiums were offered for the flowers of herbaceous plants and of shrubs and trees, and for plants of pelargonium and calceolaria, of both of which there were some excellent samples.

On May 16, Dr. Mel T. Cook, of Rutgers College and the New Jersey Experiment Station, conducted a party of twenty-two members of the staff and sophomore students of Rutgers College through the conservatories and grounds of the New York Botanical Garden, and on May 19 he made the tour of the Garden with a party consisting largely of seniors.

A special lecture on "The Cultivation of Plants" was given by Mr. Nash on April 22 and 27 to children of several of the public schools of The Bronx who were going into the school gardens on Arbor Day. This lecture was attended by 1400 children, accompanied by their teachers.

ACCESSIONS

PLANTS AND SEEDS.

65 plants for conservatories. (By exchange with the Missouri Botanic Garden.)

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

6 plants of *Doryalis caffra*. (By exchange with the Bureau of Plant Industry.)

2 plants of *Musa Cavendishii multiracemosa*. (By exchange with Porto Rico Experiment Station, through W. E. Hess.)

9 cacti. (By exchange with the United States National Museum, through Dr. J. N. Rose.)

32 plants for nursery. (By exchange with Board of Park Commissioners, Rochester, New York, through Mr. John Dunbar.)

1 plant of *Clerodendron fallax*. (By exchange with Bureau of Plant Industry.)

8 plants for nursery. (Given by Dr. R. T. Morris.)

4 plants for conservatories. (Given by Dr. F. S. Lee.)

8 Costa Rican orchids. (Given by Dr. H. H. Swift.)

13 plants for conservatories. (By exchange with the Bureau of Plant Industry.)

7 plants for conservatories. (By exchange with Dr. D. T. MacDougal.)

25 plants of *Rubus fruticosus*. (By exchange with Bureau of Plant Industry.)

29 plants for nursery. (Given by Dr. R. T. Morris.)

5 orchids for conservatories. (Given by Miss Helen Ingersoll.)

6 plants of *Inodes exul*, derived from seed. (By exchange with Bureau of Plant Industry.)

10 plants derived from seed from various sources.

150 *Paeonia* seeds. (Purchased.)

1 packet of seed of *Berberis Fendleri*. (Collected by Rose, Fitch, and Parkhurst.)

34 packets of seed for Economic Garden. (By exchange with F. A. Miller.)

4 packets of seed from Porto Rico. (Collected by Dr. Britton and Professor Cowell.)

59 packets of seed. (By exchange with Botanic Garden, Braunschweg, Germany.)

138 packets of seed. (By exchange with Botanic Garden, Leiden.)

72 packets of seed. (By exchange with Mr. A. Berger, La Mortola, Italy.)

65 packets of seed. (By exchange with School of Agriculture, Portici, Italy.)

3 packets of seed from Siam. (Given by Mr. Albert Millard.)

1 packet of seed of *Ilex opaca*. (Given by Mr. Henry Hicks.)

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OF

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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JOURNAL

OF

The New York Botanical Garden

VOL. XV June, 1914 No. 174

EDIBLE FUNGI*

The use of mushrooms in this country is as yet very limited and every season an immense quantity of nutritious, digestible, and palatable food goes to waste in our fields and forests which would be utilized in China and many other parts of the Old World. The reason for this is ignorance and fear; lack of knowledge regarding the edible kinds, and a very definite impression that some of them or most of them are dangerous.

All knowledge regarding the edible and poisonous properties of mushrooms is based on experiments, either intentional or unintentional. The only safe rule is to confine oneself to known edible forms until others are proven harmless. If one is a beginner, he is like an explorer in a new country with an abundance of attractive fruit near at hand, which may be good or may be rank poison; he cannot tell without trying it, unless some native, who has learned from his own and others' experience, shares his knowledge with him.

The majority of fleshy fungi are edible. A certain number are bitter, or peppery, or slightly poisonous, or otherwise objectionable, but not deadly. Their digestibility often depends on the way they are prepared and cooked, and on the peculiarities of

* Abstract of a lecture delivered at the New York Botanical Garden on November 15, 1913.

[JOURNAL for May, 1914 (15: 95–117) was issued June 6, 1914]

the individual who eats them. A few are deadly poisonous. Two species, *Venenarius phalloides* and *Venenarius muscarius*, are responsible for most of the deaths from mushroom eating the world over. If these two were thoroughly known and avoided in the vicinity of New York City, there would probably be no fatalities here from mushroom-eating for the next ten years.

My advice to beginners is to confine themselves at first to groups that contain no poisonous species so far as known, or to certain species that cannot be easily confused with harmful ones.

Edible Fungi for Beginners

Common mushroom, morel, chantarelle, beefsteak, and sulphur-colored polypore.

Shaggy-mane, common inkcap, and glistening inkcap.

All puffballs, provided they are white, tender, and homogeneous within.

All coral-fungi, if they are fresh, crisp, tender, and have no bad odor nor bad taste.

The oyster mushroom and its near relatives. These are large, with white gills and short stems, and grow on dead wood above ground.

After considerable study and experience, more difficult distinctions may be made and other groups taken up.

Some Critical Edible Species

Polypores that are sufficiently tender, avoiding certain Boleti and *Fomes Laricis*.

Boleti that have been tested and found edible, avoiding *Suillellus luridus*, *Ceriomyces miniato-olivaceus*, and *Tylopilus felleus* in particular, or all species with red tube-mouths and bitter or peppery taste, and species that turn blue quickly when handled.

Species of *Russula* and *Lactaria* with pleasant odor and flavor, avoiding such species as *L. rufa*, *L. torminosa*, *R. foetens*, and *R. emetica*.

Several species of *Lepiota*, avoiding *L. Morgani*, with green spores, and species of *Venenarius*.

Marasmius oreades must not be confused with *M. urens*, nor with *Inocybe infida*.

Clitocybe, *Tricholoma*, and *Collybia* are usually edible: avoid *Clitocybe illudens*. *Vaginata* too closely resembles *Venenarius*.

Before attempting to use mushrooms at all for food, one should become acquainted with the chief poisonous species, if possible, by consulting any one of several books on mushrooms to be found in the public libraries. The deadly poisonous species are included in the genus *Venenarius*, formerly known as *Amanita*. *Venenarius cothurnatus* is much more common farther south, and *V. solitarius* can hardly be called deadly.

The Chief Poisonous Species

Venenarius phalloides, *V. muscarius*, *V. cothurnatus*, and *V. solitarius*.
Clitocybe illudens.
Inocybe infida.
Panus stypticus.
Chlorophyllum Molybdites (*Lepiota Morgani*).
Russula and *Lactaria*, about ten species.
Rosy-spored species, a few.
Several of the phalloids, probably.
Several species not yet tested, doubtless.

Note that no brown-spored, purplish-brown-spored, nor black-spored species are listed above, but not all have been tested.

Nearly two hundred water-color drawings of local edible and poisonous mushrooms have recently been installed in the public museum of the New York Botanical Garden. These are not accompanied by descriptions, nor are the edible species designated, but the student of fungi will have no difficulty in recognizing most of the common local species from these drawings alone.

Preparing and Cooking Mushrooms

Reject old specimens or those infected with insects, cut off the stems except in rare cases where they are unusually tender, peel a few kinds that seem to require it, wash quickly in cold water, drain and keep in a cool place until ready to cook. As a rule,

mushrooms cannot be kept very long in a fresh condition, and this is particularly true of certain very desirable species. When more are collected than can be used at once, it is best to boil them ten minutes, drain, keep in a cool place, and finish the cooking next day as desired. If allowed to stand in water, the flavor is impaired; also, peeling may remove some of the best flavored parts.

Detailed directions for cooking mushrooms are given in most of the books. The most practical and successful methods resolve themselves into broiling, baking, and stewing. In the first, which I prefer to all other methods, the mushrooms are cooked thoroughly but as quickly as possible on both sides over a hot fire; seasoned with pepper, salt, butter, and perhaps small bits of toasted bacon; and served hot on toast. To bake mushrooms, line the pan with toast, add the specimens, season, pour in half a cup of cream, cover closely, and bake rather slowly for fifteen minutes or more according to quality. In stewing, the mushrooms are boiled in water until thoroughly cooked, then seasoned, thickened, and served on toast. This last method is often used for the tougher or poorer varieties.

W. A. Murrill

STOKES PRIZE ESSAYS*

I. Conservation of City Trees

Some people are of the opinion that scientific forestry can be applied only to the vast forests of the "West"; and that nothing can be accomplished in the congested city of New York by the application of this valuable science. Again, they believe that the planting and transplating of trees in the thickly populated sections of the City, is a waste of time and money. Those who have studied the social conditions of the congested East Side of

* These essays were submitted on Arbor Day, May 8, 1914, in competition for the eight colored pictures of "Wild Flowers Needing Protection" framed and presented by the New York Botanical Garden to the High Schools and Public Schools of the Bronx, through the aid of the Fund for the Preservation of Native Plants, donated by Caroline and Olivia Phelps Stokes.

New York know that there is immediate necessity for the planting and transplanting of trees, and for the preserving of the very few that still remain.

Since the year 1680, the vast number of trees which once grew on the present site of Manhattan were obliged to be cut down; huge skyscrapers and tenements were built up in their places, and now New York is considered the second largest city in the world. But was it necessary from the standpoint of humanity, to deprive the densely populated sections of shade trees and balmy air, the only natural resource for relief during the hot summers? The City surely has been considerate in allowing these sections to be beautified by some small parks with many trees and bushes, in which the fatigued inhabitants find relief. The Department of Parks, however, was not fortunate enough to secure men with a scientific knowledge of forestry to preserve these natural life-savers. Life-savers they really are, for during the past five summers, sickly mothers and babies, who could not afford a trip to the country, found relief by camping in the few parks of the East Side. Seward, Tomkins Square and Rutgers Square Parks which are in the heart of this section, were so thickly crowded with night campers that reserves of nearby police stations were obliged to patrol the parks while the East Siders slept. One of these parks, which had about thirty lilac bushes and a hundred trees, has now about ten trees scattered around the outskirts and very few bushes. The other two parks are almost in the same condition.

Four years ago the City planted in front of every East Side School five or six trees, with a wire net around the trunk, and a tablet with the inscription

"CHILDREN THIS IS YOUR GIFT.
USE IT AS YOUR FRIEND."

During the first summer the trees bore leaves. What joy it brought to the city child! What a precious friend it was! The next summer the trees were bare. Something was wrong with the precious friend. The soil was tilled, more soil added and still they died, and without further investigation the trees were

removed from the front of the schools. The children no longer enjoyed the first days of spring, and the hot summers, with their beloved "friends."

Up to the summer of 1912 on Second Avenue from 6th to 18th Streets, fourteen shade trees gave relief to pedestrians as well as beautifying the Avenue. Today there are four trees left, which bear hardly any leaves. Was it from the lack of nourishment that the trees did not bear leaves? No! It was the killing of the roots in building the cellars and paving the streets that caused their deterioration, although the trees could have been saved by proper treatment.

During the spring of 1912 one hundred and fifty young trees were planted on Delancey Street at the beginning of the Plaza of the Williamsburg Bridge. During the summer of the first year the trees sprouted rapidly. This greatly beautified the Plaza. The very next summer, the leaves hardly sprouted at all. What is the cause of this retardation? Is it the exhaust steam of the passing automobiles that is hindering their progress? Is it the foul air of the Subway that escapes from the iron gratings near the trees? Or is it the lack of proper care and nourishment that is killing them? Here is where the art of scientific forestry applies. The Department of Parks of New York City should employ competent men to solve the above problems. Must scientific forestry be applied only to the Pacific Coast forests when such conditions exist in the metropolis?

More attention should be given to scientific forestry amongst the skyscrapers and tenements; as transplanting, planting, and preserving of trees means joy and relief to nearly a million, while killing a tree means death to many.

JULIUS J. ROTHMAN

STUYVESANT HIGH SCHOOL

II. The Preservation of Our Native Plants

Public School No. 39.* Emilie J. Lichtenstein, Principal

The Preservation of Trees

". . . Trees, then, we see not only do service to the soul, and not only preserve for our use the springs of water, but they also affect the climate. The climates of countries are very different. They are largely influenced by the presence or the absence of trees. Humboldt, the man of science, has summed up the services rendered by forests under three heads: (1) They screen the soil from the heat of the sun's rays; (2) their leaves offer an immense surface to the cooling process of radiation; (3) their leaves give off an incalculable evaporation of moisture. From the trees we get coal and materials for building, we get also valuable drugs, gums, dyes, and articles of food. But above all these things it is important to remember that trees influence the air by taking in all the carbon dioxide which the human being exhales and giving out pure air or oxygen. We must also remember that trees influence the soil of the country, that they oppose their quiet strength to the great enemies of our race, —extreme heat and cold—and that they have an all-important bearing on the hidden springs of the earth. . . ."

Selma Mittenthal—Class 7B[1].

Preservation of Wild Flowers

". . . An appeal has been made to the public to preserve these plants or rather to leave them in their haunts and love them as they are, on the stem. If everyone could be made to understand the necessity of these proceedings our beautiful wild flowers would be much more abundant and our city could proudly say that her wild flowers were unmolested and poured forth their perfume upon the air as long as they lived or all through the summer. Among the rarest of these are the American Rhododendron, mountain laurel, blood root, round-leaved dogwood,

* The essays from Public School No. 39 were so good and showed such good teaching and interest in the preservation of our native plants that it was difficult to choose between them, so it has been thought best to select quotations from several, and indicate the author and the class for each.

spring beauty, pink lady's slipper, trailing arbutus, bird-foot violet and jack-in-the-pulpit. . . ."

Clarisse Krasowitch—8B²

Our Native Wild Flowers

". . . Can we not follow the example of the Japanese and instill into the minds of our young children the love and care of flowers as they do into theirs? From his earliest years the Japanese child is taught to cherish flowers and even the poorest laborer has his own garden which he tends untiringly. If our children, and grown-ups as well, were taught to do the same, we should not need iron fences or policemen to guard our parks."

Dorothy E. Uset—8B².

Plant Protection

"All plants have one great intention and that is to reproduce themselves. Why should the purpose of these children of nature be counteracted by some thoughtless people who break down the branches of trees and pick the fairest and most fragrant flowers. These individuals do not gain much satisfaction for by the time they return from the woods to their homes, the flowers often are faded, as the stems of the wild flowers are fragile. . . . The true reason for the unnecessary disappearance of our native flowers is due to the unwillingness of some people to partake in the great attempts made by the numerous societies formed for the protection of our native wild flowers. Therefore when we walk through some beautiful wood in spring and behold some colony of delicately tinted flowers let us not yield to temptation by removing the flowers from their cherished haunts but allow them to grow and serve the purpose of their creation. . . ."

Ida Troub—8A¹.

GEORGE WASHINGTON VANDERBILT

George Washington Vanderbilt, a member of the corporation of the New York Botanical Garden since 1903, died at his residence in Washington, D. C., on March 6, 1914.

Mr. Vanderbilt was born on Staten Island in 1862, and much of his youth was spent there on his father's farm. He early became interested in trees and other plants; these tastes led him to purchase and develop an extensive tract of land in the mountains of North Carolina as a forest preserve, to which plant nurseries and experimental grounds were added. These have been of great practical and scientific value, having increased our knowledge of many trees and shrubs. A forest school was maintained at Biltmore for a number of years, and its graduates have rendered noteworthy service to the cause of American forestry. The Biltmore nurseries have brought many rare and otherwise interesting plants into cultivation. He also brought together a large herbarium and a botanical library. Biltmore Botanical Studies, published in 1901 and 1902, contain descriptions of many trees, shrubs and herbaceous plants new to science. His services to botany are commemorated in the beautiful genus *Biltia*, dedicated to him by Dr. Small in 1903.

WHEREAS: The Board of Managers of the New York Botanical Garden have learned, with great regret, of the death of Mr. George Washington Vanderbilt,

Resolved: That the Managers deplore this loss to botanical science, and tender sympathy to his bereaved family.

Adopted by the Board of Managers of the Garden April 16, 1914.

N. L. BRITTON,
Secretary

NOTES, NEWS AND COMMENT

Dr. N. L. Britton and Mr. Stewardson Brown returned to New York, June 8, from Bermuda, where they spent the latter part of May in a continuation of the studies on Bermudian flora.

Dr. William Dana Hoyt, of Johns Hopkins University, recently spent a week at the Garden in bibliographical and herbarium work in connection with a report upon the marine algae of Beaufort, North Carolina, soon to be published under the auspices of the United States Bureau of Fisheries.

An exhibition of plants and flowers was held June 6 and 7 in the museum building by The Horticultural Society of New York, in coöperation with the Garden. Owing to the lateness of the season, and the consequent delay in the maturing of peonies and roses, which usually form the main part of the June show, the exhibition was smaller than that of last year. Mr. Havemeyer made an interesting exhibit of peonies. He also exhibited several unusual plants, among them *Spiraea Wilsoni* and *Lilium colchicum*. There were in addition other exhibits of peonies, and also of irises and of orchids, both plants and flowers. The Garden made a display of the flowers of herbaceous plants, including peonies, and of shrubs and trees.

Professor Harvey M. Hall, of the University of California, was at the Garden for two weeks during June. Dr. Hall has been in the East for the past six months, two months of which were spent at the Garden in the study of American Compositae.

Miss Florence McCormick, Ph.D., assistant professor of agricultural botany at the Nebraska Agricultural Experiment Station, is spending two months of the summer on a scholarship grant for cytological studies of Mucorales.

Mr. U. H. Long, forest pathologist in the Bureau of Plant Industry, spent the latter part of June at the Garden in studies relating to the diseases of forest trees.

Meteorology for May.—The total precipitation for the month was 2.18 inches. Maximum temperatures for each week were 77° on the 4th, 79° on the 10th, and 17th, 89° on the 22d, and *98° on the 27th.* Minimum temperatures were *35° on the 1st,* 48° on the 8th, 45° on the 16th, 40° on the 22d, and 49° on the 30th.

ACCESSIONS

MUSEUMS AND HERBARIUM

1,213 specimens of flowering plants, mostly South American. (By exchange with the Natural History Museum, Paris.)

1 specimen of *Monotropsis odorata* from the mountains of North Carolina. (Given by Professor W. C. Coker.)

14 specimens of orchids from the Philippine Islands. (By exchange with Mr. Oakes Ames.)

12 specimens of orchids from Vermont. (By exchange with Mr. H. M. Denslow.)

1 specimen of *Scutellaria parvula* from Mississippi. (By exchange with Mr. Thomas P. Bailey.)

240 specimens of flowering plants from Indiana. (By exchange with Mr. Charles C. Deam.)

12 specimens of Kützing's "Algarum Aquae Dulcis Germanicarum Decades." (By exchange with the United States National Museum.)

3 specimens of *Strumella coryneoidea* from Pennsylvania. (By exchange with Professor F. D. Heald.)

2 species of *Ganoderma* from Boggy Peak, Antigua. (By exchange with Dr. J. N. Rose.)

40 specimens of woody fungi from various parts of North America. (By exchange with Mr. W. H. Long.)

2 specimens of fungi from Colorado. (By exchange with Professor Ellsworth Bethel.)

2 specimens of fungi from Panama. (By exchange with Professor Ellsworth Bethel.)

100 specimens, "North American Uredinales," century 9. (Distributed by Mr. Elam Bartholomew.)

2 specimens of woody fungi from Alabama. (Given by Dr. H. H. Rusby.)

20 specimens of cup-fungi from western Washington. (By exchange with Mr. S. M. Zeller.)

35 specimens, "Ascomycetes," fascicle 54. (Distributed by Dr. Heinrich Rehm.)

9 specimens of fungi from Long Island, New York. (By exchange with Mr. F. S. Ames.)

PLANTS AND SEEDS.

2 plants of *Opuntia*. (By exchange with Dr. D. T. MacDougal.)

6 English walnut trees. (Purchased.)

1 plant of *Ithrea caustica*. (By exchange with the Bureau of Plant Industry.)

1 plant of *Hymenocallis Galvestonensis*. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

9 plants for conservatories. (By exchange with the Bureau of Plant Industry.)

21 rose plants. (Purchased.)

6 rose plants. (Purchased.)

2 plants of *Turraea obtusifolia*. (By exchange with Bureau of Plant Industry.)

5 plants of *Rubus*. (By exchange with the Bureau of Plant Industry.)

18 plants for nursery. (Purchased.)

12 plants for cactus nursery. (Given by Mr. H. E. Cole.)

12 plants of *Arisaema*. (Given by Mr. F. L. Pickett.)

4 plants of *Pelargonium*. (Given by Mrs. F. A. Constable.)

1 plant of *Polemonium reptans*. (Given by Mr. W. H. Bickelhaupt.)

1 plant of *Pediocactus Simpsonii*. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

5 plants for conservatories. (By exchange with the U. S. National Museum.)

152 plants for Herbaceous collection. (By exchange with Board of Park Commissioners, Rochester; through John Dunbar.)

4 plants of *Houstonia coerulea*. (Given by Mrs. Louis Chanler.)

3 plants for Herbaceous collection. (Collected by Mr. Percy Wilson.)

888 plants. (Purchased.)

13 species of cacti. (By exchange with U. S. National Museum, through Dr. J. N. Rose.)

46 plants of *Rhipsalis*. (By exchange with Superintendent of Parks, Manchester, through Dr. J. N. Rose.)

22 plants for rose beds. (Purchased.)

415 plants for nursery and decoration. (Purchased of and given by Isaac Hicks & Son.)

20 plants for decoration. (Purchased of Andorra Nurseries.)

201 plants for decoration. (Purchased.)

57 cacti. (By exchange with Berlin Botanic Garden.)

2 cacti. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

3 cacti. (Given by Mr. H. E. Cole.)

1,093 plants. (Derived from seed from various sources.)

57 plants. (Derived from seed from F. A. Miller.)

349 packets of seed. (By exchange with the Imperial Botanic Garden, St. Petersburg.)

51 packets of seed. (By exchange with the Imperial University of St. Petersburg.)

42 packets of seed. (Purchased.)

214 packets of seed. (Purchased.)

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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. XV JULY, 1914 No. 175

JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

CONTENTS

PUBLISHED FOR THE GARDEN

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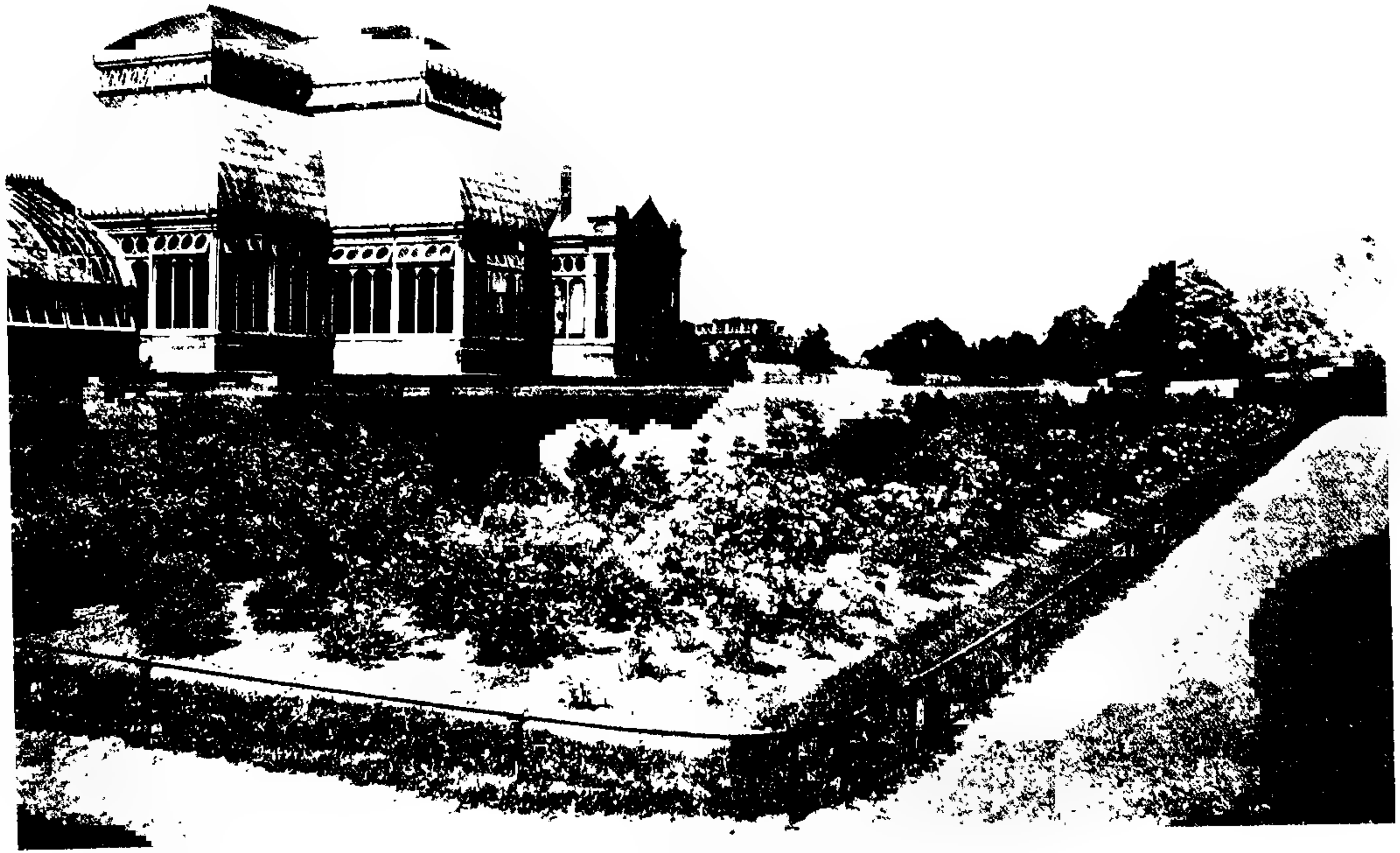

Rose bed east of Conservatory No. 1.

JOURNAL

OF

The New York Botanical Garden

VOL. XV July, 1914 No. 175

ACT OF INCORPORATION,

AS AMENDED BY CHAPTER 103 OF THE LAWS OF 1894, CHAPTER 717 OF THE LAWS OF 1896 AND CHAPTER 473 OF THE LAWS OF 1914

CHAPTER 285

AN ACT to provide for the establishment of a botanic garden and museum and arboretum, in Bronx Park, in the City of New York, and to incorporate The New York Botanical Garden for carrying on the same.

Approved by the Governor April 28, 1891. Passed, three-fifths being present.

The Corporation

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Seth Low, Charles P. Daly, John S. Newberry, Charles A. Dana, Addison Brown, Parke Godwin, Henry C. Potter, Charles Butler, Hugh J. Grant, Edward Cooper, Cornelius Vanderbilt, Nathaniel L. Britton, Morris K. Jesup, J. Pierpont Morgan, Andrew Carnegie, Thomas F. Gilroy, Eugene Kelly, Jr., Richard T. Auchmuty, D. O. Mills, Charles F. Chandler, Louis Fitzgerald, Theodore W. Myers,

[Journal for June, 1914 (15: 119–130) was issued June 26, 1914]

William C. Schermerhorn, Oswald Ottendorfer, Albert Gallup, Timothy F. Allen, Henry R. Hoyt, William G. Choate, William H. Draper, John S. Kennedy, Jesse Seligman, William L. Brown, David Lydig, William E. Dodge, James A. Scrymser, Samuel Sloan, William H. Robertson, Stephen P. Nash, Richard W. Gilder, Thomas Hogg, Nelson Smith, Samuel W. Fairchild, Robert Maclay, William H. S. Wood, George M. Olcut, Charles F. Cox, James R. Pitcher, Percy R. Pyne and such persons as are now, or may hereafter be associated with them, and their successors, are hereby constituted and created a body corporate by the name of The New York Botanical Garden, to be located in the City of New York, for the purpose of establishing and maintaining a botanical garden and museum and arboretum therein, for the collection and culture of plants, flowers, shrubs and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people.

Purposes of the Garden

Powers of the Corporation

SEC. 2. Said corporation shall have all such corporate powers, and may take and hold by gift, grant or devise all such real and personal property as may be necessary and proper for carrying out the purposes aforesaid, and for the endowment of the same, or any branch thereof, by adequate funds therefor.

SEC. 3. Said corporation may adopt a constitution and by-laws; make rules and regulations for the transaction of its business, the admission, suspension and expulsion of the associate members of said corporation, and for the number, election, terms, and duties of its officers, subject to the provisions of this act; and may from time to time alter or modify its

constitution, by-laws, rules and regulations, and shall be subject to the provisions of Title 3, of Chapter 18, of the first part of the Revised Statutes.

Board of Managers

SEC. 4. The affairs of the said corporation shall be managed and controlled by a Board of Managers as follows: The president of Columbia College, the professors of botany, of geology and of chemistry therein, the president of the Torrey Botanical Club, and the President of the Board of Education of the City of New York, and their successors in office, shall be ex-officio members of said corporation and of the Board of Managers, and be known as the Scientific Directors; they shall have the management and control of the scientific and educational departments of said corporation and the appointment of the Director-in-Chief of said institution, who shall appoint his first assistant and the chief gardener, and be responsible for the general scientific conduct of the institution. All other business and affairs of the corporation, including its financial management, shall be under the control of the whole Board of Managers, which shall consist of the Scientific Directors, as herein provided, and of the Mayor of the City of New York, the President of the Board of Commissioners of the Department of Public Parks, and at least nine other managers to be elected by the members of the corporation. The first election shall be by ballot, and held on a written notice of ten days, addressed by mail to each of the above-named incorporators, stating the time and place of election, and signed by at least five incorporators. Three of the managers so elected shall hold office for one year, three for two years, and three for three years. The term of office of the managers elected after the first election, save those elected to fill vacancies in unexpired terms, shall be three years; and three managers and such others as may be needed to fill vacancies in unexpired terms

Scientific Directors

Director-in-Chief

Representatives of the City

Elective Managers

shall be elected annually, pursuant to the by-laws of the corporation. The number of elective managers may be increased by vote of the corporation, whose terms and election shall be as above provided; and members may from time to time be added to the Scientific Directors by a majority vote of the Scientific Directors, approved by a majority vote of the whole Board of Managers. The Board of Managers shall elect from their number a President, Secretary and Treasurer, none of whom or of the Board of Managers, save the Secretary and Treasurer, shall receive any compensation for his services. Nine corporators shall constitute a quorum at any meeting of the incorporators, but a less number may adjourn.

Officers

Quorum of the Corporation

Original Endowment

SEC. 5. Whenever the said corporation shall have raised, or secured by subscription, a sum sufficient in the judgment of the Board of Commissioners of the Department of Public Parks in the City of New York, for successfully establishing and prosecuting the objects aforesaid, not less, however, than two hundred and fifty thousand dollars within seven years from the passage of this act, the said Board of Commissioners is hereby authorized and directed to set apart and appropriate upon such conditions as to the said Board may seem expedient, a portion of the Bronx Park, or of such other of the public parks in the City of New York north of the Harlem River in charge of the said Department of Parks as may be mutually agreed upon between the said Board of Commissioners and the Board of Managers of said corporation in lieu of Bronx Park, not exceeding two hundred and fifty acres, for establishing and maintaining therein by the said corporation a botanical garden and museum, including an herbarium and arboretum, and for the general purposes stated in the first section of this act. And the said Board of Commissioners is thereupon hereby authorized and directed to construct and equip

Grounds in Bronx Park 250 Acres

within the said grounds so alloted, according to plans approved by them and by said Board of Managers, a suitable fire proof building for such botanical museum and herbarium, with lecture rooms and laboratories for instruction, together with other suitable buildings for the care and culture of tender or other plants, indigenous or exotic, at an aggregate cost not exceeding the bonds hereinafter authorized to be issued by the City of New York; the use of said buildings upon completion to be transferred to said corporation for the purposes stated in this act. And for the purpose of providing means therefor, it shall be the duty of the Comptroller of the City of New York, upon being thereto requested by said Commissioners, and upon being authorized thereto by the Board of Estimate and Apportionment, to issue and sell at not less than their par value bonds or stock of the Mayor, Aldermen and Commonalty of the City of New York, in the manner now provided by law, payable from taxation, aggregating the sum of five hundred thousand dollars, bearing interest at a rate not exceeding three and one-half per centum per annum, and to be redeemed within a period of time not longer than thirty years from the date of their issue.

Construction of Buildings

SEC. 5-a. The Board of Estimate and Apportionment of the City of New York may, in its discretion, set apart and appropriate, upon such conditions as it may deem expedient, for the extension and development of the work and objects of the said New York Botanical Garden, the whole or any part of that portion of Bronx Park in the city of New York situated between the southern boundary of the land in Bronx park heretofore appropriated for the use of the said New York Botanical Garden by the Board of Commissioners of the Department of Public Parks, and the northern side of Pelham Avenue; the land so to be appropriated to be described more particularly in

Power of the City to appropriate additional land

the Board of Estimate and Apportionment hereby authorized. (Chapter 473, Laws of 1914.)

Restrictions in use of the grounds

SEC. 6. The grounds set apart, as above provided, shall be used for no other purposes than authorized by this act, and no intoxicating liquors shall be sold or allowed thereon. For police purposes and for the maintenance of proper roads and walks, the said grounds shall remain subject at all times to the control of the said Board of Commissioners of the Department of Parks; but otherwise, after the suitable laying out of the same and the construction of proper roads and walks therein by the Department of Parks, the said grounds and buildings shall be under the management and control of the said corporation.

Grounds open and free daily

The said grounds shall be open and free to the public daily, including Sundays, subject to such restrictions only as to hours as the proper care, culture and preservation of the said garden may require; and its educational and scientific privileges shall be open to all alike, male and female, upon such necessary regulations, terms and conditions as shall be prescribed by the managers of those departments.

SEC. 7. This act shall take effect immediately.

CONSTITUTION

ARTICLE I

The provisions of the act of incorporation approved April 28, 1891, as amended by Chapter 103 of the laws of 1894, approved March 7, 1894, are, in pursuance of Section 3 of said act, adopted and form a part of this Constitution.

ARTICLE II

Election of Officers

A President, two Vice-Presidents, a Secretary and a Treasurer shall be elected yearly by the Board of Managers from their number in the manner provided

by section 4 of the act of incorporation; and the persons so elected shall respectively be the President, Vice-Presidents, Secretary and Treasurer of the Board of Managers and of the corporation. Vacancies in either of said offices may be filled by the Board of Managers until the next annual election.

ARTICLE III

Appointment of committees

The Scientific Directors and the Board of Managers may respectively appoint such other persons and such committees to aid in the performance of the duties and business of their respective departments as they shall deem best.

ARTICLE IV

Adoption of By-Laws, Rules and Regulations

The Scientific Directors and the Board of Managers are each authorized to adopt such by-laws, rules and regulations in their respective departments as shall be approved by them respectively, and also to change or amend the same from time to time; and the same when so adopted by them, shall be deemed the by-laws, rules and regulations of the corporation.

ARTICLE V

Associate Members

Associate members may be admitted, suspended or expelled in the manner provided for by the rules adopted by the Board of Managers.

ARTICLE VI

Patrons, Life Members, Annual Members

Benefactors, Patrons, Fellows-for-Life, Fellowship Members, Sustaining Members, Life Members and Annual Members may be created by the Board of Managers and admitted upon the payment of such sums as shall be approved and established by the Board.

ARTICLE VII

Amendments to Constitution

Amendments to this Constitution not incompatible with the act of incorporation may be made by a vote of

four-fifths of the members present at any regular meeting of the incorporators, or at any special meeting called for the purpose by the Secretary, upon the direction of the President, on ten days' prior notice by mail of such meeting and of the proposed amendments.

BY-LAWS

I

Annual Meeting of the Corporation

The annual meeting for the election of managers and of additional members of the corporation shall be held in the City of New York on the second Monday in January. A notice of such meeting shall be mailed by the Secretary to each member of the corporation at least ten days previous. The number of elective managers may be increased, and vacancies in unexpired terms may be filled, by vote of the corporation at any annual meeting, and also at any special meeting called upon the recommendation of the Board of Managers, upon like notice, and with notice of the proposed increase.

II

President and Vice-president

At all meetings of the corporation and of the Board of Managers, the President shall preside; or, in his absence, one of the Vice-Presidents. The President, or either Vice-President, is authorized to approve bills of the Garden against city maintenance appropriations.

III

Meeting of the Board of Managers

The managers shall hold an annual meeting on the second Monday in January, following the annual meeting of the corporation. Other regular meetings of the managers shall be held on the third Thursdays of April, June and November. Special meetings may

be held by direction of the President, or, in his absence, by the direction of either Vice-President.

IV

Five managers shall constitute a quorum at any meeting of the Board of Managers, providing that not more than two are Scientific Directors. **Quorum of the Board of Managers**

V

Committees of the Board of Managers, to be appointed by the Board at each annual meeting, shall include: **Committees**

An Executive Committee,
A Finance Committee,
A Membership Committee,
A Committee on Endowment.

Special committees may be appointed at any meeting, and may be composed of managers, of members of the corporation, or of both.

VI

The Executive Committee shall consider all matters referred to it at meetings of the Board of Managers or of the Corporation and report at subsequent meetings, and shall annually nominate managers, officers and additional members of the corporation. It shall consist of seven members, including the President, Treasurer and Secretary. The Committee shall annually elect a chairman. **Executive Committee**

VII

The Finance Committee shall advise the Treasurer concerning investments and reinvestments of permanent funds, and shall have charge of such real estate as **Finance Committee**

may become the property of the Corporation. It shall consist of three members, including the Treasurer.

VIII

Membership Committee

The Membership Committee shall consist of three members and shall issue invitations for Annual Members, Sustaining Members, Fellowship Members, Fellows for Life, Patrons and Benefactors.

IX

Endowment Committee

The object of the Committee on Endowment is to increase permanent funds; it shall consist of the President, Treasurer, Secretary and two other members of the Board of Managers.

X

Treasurer

The Treasurer shall collect, receive and disburse the funds of the Corporation as directed by the Board of Managers. He shall invest and reinvest all permanent funds as advised by the Finance Committee. He shall report to the managers at all stated meetings.

XI

Secretary

The Secretary shall give notice of all meetings of the corporation, of the Board of Managers and of the Executive Committee, and shall take and preserve the minutes thereof; he shall have the custody of the seal, and shall perform such other duties as may be directed by the corporation, the Board of Managers, or the Executive Committee.

XII

Quorum of Scientific Directors

A majority of the Scientific Directors shall constitute a quorum at any meeting.

XIII

Officers of Scientific Directors

The Scientific Directors shall elect a Chairman and Secretary, who shall hold office until their successors are elected, and perform the duties which usually pertain to these offices.

XIV

Meetings of Scientific Directors

Regular meetings of the Scientific Directors shall be held on the second Saturdays of April, June, October and December, and special meetings may be held pursuant to call by the Chairman.

XV

Women's Auxiliary

The Women's Auxiliary shall consist of at least twelve members. Additional members may be elected at any meeting of the managers after nomination by the Auxiliary. This committee shall aid the managers in conducting receptions and other public functions, in obtaining contributing members, and in such other objects as may be referred to it by the Board of Managers. Honorary members of the Women's Auxiliary chosen from women who have rendered noteworthy service to the Garden, may also be appointed by the managers after nomination by the Auxiliary.

XVI

Elections to be by ballot

The election of managers and of additional members of the corporation shall be by ballot. All other votes at meetings may be taken *viva voce*, unless a ballot be demanded by some member, whereupon the vote shall be taken by ballot.

XVII

Amendments to By-Laws

Amendments to the By-Laws may be made at any meeting by a vote of a majority of the entire Board of Managers and by the unanimous vote of a quorum.

REGULATIONS FOR THE OFFICE OF DIRECTOR-IN-CHIEF

1. The Director-in-Chief is the Executive Officer of the Garden, and is responsible to the Board of Managers, and to the Scientific Directors, for the general management and control of all its departments.

He shall promptly and efficiently carry out all their regulations and directions, and be responsible for the proper maintenance and good order of the buildings and grounds.

2. He may from time to time make recommendations for the development and management of the Garden in all its departments, including the laying out of the grounds, the construction of buildings and the conduct of the museums, the herbarium or any of the departments of the Garden, accompanying the same by his estimate of the probable cost therefor.

3. He shall recommend the employment of such persons as shall be needed for the various departments of the Garden and have power to remove all employees, except those upon a yearly salary. All such salaried employees he shall have power to suspend, and, on approval of the appropriate committee or board, to discharge.

4. He shall make all necessary purchases of tools, implements and supplies for the Garden as authorized, and shall be responsible for the proper inventory, care, and use of the same.

5. He shall examine, correct and certify all bills incurred under his management, and shall keep, in books provided for that purpose, an accurate account of his expenditure of all appropriations made for Garden purposes, which books, together with proper vouchers, shall at all times be open to inspection by members of the Board.

6. He shall keep a copy of his official correspondence.

7. He shall use diligent efforts to build up the Garden Herbarium, the Library and the Museum, and the collections of living plants and trees, by correspondence, by exchanges of duplicates not needed, and by purchases, so far as means therefor are placed at his disposal.

8. He shall report to the Board of Managers, the Scientific Directors, or special committees, in such manner and at such times as they may direct.

9. He shall make no expenditures and incur no liabilities, except under appropriations made by the Board.

10. He shall devote his whole time and energies to the promotion of the Garden interests, and shall not engage in any outside work except with the approval of the Board or the Executive Committee.

PROVISIONS FOR CONTRIBUTING MEMBERSHIP.

1. *Benefactors.*—The contribution of $25,000.00 or more to the funds of the Garden by gift or by bequest entitles the contributor to be a benefactor of the Garden.

2. *Patrons.*—The contribution of $5,000.00 or more to the funds of the Garden by gift or by bequest shall entitle the contributor to be a patron of the Garden.

3. *Fellows for Life.*—The contribution of $1,000.00 or more to the funds of the Garden at any one time shall entitle the contributor to be a fellow for life of the Garden.

4. *Fellowship Members.*—Fellowship members pay $100.00 or more annually and become fellows for life when their payments aggregate $1,000.00.

5. *Sustaining Members.*—Sustaining members pay from $25.00 to $100.00 annually and become fellows for life when their payments aggregate $1,000.00.

6. *Annual Members.*—Annual members pay an annual fee of $10.00. All members are entitled to the following privileges:

1. Tickets to all lectures given under the auspices of the Board of Managers.

2. Invitations to all exhibitions given under the auspices of the Board of Managers.

3. A copy of all handbooks published by the Garden.

4. A copy of all annual reports and Bulletins.

5. A copy of the monthly Journal.

7. *Life Members.*—Annual Members may become Life Members by the payment of a fee of $250.00.

Form of Bequest.—I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of.....

PROVISIONS OF THE CHARTER OF THE CITY OF NEW YORK FOR MAINTENANCE

§613. It shall be the duty of the commissioner for the boroughs of Manhattan and Richmond to maintain the meteorological and astronomical observatory, the Museum of Natural History, the Metropolitan Museum of Art in Central Park, the Aquarium in Battery place, and such other buildings as now are or may hereafter be erected in such parks or in any other park, square or public place under his jurisdiction by authority of the board of aldermen. It shall be the duty of the commissioner for the boroughs of Brooklyn and Queens to maintain the Brooklyn Institute of Arts and Sciences, and such other buildings as now are or may hereafter be erected in any park, square or public place under his jurisdiction by authority of the board of aldermen. It shall be the duty of the commissioner for the borough of The Bronx to maintain the New York Botanical Garden and the buildings appurtenant thereto, and such other institutions or buildings as may be established or erected in any park, square or public place in his jurisdiction by authority of the board of aldermen. It shall be the duty of the several commissioners to provide the necessary instruments, furniture and equipments for the several buildings and institutions within their respective jurisdictions, and, with the authority of the board of aldermen, to develop and improve the same, and to erect additional buildings; but the maintenance of all such buildings and institutions shall be subject to the provisions of the acts incorporating said institutions, or either of them, and the acts amendatory thereof, and to the powers of said corporations thereunder, and of the boards by such acts created or provided for; and shall also be subject to and in conformity with such contracts and agreements as have heretofore been made with such institutions respectively, and are in force and effect when this act takes effect, or as may be hereafter made by the authority of the board of aldermen, and no moneys shall be expended for such purposes unless an appropriation therefor has been made by the board of estimate and apportionment and the board of aldermen. Out of the moneys annually appropriated for the maintenance of parks each

commissioner may apply such sum as shall be fixed by the board of estimate and apportionment for the keeping, preservation and exhibition of the collections placed or contained in buildings or institutions now situated or hereafter erected in the parks, squares or public places under the jurisdiction of such co missioner.

§625. The commissioner for the borough of The Bronx is hereby authorized and directed to carry out the existing contrac made by and between the department of parks of the corporation heretofore known as the mayor, aldermen and commonalty of the city of New York and the board of managers of the corporation known as the New York Botanical Garden pursuant to the provisions of chapter two hundred and eighty-five of the laws of eighteen hundred and ninety-one, entitled "An act to provide for the establishment of a botanic garden and museum and arboretum in Bronx park in The City of New York and to incorporate the New York Botanical Garden for carrying on the same," as amended by chapter one hundred and three of the laws of eighteen hundred and ninety-four, which contract provides for the allotting and setting apart for the uses of said garden of two hundred and fifty acres of land or less in the northern part of Bronx Park as shown upon a certain map thereof numbered five hundred and sixty-eight, and signed by Messrs. Vaux and Parsons, and filed with the former department of public parks of the corporation known as the mayor, aldermen and commonalty of the city of New York.

THE ROSE PLANTATION

(With Plate CXXXV)

This rose bed, with a length of about 250 feet and a width of 8 feet, is at the foot of the eastern terrace at conservatory range 1; it has an exposure to the southeast, the terrace and conservatories cutting off the bleak winds from the north and west, the hill to the east protecting it from the winds coming from that

direction; the situation is sunny and warm, conditions in which the roses delight, and they have responded quickly to the congenial surroundings.

In the successful cultivation of roses much depends upon the initial preparation of the soil, which must be thorough if success is to be achieved. The rose sends its roots deep down into the ground, and unless it is given this opportunity for root expansion, we can not hope for continued success. Good drainage is another essential, and if water is inclined to collect provision must be made for proper drainage before the bushes are planted. This bed was trenched to a depth of 18–24 inches, all poor soil being removed and replaced with good top soil and a liberal supply of well-rotted manure. The plants were set out in April, 1913. In the fall a portion was protected by simply banking the earth up around the stems for 6 or 8 inches, the remaining plants being bent down and covered entirely with earth. The first method was just as effective, and less troublesome; only about 30 roses out of over 400 died during the year.

In this collection are embraced 140 kinds, representing hybrid perpetuals, hybrid teas, teas, polyanthas, moss roses, Bourbon roses, and others. There are four rows of plants, the two rows in the rear being mainly hybrid perpetuals, the two front rows largely hybrid teas and teas, with the polyanthas and moss roses.

The hybrid perpetuals, of which there are 53 kinds, of course have a short flowering season, but while they bloom make a great showing. Among the white roses in this class are Madame Plantier, Mabel Morrison, Margaret Dickson, Frau Karl Druschki, one of the best, and Clio, the last shaded with a rosy flush. Baroness Rothschild, a shell pink, is a transition to the rose-colored ones, represented by Abel Carriere, Jules Margottin, Gloire de Margottin, a bright rose-pink, Ulrich Brunner, a brilliant cherry red, Paul Neyron, deep rose, and Magna Charta, Mrs. John Laing, Marie Baumann, and Gabriel Luizet, all with a pink tinge to the rose color. The crimson shades are represented by Camille de Rohan, a velvety crimson, Louis Van Houtte, with a touch of rose added, Fisher Holmes, a glowing

scarlet-crimson, the well-known General Jacqueminot, brilliant crimson, Earl of Dufferin, a rich velvety crimson, and Jean Liabaud, a deep crimson.

It is the hybrid teas, however, which give us our really extended pleasure in the rose garden, for they bloom continuously from early summer to late fall, some of them being in bloom practically all the season. There are a great many of these, new ones appearing each season; in this rose bed are 66 kinds. Among the yellows, and yellow roses are few, are Sunburst, an introduction of 1912, a buff yellow; Duchess of Wellington, saffron-yellow, changing to orange coppery yellow; Rayon d'Or, a pure rich yellow, the deepest of all. White Killarney is one of the few pure white ones. Among others are Belle Siebrecht, deep pink; Dean Hole, silvery carmine-pink; Gruss an Teplitz, a velvety crimson; Killarney, pale pink; Madame Caroline Testout, light salmon-pink; My Maryland, salmon-pink; Richmond, crimson; Lyon Rose, salmon-pink; Pharisaer, rosy-white shading to salmon-rose in center; Radiance, pink; La France, an old favorite, silvery rose; Souvenir du President Carnot, a white shaded rose.

Tea roses are not quite so hardy as the hybrid teas. There are 13 kinds here, including Maman Cochet, light pink; White Maman Cochet; and Lady Hillingdon, yellow.

There are 3 kinds of moss roses: Blanche Moreau, white; Salet, pink; and Crested Moss, the sepals with the moss-like crest well-developed. Baby Rambler and Annie Muller represent the polyantha roses. Hermosa is a representative of the Bourbon type.

The rose is beloved by all, and makes a strong appeal to all flower lovers. A much larger area would be needed to make a display of all the kinds which may be grown in this latitude, including standards, and the great variety of rambler roses which are deservedly so popular.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT

Professor L. H. Pennington, of Syracuse University, spent several days during July in the herbarium in studies of the genus *Marasmius*.

Professor W. C. Coker, head of the Department of Botany of the University of North Carolina, was at the Garden for several days in June studying a collection of plants from North Carolina.

Dr. Fred J. Seaver spent the early part of July at Portland, Connecticut, where he was engaged in the collection and study of local fungi, especially the fleshy Discomycetes.

Dr. H. J. Banker, professor of biology at De Pauw University, Greencastle, Indiana, visited the Garden July 10 to arrange for continuing his monographic work on the resupinate species of the Hydnaceae for NORTH AMERICAN FLORA. Dr. Banker has recently completed his studies of the stipitate forms of this family of fungi and published them in a series of articles in MYCOLOGIA.

Dr. A. B. Stout, director of the laboratories, accompanied by Mr. E. G. Arzberger, of the Bureau of Plant Industry at Washington, sailed for Europe on July 11, to visit experimental gardens and study methods of plant breeding employed in Germany, Holland, Belgium, and England. He will spend some time with Professor Hugo de Vries, at Amsterdam, Holland; and also inspect many of the large chicory plantations in Belgium. He is expected to return early in September.

Dr. Britton carried on supplementary studies of Bermuda plants from May 20 to June 8, in Bermuda, accompanied by Mr. Stewardson Brown, Curator of Botany at the Academy of Natural Sciences in Philadelphia, who had cooperated with him in these studies on previous occasions. Several species additional to the recorded native and naturalized flora were detected,

and studies of the garden plants of Bermuda were continued. Specimens of over 300 species were brought back to the Garden for examination. Mr. Peter Bisset, of the Bureau of Plant Industry, United States Department of Agriculture, was in Bermuda at the same time, and his cooperation in the field work was very valuable; Mr. Bisset's errand was a study of fruit-growing possibilities in Bermuda.

Dr. David Hooper, recently retired after thirty years of civil service in British India, was a guest of the Garden on June 2 last. Dr. Hooper is best known to American scientists as author of the Pharmacographia Indica, written in association with Dr. Dymock. This is a rather remarkable book and one of the most scholarly works ever contributed to pharmacy. It deals with the native drugs of India, considered historically, botanically, chemically and therapeutically, in all of which lines the work is excellent. The amount of original research performed by the authors, and more especially by Dr. Hooper, is very great. This work, together with many original papers on similar subjects, some years since secured for this distinguished author the award of the Hanbury medal, the highest recognition accorded in this department of science. In India, Dr. Hooper is best known for his great practical service in connection with the cultivation of cinchona, and the preparation from its bark of a cheap alkaloidal product which brought within reach of the poverty-stricken masses an efficient protection against the malarial fevers of the country. By his sane and temperate methods of living, Dr. Hooper has belied the saying that a European cannot do good work and maintain his health in tropical India. He appears in the prime of life, keen and vigorous, and we confidently expect from him many valuable contributions similar to those which he has already made.

Meteorology for June.—The total precipitation for the month was 2.36 inches. Maximum temperatures for each week were 83° on the 4th, *95° on the 12th*, 83° on the 17th, and 94° on the 25th. Minimum temperatures were *41° on the 6th*, 57° on the 9th, 48° on the 17th, and 58° on the 29th.

ACCESSIONS

LIBRARY ACCESSIONS FROM MARCH 15 TO JUNE 15, 1914

ANDREWS, HENRY C. *Coloured engravings of heaths, the drawings taken from living plants only, with the appropriate specific character, full description, native place of growth, and time of flowering of each; in Latin and English.* 4 Vols. London, 1802–09.

BARLOW, PETER. *Barlow's tables of squares, cubes, square roots, cube roots reciprocals of all integer numbers up to 10,000.* Stereotype ed. New impression. London, 1912.

BATESON, WILLIAM. *Mendel's principles of heredity.* Cambridge, 1913.

BOLDINGH, ISAÄC. *Flora voor de Nederlandsch West-Indische eilanden.* Amsterdam, 1913. (Given by Dr. N. L. Britton.)

BROOKS, WILLIAM KEITH. *The law of heredity; a study of the cause of variation and the origin of living organisms.* Ed. 2. Baltimore [1883].

BUTLER, SAMUEL. *Life and habit.* New York, 1911.

CASTLE, WILLIAM ERNEST. *Heredity; its relation to evolution and animal breeding.* New York, 1911.

CHRISTENSEN, CARL. *Monograph of the genus Dryopteris.* Part 1. *The tropical American pinnatifid-bipinnatifid species.* Köbenhavn, 1913.

CLEMENTS, FREDERIC EDWARD, & CLEMENTS, EDITH SCHWARTZ. *Rocky mountain flowers; an illustrated guide for plant-lovers and plant-users.* White Plains, 1914. (Given by Dr. N. L. Britton.)

COPE, EDWARD DRINKER. *Primary factors of organic evolution.* Chicago, 1904.

DARBISHIRE, ARTHUR DUKINFIELD. *Breeding and the Mendelian discovery.* Ed. 3. London, 1913.

EIMER, GUSTAV HENRICH THEODOR. *On orthogenesis and the importance of natural selection in species formation.* Chicago, 1898.

EIMER, GUSTAV HEINRICH THEODOR. *Organic evolution as the result of the inheritance of acquired characters according to the laws of organic growth.* London, 1890.

FLEMMING, WALTHER. *Zellsubstanz, Kern und Zelltheilung.* Leipzig, 1882.

FRUWIRTH, CARL. *Allgemeine Zuchtungslehre der landwirtschaftlichen Kulturpflanzen.* Ed. 4. Berlin, 1914.

GRAFE, VIKTOR. *Ernährungsphysiologisches Praktikum der höheren Pflanzen.* Berlin, 1914.

HERING, EWALD. *Memory: lectures on the specific energies of the nervous system.* Ed. 4. Chicago, 1913.

JOHANNSEN, WILHELM LUDWIG. *Elemente der exakten Erblichkeitslehre: deutsche Wesentlich erweiterte Ausgabe in fünfundzwanzig Vorlesungen.* Jena, 1909.

JOHANNSEN, WILHELM LUDWIG. *Elemente der exakten Erblichkeitslehre mit Grundzügen der biologischen Variationsstatistik.* Ed. 2. Jena, 1913.

JOHNSON, GEORGE WILLIAM, & ERRINGTON, ROBERT. *The apple; its culture uses and history.* 2 Vols. London, 1847. (Given by Dr. J. H. Barnhart.)

Journal of agricultural science. 4 vols. Cambridge, 1905–13.

Journal of genetics. 3 vols. Cambridge, 1910–14.

LEMAIRE, CHARLES. *Les plantes grasses autres que lés cactées.* Paris [1869]. (Given by Dr. J. N. Rose.)

LINDAU, GUSTAV. *Kryptogamenflora für Anfänger*. v. 4. Erste Abteilung. Die Algen. Berlin, 1914.

LINDAU, GUSTAV. *Kryptogamenflora für Anfänger*. v. 6. Die Torf- und Lebermoose von Dr. Wilhelm Lorch. Die Farnpflanzen von Guido Brause. Berlin, 1914.

MAGNUS, WERNER. *Die Entstehung der Pflanzengallen verursacht durch Hymenopteren*. Jena, 1914.

The Mendel journal. No. 1–3. London, 1909–12.

MOORE, T. W. *Treatise and hand-book of orange culture in Florida, Louisiana and California*. Ed. 4. New York, 1886. (Given by Dr. J. H. Barnhart.)

NEVEU-LEMAIRE, MAURICE. *Parasitologie des plantes agricoles*. Paris, 1913.

PASCHER, ADOLF A. *Die Süsswasser-flora Deutschlands, Österreichs und der Schweiz*. Heft 1: *Flagellatae 1*. Jena, 1914.

PUNNETT, REGINALD CRUNDALL. *Mendelism*. Ed. 2. Cambridge, 1907. Ed. 3. New York, 1913.

ROMANES, GEORGE JOHN. *An examination of Weismannism*. Ed. 2. Chicago, 1899.

SEMON, RICHARD. *Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens*. Ed. 3. Leipzig, 1911.

SIMPSON, CHARLES TORREY. *Native and exotic plants of Dade County, Florida*. Washington. (Given by Mr. Charles Deering.)

STRECKER, WILHELM. *Die Kultur der Wiesen*. Ed. 3. Berlin, 1914.

THOMAS, FRIEDRICH AUGUST WILHELM. *Das Elisabeth Linné-Phänomen (sogenanntes Blitzen der Blüten) und seine Deutungen*. Jena, 1914.

THOMPSON, JOHN ARTHUR. *Heredity*. Ed. 2. London, 1912.

VOLLMANN, FRANZ. *Flora von Bayern*. Stuttgart, 1914.

WEISMANN, AUGUST. *On germinal selection as a source of definite variation*. Chicago, 1902.

WEISMANN, AUGUST. *The germ-plasm: a theory of heredity*. London, 1893.

MUSEUMS AND HERBARIUM

28 specimens of cup-fungi from western Washington. (By exchange with Mr. S. M. Zeller.)

100 specimens, "North American Uredinales," Century 10. (Distributed by Mr. Elam Bartholomew.)

3,000 specimens of fungi. (Being the herbarium of W. R. Gerard.)

1 specimen of *Phyllanthus lathyroides* from Porto Rico. (By exchange with the Field Museum of Natural History.)

1 specimen, fruit of *Kigelia*, from Bermuda. (Given by Mr. E. J. Wortley.)

2 specimens of hepaticae from Connecticut. (By exchange with Miss Annie Lorenz.)

7 specimens of *Riccia* from Texas. (Given by Dr. Frederick McAllister.)

51 specimens of lichens from New England. (Distributed by Dr. R. Heber Howe, Jr.)

4 specimens of mosses from Sanford, Florida. (By exchange with Mr. Severin Rapp.)

6 specimens of mosses from Norway. (By exchange with Professor Edward B. Chamberlain.)

184 specimens of mosses from Bolivia. (Distributed by Dr. Theodor Herzog.)

2 specimens, *Ledum groenlandicum* and *Lepidium perfoliatum* from Ohio. (Given by Professor L. S. Hopkins.)

80 specimens of mosses and flowering plants from Tobago, West Indies. (Distributed by Mr. W. E. Broadway.)

1 specimen of *Juncus Hallii* from Montana. (By exchange with the United States National Museum.)

2 specimens of sedges from Mexico. (By exchange with Brother Leon.)

10 specimens of marine algae from Orient, New York. (Given by Mr. Roy Latham.)

173 plates of plants and the dissections of flowers of the Sapodilla family. (By exchange with the Natural History Museum, Paris.)

211 specimens, "Hepaticae Europaeae," Series X–XIII. (Distributed by Dr. Victor Schiffner.)

36 specimens of flowering plants from Mexico. (By exchange with the United States National Museum.)

150 specimens from British Columbia. (By exchange with the Geological Survey of Canada.)

326 specimens of flowering plants from Vermont. (Given by Dr. M. A. Howe.)

Members of the Corporation

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Edward D. Adams,
Charles B. Alexander,
John D. Archbold,
Vincent Astor,
John W. Auchincloss,
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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 32 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. 3, part 1, 1910. Nectriaceae—Pimetariaceae.

Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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SELECTION AND PREPARATION OF VEGETABLES*

Vegetable foods as purchased consist of those which are fresh, and also canned and dried. The selection demands good judgment on the part of the housekeeper. It is possible to obtain fresh vegetables the entire year in large cities, and with careful planning a green vegetable may be served hot, or in a salad form every day, and the expense be less than that of canned goods.

Let us first consider the fresh vegetables, taking them up according to plant structure.

First the roots or enlarged growth on the root. These constitute our common or winter vegetables, such as the potato, carrot, turnip, beet, parsnip, and sweet potato. In choosing any of these, a medium is preferable to a very large size. The skin should be smooth, and the vegetable feel hard or firm. A shrivelled appearance indicates loss of water, and is seen in "old" vegetables. Avoid such as have worm holes and rust spots.

A knowledge of required weights, and comparative measures is necessary if one is to get his money's worth! Many vegetables are sold by the basket, with no statement as to the quantity the buyer is getting for a given sum of money. The Massachusetts

* Abstract of a lecture delivered at the New York Botanical Garden on November 22, 1913.

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Department of Weights and Measures issues cards stating the number of pounds of a given vegetable in a bushel of that vegetable, as for instance a bushel of potatoes should weigh sixty pounds. So much has been said about "shortage" in weights that bags of potatoes are marked one peck, 15 lbs. or $\frac{1}{2}$ peck, $7\frac{1}{2}$ lbs.

All vegetables of this nature should be kept in a cool, dry place. They all need to be scrubbed and the outside skin removed. Potatoes should be pared thinly, as the best part is directly under the skin. In the turnip, quite the opposite is true. Carrots are scraped, and beets and parsnips cooked with the skins on—such skins to be removed easily, after cooking, by plunging into cold water.

In the spring the vegetables must be soaked for a long time in fresh cold water, to supply the water lost during the winter. After paring or scraping, always put vegetables in cold water, until ready to cook, to avoid discoloration. Cook in boiling, salted water, and the best plan is to make a time-table for oneself. Beets take a very long time to cook, several hours, and an excellent way is to put them in a tin pail, cover with boiling water, and bake in the oven, if one uses coal; gas is too expensive to use for such cooking. Or boil the beets for half an hour, and place in the fireless cooker.

There is a great difference of opinion as to temperature for the cooking of such vegetables. Is it better to cook at a low temperature for a long time, or at a higher temperature for a shorter time? All of these vegetables contain valuable mineral salts, and many claim that we lose these by using a large quantity of water, and then throwing it away. The French use it for soup, and if one has a large family, this is a good way to obtain a well-flavored cream soup.

All of the vegetables may be boiled and served with butter or a cream sauce, or boiled and mashed. Often two may be combined to a good advantage, such as turnips and potatoes, or carrots and turnips. Any left-over boiled vegetables may be made into cream soups, or scalloped with the addition of cheese, or used in a salad.

The vegetable which admits of the greatest variation is the potato. Filippini has in his International Cook Book over one hundred ways of serving the potato.

Carrots are still considered by many to be food for animals instead of man, and yet carrots, well cooked, are delicious, and give a touch of color to a stew or casserole, and combined with green vegetables add much to the appearance of a salad. New carrots are in the New York market at all times, and are good cooked whole, but for flavor old carrots are better in soups and stews. When cut in slices, boiled, and glazed in butter and sugar, quite a new vegetable appears. If the flavor of mint is liked, the finely cut fresh herb may be sprinkled over the carrots, and served as a border around a mound of green peas. Sweet potatoes may be glazed in the same manner, but candied in the good old Southern way, they are still better, that is, cut the raw potato into strips, cover with brown sugar and butter, and cook in an earthen dish, slowly, for several hours.

It is a pity that the white turnip is not more often served. Cut in cubes, boiled, and creamed, it is excellent with roast lamb. Kohl-rabi is new to many: it looks very much like the turnip with a slight flavor of both turnip and cabbage, and is cooked by boiling.

The bulb which is used in cooking more than any other vegetable is the onion. Onions are eaten raw and cooked in a variety of ways. When boiled, the water should be in quantity sufficient to cover the onions and boiled rapidly. Do not cover the kettle, and do not cook too long a time. The varieties are the yellow skin, silver skin, and red onion, bought by the quart, peck, or bushel; and the Spanish and Bermuda onions bought by the pound. The onion is one of the oldest known vegetables, and various countries of the world have their own particular variety of this vegetable. Garlic, which is used so much by the Italians, is found in the market in long bunches, the stems braided together. Two garlics may be bought for five cents or less, and as each one is divided into many sections, known as "beans" or "cloves," and as only one is usually used at a time, it lasts for weeks in the ordinary American household. The French

use a very small onion with a brown skin, known as shallots, and these may be purchased by the basket, holding a quart, for twenty-five cents. The leek, known to the ancient Egyptians, is a variety of onion too often neglected. Leeks are bought by the bunch, and used in soups, or if very fresh, may be boiled and served like asparagus, with two or three inches of the leaves left on. They are usually ten cents a bunch, and are very acceptable in the early spring.

The leaves and stalks of plants give us our fresh green or succulent vegetables, and include cabbage, celery, spinach, asparagus, and greens of all kinds. All of these may be cooked, but many are eaten raw, such as lettuce and other salad plants, and celery. In selecting, look for crispness, and good green color. Sometimes spinach is a bit wilted and may be soaked in cold water, the result being crisp, firm leaves. Being composed largely of water, these vegetables decrease in bulk, when cooked, to a considerable extent, and it is necessary to buy a much larger quantity. They require careful preparation, consisting usually of many washings to remove dirt, and possible insects. When boiling green vegetables the color is retained if the kettle be uncovered. Often, a small amount of bicarbonate of soda is used, and salt is added just before the vegetable is ready to serve.

One word about cabbage; it should not be overcooked, thirty minutes being sufficient, and less time when the leaves are separated. If cooked in a large quantity of freshly boiling water, in an uncovered kettle, it is most delicate, and perfectly white. The long cooking causes it to grow dark in color and renders it hard of digestion. Any left-over cabbage may be chopped and scalloped with cream and cheese, covered with buttered crumbs and baked. The Fins and Swedes make a delicious dish, by wrapping cabbage leaves around raw well-seasoned chopped meat; these rolls are tied, fried until brown in hot fat, and then cooked in a very little water or gravy until tender.

A green new to many in this country is the Swiss chard. It is boiled and served like spinach, or the midrib of the leaf which

grows large is cooked and served like asparagus with a butter sauce.

French endive, which used to be very rare in this country, and high in price, is now much cheaper, being but twenty-five cents a pound. This is eaten raw as celery is, or it may be cooked, as celery is, in stock or water. Lettuce with us is almost always considered as a salad, but the French cook it with an onion, and serve it with melted butter. They also stuff it with seasoned bread or meat, and cook as the Swedes or Fins cook the cabbage.

Very few flowers are eaten as food. The artichoke, so prized by southern Europe and California, is considered a great delicacy. In the Italian market here, one can buy small artichokes for five cents, but the large ones are from fifteen to forty cents each. They are boiled, and after the choke is removed, are served hot or cold with a rich butter sauce, or a piquant sauce such as Vinaigrette.

Cauliflower is cooked like the cabbage, and so are Brussels sprouts. Cauliflower should be firm and white, with the flowerets firmly massed together. Sometimes a "head" of cauliflower looks dark which only indicates that it has been bruised in packing. The dark spots can be cut off, and if it is to be broken up for cooking, the appearance is just as good. Brussels sprouts are purchased by the basket, fifteen cents being an average price. They should not be too large, and the leaves should be green and firmly wrapped. Cook in an uncovered kettle of rapidly boiling water. Celery and sprouts are often served together, and any left-over vegetable makes a delicate cream soup.

The fruit or seed receptacle of the plants used as food are many, and include tomatoes, cucumbers, squash, eggplant, peppers, okra, and the pods containing beans and peas.

We used to think that cucumbers and tomatoes belonged to the summer and the fall, but now we can have these excellent vegetables any time as there are, besides native, hothouse and Southern varieties. Hothouse products are very perfect in shape, and not so large, but they lack flavor in comparison with those grown in season out of doors.

The cucumber is one of the very old vegetables, known for thousands of years. We are quite accustomed to think of it for salad to be eaten raw, but cooked it retains its delicate flavor, only ten minutes being required to soften it in boiling water. It is good served with a cream sauce, stuffed and baked, or fried. The last two ways produce a flavor very like an eggplant. Overgrown cucumbers are good for cooking, the small crisp ones being better for salad.

Vegetable marrow, summer squash, and eggplant may be stuffed and baked, or fried. When fried try olive oil for the fat, and use a clove of garlic; the result is a real Italian flavor.

Peas, beans, and lentils are rich in protein, and easily become the vegetable substitutes for meat. They are successfully canned and dried. Canned peas and beans are very good substitutes for the fresh ones, if treated in the right way. The vegetables should be drained from the liquor in the can several hours before using, and allowed to stand in cold water. This water should be drained off, and freshly boiling water added. Heat the vegetables in this, again drain, and serve with butter, salt, and pepper. In choosing canned vegetables, the best brand is the cheapest in the end. Choose one which does not have too elaborate a label, but states plainly what the contents of the can are. Dried vegetables ought to be used more than they are. The thought and amount of work necessary to make them good keep some housekeepers from using them. It is so much easier to open a can, half an hour before a meal, than to put dried beans to soak over night, and then slowly cook them until tender. The fireless cooker and the casserole have done much in making long, slow cooking a success.

A word about buying green vegetables; avoid telephoning but always choose them at the market. Some days one vegetable is very high in price and poor in quality, while another is excellent and cheap. By watching the market, and making wise selection, the housekeeper can keep her family well satisfied, and for comparatively little money. Dried vegetables can be served once or twice a week, but always avoid serving any one dish too often.

BERTHA E. SHAPLEIGH.

DEADLY POISONOUS FUNGI

The collection of edible fungi, commonly spoken of as mushrooms in contradistinction to the poisonous varieties known as toadstools, has become more and more popular during the past few years in America. On the one hand, the number of well-trained mycologists who undertake the study of fungi during the summer months as a scientific pastime, regardless of the dietetic value of the material they obtain, has been greatly augmented by those individuals who look everywhere for the edible species which they have learned to identify with great accuracy. In consequence, mushroom collecting has become something of a fad in many of our summer resorts and during September and October the fields and pastures are pretty thoroughly searched for such species as the meadow mushroom, *Agaricus campestris*. On the other hand, this country has seen, during the past decade, a great influx of peasants from Italy, Hungary and Bohemia where even the children know the difference between poisonous and harmless mushrooms. As a result, many of the edible species of fungi which grow in the woods are gathered by this foreign-born population either for themselves or for sale in the local markets. In consequence of this greater interest in the subject, mushroom poisoning has become somewhat more common in America despite the warnings issued from time to time, both to native Americans who are ignorant of the first principles of mycology, and to our foreign-born citizens who are misled by the variations in color and other properties which fungi exhibit in different countries. Poisoning by fungi, however, is by no means a modern occurrence. Indeed, mushrooms have been collected from time immemorial, according to Paulet, in such countries as Russia, China, Hungary, Italy, and especially in Tuscany; being exhibited for sale in the public markets in cities like Pekin, St. Petersburg, and Florence. It is also well known that the ancient Babylonians and the early Romans employed mushrooms in great quantity both as delicacies for the rich and as daily food for the poorer classes.

In early times, knowledge of the properties of fungi must have been gained entirely from experience and the accurate training

of the peoples of the old world in the distinctions between the poisonous and harmless varieties could only have been obtained from many accidents. How common mushroom poisoning actually was, however, is not known to us. It must have been fairly frequent since the deaths of several notables from this cause have been recorded in history, not as occurring from some unexplained phenomenon but from accidents of a nature well-recognized by their contemporaries. Of such victims may be mentioned the family of the Greek poet Euripides, including his wife, two sons, and a daughter; Pope Clement VII; Emperor Jovian; Emperor Charles VI; Emperor Claudius; and a number of others. Coming down to more modern times our first definite knowledge of the number of fatalities from mushrooms came from Paulet who states that from the year 1749 to 1788 there were a hundred deaths in the environs of Paris alone. About the time of Paulet, Bulliard, the celebrated French mycologist, began to systematize the knowledge of fungi possessed by men of his generation, established the various species upon firm ground, gave accurate descriptions of their botanical characters, and pointed out their physiological properties. Indeed, many of the species of the present day were established by this tireless French mycologist.

More recently, our knowledge of the extent to which mushroom fatalities may occur in France has been augmented by the publications of Bardy who reported 60 cases in that district known as Les Vosges, and of Guillaud who estimated the number of deaths in the southwest of France at about 100 annually. Falck has also reported 53 cases in Germany with 40 deaths, and at the same time Inoko in Japan has reported over 480 cases of mushroom intoxication in eight years. In this country Palmer, of Boston, collected 33 cases with 21 deaths and Forster, of Charlestown, 44 cases with 14 fatalities. Finally, in 1900, Gillot found over 200 authentic cases of mushroom poisoning mostly in France, and Ford, a few years later, added nearly as many more found in the German, English and French literature since 1900.

Poisoning by Amanita phalloides

Botanical features

The vast majority of cases of mushroom intoxication are caused by *Amanita phalloides*, the white or deadly Amanita. This species has a characteristic appearance and should be readily recognized by collectors of even limited experience. It usually grows to a height of 5–7 inches and its white spores, its ring or annulus and its base or cup (frequently called the poison cup) render its identification comparatively simple. The colors of the pileus, varying from brownish amber to yellow, are important, but are not as a rule regarded as of specific value. In Europe the pileus is usually greenish in color, but in America the greenish color is rarely seen. *Amanita phalloides* usually grows in the woods but this rule is by no means universal. Occasionally, plants are to be found out in the open pastures near the margin of dense forests or in the grassy spots in the roads leading to and from them.

Clinical aspects

In poisoning by *Amanita phalloides* the clinical symptoms are practically always the same. After a prodromal stage of six to fifteen hours in which no discomfort is felt, the victims are suddenly seized by severe abdominal pain, cramp-like in character, and accompanied by vomiting and diarrhoea. Vomitus and stools consist of undigested food with much blood and mucus. Anuria is usually present and rarely constipation develops. Hemoglobinuria does not occur. Paroxysms of pain and vomiting alternate with periods of remission, the extreme suffering producing the Hippocratic facies described by the French as "la face vulteuse." The loss of strength is rapid and excessive. Jaundice, cyanosis, and coldness of the skin develop within a few days, followed by profound coma from which the patient does not rally. There is no fever. Convulsions are absent in the early stages and when present in the late stages are usually a terminal event. Ocular symptoms also do not usually occur. The course of the disease lasts four to six days in children and eight to ten in adults but if large quantities of the fungus are

eaten a very profound intoxication develops and death may occur within 48 hours. The mortality in "phalloides" intoxication is extremely high, varying from 60 to 100 per cent., and is dependent somewhat upon the amount of the poisonous material ingested and probably somewhat upon the treatment. It requires surprisingly small quantities, however, to bring on fatal consequences and there are numerous deaths on record from eating one or two good-sized specimens. Plowright has reported the death of a child of ten years from the consumption of about a third of the top of a small plant eaten raw. Recovery after ingestion of any quantity of *Amanita phalloides* may be regarded as extremely rare but not impossible. There is no difficulty in distinguishing between a poisoning due to this fungus from one due to other species such as *Amanita muscaria* since the entire clinical course of the disease is different.

Autopsies upon individuals killed by *Amanita phalloides* have been carried out by a number of observers but our knowledge of the lesions is by no means satisfactory. There is little to be found to account for the violent paroxysms of pain, vomiting, and diarrhoea. Death seems to be due to the extreme fatty degeneration of the liver. The poisoning resembles most closely phosphorus poisoning (Ford).

Poisonous constituents

Modern knowledge of the properties of this plant dates from the work of Kobert, who established the important fact that extracts of *Amanita phalloides* contain a substance which lakes or dissolves the blood corpuscles of many animals and of man. Subsequent work upon *Amanita phalloides* has been conducted chiefly by American investigators. It was first shown by Ford that extracts of *Amanita phalloides* contain the hemolytic material described by Kobert and in addition a heat resistant body which will reproduce in animals the majority of the lesions described in fatal cases of *Amanita phalloides* intoxication in man. These two substances were named by him the amanita-hemolysin and the amanita-toxin. The active principle of the plant is the alcohol-soluble toxin. This resists the action of heat, of drying,

and of the digestive juices and reproduces in animals the lesions of phalloides intoxication in man.

Treatment

There is no satisfactory method of treating individuals poisoned by the deadly Amanita. It is essential that competent medical advice be obtained as soon as possible and every effort made to rid the alimentary canal of the noxious material in the hope of doing so before enough poison is absorbed to bring on fatal results. Active emetics and purgatives should be administered at once and in case these are not effective the stomach should be washed out and the lower bowel irrigated. Even then, it is frequently impossible to prevent the absorption of the poison which takes place with great rapidity. In the later stages stimulants should be employed with great freedom in the hope of tiding the patient over the periods of weakness. Narcotics should be employed to relieve the intense pain and whenever convulsive movements are seen. *Atropin has no effect in Amanita phalloides intoxication* and no reliance should be placed upon the drug in poisoning by the deadly Amanita. Efforts to manufacture a curative serum by the immunization of animals with the poisons in this fungus have thus far been unsuccessful.

Poisoning by Amanita muscaria Linnaeus

Botanical features

Poisoning by *Amanita muscaria* or the "fly agaric" is, next to that following the ingestion of *Amanita phalloides*, the most frequent variety of mushroom intoxication. This is primarily due to the great abundance of this species and its wide distribution over the surface of the world. The *Amanita muscaria*, in addition, more than other fungi is subject to great variations in color, size, and markings due to geographical distribution and seasonal changes. This may possibly account for the numerous accidents in America resulting from mistaking *Amanita muscaria* for *Amanita caesarea*, one of our most beautiful and highly prized edible Amanitas. Accidents of this nature have occurred most frequently among foreigners, a fact which seems to indicate the

closest resemblance between specimens of certain European species and other American species.

Clinical aspects

The clinical features of poisoning by *Amanita muscaria* are quite as characteristic as those in *Amanita phalloides* intoxication and should enable physicians to distinguish clearly between the two conditions. Unfortunately, poisonous fungi are usually gathered by the ignorant who sometimes eat a number of different varieties and consequently the symptoms in the patients point to the combined action of different toxic principles. In general, however, there is no difficulty in recognizing the character of the intoxication. In *Amanita muscaria* poisoning there is usually a very short interval between the ingestion of the fungi and the first signs of trouble. This prodromal stage varies from one or two to five or six hours depending upon the amount of the fungi eaten. Careful observation of this feature will frequently be of the greatest value in deciding upon the kind of intoxication which the cases present. In the severe cases the patients show an excessive salivation and perspiration, a flow of tears, nausea, retching, vomiting and diarrhoea with watery evacuations. The pulse may rarely be quickened, but it is usually slow and irregular. There is no fever. The respirations are accelerated and the patients dyspnoeic, the bronchi being filled with mucus. Mental symptoms are also present, particularly giddiness with confusion of ideas and rarely hallucinations. All these symptoms may vary in their intensity, at some times the gastro-intestinal predominating and at other times the mental. In light cases, where small quantities of the poisonous fungi are consumed, only an excessive salivation or perspiration may be noticed, with uneasiness and discomfort in the stomach and bowels, the symptoms subsiding spontaneously in a few hours. In the severe cases, the vomiting and diarrhoea may be so pronounced as to rid the alimentary canal of the offending material and the nervous symptoms then become the predominant ones. With large quantities of poison also the patients may show the nervous manifestations from the start, delirium, violent convulsions, and

loss of consciousness developing in rapid succession and the patients sinking into a coma from which they can be roused with difficulty if at all. Rarely, consciousness is retained till the end, the patients dying from a paralysis of respiration. Finally, in many cases, after the preliminary attack of vomiting and diarrhoea, the patients sink into a deep sleep from which they wake several hours later profoundly prostrated but on the road to recovery. In such cases the effect of the poisoning passes off rapidly, the patients being restored to normal health within two or three days. There are no late effects or after-effects in *Amanita muscaria* intoxication, and the prognosis is always good if the patients recover from the preliminary symptoms. Chronic lesions such as develop in *Amanita phalloides* intoxication and are to be referred to the degenerative changes in the internal organs, do not occur with *Amanita muscaria.* Rarely, the nervous manifestations of "muscaria" intoxication become much more pronounced than the alimentary and the patients become the victims of excitement and hallucinations evidencing many of the symptoms of alcoholic intoxication. This variety of poisoning is particularly common in Siberia where decoctions of *Amanita muscaria* are employed to induce orgies of drunkenness in which the most disgusting practices are followed, according to Kennan. The physiological effect of the Siberian *Amanita muscaria* has never been clearly understood and the symptoms shown by the Koraks who employ the fungus as an intoxicant are seldom seen either in Europe or in America. Possibly the method of preserving the plants may alter the poisonous principles in them or possibly the Siberian plants do not contain the same poisonous substances as the European or American varieties. Death, however, is by no means an infrequent occurrence among the Koraks from an overdose of *Amanita muscaria* and, as we shall see later, the active principle of the European plants, muscarin, has also been obtained from the Siberian.

Autopsies upon individuals dead from the ingestion of *Amanita muscaria* have revealed surprisingly little. The pathological changes in the internal organs seen with *Amanita phalloides* are lacking, particularly the hepatic lesions. In general, the findings point to the action of a profound nerve poison (Ford).

Treatment

The outlook in poisoning by *Amanita muscaria* is more hopeful than when *Amanita phalloides* has been ingested, because of the lack of chronic and degenerative lesions produced by the latter species. *Amanita muscaria* causes an acute intoxication which comes on soon after the ingestion of the fungus, develops rapidly, and is amenable to treatment. As we have indicated above, atropin is a perfect physiological antidote for muscarin. Whenever, therefore, the patients show evidence of muscarin poisoning such as lacrymation, salivation, contraction of the pupils, delirium, hallucinations, and coma, atropin should be administered at once and in large doses. At the same time the stomach and bowels should be emptied of the ingested material by the free use of emetics and purgatives. Even though the vomiting and diarrhoea are pronounced, drugs should be employed to increase this action since it is essential that all the fungi be removed and the absorption of poison be prevented. In refractory cases with bad heart action, respiratory distress and coma, atropin should be administered intravenously. In such cases atropin, indeed, offers the only hope of saving the patient's life.

Prophylaxis

Mushrooms are usually eaten for their flavor which makes them an agreeable relish and food-accessory rather than a staple article of diet. There is no general cook-book test to distinguish the dangerous fungi from the edible ones. The habits and appearance of the poisonous species must be studied until one may recognize them with the same ease and certainty as any of the common plants of our gardens. Neglect of this precaution in gathering mushrooms for the table will sooner or later cause a typical attack of poisoning, and in such cases it should be remembered that the mortality is often as high as in any of the most fatal diseases. The rapidly increasing number of deaths in this country from mushroom poisoning shows that some effort must be made to disseminate exact information about the dangerous species in order to prevent unnecessary suffering and death.

There is a tradition in this country and Europe that treating *Amanita muscaria* (Coville) with vinegar and salt water removes the poisonous constituents. This treatment if repeated several times would probably remove muscarin and similar substances but the danger from incomplete extraction of the poison is still too great to recommend its use. In the case of *Amanita phalloides*, Radais and Sartory have shown that such treatments do not reduce the toxicity of the fungus in spite of popular belief to the contrary. There is little doubt that in some countries people habitually eat *Amanita muscaria* in small quantities, both treated and untreated, with no apparent signs of poisoning, but this does not warrant us in ever allowing ourselves to experiment upon the edibility of such poisonous fungi. Generally, in this country, no one eats *Amanita muscaria* because of its well known dangers. In some of our investigations (Clark and Smith) on American specimens of this plant from different localities we found apparently great differences in toxicity, possibly due to local variation. Furthermore, under certain conditions, heat may destroy the poisons in *Amanita muscaria* as reported by Ford and others, but neither does this observation warrant us in concluding that the dangers from eating this fungus are overestimated.

The first necessary prophylactic measure is to impress upon mushroom lovers that *there is no easy empirical test to distinguish between the edible and poisonous fungi.* No one should eat an unfamiliar mushroom until it has been identified as a harmless species by a well-trained mycologist. It is not difficult to learn to know fungi at a glance if one is willing to study them closely and to remember the points of difference, in form, color, and habit among the various species. Unfortunately, there are a few "mushroom handbooks" in this country, which are unfailing sources of misinformation, and they have evidently been written by people of no training and poor judgment. In one case, color plates of *Amanita muscaria* and *Amanita caesaria* have the names of these two species transposed. Identifications based on pictures are dangerous unless the publication of such unreliable books is prevented. After all, the number of poisonous species

is very small and when they are eliminated there are still many desirable fungi which are perfectly safe esculents.

So far we have mentioned only the prophylactic measures to be taken in eating wild mushrooms gathered in the fields, but there is a broader phase to be considered; this is the question of mushrooms in the public markets. If these markets are supplied by wild fungi gathered for the purpose it is necessary to see that no poisonous species become mixed with the others. In European countries many of the public markets have an official mushroom inspector, whose duty it is to examine all lots of fungi before they are exposed for sale and to condemn all fungi not known to be entirely harmless to man. With the increasing taste for mushrooms in this country and the larger stocks carried during the season, it may become necessary for us to control our mushroom supply in a similar manner. Several deaths have been caused by poisonous fungi bought in our public markets.

Even the use of cultivated mushrooms does not guarantee immunity from trouble by poisoning since it is believed by several investigators that harmless fungi may become poisonous if kept too long before consumption (Kobert). This often happens in markets and restaurants where mushrooms become slightly decomposed before they can be sold. Another danger is that cooked mushrooms may develop toxic properties after being kept during the summer weather and again served at subsequent meals (Frey). On chemical grounds it is easy to see that the unstable nitrogenous substances in edible fungi could easily be changed into toxic constituents by the action of microörganisms. This is another matter that ought to be studied by chemical and pharmacological methods before we can feel at all satisfied with our present knowledge of the properties of poisonous mushrooms.

WILLIAM W. FORD AND ERNEST D. CLARK

JOHNS HOPKINS UNIVERSITY, BALTIMORE, MD.

BUREAU OF CHEMISTRY, WASHINGTON, D. C.

STOKES PRIZE ESSAYS*

III. The Protection of Trees

In the city, shade trees growing along the street, are, of course, more or less unprotected and are often injured. When, for instance, a driver leaves his horses which delivering a package, they will frequently nibble the leaves or bark of any tree that may be near by.

Often, while a tree is still young, the tender terminal twigs are thus destroyed. Then, when new sprouts appear, some other horse will very likely bite them off. This may continue year after year until the tree either dies or becomes so stunted that it never grows up to beautiful maturity.

In those parts of the city where buildings are tall, trees do not thrive because the rays of the sun are cut off from them. Trees are often cut down to make a place for a house to be erected. In fact, buildings are their greatest enemies.

In parks, children delight in pulling off the branches of some trees. Grown people, also, pull off their leaves and branches.

Smoke is another dangerous enemy. It will come out of the factories and fill the pores of the leaves. This will keep out the air; and, as the tree cannot live under such circumstances, it dies. In Pittsburgh, the smoky city, few trees thrive.

Gas leaks are also dangerous. Trees breathe just as people do. If the poisonous gases get into the trees, it will kill them just as it would us.

In the country, trees thrive better than in the city. However, they have many dangerous enemies. Among them are fires, insects, careless people, and fungi.

Insects bite at the leaves or bore into the wood, and some larger ones bite at the branches. This hurts the tree.

In the forest an old tree will often be struck by lightning. This may set fire to other trees. Every year many trees lose their lives in this way.

* These essays were submitted on Arbor Day, May 8th, 1914, in competition for the eight colored pictures of "Wild Flowers Needing Protection" framed and presented by the New York Botanical Garden to the high schools and public schools of The Bronx, through the aid of the Stokes Fund for the Preservation of Native Plants.

In the summer, people out for a picnic will break off the branches for fans, or, perhaps build a shelter with them. Children swing on the branches and often break them off.

The fungi, however, are about the most dangerous enemies in existence, as few trees are protected against them. If the fungus finds any open place in the bark, no matter how small, it will run its little fibers in and begin its gruesome work. After inserting its fibers, the fungus begins to take all the nourishment from the tree. The tree then becomes hollow and is soon blown down.

No tree is proof against storms. The Carolina poplar and soft maple sometimes become so loaded with snow that their branches break off, especially if the wind is strong.

Everybody can, if they will, take care of trees. If children would not cut off the branches and carve their names in the bark, more trees would be fine. When grown-ups are building a house they should try and think about the trees. They might build on a spot where there are no trees, or, perhaps, build in such a way that the trees would not be injured.

ELIZABETH PEARSON—5 B.

P. S. No. 26, The Bronx,
HANNAH T. MCMANUS, *Principal.*

PROFESSOR FRANKLIN W. HOOPER

Professor Franklin W. Hooper, Director of the Brooklyn Institute of Arts and Sciences for the past twenty-five years, died on August 1 at his summer home in Walpole, New Hampshire, at the age of sixty-three. He is survived by his widow, the daughter of Mr. Peter S. Holden, and a son and daughter.

Professor Hooper was born in Walpole, New Hampshire, and educated at Harvard University. During 1875 and 1876, he served the Smithsonian Institution in an exploration of the Florida Keys; after which he became principal of the Keene High School in New Hampshire and remained in that position until 1880, when called to Adelphi Academy in Brooklyn as Professor of Chemistry and Geology.

He was elected director of the Brooklyn Institute in 1889 and immediately entered upon an active campaign for the development of the institute which proved remarkably successful. Appropriations were secured for handsome buildings, a large endowment fund was raised, thousands of members were added to the roll, and an educational system by means of exhibits, publications, and lectures scarcely equalled elsewhere was provided for all classes of people at little or no expense to them. Professor Hooper literally exhausted his wonderful energies in serving the institution he had thus developed, which was dearer to him than life.

Professor Hooper also served the public as trustee of the Brooklyn Art Association, trustee of the Brooklyn Public Library, trustee of Antioch College, Ohio, director of the New England Society of Brooklyn, and member of the Brooklyn Board of Education. He was a fellow of the American Association for the Advancement of Science, an officer in the American Bison Society, a member of the American Forestry Association, a member of the Committee on Lectures on History of Religion, a member of the National Geographic Society, a member of the Oriental Society, and a member of the Hamilton, University, Montauk, Unity, and Harvard Clubs.

LATE SUMMER LECTURES, 1914

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

Aug. 1. "Reef-building and Land-forming Sea-weeds," by Dr. M. A. Howe.

Aug. 8. "Medicinal Plants Found in the Vicinity of New York City," by Dr. Wm. Mansfield.

Aug. 15. "Evergreen Trees and Shrubs," by Mr. G. V. Nash.

Aug. 22. "Woody Fungi and Their Injurious Effects on Trees," by Dr. W. A. Murrill.

Aug. 29. "The Trees of the Rocky Mountains," by Dr. P. A. Rydberg.

Sept. 5. "The Life History of a Tree," by Dr. C. S. Gager.

Sept. 12. "Diseases of Cultivated Plants," by Dr. G. P. Clinton.

Sept. 19. "Interrelations between Botany and Geology," by Dr. Arthur Hollick.

Sept. 26. "Wild Flowers of Autumn," by Dr. N. L. Britton.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for crosstown trolley, transferring north at Third Avenue.

NOTES, NEWS AND COMMENT

Professor F. L. Stevens, of the State University of Illinois, was a visitor at the Garden on August 4.

Mr. William C. Barbour, of the High School of Commerce in this city, is spending the summer at the Garden. He is making a study of lichens in general and giving special attention to the forms occurring in this vicinity.

Volume 10, part 1, of North American Flora was published July 28, 1914. It comprises 76 pages by Dr. W. A. Murrill on the Agaricaceae. The part contains a treatment of the last ten genera (42–51) of the tribe Agariceae, family Agaricaceae. Two hundred and eighty-one species are described, thirty-nine of which are new. Extra copes of this part were printed in order to supply the demand for literature on the gill-fungi.

Sir George M. Bullock, Governor of Bermuda, spent the afternoon of August 2 inspecting the Conservatories and Plantations of the Garden. He was especially interested in the hardy trees and shrubs that might be grown in Bermuda and also in increasing the number of attractive tropical plants in his beautiful public gardens at Government House. Exploration in Bermuda undertaken by the Garden has always received the most cordial cooperation from Governor Bullock.

A separate in advance from Bulletin No. 31 of the New York Botanical Garden on "Philippine Mosses," by Mr. Robert S. Williams, Administrative Assistant, appeared July 23, 1914. Of the 240 species collected by Mr. Williams in the Philippines several years ago and treated by him in this paper, 27 are described as new and three new genera are added. Mr. Williams collected over a small area in central and northern Luzon and in the southwestern and southeastern parts of Mindanao. There is still very much to do in the way of exploration in the Philippines. Much of the territory in northern Luzon and eastern Mindanao may be expected to yield large additions to the Philippine moss flora.

Meteorology for July.—The total precipitation for the month was 5.36 inches. Maximum temperatures for each week were 85° on the 2d, 91° on the 12th, 89.5° on the 18th, and *91.5° on the 21st.* Minimum temperatures were 54° on the 1st, 56° on the 7th, 53° on the 20th, *52.5° on the 23d*, and 54.5° on the 29th.

ACCESSIONS

MUSEUMS AND HERBARIUM

5 specimens of flowering plants from Alberta. (By exchange with Mr. Ernest Thompson Seton.)

2 specimens of peanuts from China and Java. (Given by Dr. H. H. Rusby.)

1 specimen of *Bryum squarrosum* from Astoria, Oregon. (By exchange with Dr. Julius Röll.)

3 specimens of *Allium* from Pennsylvania. (Given by Mr. Bayard Long.)

94 specimens of flowering plants from Vancouver Island. (By exchange with the Geological Survey of Canada.)

1 specimen of moss from Canada. (By exchange with Professor Irénée Theriot.)

1 specimen of woody fungus from Maxton, Arizona. (By exchange with Mr. W. H. Long.)

75 specimens "Mycotheca Boreali-Africana," fascicles 5, 6, 7. (Distributed by Professor René Maire.)

100 specimens "North American Uredinales," century 11. (Distributed by Mr. Elam Bartholomew.)

100 specimens "Fungi Columbiani," century 43. (Distributed by Mr. Elam Bartholomew.)

12 specimens of fungi from Colorado. (By exchange with Professor Ellsworth Bethel.)

1 specimen of Manica, roots and stems, from Brazil. (Given by Dr. H. H. Rusby.)

13 specimens of hepatics from Washington. (Collected by Mr. A. M. Foster.)

1 specimen of *Fissidens polyphyllus* from France. (By exchange with Mr. Gabriel Dismier.)

4 specimens of mosses from Norway. (By exchange with Dr. I. S. Hagen.)

45 specimens of marine algae from Bayville, New York. (Given by Mr. Daniel G. Banks.)

15 specimens of marine algae from Orient, New York. (Given by Mr. Roy Latham.)

50 specimens "Phycotheca Boreali-Americana," for the Columbia University Herbarium. (Distributed by Collins, Holden, and Setchell.)

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BRONX PARK, NEW YORK CITY

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JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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Museum front showing fountain and new plantation.

JOURNAL

OF

The New York Botanical Garden

VOL. XV September, 19.4 No. 177

THE JOHN INNES KANE FUND

Mr. John Innes Kane served as a member of the Board of Managers of the Garden from 1896 until his death in 1913. He was Chairman of the Membership Committee during this period and for many years was a member of the Executive Committee. His interest in botanical science and in the development of the New York Botanical Garden was great, and his untimely death was deeply deplored.

The following letter was received from Mrs. Kane in December, 1913:

1 WEST 49TH STREET,

December 17, 1913.

DR. N. L. BRITTON, *Secretary*,

New York Botanical Garden.

My dear Dr. Britton:

If it will be agreeable to the Managers of the Garden, I shall be glad to establish a memorial to my late husband, John Innes Kane, remembering his interest at all times in the Garden. I shall be prepared to send to the Managers a cheque for ten thousand dollars upon learning that such purpose is approved by them.

I should wish the fund to be called "The John Innes Kane Fund," to be held and invested and the income applied to the purchase of living plants for the grounds and greenhouses.

Please present the subject in the proper quarter, and inform me.

Yours faithfully,

(Signed) ANNIE C. KANE.

[Journal for August (15: 153–174) was issued August 25, 1914]

At a meeting of the Board of Managers held December 18, 1913, the following resolution was adopted:

Resolved: That the Board of Managers of the New York Botanical Garden gratefully, and with high appreciation, accepts the gift of Ten Thousand Dollars by Mrs. John Innes Kane as a memorial of her late husband, for many years a member of this Board, in accordance with the terms of her letter of December 17, 1913, addressed to Dr. N. L. Britton, Secretary, the income of the "John Innes Kane Fund" to be applied to the purchase of living plants for the grounds and greenhouses.

This foundation is the first which has been established at the Garden for the specified purpose of increasing the collections of living plants, and it will be of great service, both by supplying specimens for scientific investigation and for decorative plantations.

A portion of the income of the "John Innes Kane Fund" for 1914 was used in the spring for the purchase of ericaceous evergreens for planting the semicircular plot 120 feet long, averaging 15 feet wide, in front of the lower marble basin of the bronze fountain immediately in front of the museum building, hitherto maintained as lawn. The background of this fountain had previously been planted with arbor vitae, *Chamaecyparis* and other conifers.

The plants purchased and installed this spring include 150 specimens of low rhododendrons of six different kinds, occupying the two ends of the strip, the middle portion being occupied by two species of *Pieris*, *Azalea amoena Hinodegri* and *Leucothoë Catesbaei*.

A photograph of the museum front showing the fountain and the new plantation is reproduced herewith.

N. L. Britton.

POISON IVY

(With Plates CXXXVII, CXXXVIII, CXXXIX, and CXL)

Poison ivy, *Rhus radicans*, is one of the most widely distributed of the plants that occur in the eastern United States. No matter

Poison Ivy, trailing form.

where you go, from the peaks of the Catskill Mountains to the shores of the oceans, you will find poison ivy. Every year it becomes more widely distributed. This is due to its effective method of propagation, to its hardiness, and to its attractiveness.

The seeds of poison ivy will develop under almost all conditions. Like many other seeds, they are not harmed by the cold of winter, so that when weather conditions are favorable, the mature plant develops. Poison ivy will adapt itself to many varying conditions, and its habits of growth under varying conditions are as variable as the conditions. It is without doubt one of our most attractive plants. Because of its beauty it is frequently allowed to grow beside old fences and unsightly hedges, which are completely covered by its luxuriant growth.

Poison ivy, depending on the conditions, grows as a trailing vine (Plate CXXXVII); a climbing vine (Plate CXXXVIII); or as a shrub (Plate CXXIX). The trailing form is met with most frequently on the borders of woods, in meadows, and in open places between trees. Under these conditions the main stem trails along the ground, rooting at the joints and developing numerous aerial branches. When the trailing form comes in contact with a fence or shrub, it becomes climbing. But instead of developing roots which function as absorbing organs it develops thousands of small roots which function as hold-fast organs. By means of these roots it is able to climb the perpendicular face of a cliff or a tree trunk. From this vertical vine-like stem, numerous lateral branches develop, some of which become attached to the tree, while others remain free. In some instances the horizontal branches grow to such a length that they resemble the branches of a tree and if the growth of the poison ivy is sufficiently vigorous it may completely overshadow the branches of the tree.

The shrub form of poison ivy is usually found growing in open exposed places. When undisturbed, it grows to the size of a small tree with good sized branches. The trunk is often free from branches for several feet from the ground. The spring foliage which develops annually on all forms is of an attractive reddish-purple color. This color is gradually replaced by the chlorophyll green of the mature leaf.

The leaves of poison ivy are three-foliate. The two lateral leaflets are nearly sessile and somewhat egg-shaped. The margin of the leaf varies from entire to strongly notched on the side parallel to the stem. The terminal leaflet has a short stalk and prominently marked apex. All the leaflets are of a bright shining green color above, and slightly paler beneath. These leaves begin to change color in August. At first the green of the upper surface becomes marked between the green veins with copper-colored splashes. Gradually the color changes to dark crimson and spreads to the veins which now have become yellow, so that the leaf is marked at this period by broad bands of dark crimson and narrow bands of yellow. Finally the leaf becomes a uniform color, the color varying from pink to red and to brown. It is the brightly colored forms of poison ivy that are most prized for bouquets by those unfamiliar with its nature. Only last fall while crossing the Fort Lee Ferry, a man who sat beside me asked me if I could tell him the name of the bright red leaves surrounding a bouquet of asters. "My two little children are asking me to tell them the names of the plants that I take them from my walks," said he. When I told him that they were poison ivy leaves, he seemed very grateful for the information.

The flowers, which occur in panicles and which are green in color, are small and inconspicuous. The individual flowers have a four to six-parted calyx. The petals are greenish-white and spreading. The flowers have five stamens, a solitary pistil, one ovule, and a three-parted style. The fruit is small, rounded and greenish-white in color.

After the first frost the leaves begin to fall. In a short time the branches are entirely bare. During this, the winter stage of the plant, the stems appear dark gray. The thousands of hold-fasts on the climbing form, which are now readily seen, appear like tufts of brownish black hairs. During the late fall, winter, and early spring many people are poisoned by coming in contact with the stem and berries.

Poison ivy is often mistaken for Virginia creeper, *Parthenocissus quinquefolia*, a plant which is frequently found growing with poison ivy. The leaves of the former (Plate CXL) are five-

Poison Ivy, climbing form.

Poison Ivy, shrub form, growing at Crooks' Point, Staten Island.

parted instead of three-foliate as in those of the poison ivy. The three upper leaflets are usually larger than the two lower ones. The margin of the leaflets are coarsely toothed to or below the middle. The veins are more prominent on the under side of the leaf. In early fall the leaves of Virginia creeper change from a dark green to a bright scarlet color. The bright color of the leaves together with the clusters of dark blue berries makes this plant much sought after in decorative planting.

Poison ivy, or poison oak, as it is known commercially, poisons more people in this section of the country than any other plant. The result of the poisoning seldom proves fatal, yet the person affected suffers greatly from the intense irritation and swelling of the tissues and skin, which irritation is caused by the poisonous fatty or resinous constituent of the plant. To people susceptible to its effects, it acts as an irritant or caustic poison. Some people are so susceptible to its effects that a few pollen grains falling on the skin will produce poisoning; while with others, direct contact with the leaves of the plant is necessary to produce irritation.

The first effect of poisoning by ivy is a mild irritation of the skin, which the sufferer instinctively rubs, unless he suspects the source of the irritation. Even then, some people do not refrain from scratching the skin. The result is that the outer skin is broken or removed. This gives the poison access to the inner and more sensitive tissues.

The secondary effect of this poisoning is reddening of the skin. This is followed by the blister stage. These blisters are caused by the infiltration of water between the outer and inner layers of the skin. If these blisters are perforated and the water allowed to run on an unaffected part, that part in due time develops symptoms of poisoning. In fact, a brisk rubbing of the surface affected during any stage of infection and a subsequent touching of an unaffected part will cause the poison to take effect.

The effect of poison ivy on the skin can be effectively counteracted during any of its stages by rubbing the parts well with a paste of bicarbonate of soda and finally leaving on the affected part a layer of this pasty mass, frequently moistening it as the water evaporates.

Another method is to wash the part suspected of ivy poisoning with strong grain alcohol. The fatty or resinous nature of the poisonous substance of this plant is saponified when treated with an alkali, which of course changes its chemical composition, thus rendering it harmless. While the alcohol treatment is based on the fact that the alcohol dissolves the fat which is thus removed from the surface of the skin, the alcohol treatment proves efficacious only during the first stage of poisoning.

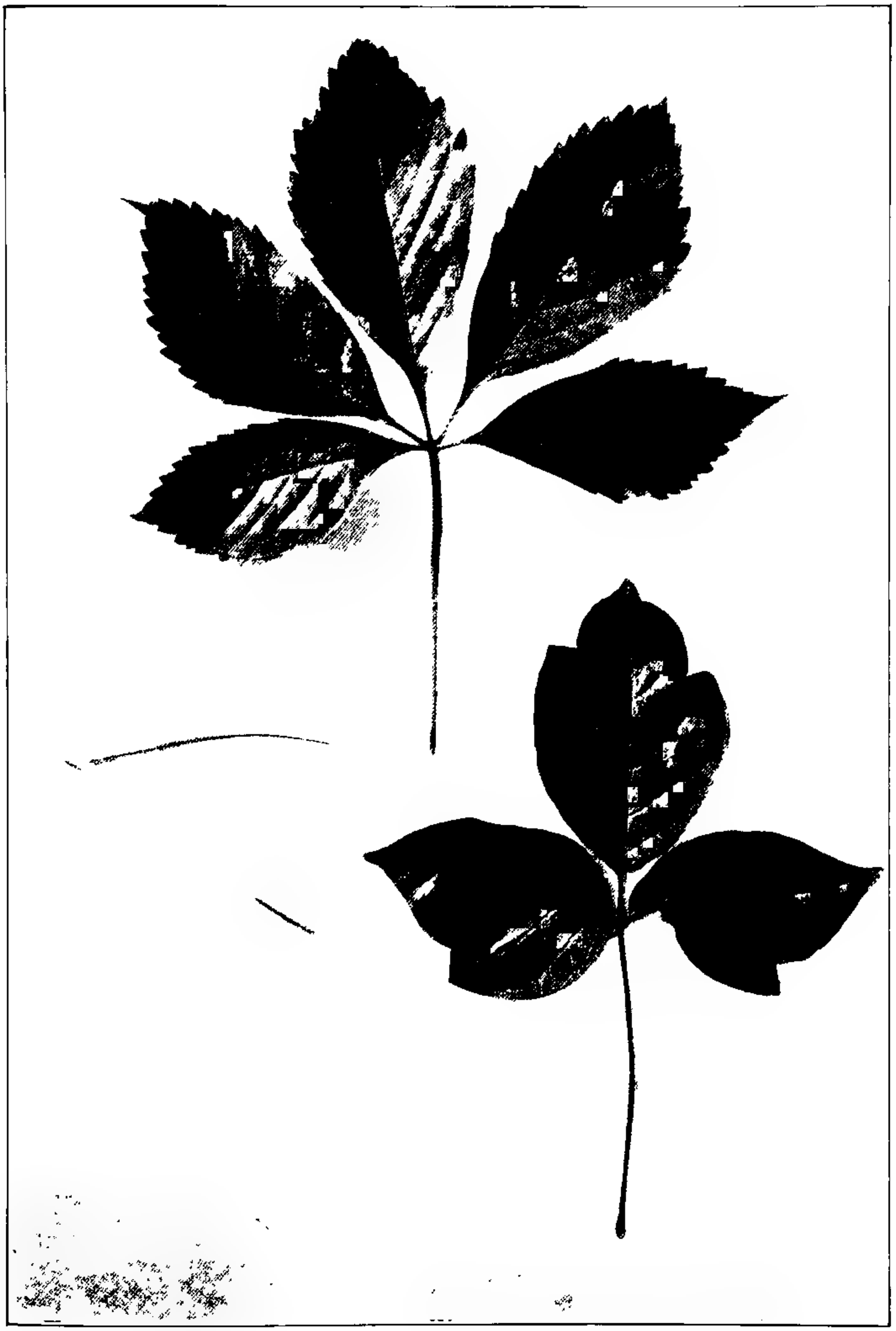
Thousands of people are poisoned every year by poison ivy, much to their discomfiture, both from a physical and a financial standpoint. A large manufacturing concern in the city only recently asked me to arrange an exhibit of poison ivy for their employees. Their attending physician informed me that each year numbers of the men are affected with poison ivy. In fact, cases of poisoning have been so common during the past year that the company decided to teach their men to identify the plant, and to apply the proper method of treatment in case of poisoning.

For several years past efforts have been made to exterminate poison ivy in the New York Botanical Garden, especially in the vicinity of the main paths. Workmen, who are not susceptible to the poison of the plant, root out and destroy the plants, which is the only effective method of eradication. It is necessary to go over the same areas year after year to dig out any plants that may spring up from roots that remained in the soil or from seed. After the first thorough uprooting the work for successive years is much less and in a few years the eradication is complete.

Is it not time that steps be taken to rid the country of this pest? We can at least make a beginning by having exhibition beds of poison ivy in all our public parks. In making such an exhibit it will not be necessary to search beyond the park limits for these plants. In all the parks of the city there are thousands of plants of poison ivy. Why not rid our parks of these plants, push the campaign of extermination to the state, and finally to the whole country? Poison ivy has become a menace to public health. For that reason every person should be familiar with it.

WILLIAM MANSFIELD.

COLUMBIA UNIVERSITY.



Leaf of Poison Ivy (*Rhus radicans*) in lower part of plate. In upper part of plate a leaf of Virginia creeper (*Parthenocissus quinquefolia*) sometimes mistaken for Poison Ivy.

FOSSIL WOOD FROM THE PETRIFIED FOREST OF ARIZONA

The Museum has recently acquired, through the kindness of Mrs. John I. Kane, two fine specimens of fossil wood, from the so-called "Petrified Forest," near Adamana, Arizona. The specimens consist of complete cross sections of a tree trunk about thirteen inches in diameter, one of which is polished so that the mineralization and what remains of the original structural characters of the wood are clearly shown. The region which includes the most interesting features of the forest is embraced in the Petrified Forest National Monument, a reservation created by proclamation of President Roosevelt, on June 8, 1906. The original reservation was, however, deemed to be more extensive than necessary and was reduced in 1911 to its present area of forty and one half square miles. Under the conditions which now obtain specimens of the fossil wood may not be taken away by collectors as was formerly freely done, and the Garden is, therefore, to be congratulated on having secured these two specimens, especially the polished one, which was sent to England by Tiffany and Company, in order that the work of polishing could be satisfactorily done.

The particular form of fossilization exemplified in the wood from this region is what is known as silification, or the replacement of the woody tissue by silica in one or more of its various forms, chalcedony, jasper, quartz crystals, etc. Of course every intelligent person now knows that fossil wood of all kinds represents what was formerly the wood of living trees; but it may be interesting to note that this fact was a subject of controversy and discussion until the beginning of the last century, and that all of the older writers on natural history who had occasion to study such material had either very vague or entirely erroneous ideas in regard to its true nature and origin. In Gerard's "Herbal," published in 1597, for example, may be found these words in connection with his discussion of a fossil tree stump: "Among the wonders of England this is one of great admiration, and contrary unto man's reason and capacitie, that there should bee a kinde of Wood alterable into the hardnesse of a stone called

Stonie Wood, or rather a kinde of water, which hardeneth wood and other things into the nature and matter of stones."

Fossil wood and fossils in general were, for the most part, regarded as freaks of nature; but in 1693 John Ray, in his "Physico-Theological Discourses," expresses grave doubt that Nature should engage in useless and wanton ornamentation of rocks and stones, such as he observed in connection with fossil shells and other animal remains; "Yet," he finally observes, "I must not dissemble, that there is a *Phenomenon* in Nature, which doth somewhat puzzle me to reconcile with the prudence observable in all its works; and seems strongly to prove, that Nature doth sometimes *ludere*, and delineate Figures, for no other end but for the Ornamentation of some stones, to entertain and gratifie our Curiosity, or exercise our Wits. That is, those elegant Impressions of the Leaves of Plants upon Cole-Slate."

ARTHUR HOLLICK.

AUTUMN LECTURES, 1914

Lectures will 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. 3. "The Economic Importance of Fungi," by Dr. F. J. Seaver.

Oct. 10. "Carnivorous Plants," by Dr. J. H. Barnhart.

Oct. 17. "The Flora of New York and Vicinity," by Mr. Norman Taylor.

Oct. 24. "The Production and Utilization of Plant Hybrids," by Dr. A. B. Stout.

Oct. 31. "Botanical Travels in Europe," by Dr. W. A. Murrill.

Nov. 7. "A Botanist in India and Java," by Dr. C. F. Millspaugh.

Nov. 14. "The Influence of Radium on the Production of Field Crops," by Dr. H. H. Rusby.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for crosstown trolley, transferring north at Third Avenue.

CONVENTION OF THE AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS

The sixteenth annual Convention of the American Association of Park Superintendents was held at Newburgh, New York, and New York City, August 24 to 27 inclusive. It was one of the most successful conventions in the history of the association, the attendance being large, with representatives from many parts of the United States and Canada. The membership registration was seventy-two, which, with the guests, made a total attendance of about one hundred and fifty. The headquarters at Newburgh were at the Palatine Hotel, in New York City at the Hotel Astor.

The opening meeting was held in the Y. M. C. A. building at Newburgh, the mayor making an address of welcome, followed by an address by Park Commissioner Belknap. President Richards responded for the Association. An interesting paper on the life and work of Andrew Jackson Downing, the father of landscape gardening in America, was read by Professor F. A. Waugh, of Amherst, Mass. This was followed by a paper on "The Preservation of Natural Woodlands Under Park Conditions," by Mr. Ogelsby Paul, landscape gardener at Fairmount Park, Philadelphia. On account of illness, Mr. Paul was unable to be present, so the paper was read by Mr. H. W. Merkel.

Tuesday was a day of sightseeing, with an early trip across the Hudson to Mount Beacon, famous in Revolutionary times. From this high point a magnificent view of the Hudson and its valley was obtained. The remainder of the day was occupied in

visiting, by aid of automobiles, the many places of interest in Newburgh, including its parks, private gardens, and the home of Downing. The Association was entertained at luncheon by Mrs. E. H. Harriman at Tuxedo Inn, in Tuxedo Park, twenty-five miles distant, to which we were rapidly driven by automobiles. In the evening a reception was tendered to the Association by the citizens of Newburgh at the Coldwell Lawn Mower Plant.

On Wednesday the Association was the guest of the Hon. George W. Perkins, president of the Interstate Park Commission. As his guests we were taken down the Hudson in a specially chartered steamer, the "Albion." A stop of an hour was made at West Point. At Bear Mountain a stop was made for luncheon as the guests of Mr. Perkins. After luncheon Mr. Perkins made an address in which he described the work which had already been done in the establishing of this vast park and his hopes for its future development. He is much interested in this work and is giving much of his time to promoting it. At three, the party embarked and proceeded down the river.

Thursday was devoted to an inspection of the parks and gardens of New York City. After addresses of welcome at the Hotel Astor by city officials, the party proceeded in automobiles furnished by the City of New York and the Fifth Avenue Stage Company. Central Park, Riverside Drive and Van Cortlandt Park were visited. The party was met at the Mosholu Bridge by an automobile bearing the flag of the New York Botanical Garden, which led the procession of cars through the grounds of the Garden. They left the cars at the west end of the Long Bridge, where they proceeded on foot through the Hemlock Forest and the Economic Garden. Again entering the autos, after a short drive through the southern end of the grounds, they proceeded to the New York Zoölogical Park, where they were entertained at luncheon by that institution. The remainder of the afternoon was spent in a drive through the streets of New York and through Central Park, crossing into Brooklyn over the Brooklyn Bridge, where some of the parks were visited, and terminating the day and the convention at Coney Island.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT

The Horticultural Society of New York, in coöperation with the Garden, gave a Gladiolus Exhibition in the Museum on Saturday and Sunday, August 15 and 16. There was a large display of gladioli. Mr. T. A. Havemeyer made his usual extensive exhibit of superb blooms of this popular flower.

The collection shown by Mr. T. A. Havemeyer of fifty-seven kinds, secured the first prize for the largest and best collection. A second prize went to Mr. John Lewis Childs for a collection of forty-six kinds. Mr. Childs also secured the first prize for a collection of twelve varieties, three spikes of each; and likewise first prize for a vase of twenty-five white with "Snow King," and second for a vase of twenty-five pink with "Fascinator," the first prize for this class going to Mrs. DeLancey Kane of New Rochelle with a vase of "America." These prizes were in the open-to-all classes.

Mr. Havemeyer was also a winner in the non-commercial classes, securing first prize for the best six kinds, two spikes of each; and also first prize for the best vase of white, six spikes, with "Zephelin," and for the best vase of pink with "Panama." A special cash prize was awarded to Mrs. F. A. Constable for a vase of *Helianthus rigidus Miss Willmott.*

The Garden made exhibits of the flowers, not for competition, of thirty-three kinds of shrubs and of nineteen kinds of herbaceous plants. A collection of shrubs in fruit, including sixty kinds, was also made and attracted much attention. A collection of orchid plants was also shown.

The report of the Bronx Parkway Commission for 1914, recently received, records great activity during the year past, including the purchase of 392 parcels of real estate, the reclamation of considerable areas within the Parkway, the cutting out of over 1,300 dead trees, and the pruning of over 6,000 with tree surgery to over 1,600, the planting of 5,000 shrubs and saplings, and the planting of 20,000 cuttings in the nursery. The report also gives the history of the project, the commission

having been appointed in 1907, and the first appropriation of $35,000 having been made in July, 1911. It will be remembered that this parkway will extend from the northeastern boundary of the Garden at Williamsbridge northward along both sides of the Bronx River to Valhalla, a length of about fifteen and one half miles, and will protect the Bronx River from pollution.

Several members of the Bedford Garden Club visited the Garden on Saturday, August 15, and remained to the flower show and lecture. This club was organized about two years ago and has a membership of one hundred women who own, plan, and work in their gardens. It meets twice a month during the summer to hear papers written by the members or lectures by professional speakers on gardening topics and discussions of garden problems. A public flower show is held once a year, and various excursions are made to interesting gardens in other localities. Among the members who visited the Garden, were Mrs. Henry Marquand, Mrs. Henry C. Hopkins, Mrs. Merrill E. Gates, Mrs. Nelson B. Williams, secretary of the club, and Miss Delia W. Marble, vice-president.

Dr. Florence A. McCormick, assistant professor of agricultural botany in the Nebraska Agricultural Experiment Station, presented the results of two months' research work at the Garden at an informal conference held on the afternoon of August 12, which was attended by fifteen local botanists interested in cytological subjects. A few years ago, Dr. McCormick discovered a "central body" in the zygospore of the ordinary black mould of bread, and her object this summer has been to trace the history of this body and to determine its function in the zygospore. A large amount of culture work and sectioning has been necessary in the prosecution of this difficult piece of research, and many of the preparations made have not yet been studied.

Dr. Johan Nordal Fischer Wille, professor of botany and director of the Botanical Garden of the University of Christiania,

Norway, spent two weeks of September at the New York Botanical Garden. Professor Wille is well known to American botanists, especially by his studies of the green algae. Among his papers in this field is the treatment of the Chlorophyceae in Engler & Prantl's "Die natürlichen Pflanzenfamilien." Professor Wille is one of the foreign delegates to the celebration of the twenty-fifth anniversary of the organization of the board of trustees of the Missouri Botanical Garden to be held at St. Louis on October 15 and 16.

At the request of E. H. Anderson, Director of the New York Public Library, Astor, Lenox and Tilden Foundations, 45 sets of the essays by Mrs. Britton on "Wild Plants Needing Protection" which are illustrated with colored plates by the aid of the fund for the Preservation of Native Plants given by Miss Maria and Olivia Phelps Stokes, have been sent for distribution to the branches of the library in various parts of the city.

Mr. J. R. Johnston, who has made extensive investigations of cocoanut and sugarcane diseases in tropical America, spent August 10 to 12 at the Garden consulting the herbarium and library. He has resigned his position with the Porto Rico Sugar Growers' Association at Rio Piedras, Porto Rico, to accept the position of plant pathologist in the agricultural experiment station at Santiago de las Vegas, Cuba.

Miss Laura M. Bragg, Curator of Books and Public Instruction, Charleston Museum, Charleston, South Carolina, spent several days at the Garden about the middle of August, looking up records of South Carolina plants in the herbarium.

Dr. Adolf J. A. Fredholm, professor of agronomy, College of Agriculture and Mechanic Arts, Mayaguez, Porto Rico, visited the Garden in August.

Meteorology for August.—The record of the rainfall at the Garden for August 11 was lost. The record at the municipal building at Tremont Avenue for that date was 0.90 inch. In-

cluding this figure the total precipitation for the month was 2.03 inches. Maximum temperatures for each week were 87.5° on the 1st, 91° on the 9th, 97° on the 19th, and 89.5° on the 24th. Minimum temperatures were 60° on the 7th, 55.5° on the 14th, 59° on the 18th, and 55.5° on the 26th.

ACCESSIONS

MUSEUMS AND HERBARIUM

2 specimens of fungi from New York. (By exchange with Mr. Stewart H. Burnham.)

1 specimen of woody fungus from British Columbia. (By exchange with Professor T. C. Frye.)

1 specimen of woody fungus from Florida. (By exchange with Dr. Roland M. Harper.)

55 specimens of fungi from Porto Rico. (By exchange with the University of Porto Rico.)

71 specimens of fungi from California. (By exchange with Professor W. A. Setchell.)

1 specimen of *Thelephora pedicellata* from Texas. (By exchange with Professor Frederick H. Blodgett.)

770 specimens of fungi from southern Europe. (Collected by Rev. G. Bresadola.)

1 specimen of *Lentinus Ravenelii* from Orient, Long Island. (By exchange with Mr. Roy Latham.)

1 specimen of *Exobasidium* from New York. (By exchange with Miss Delia W. Marble.)

36 specimens of fungi from Austin, Texas. (By exchange with Dr. Frederick McAllister.)

1 specimen of fleshy fungus from Wisconsin. (By exchange with Dr. Lewis Sherman.)

1 specimen of *Clitocybe multiceps* from Rochester, New York. (By exchange with Mr. William E. Abbs.)

8 specimens of woody fungi from Ontario, Canada. (By exchange with Mr. J. H. Faull.)

1 specimen of fleshy fungus from Orient, Long Island. (By exchange with Mr. Roy Latham.)

1 specimen of woody fungus from Westchester County, New York. (By exchange with Miss Delia W. Marble.)

68 specimens of mosses from the Philippine Islands. (Collected by Dr. A. D. E. Elmer.)

12 specimens of mosses from Canada. (By exchange with Mr. John M. Macoun.)

1 specimen of *Octoblepharum albidum* from Tobago, West Indies. (Given by Mr. W. E. Broadway.)

5 specimens of lichens from Wyoming. (By exchange with Professor Aven Nelson.)

2 specimens of hepatics from Wyoming. (By exchange with Professor Aven Nelson.)

8 specimens of mosses from New Zealand. (Given by Professor Edward B. Chamberlain.)

3 specimens of mosses from California. (By exchange with Professor Irénée Theriot.)

6 specimens of mosses from Arizona. (By exchange with Professor L. N. Goodding.)

PLANTS AND SEEDS

2 cacti from Cuba. (Collected by Bro. Leon.)

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

5 plants of *Populus deltoides*. (Given by Mrs. N. F. Flynn.)

2 plants for nursery. (Given by Mr. E. C. Wurzlow.)

22 plants for fountain. (Purchased.)

2 plants for nursery. (Given by Miss Juliet Turner.)

3 rose plants. (Purchased.)

2 plants of *Ophioglossum vulgatum*. (Collected by Dr. H. H. Rusby.)

3 plants of *Dudleya Parishii*. (By exchange with U. S. Nat. Mus., through Dr. Rose.)

12 plants of *Azalea mollis Hollandea*. (Purchased.)

17 plants for conservatories, from Panama. (Collected by Dr. J. N. Rose.)

1 *Cattleya* from Brazil. (Given by Dr. H. H. Rusby.)

1 plant, *Cynometra portoricensis*, from Porto Rico. (Collected by H. C. Cowles.)

37 cacti, from Nevada. (Collected by Dr. D. T. MacDougal.)

1 plant, *Opuntia Opuntia*. (Collected by Dr. N. L. Britton.)

10 plants of *Peramium pubescens*. (Collected by Mr. Percy Wilson, at Scarsdale, N. Y.)

1083 plants. (Derived from seed of various sources.)

1 pkt. seed of *Chamaedorea Pacaya*. (By exchange with Bureau Plant Industry.)

146 plants from Panama. (Collected by Mr. A. J. Corbett.)

1 plant *Hariota villigera*. (Given by Mr. Leonard Barron.)

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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Term expires January, 1917

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THE SOIL, THE BASIS OF SUCCESS IN GARDENING AND IN OTHER LINES OF PRODUCTIVE WORK*

It is but recently that the proper use of the soil has become one of the greatest problems that is before the world.

The present business inactivity and the oppressive high cost of living is being experienced in other nations, and the cause in every instance is traceable to the soil. The increase of population and the demands of consumption are everywhere greater than the production of food supplies.

The soil has always been one of the great sources of wealth, and as such its productive power should have been most carefully and intelligently conserved and improved, for it is the greatest asset a nation can possess. The general unrest and financial uncertainty of the present time is world-wide for the reason that the soil of all nations of large population is not contributing of its wealth sufficient to meet the expanding needs of the people.

Europe is carrying a war debt of over $30,000,000,000, the interest of which is paid in two ways, by borrowing more money and by raising tax rates. With war pensions, the building of battleships and army appropriations, our own country is steadily approaching the conditions of the debt-ridden countries of Europe, while the great problem of the soil, the greatest source of national wealth and the most potent factor in the undis-

*Abstract of a lecture delivered at the New York Botanical Garden on June 6, 1914.

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turbed growth and development of the industries and peace of our nation, is not receiving the thought or consideration that is due from the highest type of statesmanship.

With these economic conditions affecting large numbers in our cities, a new interest has been awakened in land with a higher appreciation of its value in providing the means for support. There is, at the present time, a growing demand for greater knowledge of the land. Children are being instructed in gardening, boys and girls are organizing corn and tomato clubs, and are being taught the principles of plant growth. Garden clubs are being organized by women, that greater knowledge may be obtained of the principles and practice of gardening. Schools of horticulture are in operation for the education and training of women in horticultural work, while large tracts of land are being purchased by capitalists where every line of agricultural operation, live stock breeding, gross culture of orchards, and gardening under glass and on broad acres in the open are being developed.

In all of this activity and interest in the ownership of land, a greater knowledge of the soil is of the highest importance, for upon it lies the basis of success in garden work and of every line of production. When the soil had an abundance of virgin fertility but little knowledge of its constituents was necessary. The one and main requirement was that of preparing a seed bed and planting the seed, when a sixty or a hundred fold increase was quite certain. A century or more ago, so abundant and available was the plant food in most soil in the United States that any person with fair intelligence could purchase and from its income pay for it in a short time. Land was so certain to produce income that it was sought as the most desirable and safe security upon which to loan money. At that time no land banks and long time loans at a lower rate of interest were necessary. The most prosperous farmers were the bankers of their community and who loaned money to those who needed it.

In the past half century these conditions have changed, the soil has become depleted, and has failed to meet the increased demands made upon it by our modern civilization. The present

great problem is, how to obtain from the soil its hidden wealth with which to meet the present needs of the world, how the producer may increase needed food supplies with a reasonable profit in so doing, while the consumer may obtain them at a moderate cost.

The best scientific authorities in many nations are now giving the most exhaustive thought, study and work to the problems of the soil. That the soil contains plant food in sufficient quantity to meet the increasing needs of the world for ages to come there is no question of doubt, but conditions now are such that to meet them requires greater and more varied knowledge than in the past.

Much is known about the origin of soils, about the rocks from which soils have been made, about the life of the many ages of time that is stored up in every atom of soil for present and future needs, but about the nutrition of plants and how they appropriate and utilize food, there is much mystery of which the highest scientific authorities admit they know as yet but little.

The United States expends annually about $125,000,000 for commercial fertilizers. It is known that practically one third of this expenditure is lost, or from which no results are obtained in an increase of crops. The value of the animal manure annually produced in the United States is estimated to be $2,800,000,000. It is estimated that through waste sixty per cent. of this value, or $1,500,000,000, is lost and fails to produce increase in crops.

Recent scientific investigations and research are making discoveries that there are substances in the soil in the form of acid compounds that exert influences upon the soil and upon the constituents in fertilizers that are responsible for their failure to produce increased yield. Many gardeners and farmers, as also experiment stations, have discovered that in many instances the increase in yield of crops has not paid the cost of the fertilizers applied, and many farmers have condemned their use. This has given rise to further investigation of soil conditions as also to the processes by which plants appropriate food substances.

It was not until the close of the last century that the chemistry

of the soil was given much consideration, and then, as now, different theories were put forth. Aristotle believed that matter could be divided into the four elements of air, earth, fire and water. About the beginning of the seventeenth century Van Helmont believed he had proved that all of the products of vegetables were capable of being generated from water. Two hundred years ago Jethro Full put forth the theory that the food of plants consisted of fine particles of soil which in very minute form were taken up and absorbed by plants. While his theory was a mistaken one, his practice of fine tillage applies to the best methods of today. He planted wheat in rows and cultivated it while it was growing the same as corn. To meet with the highest degree of success and satisfaction in the ownership and management of land it is now necessary to know much about the soil. That which may be considered poor or infertile soil may be capable of the largest production. It may contain deleterious compounds in the form of certain acids that make the food substances of plants unavailable.

Not many years ago there was not a single soil compound that had been separated and identified. Now there are over thirty-six, some of which are antagonistic to the life of some of our most valuable plants. In this fact may be found one cause of many of the diseases of plants through an environment that is destructive to the health of plants.

Medical science has discovered that proper sanitation is essential to the health and life of human beings and to all animal life, and agricultural chemistry in its modern study and research has made a like discovery, that plants give off from their bodies excreta the same as is done by animals that will produce an environment which in time will be destructive to their own life, but which, however, may be beneficial to other plants. When dairy cattle are long kept confined in stables, where their excreta is allowed to produce unsanitary conditions, and pure air is not provided by proper ventilation, they soon contract disease.

Bovine tuberculosis is often caused by unsanitary conditions, and environment surrounding cattle, yet the fermenting excreta that will cause the disease and death of cattle will give life and

perfect development to plants when applied to the soil in which they live and grow. Plants, however, have always an abundance of oxygen surrounding them, which working upon the animal manures in the soil converts them into life-sustaining properties for plants. It is for this, as also for other reasons, that in the growing of crops rotation is beneficial. The plants that in their nature must remain in the same soil for years are subject to diseases not known or experienced by those that may be changed to different soil.

In garden work the rose may be taken as a plant that is particularly difficult to keep in satisfactory condition beyond a short period. With the best of culture and with the most liberal and judicious fertilizing it is continually attacked by a number of diseases which weaken and finally destroy its power to make strong vigorous growth and to produce satisfactory flowers. This will apply to other desirable plants that must necessarily occupy the same soil for a number of years.

I have seen the toxic extract taken from soil in which wheat had been grown for several years and applied to other soil in which wheat was sown. The young plants were struggling for life, wilting and dying, while seed that was put in new soil made strong and vigorous plants.

Apple orchards have been known to suddenly begin to decline without any well-known cause that was discoverable after thirty years of regular bearing. Orange trees, in some soils in California and in Florida, have been injured by the dying back of the ends of the branches, causing thousands of dollars of loss to their owners. There are without doubt conditions of the soil that have developed that are responsible for these tree diseases. Rotation wherever it may be followed is a good policy to adopt even with trees, where land may be available by planting new orchards on new soil and cutting out the old. Rotation in gardening, where it is possible to grow clover, peas, or vetch, will save crops from many kinds of diseases and from certain insect pests. In intensive market gardening this is somewhat difficult on high-priced land.

Thorough aëration of the soil is essential. Oxygen is as nec-

essary to the correction of unhealthful conditions caused by the decomposition of plants as it is for the sleeping apartments of a home. Oxygen plays a very important part in its effect upon different soil compounds and upon the chemical fertilizers that are applied to the soil.

Underdraining works advantageously in two ways, in carrying off surplus water quickly and in supplying the soil more freely with the oxygen it requires. There are orchards a century old, still in healthy condition and bearing fruit, that were provided with under drains before the trees were planted. Where irrigation is practised the underdraining will be found to be a necessity to carry off deleterious matter that accumulates in the soil. I have seen beautiful orchards less than twenty years ago planted in irrigated soil that were dying, their feeding roots having been destroyed by alkalies and acids that had accumulated and which might have been carried off through drains properly provided.

The application of lime will be found to be highly beneficial to most soils. The most productive soil is that which is derived from limestone. Lime is essential to the growth of vegetation. The best horses and cattle are those reared in limestone sections. The best trees and fruits and the most beautiful flowers are grown in limestone soil. Of all requirements needed by the soil today, without doubt, lime is one of the most essential. Humus is a most important element in its action in the soil, but without lime the process of decomposition of both animal and vegetable matter will be slow, while without its presence, beneficial bacteria cannot live, and without which clover, alfalfa, vetch, peas, and other legumes cannot grow.

The soil over large sections has lost much of its lime by the growing of crops that are sold and carried off from the land; while a further loss follows from heavy rainfalls. The very general failure to grow alfalfa in the older soil of the country is on account of the absence of needed lime. Alfalfa may be grown as successfully in Maine as in New Mexico if the soil is properly prepared, is heavily limed, and hardy varieties suited to the climate are used.

Carbonate of lime is the best form to use. Its action is some-

what slower, but better, while it is more congenial to all classes of vegetation. Used in connection with the preparation of the soil and in combination with fertilizers for roses it will give a strong vigorous growth of plants, well-developed better buds, and beautiful and most lasting blooms.

The soil is a store-house of mysteries, many of which have not yet been solved. Investigation, study and experimentation are going on along many lines by able scientists in our own country, while the same work is being done by the agricultural chemists of other nations. At the present time there is being erected at Rothamsted, England, a fitting memorial to the memory and services of two great men, Sir John Bumet Laws and Sir J. Henry Gilbert, who devoted fifty years of their life's work and much money to the science of agriculture.

A large laboratory is being erected, the purpose of which is to continue their work, which is to be confined exclusively to the many great and unsolved problems of the soil which doubtless will require another half century of time. No greater honor can be conferred and no monument more merited than to the memory of men who have given their life work to the millions of people whose best opportunity, prosperity and greatest blessings are largely dependent upon good and productive soil.

GEORGE T. POWELL.

A PLEA FOR THE WILD FLOWERS

The wild things of nature are coming to their own! To the cries "Save the Trees," "Protect the Birds" another note of entreaty and admonition has lately been added: "Preserve the Wild Flowers." When in the midst of luxurious abundance it is a difficult thing to imagine that devastation is possible, yet that is the danger apprehended by the lover of wild life, tree, bird and flower today, unless individual effort be more strenuously directed toward their conservation.

For the preservation of trees there have sprung up all over the country national, state and private forestry associations

which are educating public sentiment and are instrumental in securing the enactment of laws that make it a misdemeanor, punishable by fine or imprisonment, or both, to destroy trees under certain conditions. Societies for the protection of song and game birds, named after the greatest early American authority on birds—Audubon—have created such sentiment against the wanton killing of birds for their plumage or sport, that no thinking woman will now be seen with the body or the wing of a bird upon her hat, and the proverbial "bad boy" is to a large extent ashamed to use his sling or gun.

It should be the pleasure and duty of parents, and all persons having children in charge to discourage the wanton and unthinking picking of flowers. I believe most of the little folk could be educated to a feeling of tenderness toward flowers and that a sense of personal responsibility in the protection of their beauty might take the place in their minds of the rapacious desire of possession. Our young flower lovers might become true observers, and conservationists, if sympathetically instructed in the fact that careless pulling of a flower dislodges the root and often destroys the whole plant. Directed toward the observation of seeds, their ripening and dissemination, children may be made to realize that the loss of one flower often prevents the sowing of hundreds of others. Flowers belong to childhood: are part of its rightful heritage; let them fulfil their function in the lives of youth; see to it that their appeal be OF LIFE not OF DESTRUCTION—a call to the reverence of the beautiful things in nature; a means of developing those rarer qualities of gentle and kindly restraint.

May we never pick wild flowers then? Yes, certainly, but with discrimination; with a due regard for the rights of the plants that bear them and with a consideration for those persons who will follow upon the pathway that you are enjoying.

In the accessible neighborhood of large civic centers where the city's business and manufacturing plants, together with its residence areas, are constantly extending, there appear to be but three methods only of preserving the flora natural to the region in which each center lies. These may be indicated essentially as follows:

Urge upon the civic center the great need of at least one large NATURAL PARK, including woodland now wild, and, if possible, a river or stream. Such park to have walks and drives BUT NO LAWNS, FLOWER BEDS, nor SET PLANTING whatever. Bring into such park in profusion all the species of native wild plants that will grow therein—plant them naturally AND LET THEM ALONE.

Urge legislation that will exempt from taxation all neighboring woodlands, providing no cattle are pastured therein nor use made thereof, providing that the owners place such lands under the supervision of local Park Boards and allow free use by the people so long as the lands are exempt.

Urge upon the school management that they set aside one school day of each school month from April to November inclusive, to the purpose of a field pilgrimage to floral regions. Such pilgrimages to be conducted by persons competent to instruct the pupils in the nature and love of plants and the essential principles of their conservation.

DR. C. F. MILLSPAUGH,
Curator of the Department of Botany of the Field Museum of Natural History, Chicago.
President of the Wild Flower Preservation Society of America

NOTES, NEWS AND COMMENT

Dr. W. A. Murrill, assistant director, visited Washington and vicinity during the latter part of September and collected a number of fungi of interest. He found the two poisonous species *Venenarius phalloides* and *Clitocybe illudens* especially abundant, the latter growing in open fields, as well as in woods, about old stumps and buried roots. All of the woodlands were found to be infected with the chestnut canker, which caused the death of many individual branches this season, but is expected to do the greatest damage in the next two or three years. As a large percentage of the timber about Washington is chestnut, the loss will be very considerable.

Mr. James P. Kelly has recently been appointed instructor of botany in the Pennsylvania State College. During the past two years Mr. Kelly has been a student of the Garden, taking the degree of M.A. at Columbia University in the spring of the present year.

Professor C. E. Allen, head of the department of botany at the University of Wisconsin, was a visitor at the Garden on September 23. Professor Allen and family spent the past year in France and Switzerland and were returning to Wisconsin for the beginning of the school year.

Mr. Allen C. Fraser, B.S. Cornell 1913, who has been assistant and scholar in plant breeding at the Garden during the past two summers and an assistant in botany at Columbia University during the past academic year, has accepted the position of instructor in the department of plant breeding in Cornell University.

Dr. Charles F. Millspaugh, Curator of the Department of Botany of the Field Museum of Natural History, Chicago, will lecture at the American Museum of Natural History on Thursday, November 5, at 4 P.M. in the children's course making "A Plea for the Wild Flowers." Dr. Millspaugh is President of the Wild Flower Preservation Society of America and has been very active in organizing the Chicago Chapter.

Dr. Francis W. Pennell has been appointed as Associate Curator of the Museum, filling the position made vacant by the death of Dr. Charles Budd Robinson. Dr. Pennell is a graduate of the University of Pennsylvania, from which institution he holds the degrees of B.S. and Ph.D. He has prosecuted botanical investigation there, at the Academy of Natural Sciences in Philadelphia, at the United States National Museum, in the vicinity of his home in Delaware County, Pennsylvania, and at points in the southern and southeastern states.

North American Flora, Volume 29, Part 1, was issued August 31. It comprises 102, and is devoted to the first five families of the order Ericales: Clethraceae, by Dr. Britton; Monotropaceae, by Dr. Small; Lennoaceae and Pyrolaceae, by Dr. Rydberg; and Ericaceae, by Dr. Small, who supplied the ordinal diagnosis and key to the families. In the last-named family, the genus *Uva-Ursi* was contributed by Dr. Le Roy Abrams.

A monograph on "The Marine Algae of Peru," by Dr. Marshall Avery Howe of the Garden staff, was published on September 19, constituting volume 15 of the Memoirs of the Torrey Botanical Club. The work comprises 185 pages of printed text, accompanied by 66 plates and 44 text figures. The report is based chiefly upon a collection of sea plants made by Dr. Robert E. Coker, now of the United States Bureau of Fisheries, while acting as fisheries expert to the Government of Peru in the years 1906, 1907, and 1908. Dr. Coker's collection proves to have been one of the largest and best in its field ever made in South America. The author is now able to ascribe 123 species of marine algae to Peru—a number nearly double that previously known. Of these, 29 species appear to be new to science. The large proportion of novelties is due in part to the inclusion of a number of inconspicuous endophytes and epiphytes, which offered an essentially unworked field so far as South America was concerned. Dr. Coker was apparently the first collector of seaweeds in that region to use a dredge, a fact that may account for his finding certain species that seem to have been overlooked by his predecessors. Through the courtesy of the curators of various European herbaria, the writer has been able to examine the original materials on which numerous species described from South America were based, and this circumstance has contributed much to the scientific value of the monograph. The report was prepared at the request of the Ministerio de Fomento of the Peruvian Government as a contribution to the knowledge of the aquatic resources of Peru, and the expense of publishing the paper has been met in a considerable part by a subsidy from the Government of Peru.

Meterology for September.—The total precipitation for the month was 0.20 inches. Maximum temperatures for each week were 95° on the 2d, 89° on the 7th, 91° on the 18th, and 96° on the 21st. The minimum temperatures were 51½° on the 5th, 42° on the 10th, 43½° on the 15th, and 34° on the 29th. The first light killing frost of the season occurred on the night preceding the 29th, when only such tender plants as *Coleus* and *Lycopersicum esculentum* were affected. The month was rather unusual in the high temperatures reached and in the extremely light rainfall.

ACCESSIONS

MUSEUMS AND HERBARIUM

11 specimens of mosses from Kansas. (By exchange with Mr. C. H. Demetrio.)

10 specimens of mosses from North Carolina. (By exchange with the New York State Museum.)

150 specimens of mosses from North America. (Given by Mr. O. D. Allen.)

18 specimens of mosses from Cuba. (By exchange with Brother Leon.)

5 specimens of mosses from Central America and South America. (By exchange with Professor V. F. Brotherus.)

18 specimens of mosses from Antigua and St. Domingo, West Indies. (By exchange with the United States National Museum.)

1 specimen of moss from New Zealand. (By exchange with Mr. H. N. Dixon.)

1 specimen of *Sphagnum cuspidatum Torreyanum* from Martha's Vineyard, Massachusetts. (Given by Mr. E. P. Bicknell.)

482 specimens of fungi from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

1 fungus from Staten Island, New York. (Collected by Dr. N. L. Britton and Dr. Arthur Hollick.)

1 specimen of cup fungus from the Adirondack Mountains. (By exchange with Dr. L. H. Pennington.)

1 fleshy fungus from the New York Botanical Garden. (Collected by Dr. W. A. Murrill.)

8 specimens of fleshy fungi from Kentucky. (By exchange with Dr. Florence A. McCormick.)

2 specimens of woody fungi from Wisconsin. (By exchange with Dr. Lewis Sherman.)

5 specimens of woody fungi from Corvallis, Oregon. (By exchange with Mr. C. E. Owens.)

1 specimen of *Craterellus ochrosporus* Bart. (By exchange with the Missouri Botanical Garden.)

2 specimens of fungi from Pennsylvania. (By exchange with Dr. F. D. Kern).

2 specimens of woody fungi from Milwaukee, Wisconsin. (By exchange with Dr. Lewis Sherman.)

90 specimens of fungi from Staten Island, New York. (Collected by Dr. N. L. Britton and Dr. F. J. Seaver.)

17 specimens of mosses from Wyoming. (By exchange with Professor Aven Nelson.)

3 specimens of mosses from Finland. (Given by Professor Edward B. Chamberlain.)

4 specimens of hepatics from Cuba. (By exchange with Brother Leon.)

50 specimens of hepatics from North America. (Given by Mr. O. D. Allen.)

25 specimens of mosses from Sanford, Florida. (Given by Mr. Severin Rapp.)

5 specimens of lichens from North Carolina and Oregon. (By exchange with the New York State Museum.)

10 specimens of mosses from Missouri. (By exchange with Mr. C. H. Demetrio.)

1 specimen of moss from Pennsylvania. (By exchange with Professor Irénée Theriot.)

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VARIEGATED ABUTILONS

(With plate CXLI)

The Abutilons, well known and somewhat widely cultivated in the old gardens usually under the name of flowering maple or Chinese bell-flower, were derived from several species native to the tropics of both hemispheres. The forms most commonly seen in cultivation today are the variegated types, *Abutilon Savitzii*, *Abutilon Souvenir de Bonn*, and various forms cultivated under the name *Abutilon Thompsonii*. Several other species possess variegation quite similar in appearance to that of *A. Thompsonii*. Of these *A. megapotamicum variegatum*, *A. Sellovianum marmoratum*, and *A. Darwinii tesselatum* should be mentioned.

Abutilon striatum Thompsonii was evidently the first of the variegated Abutilons to be introduced into cultivation. According to Koch (1868) it was first displayed by Veitch at Ghent and it is stated that it originated in the West Indies. Soon after it was exhibited by Veitch and Son before the Royal Horticultural Society of London and on account of its yellow-flecked foliage immediately attracted the attention of horticulturists. (Gardener's Chronicle 11: 945. 1868.)

There are at the present time various types in cultivation under the name *Abutilon Thompsonii* which show marked differences especially in the shape and in the pubescence of the leaves. This fact has been recently noted by Lynch (1910). Brown (1910) in tracing further the taxonomic relationships of

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these forms reports that previous determinations of *A. striatum* include two distinct species with a confusion of the real *A. striatum* of Guatemala with *A. pictum* of Brazil. His classification places variegated forms of this group in each of the following: *A. pictum* Walp.; *A. striatum Thompsonii* Veitch; *A. Thompsonii* Hort.; *A. striatum kewense* N. E. Br. The treatment of this group in the new edition of Bailey's Cyclopedia of Horticulture differs somewhat from Brown's treatment in giving the names *A. striatum spurium* Lynch, and *A. hybridum* Hort. in addition to the first two mentioned above as forms which have been confused with the true *A. striatum Thompsonii.*

It is evident that there are numerous forms with variegation quite similar to that of the original *A. striatum Thompsonii*, but with quite different foliage and flower characters. The origin of these various types is a matter of considerable interest. There seems to be no conclusive evidence regarding vegetative variations in the original strain of *A. striatum Thompsonii* or of the repeated spontaneous origin of the flecked variation in these forms. Soon after its introduction, *A. striatum Thompsonii* was propagated quite extensively by grafting and it was noted that the variegation was infectious and that green plants used as stock often became variegated. In this way the type of variegation was communicated to numerous varieties and hybrids of horticultural origin and these have been generally propagated under the name *A. Thompsonii.* It is known that the variegated varieties of *A. Darwinii*, *A. Sellovianum*, and *A. megapotamicum* originated by grafting *A. striatum Thompsonii* on pure green plants of these species.

In the plate accompanying this article, typical leaves of two of these types are shown. One (fig. 1) has three-lobed leaves evidently much like *A. pictum* Walp. The other (fig. 2) has 5–7-lobed leaves. Neither of these conform exactly to the original descriptions of *A. striatum Thompsonii.* In fact it does not appear that the true form of this variety is in cultivation in America.

The nature and cause of infectious variegation is a matter of much interest and has already been a subject of considerable

scientific investigation. It was observed by Lemoine (1869) that when *A. striatum Thompsonii* was grafted on plants of *A. megapotamicum* and *A. venosum* the variegation spread into the green branches of the stock. Lindemuth (1897 to 1907) and Baur (1904–1906) especially have greatly extended the knowledge of the nature of the variegation. The variegation is readily transferred by grafting to about fifty species and varieties of *Abutilon* or closely related forms with, however, some difference in the degree of susceptibility. At least certain strains of two species, *Abutilon arboreum* and *Lavatera arborea*, are considered immune. Applications or injections of sap extract do not in any case produce the chlorosis. The infection occurs in susceptible plants only through direct grafting with infected plants, and is not transmitted through seed to progeny.

Baur (1906) developed the theory that the variegation is caused by a virus which is produced in variegated leaves in the presence of light and which carries the infection into newly formed leaves. Also that in each yellow variegated plant the virus is sufficient to infect only two or three newly formed leaves at one time; this amount is consumed by the continued growth of leaves, so that new leaves are green if the production of new virus is prevented. In no sense does he consider the possibility of this virus being a parasitic organism. He considers that it can either be a growth product of the sick plant increased by contact with the material within the plant cells, or a chemically highly organized material, itself capable of growth.

The type known as *Abutilon megapotamicum variegatum* first originated in 1869 from grafting the pure green species with *A. striatum Thompsonii* (Lemoine, 1869). The *Abutilon megapotamicum variegatum* now in the trade is quite true to the original type, although forms with a slightly different habit of growth and larger leaves are given different trade names. One of these is the *Abutilon Eclipse*, a plant which grows more erect and has larger leaves than the true *Abutilon megapotamicum variegatum*. The latter has a somewhat trailing habit of growth, making it very suitable for use in hanging baskets. Its leaves are narrow and lanceolate, brightly variegated with yellow flecks scattered

irregularly over the surface of the leaf, sometimes very deep yellow in color standing out conspicuously from the surrounding green, while at other times the spots become quite dim—appearing light green (fig. 3). Its flagon-shaped bright red and sulphur-colored flowers add to its attractiveness as a plant. Plants of this type often lose their variegation and become permanently pure green plants (fig. 4.).

Branches on the same plant usually show marked differences in the degree of variegation. All or part of the leaves on a branch may be wholly green. In the plate figs. 3 and 4 are two twigs from the same plant; one bore leaves strongly variegated while the other bore green leaves.

Lindemuth (1907, p. 39) reports that he first produced the variegated variety of *Abutilon Sellovianum* in 1870 through grafting with *A. striatum Thompsonii.* The species is readily susceptible and the variegation which appears seems quite identical with that in *A. striatum Thompsonii.*

It appears that the various forms which have become infected directly or indirectly from *A. striatum Thompsonii* can in turn transmit the infection to other susceptible forms. It is interesting to note that forms of *Abutilon striatum Thompsonii* observed by Baur and Lindemuth occasionally produce branches that are pure green and which are immune to the infection.

Chlorosis or variegation that is infectious is known in other genera besides *Abutilon;* such as *Jasminum, Fraxinus, Liburnum, Ligustrum, Kitaibelia,* and *Nicotiana.* The chlorosis of tobacco has attracted considerable attention on account of the economic importance of the plant, and it is of special interest in that the expressed cell-sap can carry the contagion, a condition that according to present knowledge does not prevail in *Abutilon.*

Of the Abutilon varieties which have leaves with a marginal white zone, *Abutilon Savitzii* is of principal importance. The history of this type seems rather obscure. One brief report credits a gardener named Savitz, in St. Veit in Kärnten, with breeding it from seed. In one instance it is described under the name of *Abutilon venosum Savitzii* as a plant having a white variegation that invades almost the entire leaf surface. Again

it is called an improved *Souvenir de Bonn*. But all attempts at identifying it point to the white margination of the leaf, its most striking characteristic.

The typical leaf of this variety consists of five lobes irregularly margined with white which often invades the dark grayish green central portion of the leaf (fig. 5). In the very young leaves the white margin appears as a deep cream, which becomes more white with the advancing age of the leaf. Frequently, however, unsymmetrical leaves develop. Often the white margin of entire lobes or parts of lobes is interrupted by the invasion of green tissue protrusions which cause the leaf to develop abnormally (fig. 6). These green tissue protrusions, due to their greater rate of growth, cause a twisting and bulging of the leaf surface which imparts an odd appearance to the leaf.

The variegation in the *Abutilon Savitzii* is non-infectious, and all efforts to transfer the white margination of leaf to numerous green forms of the genus *Abutilon* by grafting methods have failed.

The white or almost colorless tissue which forms the margins of the leaves also extends over the green tissue in the central portion of the leaves. The white cells are external or peripheral and the green are internal. Baur (1909) applied the term *periclinal-chimera* to various pelargoniums having this sort of arrangement of green and white cells.

Irregularities in the vigor of growth of the green and white cells in growing points result in varying amounts of green and white in the mature leaves. When the external white tissue grows to the exclusion of the green, a white leaf is formed. When the green cells develop most rapidly, they protrude through the enveloping layers of white cells and forms leaves in part or wholly green, or even all green shoots. Figure 7 shows a pure green leaf from a plant of *A. Savitzii*. These pure green leaves are larger and more regular in shape than are the typical variegated leaves. In propagating *Abutilon Savitzii*, these pure green branches are constantly being discarded by gardeners. A pure green plant derived from *A. Savitzii* at the New York Botanical Garden was grafted with a small scion from

a plant with the *Thompsonii* type of variegation. The variegation spread into the new leaves of the green plant and the whole in time became fully variegated.

Abutilon Souvenir de Bonn is quite similar to *A. Savitzii*, but the white margin is more regular, is narrower and seldom invades the center of the leaf. The leaves are five-lobed, but the lobes are narrower and the leaf more indented. (Compare fig. 9 with fig. 5.) First reference to this form appeared in 1893 (Taplin, 1893), but its exact origin is not known. A plant of this type at the New York Botanical Garden gave an all green branch, a leaf of which is shown in fig. 8.

The purely green branches, it may be presumed, produce leaves which resemble closely the parent types from which *A. Savitzii* and *A. Souvenir de Bonn* originated. The quite marked differences in the two (figs. 7 and 8) indicate that they are not from a common parent, and that one is not derived from the other, and suggests that the type of bud variation which results in a peripheral chimera has occurred spontaneously in these two cases.

The variegated Abutilons can be grouped into two classes; those with a mottled variegation that is infectious and those with a non-infectious variegation with the white cells at the periphery. Both types are of importance in horticulture, especially for use as bedding plants; both types are of special scientific interest. *A. striatum Thompsonii* is in a way a plant of historical interest, for upon it has centered much study regarding the nature of infectious variegation.

KATHERINE W. REID.

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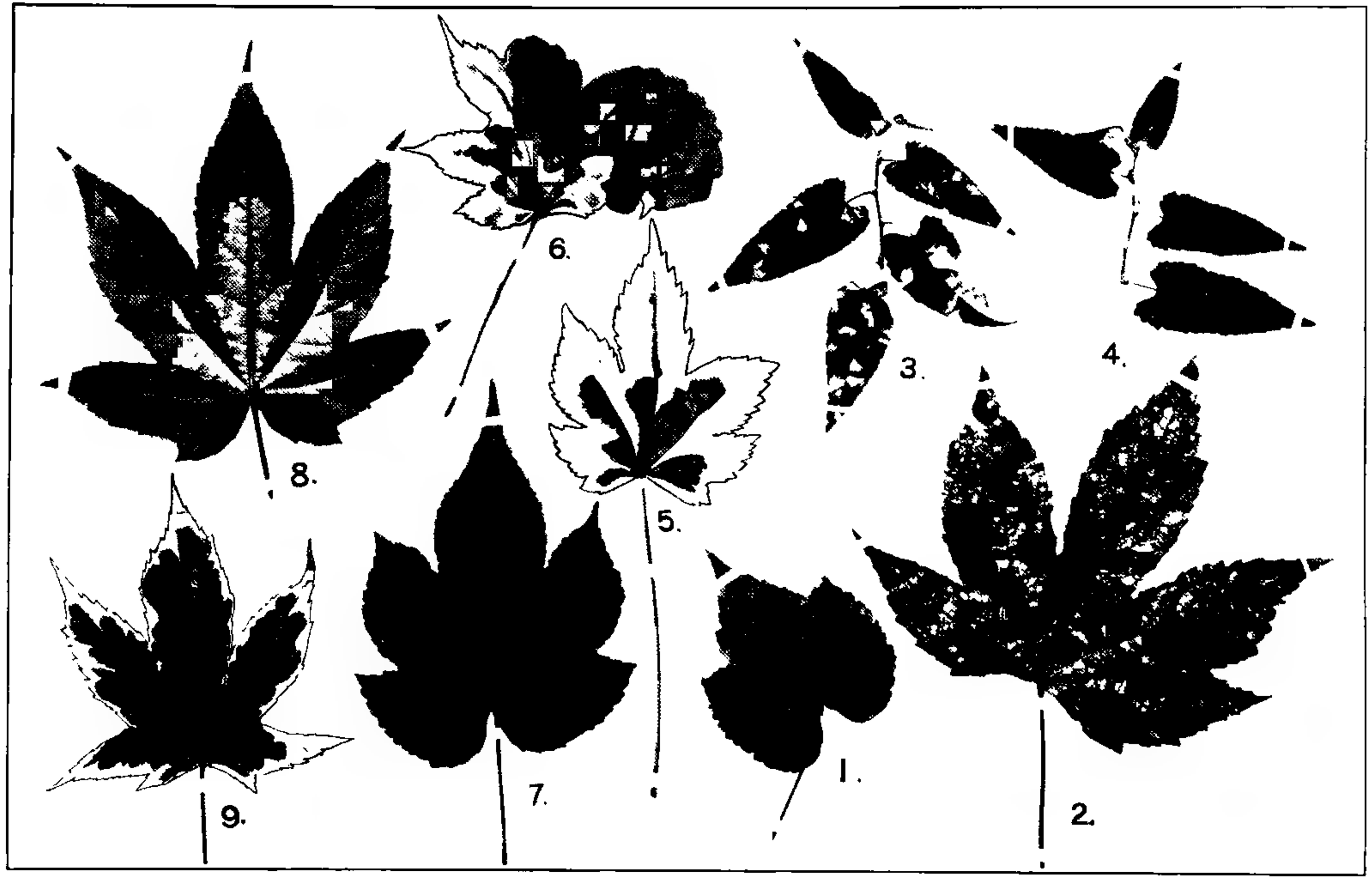

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EXPLANATION OF PLATE CXLI

FIG. 1. Leaf from an *Abutilon* with the *Thompsonii* type of variegation.

FIG. 2. Leaf from an *Abutilon* with the *Thompsonii* type of variegation.

FIG. 3. Branch from *Abutilon megapotamicum variegatum* showing the variegation of this type.

FIG. 4. Branch of *Abutilon megapotamicum variegatum* showing pure leaves; from the same plant as branch shown in fig. 3.

FIG. 5. Leaf of *Abutilon Savitzii* showing the typical white margination of this type.

FIG. 6. Abnormal leaf of *Abutilon Savitzii* showing a protrusion of green tissue.

FIG. 7. A pure green leaf of *Abutilon Savitzii.*

FIG. 8. A pure green leaf of *Abutilon Souvenir de Bonn.*

FIG. 9. Leaf of *Abutilon Souvenir de Bonn* showing the typical white margination.

REPORT OF THE DIRECTOR OF THE LABORATORIES ON HIS TRIP TO EUROPE

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Sir: In accordance with your instructions, I spent the time from July 11 to August 22 in a trip to Germany, Holland and England, for the purpose of visiting botanical gardens, institutions for botanical research and concerns engaged in the commercial production of seed. Special study was made of the methods used in plant breeding and of the equipment of laboratories. It was also planned to collect specific data which are relavent to the experimental work that I am conducting at our Garden with *Coleus* and *Cichorium Intybus.*

I was accompanied by Mr. E. G. Arzberger of the Bureau of Plant Industry, U. S. Dept. of Agriculture, who furnished a high-grade film camera with which about fifty photographs were taken for the Garden collection. Mr. Arzberger's botanical training and his familiarity with the German language enabled me to obtain exact information from various German gardeners, especially with reference to important and rather technical points regarding the growing of chicory for seed.

Leaving New York City, July 11, on the S. S. Kaiserin Auguste Victoria, we proceeded to Hamburg where we arrived on the evening of July 20. Two days were spent at Hamburg at the Institut für allgemeine Botanik and Botanical Garden mostly in the company of the director, Professor Dr. Hans Winkler. Here it was a special pleasure to observe the methods and progress of Dr. Winkler's brilliant experiments in the production of graft-chimeras and graft-hybrids and to see several chimeras not yet described. At the present time additions are being built to the main building to provide for considerable expansion in practical and scientific research, and I was able to note the general arrangement of the new laboratories.

In the greenhouses special study was made of the plan and construction of the liverwort house which is probably the best of its kind in existence. It contains between fifty and sixty species of liverworts and numerous species of mosses growing in profusion and luxuriance in pots and on the walls of the house. Observations were made on the treatment of various plants both in greenhouse and garden culture and of the various hybrids grown for exhibition. I may say that Dr. Winkler plans to provide at the Hamburg garden a botanical center for the exchange of exotic plants, especially of those from South America. The excellent shipping facilities of Hamburg gives the garden special advantages for development in this line which is it Director Winkler's plan to utilize.

From Hamburg we went direct to Berlin on the late afternoon of the 22d. The greater part of one day was spent in a visit to the nurseries of L. Späth near Berlin. Here a number of hybrid trees and shrubs were seen and special notes taken of

variegated varieties of trees and shrubs for the study of which the nurseries give unusual opportunities. One day was spent at Dahlem in visiting the Königl. Botanisches Garten, the Kaiserliche Biologische Anstalt für Land und Forstwirtschaft and the Pflanzenphysiologisches Institut der Königl. Universität. The gardens, greenhouses, laboratories and experimental plants at these institutions afforded much that was interesting and instructive.

One day was spent at the experimental gardens of Professor Baur at Friedrichshagen. Here we met Professor Baur and several of his assistants and students, all of whom very kindly explained the various experiments under way which were chiefly concerned with hybridization studies of various cereals, of cabbage, kohlrabi, cauliflower, kale and brussels sprouts, and of turnips and rape. It was a particular pleasure that we were accompanied on this trip by Dr. George H. Shull of the Station for Experimental Evolution at Cold Spring Harbor, Long Island. Dr. Shull has been spending a year in Berlin and was well posted on the work at Friedrichshagen. We also dined and spent a pleasant evening with Dr. and Mrs. Shull. The 26th, which was Sunday, was spent in a long walk through the Tiergarten, when some time was spent in its rose garden.

Early the next morning we started for Quedlinberg which we reached about noon. Along the railroad track, especially in the vicinity of Magdeburg, there were numerous fields of chicory, some of at least twenty acres in extent. Magdeburg is perhaps the world's greatest center for the growing of root-chicories. I had been in correspondence with the firm of Dippe Brothers for some time and, at their request, had notified them of the date of my visit. Mr. Julius Schaefer of the firm met us at the railroad station and provided every facility for seeing the extensive fields of plants grown for seed. A spirited span of horses were furnished and gardeners in charge of chicory growing, of phlox plantations, of the trial grounds, and of varieties having double flowers (stocks, petunias, etc.) were at my service ready to give any information desired. It was a delightful experience to be driven for hours through fields of gaily colored flowering

plants (*Phlox*, *Delphinium*, *Tropaeolum*, etc.), or by large fields of beans, onions, cereals, sugar-beets, etc., all carefully grown and specially selected for seed production. The extensive greenhouses and cold-frames with potted plants were likewise of interest. It seemed that every plant for which there is demand in the seed trade and which could be successfully grown in the climate could be found at Quedlinberg. Here I was especially fortunate in seeing six different varieties of chicory in the first and second year of growth in large fields grown for seed, and also several varieties growing in the proving or testing plats. One single field of the "spitzköpfige verbesserte Magdeburger" variety covered about fifty acres. The head gardener who has been in charge of the chicory growing for many years gave considerable information regarding methods of selection, origin of varieties and the degree of variation which they exhibit. The firm also makes a specialty of *Petunia* and *Matthiola*, and I was able to see a large number of varieties grown in considerable number and note especially the treatment of the double-flowered varieties. The information regarding *Cichorium* gained at Quedlinberg was so satisfactory that I decided not to visit the fields near Magdeburg but to proceed directly to Leipzig, which was reached late in the evening of the 28th.

The forenoon of the 29th was spent at the Botanisches Institut und Gartens der Kgl. Universität of Leipzig, where we met the director, Professor Wilhelm Pfeffer, and were shown through the laboratories of the Institut. As the International Austellung für Buchgewerbe und Graphik was situated but a short distance from the Institut, we embraced the opportunity to see the exhibition. Special attention was paid to the exhibits of photography applied to bacteriology, cytology and histology, and to the scientific exhibits in colored and lithographic reproduction. Had our schedule allowed, I should have been greatly pleased to spend more time at the exhibition.

The 30th was spent in a trip to Halle. It was a busy day. In the forenoon the Landwirtschaftliches Institut der Universität Halle was visited. Here Dr. P. Holdefleiss, professor of plant breeding, and Dr. Max Hollrung, professor of plant pathology,

very kindly explained the plan and organization of their work and showed the laboratories and botanical garden, all of which were of particular interest as they are developed almost entirely for instruction. The experimental farm of the institute is situated at some distance outside the town. As the main experimental work was with cereals which had been harvested, a visit to the farm was not made by us. In the afternoon the laboratories and gardens at the Botanisches Institut were inspected and much seen that was of interest.

On the morning of the 31st, Mr. Arzberger went to Dresden, where he planned to spend a day and then visit for a few days with relatives who live some distance south of Dresden. I planned to spend the remainder of the week at Erfurt. Taking an early train from Leipzig, I reached Erfurt about ten o'clock and immediately went to the office of the firm of Ernst Benary, seed growers. Here Mr. Lawrence Ainsworth, an English gentleman connected with the firm, took me in charge and the entire day was spent in the plantations and greenhouses of the firm. Here nine varieties of *Cichorium* were observed in the trial grounds and information obtained regarding the type of each variety, the methods of selection, and the amount of variation exhibited. I was especially glad to see these, as the seed of the cultivated varieties I have grown in the experimental garden at our New York Botanical Garden came from the firm of Ernst Benary. Other plants of considerable interest to the plant breeder were noted, among which can be mentioned double-flowered *Tropaeolum*, double-flowered fuchias, cockscomb, poppies, a large collection of begonias, and many varieties of double-flowered hollyhocks derived from the celebrated Chater collection. The firm makes a specialty of *Coleus* and I was able to make observations regarding the types which they are developing. To Mr. Ainsworth I am greatly indebted for many valuable suggestions regarding plants that offer special attractions and opportunities for practical and scientific study.

The next morning, August 1, the reports indicated that Germany would surely be involved in war and hence there was no assurance that regular passenger trains would run. In the

forenoon I made a hurried trip to the greenhouses of the firm of Haage and Schmidt, where I saw a fine lot of *Coleus* of several varieties new to the trade. Leaving Erfurt on the noon train, I reached Nürnberg in the evening. Here I found the hotels crowded with Americans and English who were hurriedly leaving the continent. During the next day, which was the first day of mobilization of the German army, there was much uncertainty regarding train service and as the day progressed it was evident that there might be considerable difficulty in reaching Holland. In the afternoon Mr. Arzberger arrived at Nürnberg several days ahead of our schedule, as I had already done. We took an evening train for Amsterdam, which we reached about ten o'clock the next night. The next day (August 4) several hours were spent at the Hortus Botanicus where the most interesting feature was the experimental garden of Professor Hugo de Vries in which the cultures of *Oenothera* were in excellent condition for observation. Many plants of special botanical interest were seen in the greenhouses and in the display gardens. We returned the next day and spent several hours with Professor Stomps who showed us through the laboratories of the institution. A visit was also paid to the American consul at Amsterdam, from whom we learned that England had declared war against Germany. Acting upon his advice, we left Amsterdam by rail that afternoon, crossed the channel from the Hook of Holland to Harwich that night and from thence proceeded by rail to London, where we arrived on the afternoon of the 6th. The 7th was utilized in securing satisfactory hotel accommodations and in arranging for steamship transportation to America. We had purchased passage some months before on the S. S. Caronia of the Cunard Line for its sailing August 25. This boat was however commandeered for war service and the Cunard officials at London were unable or unwilling to provide passage on other boats of their line before October. This was decidedly beyond consideration, so we secured passage on the S. S. St. Louis of the American Line, sailing the 15th of August for Liverpool. This arrangement left a week which was fully utilized in visiting places of botanical interest. The entire day of the 8th was spent at the Royal

Botanic Gardens at Kew. The grounds and greenhouses were visited as thoroughly as the limited time would allow and some time was spent in the herbarium where examination was made of specimens of *Abutilon* and *Coleus*.

On the next day a visit was made to Regents Park where several hours were spent in the Royal Botanic Garden of London. In the forenoon of the 9th several hours were spent at the botany building of the Royal College of Science. The afternoon was spent at the Physic Garden in Chelsea. Here there was seen an interesting collection of living plants of special botanical interest. On the morning of the 10th, we went to Merton to the John Innes Horticultural School, of which Professor William Bateson is director, but who was absent at the time of our visit. His assistants and students, however, very kindly explained the various lines of research in progress and many things of interest were seen. From Merton we went a short distance to Raynes Park, where the rest of the afternoon was very pleasantly and profitably spent at the establishment of James Carter and Company.

On the 12th a trip was made to Cambridge. Several hours in the forenoon were spent at the Cambridge University Botanic Garden where Mr. Lynch, the curator, kindly showed us about the grounds. One feature of special interest to me was the arrangement of laboratories and research rooms attached to the greenhouses. Professor Punnett met us at the Gardens and conducted us to the botany building of Cambridge University, where we met Professor Blackman, who showed us through the building. The rest of the afternoon was very pleasantly spent with Professor R. C. Punnett. His private laboratory, greenhouses and principal experimental gardens are provided in connection with his home at Whittinghame Lodge, and as the garden joins the experimental farm of the University, I was able to observe the crops grown for experimental study by both Professor Punnett and by Professor Biffen and his associates.

On the 13th, a trip was made to the garden and laboratories of the Royal Horticultural Society at Wisley. Here some time was spent with Dr. A. S. Horne in an inspection of the student and

research laboratories. Dr. Horne also explained the research in plant pathology now in progress at the garden. Mr. F. J. Chittenden, who is director of the laboratories, then took me in charge for a trip through the greenhouses, orchards, experimental gardens, rock garden, and floricultural plantings. I had already written to Mr. Chittenden regarding certain aspects of the early breeding of *Coleus* in which the Royal Horticultural Society took a prominent part, and, in response to my inquiries, Mr. Chittenden had obtained through personal inquiry and correspondence important data bearing on the question and which he very kindly supplied to me.

As there was some uncertainty regarding the movement of passenger trains, it seemed best to start for Liverpool in the forenoon of the 14th. We embarked from that port on the S. S. St. Louis the next day and reached New York in the night of the 22d.

The above rather diary-like account of my movements conveys but slight impression of the many interesting plants seen that were new to me, of the many botanical features that I was privileged to see, and of the many pleasant acquaintances that were made. While the outbreak of war somewhat interfered with the plans, I feel that the main purposes of the trip were realized in a degree fully commensurate with the time expended.

A. B. STOUT,
Director of the Laboratories

THE DAHLIA EXHIBITION

A very successful exhibition of dahlias was held by The Horticultural Society of New York, in coöperation with the New York Botanical Garden, in the museum building, October 26 and 27. There was a large display of this increasingly popular flower, in all its forms, from the little pompons up to the large-flowered showy ones. The exhibition opened at two on Saturday continuing until five, and on Sunday was open from ten to five. There was a large and appreciative attendance. There were classes which were open to all and others which were restricted to non-commercial growers only.

One of the most attractive features was a display, not for competition, made by Mr. O. P. Chapman, Jr., of Westerly, Rhode Island. It consisted of two tables, each about sixteen by three feet. One of these attracting unusual attention was a color scheme of autumn tints. It produced a most harmonious and pleasing effect, and clearly demonstrated how much more effectively the dahlia may be shown in this way than in the ordinary formal one. It really brought out the great decorative value of the dahlia. Mrs. Chapman, who personally arranged the display, is to be congratulated upon the charming result. The Horticultural Society of New York awarded this display a silver medal, and a special cash premium was awarded to it by the New York Botanical Garden.

The following premiums, offered by the New York Botanical Garden, to be awarded by the Exhibition Committee of the Council of The Horticultural Society of New York, were awarded. In the open-to-all classes, for the largest and best collection, of not less than six types, the flowers on short stems, the first premium was won by Mr. George L. Stillman, Westerly, Rhode Island, with a superb collection of two hundred and eight vases, the second going to N. Harold Cottam & Son, Wappingers Falls, New York, with a collection of one hundred and four kinds. The first prize for a vase of twelve cactus dahlias was awarded to Head's Bergenfield Nurseries, the second to P W. Popp, and the third to Nathan A. Miller. For a vase of twelve decorative dahlias, the first prize was awarded to Mr. W. A. Manda, the second to Nathan A. Miller, and the third to N. Harold Cottam & Son. A vase of twelve show or fancy dahlias brought the first prize to N. Harold Cottam & Son. In the class for twelve pompons, the first prize was awarded to William Shillaber of Essex Fells, New Jersey, J. P. Sorensen, gardener, the second to N. Harold Cottam & Son. Mr. George L. Stillman of Westerly, Rhode Island, secured the first prize for a vase of twelve single or collarette dahlias, Head's Bergenfield Nurseries taking the second, and Nathan A. Miller the third. There were two entries for a vase arranged for effect, the first prize being awarded to Mr. P. W. Popp, the second to Dr. M. A. Howe.

In the class restricted to non-commercial growers, for a collection not to consist of over fifty blooms, the first prize was awarded to Mr. P. W. Popp, for a collection of forty-nine vases, the second, for a collection of forty-four vases, to Mr. William P. Clyde, New Hamburg, New York, H. J. Osterhoudt, gardener. For a vase of eight cactus dahlias the first prize was secured by Mr. Popp, the second by Mr. George D. Barron of Rye, New York, James Linane, gardener, and the third by Mr. William P. Clyde. A vase of eight peony-flowered dahlias won the first prize for Mr. Popp, Mr. Clyde taking the third, the second prize not being awarded. Mr. Popp also won the first prize for a vase of eight decorative dahlias, Mr. George D. Barron the second. The first prize for a vase of eight pompon dahlias went to Mr. Shillaber, the third to Mr. Barron, the second not being awarded. In the class for eight single or collarette dahlias, Mr. Popp was also a first prize winner, Mr. Barron won the third, the second not being awarded.

The following special prizes, given by the New York Botanical Garden unless otherwise indicated, were also awarded: Mr. William Shillaber, for a collection of ninety-two vases of annuals, bronze medal by The Horticultural Society of New York; Mrs. F. A. Constable, Mamaroneck, New York, James Stewart, gardener, for a vase of *Conoclinium coelestinum;* Mr. W. Atlee Burpee, certificates of merit by The Horticultural Society of New York for the peony-flowered dahlias "Mrs. Hugh Dickson" and "Mrs. W. E. Whineray," special mention being given to the peony-flowered dahlia "Mrs. George W. Kerr"; Lager & Hurrell, for a collection of cut orchids; Mr. O. P. Chapman, Jr., for an artistic display of dahlia blooms, silver medal by The Horticultural Society of New York, and cash prize by the New York Botanical Garden; Mr. George L. Stillman, certificates of merit by The Horticultural Society of New York for the new seedling cactus dahlia "George L. Stillman" and for the new seedling semi-single dahlia "Searchlight," special mention being made of the new seedling peony-flowered dahlia "Flower-girl"; P. W. Popp, for a display of collarette blooms and also for a vase of the peony-flowered dahlia "Weber"; Mr. W. A. Manda,

certificates of merit, awarded by The Horticultural Society of New York, for the new dahlias "Josef Manda" and "Bohemia Garnet," and special mention for the new dahlia "Veronica Manda."

The New York Botanical Garden made an interesting exhibit of thirty-two kinds of shrubs in fruit, and of twelve kinds of shrubs in flower. These attracted much attention, especially the fruiting specimens.

A meeting of The Horticultural Society of New York was held in the lecture hall of the Museum at 2:30 o'clock on Saturday afternoon. After the routine business was attended to, Dr. N. L. Britton read a short paper upon the origin of the name *Dahlia* and also gave a short account of its distribution, stating that there were about ten recognized species of the genus at the present time. Dr. Rusby followed with an illustrated talk on the home of the dahlia and its environment. This lecture was listened to with much interest by a number of dahlia enthusiasts present. At the conclusion of Dr. Rusby's remarks, Mr. P. W. Popp, an expert dahlia grower, described the present-day methods of dahlia culture. This was discussed by a number of those present, including Mr. Cottam, Mr. Lager, Mr. Head, Dr. Southwick and the lecturer himself.

The exhibition and the lecture and discussion in reference to the dahlia were a great success, and it is to be hoped that a dahlia show may become a permanent autumn feature. This flower is becoming more and more popular and its great usefulness for decorative purposes is bound to make it more and more desirable.

G. V. NASH

THE UNDERWOOD LIBRARY AND COLLECTION OF FUNGI

The Underwood Library purchased by the New York Botanical Garden in July, 1914, consists of 307 bound volumes and a large number of unbound pamphlets. It comprises in general more or less complete sets of certain periodicals, such as "Hedwigia," "Grevillea," "Journal of Mycology," and "Revue Bryologique"; works on phanaerogams including botanical excerpts from reports

of exploring expeditions in the South and West; text-books; and works on cryptogamic botany. It is especially rich in publications on hepatics and ferns. Many duplicate books from this collection have been placed in the laboratories and herbaria. A complete list of accessioned books from the Underwood Library appears in the October and November numbers of the Garden JOURNAL.

The Underwood Collection of Fungi, containing 17,000 specimens, was purchased by the New York Botanical Garden in July, 1914. In addition to valuable sets of published exsiccati, it contains a full representation of all the fungi collected by the late Lucien M. Underwood at Auburn, Alabama; Greencastle, Indiana; Syracuse, Kirkville, Jamesville, and Clyde, New York; West Goshen and Redding, Connecticut; and at many points in and about New York City. There are also miscellaneous specimens from many parts of North America, either collected by Dr. Underwood in his travels or sent in by collectors for determination. All groups of fungi are well represented in this collection and the specimens are well preserved. Many of them are valuable types. W. A. MURRILL.

NOTES, NEWS AND COMMENT

Dr. P. A. Rydberg, of the Garden staff, spent two weeks in November at the National Museum, Washington, D. C., in a study of the HELENEAE, a tribe of the Compositae, in preparation for a forthcoming number of North American Flora.

Professor L. H. Pennington, of the department of botany, Syracuse University, spent several days at the Garden during November in studies of herbarium material of fungi pertaining to studies for North American Flora.

The immediate effects of the weather conditions during the past summer and autumn were especially noticeable in two young trees of the sweet or star-leaved gum (*Liquidambar Styraciflua*)

growing in the New York Botanical Garden. During the early part of September in the midst of a pronounced drought these two trees dropped their leaves until they were almost entirely defoliated. In a short time, however, buds that had formed for development in the following year opened and a new crop of leaves appeared. The oldest of these soon reached the normal size and during the latter part of October turned red and dropped from the trees in quite the normal manner. With the coming of the first hard-killing freeze of October 28, the younger leaves were killed and these became shriveled and dried and remained on the tree for some time. In some cases the new growth formed a scale-bud in the usual fashion, but in many cases the buds remained open and were killed by the cold.

Thus in a single season two crops of leaves were formed and two sets of scale-buds developed, and when lateral buds developed branched twigs were produced.

It should be noted, perhaps, that the two trees in question are young trees about fifteen feet tall that were transplanted to the present position about five years ago, and have quite likely not reached full root development for necessary root action in time of periods of summer drought.

The twenty-fifth anniversary of the foundation of the Missouri Botanical Garden was celebrated at St. Louis on Thursday, October 15, and Friday, October 16. Dr. N. L. Britton, accompanied by Mrs. Britton, represented the New York Botanical Garden at this interesting event. A number of distinguished European botanists were expected to attend and take part in the scientific programme during the celebration, but the European war prevented all of them, except Professor N. Wille, of the University of Christiania, Norway, leaving their institutions. Dr. and Mrs. Britton escorted Professor Wille to St. Louis, stopping over a day at White Sulphur Springs, West Virginia, in order to show him something of the vegetation of the mountains there; Professor Wille is a highly distinguished authority on fresh-water algae and during the visit to White

Sulphur Springs collected a considerable number of specimens of these plants.

The programme of the celebration at St. Louis included scientific sessions on both October 15 and October 16 in the lecture room of the Missouri Botanical Garden, which were attended by a large number of American botanists. Dr. George T. Moore, director, delivered an address of welcome and was followed by Dr. Britton with an account of the vegetation of Mona Island, illustrated by lantern slides.

Interesting features of the celebration were a motor-car trip through the city of St. Louis and its park system; a reception at the residence of Dr. Moore; an inspection of the greenhouses and grounds of the Missouri Botanical Garden; and a banquet given by the trustees of the Garden at the Liederkranz Club.

Returning to New York by way of Chicago, Dr. Britton and Mrs. Britton both addressed the Chicago Chapter of the Wild Flower Preservation Society of America at a meeting held at the Art Institute on the afternoon of Monday, October 19, and spent a day with Dr. C. F. Millspaugh, curator of botany at the Field Museum of Natural History, examining the collections of that institution. Tuesday was given to a visit to the Buffalo Botanical Garden, where they were the guests of Mr. John F. Cowell, director, and recent developments of that institution were studied.

Professor William L. Bray, of Syracuse University, has been granted leave of absence for the current year and will spend the winter with his family in the Bronx. During the summer and early fall, Professor Bray has been making a general reconnaissance survey of the vegetation of New York state with a view to the preparation of a bulletin to be published by the New York State College of Forestry. The results of the field exploration and collections will be worked up at the Garden during the winter and it is expected that more substantial scientific outcome will be realized from this enterprise than could be suitably embodied in the semi-popular bulletin above mentioned.

Meteorology for October.—The total precipitation for the month was 2.42 inches. The first rainfall was on October 16, breaking a prolonged drought. From the 11th of August until October 16, but 1.26 inches of rain fell, and from August 28 until October 16, but 0.22 inches fell.

The maximum temperatures for each week in October were 82° on the 3d, 86° on the 11th, 81° on the 21st, and 64° on the 26th. Minimum temperatures were 50° on the 7th, 40° on the 14th, 42° on the 24th, and 29° on the 28th. The first general and hard-killing freeze of the season was on the night preceding the 29th.

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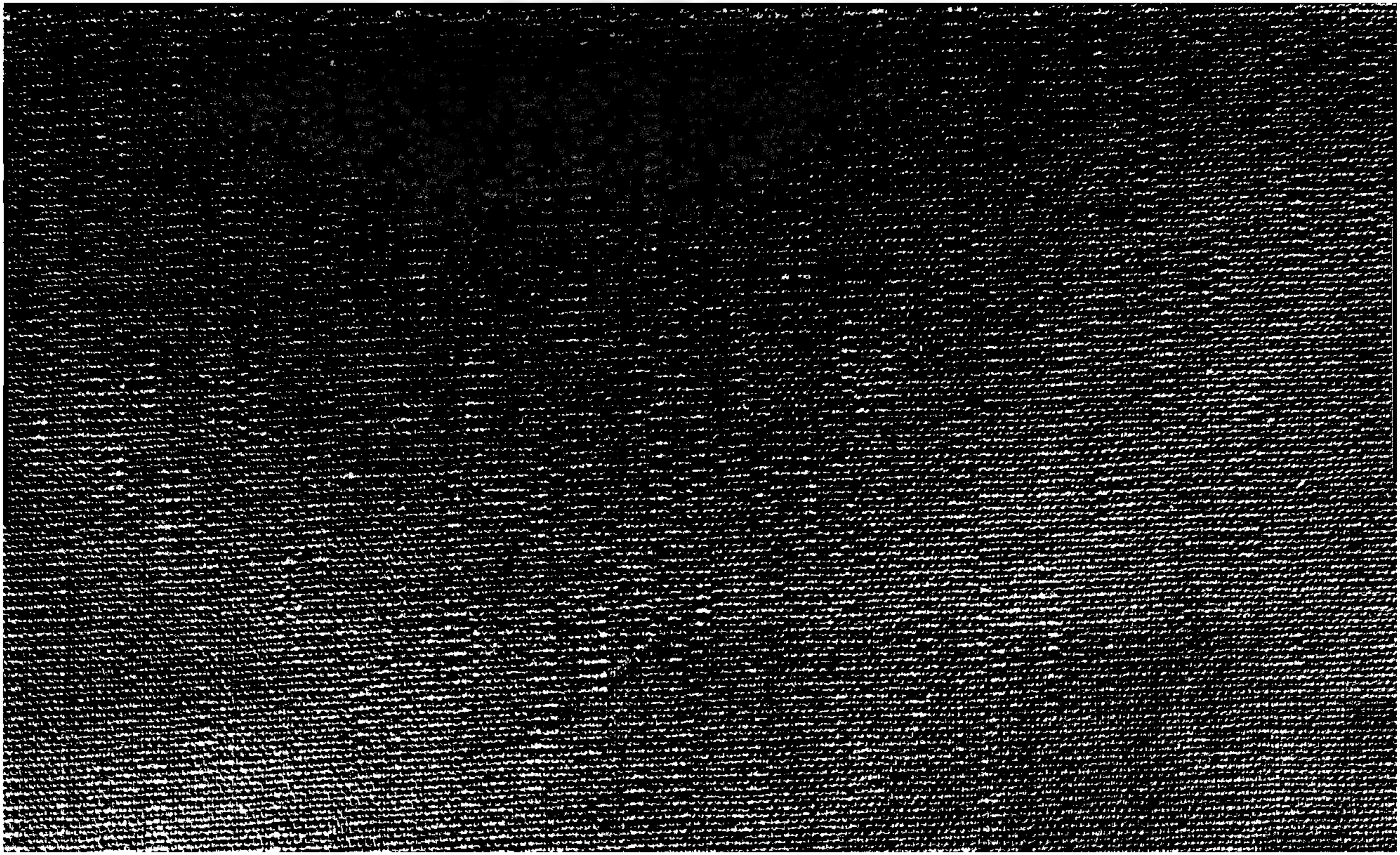

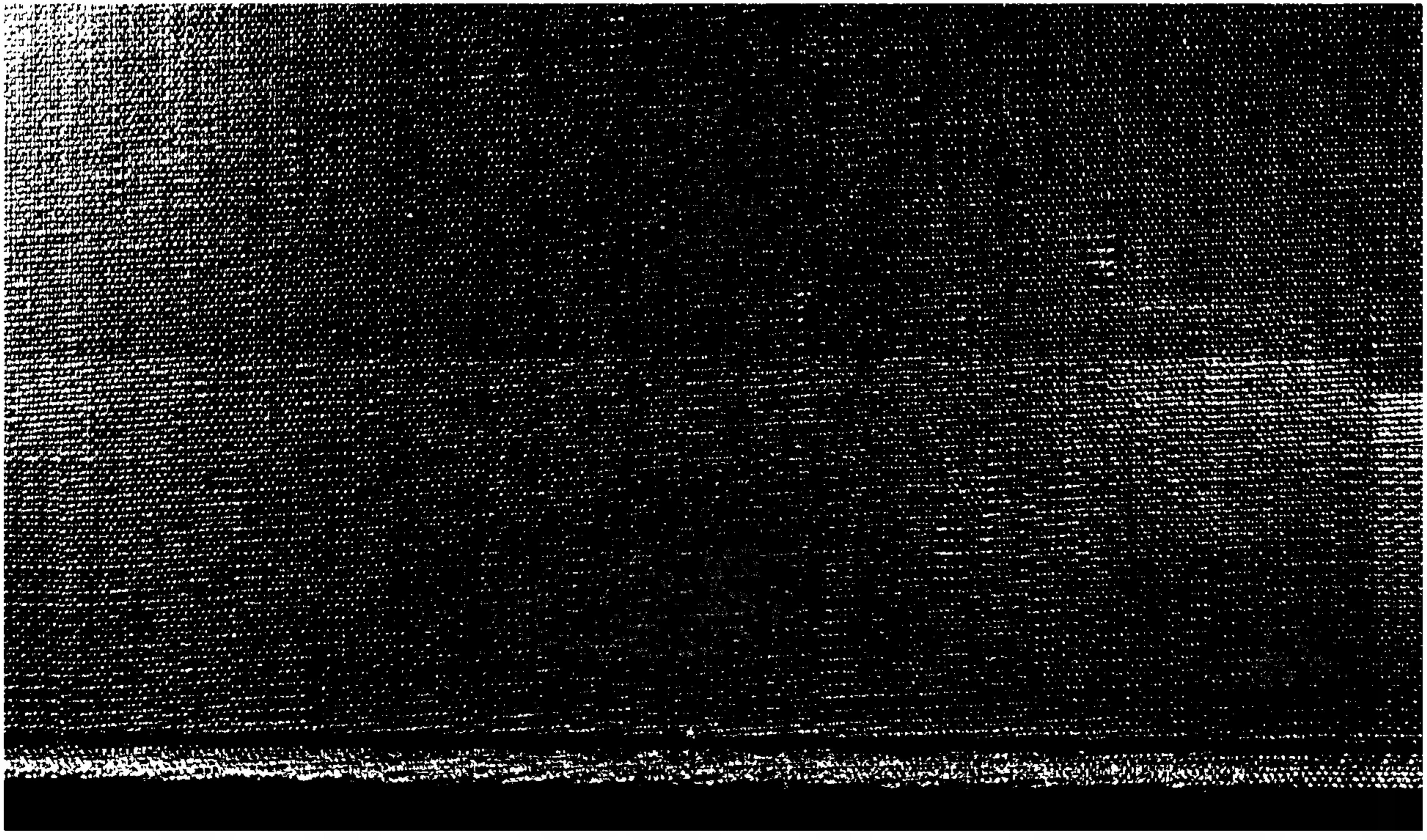

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

VOLUME XVI

WITH 23 PLATES

1915

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Seedling cabbages, the larger ones, in the upper row, grown with R A F, the others without.

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VOL. XVI January, 1915 No. 181

THE INFLUENCE OF RADIO-ACTIVE EARTH ON PLANT GROWTH AND CROP PRODUCTION*

With Plates CXLII–CLI.

Up to the time of the discovery of radium, anthracite coal represented about the highest known degree of stored energy. Radium is now believed to embody 360,000 times the energy of anthracite coal. The energy of radium is, however, of a totally different kind from that of coal. The energy of coal and other ordinary substances is exerted by the atoms of which they are composed; that of radium by the separation of these atoms into smaller bodies and the liberation of the energy of these particles.

As a result of this great difference, radium can perform work only of a totally different character from that performed by ordinary substances. It is the dream of the physicist to discover a method by which the energy of radium can be exerted without this dissolution of its atoms, the effect of which would be revolutionary in the mechanical world.

It has been claimed by some French investigators that they have already solved this problem, and that they have found several ways of applying radium in the performance of mechanical work, but the claim appears improbable. So far as the scientific world now knows, the effects of radium are wholly exerted by the separation of its atoms into inconceivably minute bodies, of three kinds, which dart off with extreme velocity, penetrating and passing through almost all substances and producing their effects as they go.

*Lecture delivered at the New York Botanical Garden on November 14, 1914.

These particles, "emanations," as they are known, are spoken of as "rays," notwithstanding that they are in reality matter, or substance.* They are so light that, even after long periods, the radium that is losing them cannot be seen to have lost weight. They are so numerous that, although constantly given off in vast numbers, it is estimated that it would require 2,000 years to exhaust one half of these rays in a particle of radium, and there is no way known by which the radium can be made to cease losing them. These emanations will accumulate in substances into which they enter, especially water, and will later be given off therefrom as they are from the radium, but while the substance still contains them and is giving them off, it is said to be radio-active, and it possesses, for the time, the valuable properties of the radium itself. This is especially true of water, as applied in medicine or to plants. It is to be noted that such emanations are not radium itself and do not contain radium; neither does the substance in which they are held. On the other hand, radium enters into various combinations with acids and these compounds may be dissolved in water and other liquids. Such solutions are radio-active, like those containing the emanations, and give off the emanations, but they differ from them in that they actually contain the radium metal. The bromide and the chloride of radium are the soluble compounds most used, the sulphate the principal insoluble one.

The rays given off are of different kinds, exhibiting different phenomena, having different velocities, penetrating different substances and for different distances and producing different effects on the bodies which they attack. They are distinguished as alpha, beta and gamma rays.

On striking various substances in their flight, the rays cause the latter to become luminous, so that watch dials to which radium is applied appear with perfect plainness to the eye in absolute darkness and remain thus luminous practically forever. The rays also produce photographs in perfect darkness and through almost any substance placed between them and the plate or paper.

*Strictly speaking, the term "emanations" applies only to the residue left after the first rays (alpha rays) have separated from the radium atoms.

The practical application of radium that is best known to the public is for the alleviation, and in a great number of cases, the complete cure of cancerous affections. They will later learn of other equally important medical uses for the substance, some already established, others yet to be developed. Just how radium acts upon the body and its internal enemies in producing these results is but imperfectly known, yet a great deal is known about it, and it is certain of these facts which first suggested the probability that radium would increase crop production, in agriculture. It was early learned that although a strong, concentrated application of radium could kill the cancerous disease, a much milder application might greatly stimulate its growth, so that the cancer would quickly destroy the patient. It was also found that this same difference between the effects of mild and intense action on cancer existed in the case of healthy vital functions, the former being healthfully stimulating while the latter is so destructive as to render the careless handling of concentrated radium preparations extremely dangerous.

Since the general nature of living animal and vegetable protoplasm is identical, the question of influencing plant growth by the action of radium was at once suggested. Could it be applied to field crops so as to produce an increased yield? Could it be applied to crops suffering from animal or vegetable parasites, so as to kill the latter, as it kills cancer in man? Or, would the crops suffer more from such an application than would their diseases? If the application were found beneficial, would the amount of radium required for the purpose render the operation unprofitable? Or, seeing that the activity of a particle of radium goes on for centuries with no apparent diminution, would a single application to the soil permanently increase its agricultural productivity?

Plant physiologists, all over the world, took up investigations bearing on these questions. As would naturally be expected, these early investigations were restricted to experiments in laboratories, greenhouses and gardens. In Europe, something has been done in experiments with field crops and orchards, but

in this country no reports of extensive field trials have heretofore been made.

In October, 1913, I arranged with the Standard Chemical Company of Pittsburgh, Penn., to make preliminary trials on an extensive scale. In view of the cost of radium and its preparations, the reader may wonder how such an experiment could be undertaken. It requires about 400 tons of radium ore of standard quality to yield a gram, about fifteen and a half grains, of radium, which amount could easily be carried on a man's thumb nail. The regular market price is $10,000 a grain, or $120,000 a gram, equal to $70,000,000 a pound. This problem was solved by making use of the finely powdered residue remaining after all the radium possible has been extracted, but leaving some two or three milligrams to the ton, worth some $3000, yet a by-product unless a special use for it could be discovered. Various other substances, especially uranium, are present in the material.

Before proceeding to describe these experiments and their results, it is desirable to briefly summarize the results of previous experimental work.

The most extensive work that has been published in English of the influence of radium on the growth of plants is that of Dr. Charles Stuart Gager, of Brooklyn, N. Y., which appeared in the fourth volume of the MEMOIRS OF THE NEW YORK BOTANICAL GARDEN, December 2, 1908. Nearly all the authors quoted by Dr. Gager had reported that the effect of radium was to retard or inhibit plant development, results which, as it will be here shown, were due to the use of enormously excessive quantities. Guilleminot had especially commented on the difference between the effects of low and high activities. He stated that while a certain low activity had no effect upon plants, the effect of from six to twelve times that amount would markedly retard growth, and from eighteen to seventy-two times would completely destroy. Yet he expressed the opinion that there was no strength that would positively stimulate growth. It was said that the distance at which the radium would act was limited to about two centimeters, less than an inch. Roots were found to be

more susceptible than other parts of the plant. Some plants were more resistant than others and the turnip was mentioned as being especially so. Excessive branching of certain tissues was reported. It was found that parts of plants exposed to radium emanations would themselves become radio-active. The degrees of such radio-activity were, the root most, then, in order, stems, buds, leaves and flowers. It was decided that this activity did not exist in the tissues themselves but in their contained water.

Gager himself employed numerous methods of experimentation. He used tubes of glass and other substances which were coated on the inside with substances containing radium. He also used rods similarly coated on the outside. Such tubes or rods would be laid upon dry seeds for various periods of time and the seeds were then planted and their germination and growth compared with those of others not so treated. Seeds were soaked in water containing the emanations and were then planted and similarly compared. Plants were grown in water containing the emanations, while others, growing in the soil, were watered with such water. Plants were grown under bell jars in air that was kept charged with the emanations. Radium tubes and rods were buried in the soil in which seeds were planted. The radio-activities to which the seeds and plants were subjected in these experiments varied from 7,000 X up to 1,500,000 X, all of which however, we now know were excessive. He always found the damage greater with the increase of activity. Similarly, he found that the seeds farthest away from the buried tube showed successively less injury. In short, it is seen that in every case of a change of conditions which resulted in a lower activity being exerted upon the seed or plant, the damage was less and he did not fail, as Guilleminot had done, to find strengths that would markedly stimulate germination and growth. He finally reached a conclusion expressed as follows: "*The rays of radium act as a stimulus to protoplasm. Retardation of growth following exposure to the rays is an expression of over-stimulation; acceleration of growth indicates stimulation between a minimum and an optimum point.*" He agreed that the root was more affected

than the other parts of the plant, and his experiments show that members of the grass or grain family are more strongly influenced than others with which he experimented. He concluded that the gamma rays can penetrate as much as a foot in moist soil. As my own experiments show, they produce important effects at a distance at least seven or eight times as great as this.

In France, Petit and Ancelin reported that by placing the seeds between sheets of blotting paper moistened with radio-active water, not only were a much larger number of ray-grass seeds germinated than when plain water was used, but the roots at the end of the thirteenth day were ten times as long as in the latter. With wheat and corn the increased length was not so great, but was very marked, as was also the greater length of the stems.

The National Agricultural School at Grignon, France, experimented with six varieties of potatoes and obtained by the use of radium an average gain of more than 16 per cent. in the weight of the crop, the potatoes at the same time containing more starch and being correspondingly more mealy and palatable. Barley so treated gave 17.6 per cent. more straw and 12.5 per cent. more grain. Mustard gave 27 per cent. more straw and 34 per cent. more seed. Flax gave 24 per cent. more straw and 6 per cent. more seed. White vetch gave 19 per cent. and fenugreek 11.5 per cent. more fodder.

At the Agricultural School of Berthonval, the experiments were made on plots of a hectare each. Upwards of a 15 per cent. increase in the yield of grain was obtained by the radium treatment and over 14 per cent. in that of sugar beets.

At the Harper-Adams Agricultural College at Newport, Foulkes also obtained a 14 per cent. increase in the yield of table beets and more than 20 per cent. in turnips, plots of a hectare each being employed.

Messrs. Vilmorin, Andrieux & Co. and others experimented with flowers, obtaining very satisfactory results on chrysanthemums, roses and other cut flowers.

All experimenters with plants in pots have reported such phenomenal increases in root development that the plants

quickly became root-bound and had to be successively transferred to larger pots.

A most extensive series of experiments has been carried on at Joachimsthal by Dr. Julius Stocklasa, Director of the Chem.-Phys. Institute at Prague, with the coöperation of four assistants. These experiments extended over a period of seven years, the results being embodied in a voluminous report, made in September, 1913. There were many series of experiments. In one set, the plants were grown in ordinary soil and watered with water possessing various degrees of radio-activity. In another set they were grown in water supplied with plant food similarly charged, while in another set radio-active earth was employed. The following results were obtained.

The first experiments were directed toward ascertaining the effects of radium upon the activity of those bacteria which take nitrogen from the atmosphere and fix it in the soil in the form of plant food, thus enriching the soil. He found that liquids containing these bacteria gained from 32 per cent. to 76 per cent. more plant food in this way under radio-active influence than without it. Unused soil gained from 10 per cent. to 30 per cent. more fertility in a few months from this cause under the same conditions than without the radium.

Many previous experimenters had reported that radium exerted a toxic action on plant life, while others had declared to the contrary. Stocklasa repeated all these experiments, but in two series, one with very small amounts, the other with large amounts of the radium. He found that in most of the latter cases the effects were toxic, while in the former they were healthfully stimulating. He also found that different plants differed so materially in their susceptibility that the same amount of radium might be stimulant to one but toxic to another. What was even more interesting and important, he showed that families of plants manifested this difference.

When a very low radium activity was employed, the germination of seeds was increased from 70 per cent. to 130 per cent., but it was retarded by a high activity. Drying and weighing two sets of plants after 48 days of growth, one set grown under

radio-activity, the other not, the former showed an increase of over 200 per cent. in peas, over 100 per cent. in beans and lupines and nearly 900 per cent. in barley. In another set of experiments, with lentils, peas and wheat, the gain by the use of radium ranged from 62 per cent. to 158 per cent. With buckwheat, the increase ran from 42 per cent. to 106 per cent. With poppies, there was an increase of 117 per cent. in the seed, and 32 per cent. in the plant exclusive of the seed, or 50 per cent. in total. With lupines the seeds gained 64 per cent., the total gain being 60 per cent. The greatest gain was in the early stages of growth, the ratio decreasing thereafter.

These studies taught that all the main functions of the living cell are greatly stimulated by radium. The fact that starch production went on in darkness, and other corroborative facts, indicated that the effects of the radium closely resemble those of the ultra-violet rays of the sun.

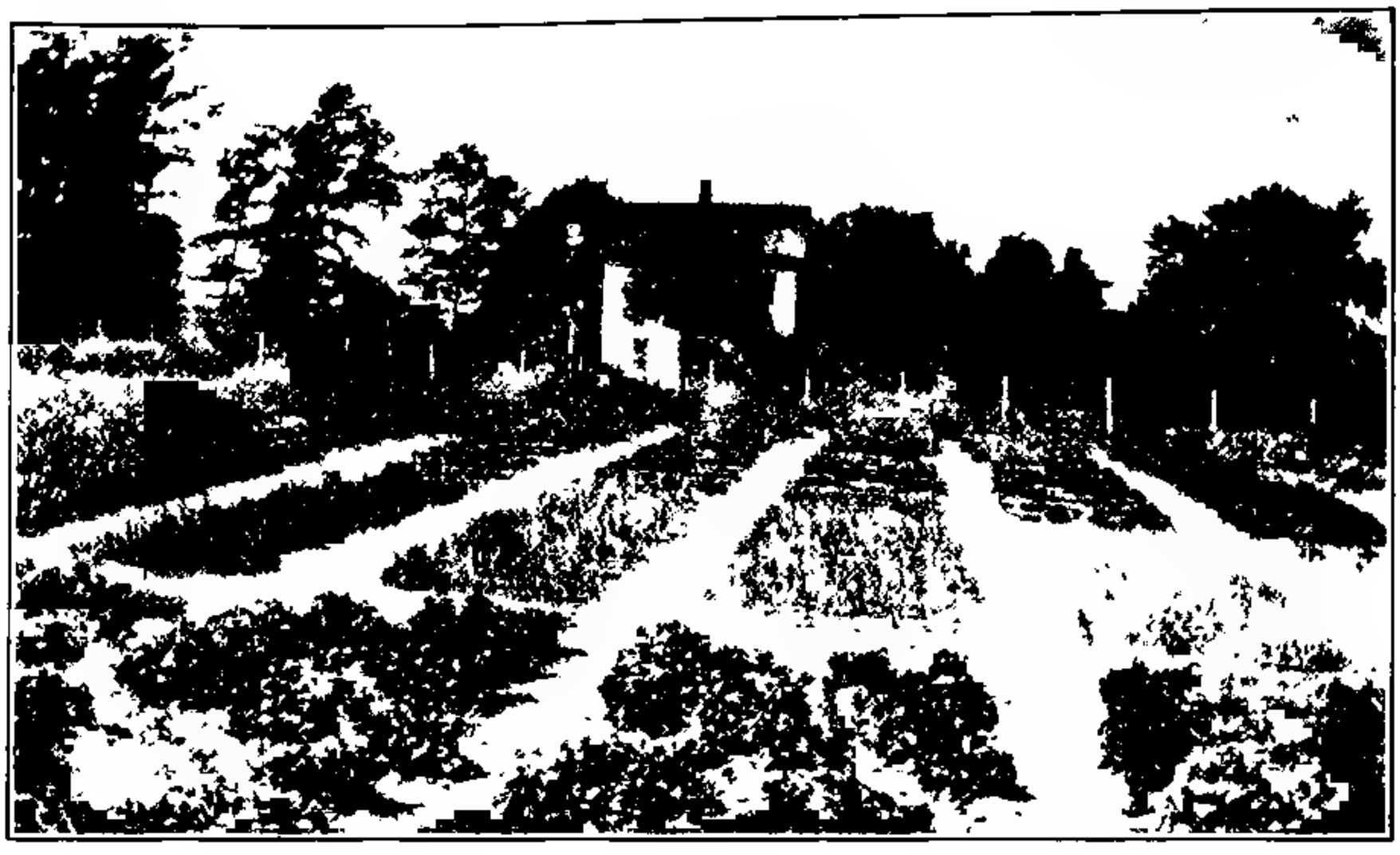
Stocklasa also succeeded in synthetizing sugar by this radio-activity. The bearing of this fact upon the possible increase in sugar production by plants is momentous. It also explains the great increase in sweetness observed from the radium treatment of beets, carrots, tomatoes, pumpkins, squashes, melons, sweet corn and other vegetables. The fact that sugar-beets showed no increase in sugar content is perhaps due to their having reached a practical maximum in sugar production.

He summarizes as follows:

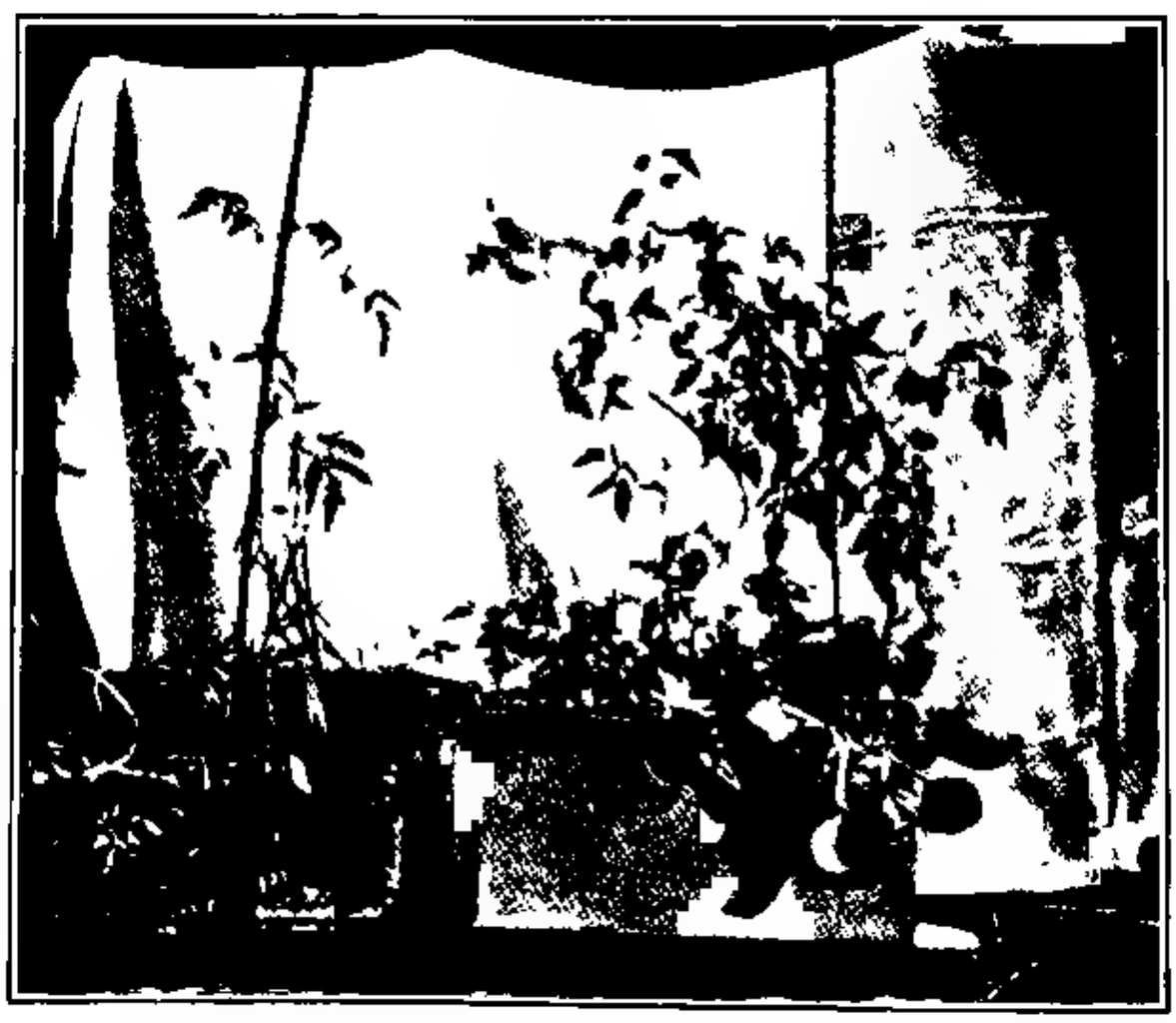
"All of our researches point to the fact that radium emanations with a low activity favorably influence the caryokinesis of the cell, the entire development of the plant, the mechanism of the metabolism, the photo-chemical assimilation in the chlorenchyma, bud formation and finally fructification. Emanations of too great activity exert an inhibiting influence on the growth of the plant and cause toxic symptons in the cells, both in those containing chlorophyll and those free of this substance."

He also says that if we assume that under ordinary conditions land will produce 200 cwts. per hectare of corn or cattle turnips, we may expect 300 or 400 cwts. under the influence of radium.

He concludes, finally, that the effects of radio-activity are



Effects of R A F on onions (lightly shaded plots). The 200 lb. plot is at the left. The control plot is at the right and scarcely showing.



Comparative growth of seedlings of cabbage and tomato, with (at right) and without (at left) R A F.

greatest on young foliage and almost equally great on the petal tissues of the flower.

Against this array of positive evidence as to the stimulating effects of the radium, I had the negative effect of a caution from the French Agricultural Bureau against the probability of such a pronounced action as had been reported, on the ground that the amounts of radium in radio-active earths which had been employed were so very small. Little weight could be given to this suggestion, because of its purely speculative character. Although it was pointed out that ordinary farm soil is radio-active, often more strongly so than the radium mixture that was applied in the experiments, it was a pure assumption that this activity is wholly due to radium, or that such radium is actually present in the top-soil, and in fact it seems far more probable that it is in part due to the direct effect of the sun upon the soil. However, the case was one that called preëminently for the actual test of experimentation and to this I applied myself in the most practical possible way.

I made it my business, for the time being, to ignore all theoretical considerations and to proceed with my trials precisely as a farmer would proceed in preparing the land and applying the radio-active material for a market crop.

My experiments and observations included the winter culture of radishes in a market gardener's greenhouse, some seedlings in window boxes in my own home; field crops covering more than one hundred acres at Northfield, Ohio, under the direction of Mr. W. W. Darley: an experimental garden at Pittsburgh, and the plantation of an acre and a half at Nutley, N. J., of which I have had immediate personal charge throughout the season.

The greenhouse radishes were already about an inch high when the radium was applied. A furrow was scratched midway between the rows, which were four inches apart, and the powder sowed therein at the rate of sixteen grains to the square foot, which is equal to about fifty pounds to the acre. A square yard was thus treated and was compared with an exactly similar square yard upon the same bench, about ten feet distant. The radium radishes soon appeared much inferior to the others, and

continued to do so to the end of the experiment, the tops being smaller, as though stunted, but on harvesting and weighing the green tops and the roots separately, the tops were found to weigh 17 per cent. less from the radium plot than from the other, while the radishes weighed about 20 per cent. more.

The season of growth had been very bad, February being very stormy, with little sunshine, and that little largely excluded by snow lying upon the glass roof. This observation is of much importance, indicating that it required less green leaf surface under deficient sunlight for the plant to manufacture a larger amount of food for deposit in its root. It will later be seen that various other experiments indicate and elucidate this principle.

Both of my window boxes were filled from the same pile of soil, similarly treated in every way except that in one the above-mentioned amount of radium earth was mixed through the soil. All operations were conducted for both boxes at the same time. Their positions in the window were exchanged from time to time, so as to preserve absolute equality of conditions. In the boxes I sowed cabbage and tomato seed in alternate rows. The seeds germinated one or two days earlier in the radium box and the plants were already well developed when those in the other box broke through the ground. The difference was more marked with the cabbages than with the tomatoes. The original lead of the radium plants continued to increase throughout the experiment, and after some two months, when the experiment was brought to a close, a given number of plants in the radium box would have weighed from six to ten times as much as from the other.

In Mr. Flannery's garden I particularly noted the great gain of turnips and beets under the radium influence over those without it. Radishes, which I did not myself see, were said to have yielded more than 100 per cent. increase under the radium treatment. The quality of the radium-grown vegetables was a matter of special comment by all who tried them, and this has proved true of all vegetables raised elsewhere under this treatment.

Operations at the Northfield farm were greatly handicapped

by the heavy rains of March, April, and May, which delayed planting for more than a month beyond the proper time, and which later drowned portions of the crops in low places. Later severe drought caused further injury. Many of these results are, therefore, not yet available, but the growing crops, which I have observed with great care on various occasions, have shown results in all respects similar to, but greater than those recorded at my Nutley plantation, which I shall now describe.

The powdered radium ore tailings were applied to the land in the proportions of about 25, 50, 100, and 200 pounds, respectively, to the acre. This meant, on plots of 5 by 20 feet, only one, two, four, and eight ounces, amounts inconveniently small

DIAGRAM 1. Plan of a set of plots.

for uniform distribution. Therefore, to each such portion eight ounces of ordinary fertilizer was added and very thoroughly mixed by steam power. This mixture made of the tailings, a sort of radio-active fertilizer, for which the symbol R A F will here be used, although the figures stated will actually represent the amount of the tailings contained therein.

A field having an area of one and one-half acres was secured and surrounded by a high fence to prevent possible interference. Half of the ground formed a gentle slope to the east, the remainder occupying the level above. The ground was a light, decomposed sand-shale and was moderately stony. Through this plot, from east to west, was laid a road six feet in width. On one side the strip was 114 feet wide, on the other 78 feet. The whole was divided into thirty-four sets, each set consisting of five plots.

One plot, AA, was treated with R A F at the rate of 200 pounds to the acre; another, BB, with 100 pounds; a third, CC, with 50 pounds; DD, with 25 pounds, and X with none, although it received the 8 ounces of fertilizer. Each set of plots was nine-

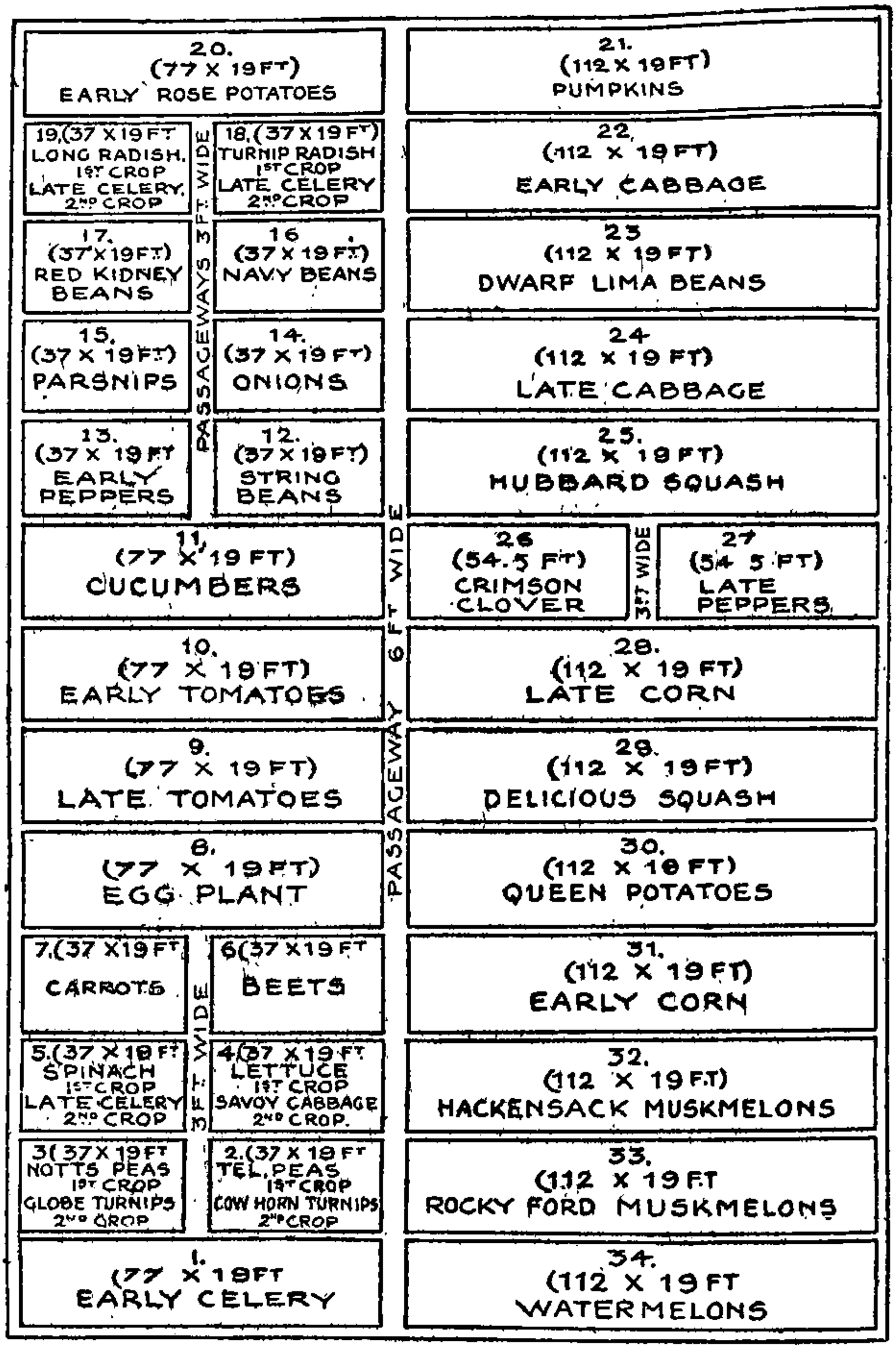


DIAGRAM 2. Plan of the farm.

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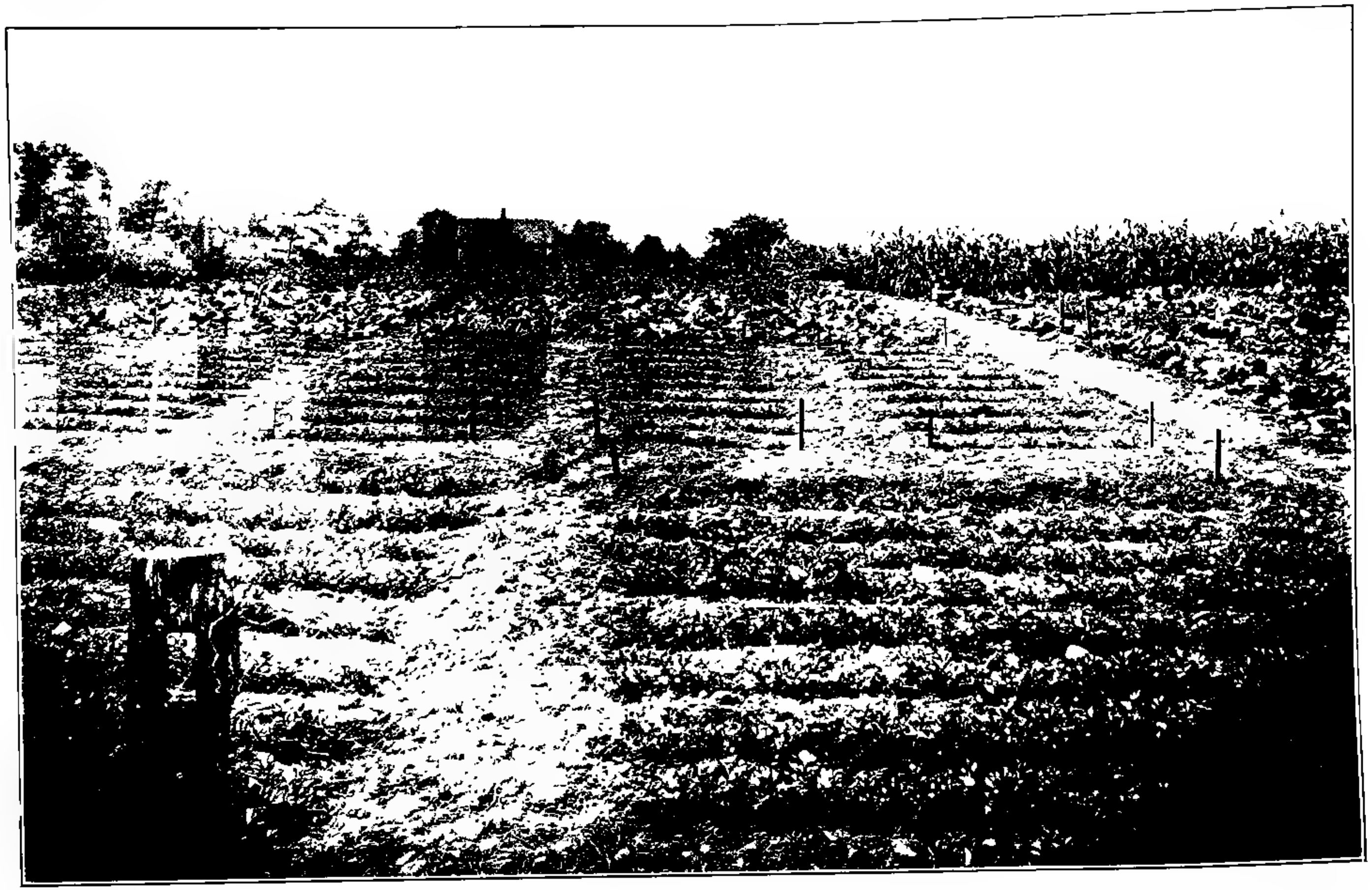
Southern half and part of northern half of farm, looking west from neighboring roof.



Celery in foreground; next, four plots of turnips; at right, without R A F, but its left hand portion favorably affected by emanations crossing path from 25 lb. plot.

teen feet wide, and the plots composing the sets were, respectively, five, thirteen, nine, or twenty feet by nineteen feet, according to the nature of the crop. Each plot was separated from those on its four sides by paths three feet wide, except for the central road, which was six feet wide. As will be seen from what follows, this three feet was too narrow a separation to prevent the rays of the radium from reaching every plot on the tract and modifying its yield.

Each plot of a series received exactly the same amount of the same kind of fertilizer, applied at the same time and in the same way. Every operation of seeding, hoeing, cultivating, etc., was performed across all five plots at once. Thus, if rain or other condition caused interruption, no plot would have any advantage or disadvantage as to time over any other. In short, absolutely no differences existed in the conditions affecting the growth of plants in the five plots of a series, except as to the amount of R A F that was applied.

In all but one case, the R A F was sowed equally over the surface and then dug in. In this one case, part of it was put in the rows, in order that a comparison of results might be obtained. When some of the early crops were harvested, the ground was again dug, and other crops planted. More fertilizer was then applied, but in no case was any more R A F added. The R A F in the soil was, however, much more thoroughly distributed by this second digging.

That the 3-foot path was not sufficient to prevent the emanations from crossing and affecting the adjoining plots is fully proved by the observations which follow. A 5 by 19 foot plot of turnips, not treated with radium, lying just north of one treated with 25 pounds R A F to the acre and having the rows running north and south, shows the plants at the southern end of each row, and, therefore, separated by only the 3-foot path from the 25-pound plot, twice as large and strong as those at the northern ends. The graduation in size from the large to the small plants, in all ten rows, is almost as regular as though produced mechanically. There is an exactly similar difference among the turnips in the 25-pound plot, those at the southern ends of the rows, separated by 3 feet from the 50-pound plot, being twice as large

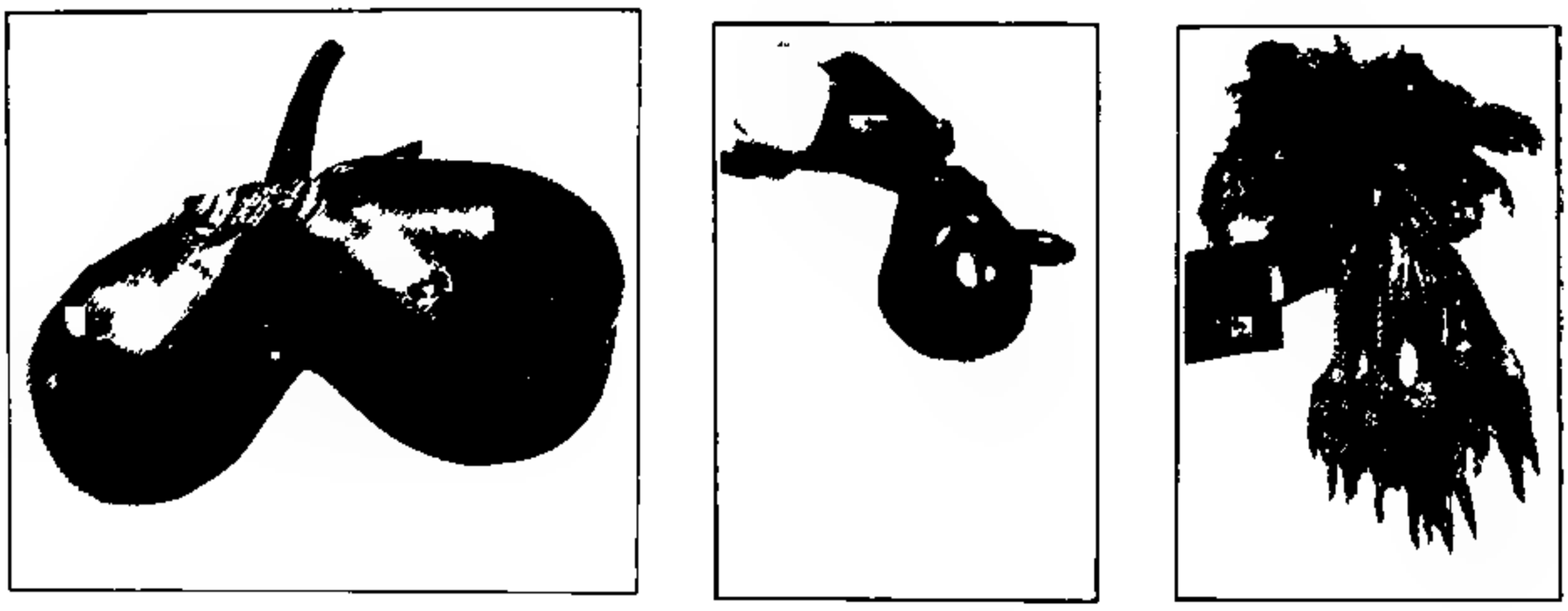
as those at the northern end, with the same regular gradation. Between the 50-pound and the 100-pound plots there is little difference, showing that 50 pounds produces about the maximum effect on turnips.

Between the 100- and the 200-pound plots, however, there is a similar but reversed relation. The turnips in the 200-pound plot are stunted by an excess of R A F, just as was the spinach that occupied the same plot in the early spring. Now, the plants in the 100-pound plot, lying across the path from the 200-pound plot, are similarly stunted, while their size increases regularly from that side to the north side, where they are as large and fine as in the adjoining 50-pound plot. In the series of plots next to the west, the celery plants show exactly the same series of differences as do the turnips.

Had I performed no other experiments than these this year, I should have regarded the results as conclusive, since there is no other possible cause for the differences in the plants than the effects of the different amounts of R A F. It is in this way that I explain the wide difference in the extent of the gains by R A F at the Northfield farm and those at Nutley. At Northfield the plots compared are acres in extent, so that the radioactivity from one could affect only a very narrow strip of the other, and the difference in weight of crops would show the full difference in activity of the radium. At Nutley, on the other hand, no plot, even though no R A F was applied, was entirely free from radium influence, which increased its yield above the normal, and decreased the differences between it and the radium-treated crops. It has been suggested that the effects on the crops were due to the uranium contained in the R A F, because of the very small amount of radium present. Except in part, this is obviously impossible, since the uranium could affect only the plot in which it was placed. The only possible substance the influence of which could cross the path to the neighboring plot is the radium.

All these results are permanently and indisputably recorded by a series of photographs, which display with great accuracy minute differences between the respective plots.

In the accompanying table each plot is indicated by the number



Branching of fruits of egg-plants and carrots on plots treated with 200 lbs. R A F to acre.

Row of turnips from control plot; those at left favorably affected by emanations from adjoining 25 lb. plot.

Globe turnips, 200 lb. plot at left, 100 lb. plot at right. Late celery in rear.

Plot of celery at left stunted by excess (200 lbs. to acre) of R A F, and left side of adjoining plot similarly affected by emanations crossing the path.

of pounds of R A F that it received to the acre. It will be observed that no plot received less than twenty-five pounds, while at Northfield the plot with the least R A F, namely D, received twelve and a half pounds to the acre. On the other hand, none at Northfield received more than 100 pounds, (A), while at Nutley AA represents 200 pounds to the acre.

In several cases, a second crop was planted on plots from which the first crop was harvested early in the season.

Some of the facts indicated by these results will now be stated.

Nearly all, if not all field crops gave an increased yield under the influence of the proper amount of R A F. The largest gain recorded at Nutley was 129 per cent.; at Northfield 135 per cent.

Probably the yield of all crops will be decreased if a sufficient excess is applied. In most of the cases, such excess was not reached by the 200 pounds R A F to the acre, although in most cases the greatest gain was attained by a smaller amount.

The amount of radium required for the greatest results differed with different crops.

AA was best in five cases.
BB was best in eight cases.
CC was best in five cases.
DD was best in eleven cases.

Families of plants showed the same varying susceptibility. Members of the Cruciferae or mustard family, comprising mustard, rape, cabbage, cauliflower, sprouts, kale, kohl-rabi, turnips and radishes were greatly benefited. So were the Cucurbitaceae, comprising the pumpkin, cucumber, squash and melons; in fact, more so than any others. The Gramineae or grass family, comprising hay, corn, sugar cane, sorghum and lawn grass, was enormously benefited. In this connection, it is to be noted that lawns have been peculiarly benefited, because of the special activity of radium on young growing leaf tissue. It is also to be noted that all observers have remarked on the great effect in improving the showiness of flowers.

The effect of the R A F on a second crop on the same ground was greater than on the first. This is probably due to the more

TABLE I

TABLE SHOWING POUNDS PRODUCED FROM PLOTS VARIOUSLY TREATED

	AA, 200 Lbs. RAF to Acre	BB, 100 Lbs. RAF to Acre	CC, 50 Lbs. RAF to Acre	DD, 25 Lbs. RAF to Acre	X, No RAF	Per Cent. of Increase Over X				X Over Next Best
						AA	BB	CC	DD	
Leguminosae										
Telephone peas	20.9	21.15	23.11	19.4	22.	....	.....	8.	....	....
Nott's peas	13.11	16.	15.2	20.6	16.10	....	.....	....	22.5	....
String beans	33.10	35.2	32.7	30.14	31.11	....	11.	....	....	....
Lima beans	68.	92.	81.5	93.	79.5	....	.....	....	17.	....
Chenopodiaceae										
Spinach	4.3	9.12	11.14	16.1	15.5	....	.....	....	5.	....
Beets	133.	132.	133.	126.	133.	All equal.		....	....	....
Solanaceae										
Potatoes	48.	56.	65.	66.	61.	....	.....	....	8.2	....
Early tomatoes	181.	270.	309.	293.	330.	....	.....	....	....	7.
Late tomatoes	169.	†226.	242.	213.	267.	....	.....	....	....	10.
Egg plants	160. (1.9) ea.	160. (1.7 ea.)	118. (1.7 ea.)	120. (1.9 ea.)	153.	4.5	4.5	....	....	....
Early peppers	14.	28.	24.	28.5	29.	....	.....	....	....	3.6
Late peppers	18.5	16.	13.	12.5	13.	42.	.....	....	....	....
Cucurbitaceae										
Cucumbers	8.15 (5 oz. ea.) 4.15 small	7.7 (3.8 oz. ea.) 5.8 small	9.12 (4.5 oz. ea.) 4.14 small	10.1 (3.8 oz. ea.) 3.15 small	7.14 (4 oz. ea.) 5.10 small	....	.....	....	35.7 5.4 total	....
Pumpkins	277. (6.9 ea.)	243. (6.4 ea.)	321. (7.1 ea.)	222. (6. ea.)	206. (5.1 ea.)	....	.....	56.	....	....
Hubbard squash	185. (7.7 ea.)	232. (8. ea.)	150. (200) (6.8 ea.)	100. (133) (6.7 ea.)	161.5 (7.7 ea.)	....	44.	....	....	....
Watermelons	370. (19. ea.)	340. (9.75 ea.)	378. (11.33 ea.)	333. (8.12 ea.)	269. (8.25 ea.)	....	.....	27.7	....	....
Delicious squash	217.	233.	226.	258.	188.	....	.....	....	35.5	....
Hackensack melons	87.	103.	116.	68.	73.	....	.....	59.	....	....
Rocky Ford melons	39.	83.	72.	50.	46.	....	80.	....	....	....

TABLE I—*Continued*

	AA, 200 Lbs. RAF to Acre	BB, 100 Lbs. RAF to Acre	CC, 50 Lbs. RAF to Acre	DD, 25 Lbs. RAF to Acre	X, No RAF	Per Cent. of Increase Over X				X Over Next Best
						AA	BB	CC	DD	
Cruciferae										
Turnip radish	54.1	57.4	64.10	66.10	64.7	....	.....	....	2.5	....
Long radish	.....	81.3	78.1	70.5	58.	....	70.	....	....	....
Early cabbage	384. (3.2 ea.)	412. (3.4 ea.)	388. (3.1 ea.)	280. (3.3 ea.)	349. (4. ea.)	....	18.	....	....	....
Late cabbage	460. (4.8 ea.)	404. (4.6 ea.)	458. (4.7 ea.)	420. (4.3 ea.)	405. (4.4 ea.)	13.6	.....	....	....	....
Flat turnips	.....	15.	.....	.....	11.	....	36.	....	....	....
Long turnips	.....	32.	.....	.....	14.	....	129.	....	....	....
Gramineae										
Late corn	81. (0.55 ea.)	80. (0.6 ea.)	90. (0.56 ea.)	95. (0.61 ea.)	63. (0.42 ea.)	....	.....	....	50.	....
Early corn	95. (6 oz. ea.)	92. (5.3 oz. ea.)	90. (5.7 oz. ea.)	95. (5.5 oz. ea.)	88. (5.5 oz.)	8.	.....	....	8.	....
Umbelliferae										
Carrots	85.	104.	138.	118.	111.	....	.....	24.	....	....
Parsnips	.....	.....	.....	.....	.....	....	.....	....	....	....
Celery	.....	.....	.....	.....	.....	....	.....	....	....	....
Liliaceae										
Onions	33.	.....	.....	.....	24.5	35.	.....	....	....	....
Compositae										
Lettuce	32.12	31.	26.12	34.5	36.9	....	.....	....	29.	....

uniform diffusion of the R A F through the soil, caused by continued tillage. The essential fact regarding the action of the radium is that each particle is shooting its rays in all directions through the soil. It is therefore to be expected that more uniform diffusion would produce greater results. This teaches the importance of thoroughly working the R A F through the soil.

The effect upon germination, when small amounts are used, was to increase the percentage of seeds germinated and to accelerate the process.

The earliest effect of radium is to increase the root growth. Often the stem growth will be retarded for a time, but will later undergo a great acceleration.

A given amount of sunlight has produced a greater amount of growth when radium was used, and the same amount of food production has resulted from a smaller amount of green tissue, or tops in case of the green-house radishes.

An increased tendency to branching has been observed when a large amount of R A F is applied to the soil.

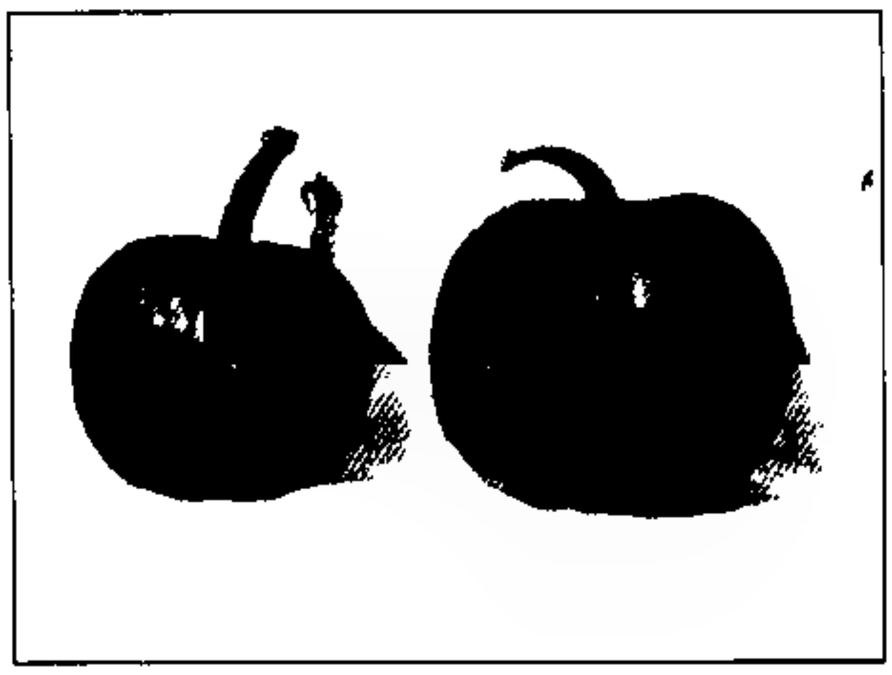
Perhaps the most important effect of the radium was that of improving the edible properties of the products. Potatoes were more mealy. Root crops were remarkably tender, sweeter and of finer flavor. Beets, carrots, onions, sweet corn and similar vegetables were markedly sweeter. Tomatoes were also sweeter and chemical analysis showed them to contain less water and more sugar. Radium-grown string beans and peas were peculiarly sweet.*

My experiments indicate, besides the above, the following facts which cannot be asserted without further evidence.

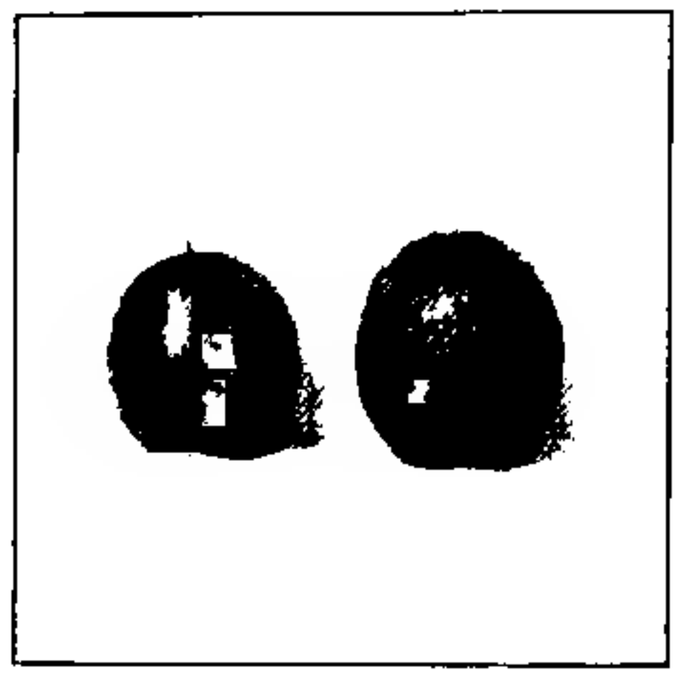
My plots of lettuce, after being planted out, were visited by a severe frost which either immediately or very shortly caused the death of a number of them. The percentage of death in the several plots decreased with the amount of R A F present.

The results of experiments with turnips are of greater interest and perhaps of greater importance than any others secured. Two varieties were planted, one the cowhorn, which produces a

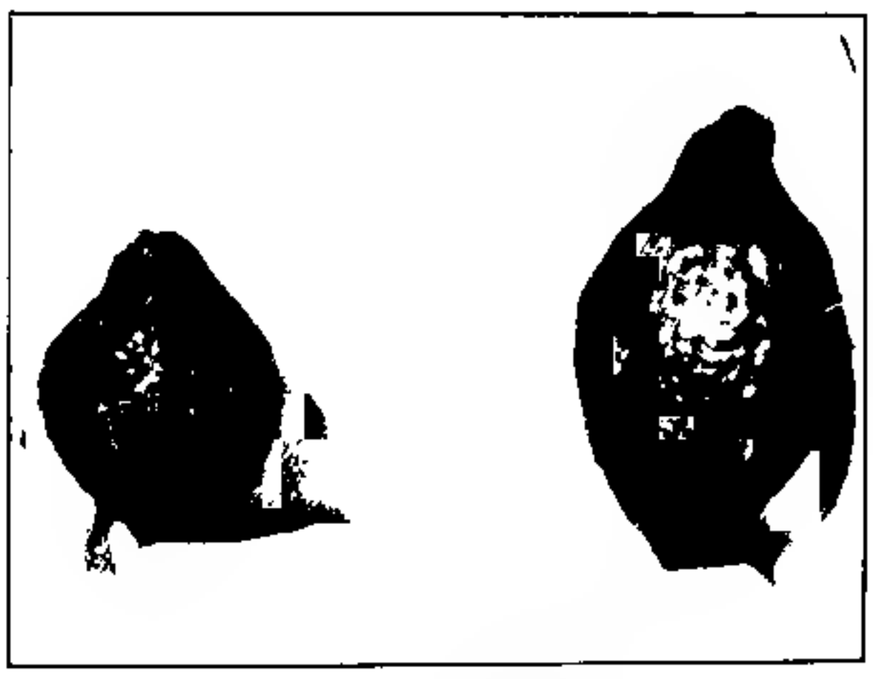
*This increase in sugar content, however, has not been found uniform. A number of the vegetables produced at the Northfield farm were subjected to chemical analysis, without finding any noteworthy or characteristic change in composition.



Pumpkin.



Watermelon.



Hubbard Squash

Delicious Squash.

The weight of each fruit at the right bears the same ratio to that of the one at the left as the total weight of the radium treated crop bears to that of the control.

The leaves of pumpkins in central plot without R A F, scarcely reach to a man's knees Cabbage in foreground.

Two hundred pound plot of pumpkins with foliage reaching nearly to man's waist.

long slender root like a carrot and the other the white globe, producing a short rounded root, half or more of it borne above the surface of the ground. These varieties were selected in order to ascertain whether the longer variety would show a greater effect from the action of the R A F, as I had previously found true of long radishes as compared with small round ones, in which case the latter showed only 2 or 3 per cent. increase over the control plot, while the former showed 70 per cent. in merchantable radishes and 40 per cent. in total.

In the case of the globe turnips I collected 11 pounds from the control plot and 15 from the BB plot, a gain for the latter of about 36 per cent. In the case of the long turnips, I harvested 14 pounds from the control plot and 32 from BB, a gain of about 129 per cent. These two instances go far toward indicating that the larger the amount of root buried in the soil, and thus exposed to the action of the emanations, the greater will be the gain in that crop. This result agrees with theoretical considerations. It has been established that the entire plant, and more especially the root, becomes radio-active and that this activity resides in the contained water, which would naturally impart a greater activity to that one with a larger root surface buried in the soil, where it can absorb the radio-active water, this water continuously stimulating all the cells with which it is in contact.

There are other interesting considerations in this case. The season of turnip growth, from late August to middle October, was this year marked by an almost total absence of rain, so that the crop was practically a failure. At the time of collection, Oct. 14, the foliage on the control plots was completely dead and dry. The DD plot of cowhorn turnips was almost as bad while the other three, especially the AA plot, were successively less damaged, having more or less green foliage and being still in a growing state. Therefore, had the time been extended, the percentage of gain over X would have been still greater than that now recorded. On the other hand, the conditions and the results are now abnormal, and we probably could not expect such large differences under ordinary conditions.

As to the round turnips, the same difference existed, although

in somewhat lesser degree. This again brings us to the consideration of the influence of radium upon the plant's resistance to drought. It indicates quite clearly that the effect of the radium is to increase such resistance. In the case of my egg plants, however, it appeared to decrease such resistance. The latter result appears somewhat contradictory of the effects upon the plant's resistance to frost. The injury to the plant, and the nature of such injury, from frost, is closely akin to that from drought, and as we have seen in the case of lettuce, radium appears to increase resistance to drought. It is possible that this discrepancy is due to the fact that the turnips continued to grow where the seeds germinated, while the egg plants, of rather large size, were attacked by drought just after they had been transplanted from the seed bed.

Some little light has been thrown upon the effects of radium upon plant diseases. The early part of the season was very wet, and the tendency to blight in cucumbers, squashes, and muskmelons, to smut in sweet corn, and to fruit rot in eggplants and tomatoes was rather marked. The damage in the radium-treated plots was not the same in the different crops. Cucumbers and squashes appeared to suffer most where there was most R A F, the melons where there was none. Early corn (Golden Bantam) suffered about twice as much from smut where there was most radium as where there was none, while late corn (Country Gentleman) showed little difference in the different plots.

This is probably the reason for the small percentage of increase in the crop of Golden Bantam as against 50 per cent. increase in Country Gentleman, from the effects of the radium. Had all smutted ears from the former been good, and therefore weighed with the others, the yield from the R A F plots would have been much greater.

Tomatoes and eggplants suffered very little from rot on the heavily treated plots, but severely where there was little or no R A F. In the case of eggplants the ratio of damage on the different plots ran almost exactly the same, but inversely, with the amount of R A F applied.

Two hundred pound plots of early cabbage and pumpkins. No cabbage destroyed by cut-worms.

DD plot of cabbage (25 lbs. of R A F) with many destroyed by cut-worms.

One of the most interesting observations referred to the activity of cut-worms upon cabbage plants. Both early and late cabbages were heavily attacked by this pest, more especially the early ones. About a third of the plants were cut off in the control plot and almost as many in DD. When replaced by new ones, many of the latter were again cut down. The CC plot also lost quite a number, but the AA and BB plots only one plant each. It did not appear to me possible that this difference was due to the presence of radium and I should scarcely have noted it but for the fact that a gentleman who had applied R A F to his lawn in Virginia called to say that his was the only lawn in his neighborhood that had not suffered from cut-worms, some having suffered so greatly as to be nearly destroyed. It will be very desirable to follow up these two cases with others and ascertain whether the R A F is actually responsible for the protection observed.

The relative effects on the upper and lower portions of a sloping plot have not been uniform. Of ten rows of celery so planted, plants in the lower rows are nearly twice as large as those in the upper ones, and the transition is gradual and nearly equable. A possible explanation of this is by assuming that in case of a hard rain, with surface drainage, the emanations in the water in the soil would quickly diffuse through the surface water and be carried downward. In the case of egg plants there is an equal difference, but in favor of those in the upper rows. One might explain this by assuming that the emanations from the upper rows, which escape into the air, would pass over the surface of the ground in the lower rows. Their action upon the aerial tissues is relatively slight. Those from the lower rows would strike the roots of the plants in the upper rows. The explanations are mutually contradictory, but so are the effects observed in the two cases.

In conclusion, it may be stated that the yield of most crops has been increased by the addition of some amount of R A F. the amount differing with different crops. The beneficial effects continue over successive crops, perhaps for many years. The largest amount required by any crop would cost less than the increased market value of such crop of the first year.

Radium is not a plant food. The necessity for fertilizer is but little decreased by its use. The fertility of unused ground will spontaneously increase at a much greater rate when treated by radium.

Subjects worthy of investigation are the effects on yield of fruit trees and vines; the specific effects on individual plant diseases; the relative value of placing the R A F in the rows or hills and of sowing it broadcast; the effects on the decomposition of organic matter in the soil; the influence of the different kinds of soil upon the result; the ultimate effects on the vitality and quality of crops raised from seeds successively produced for some years on radium treated soil; the influence on the medicinal strength of drug plants; the effect on crops not tested in my experiments, as flax, mustard, sweet potatoes, peanuts, cotton, tobacco, sugar cane, pieplant, alfalfa, etc.; specific effects on different flowers.

The results at the Weja (Northfield, O.) farm call for some special consideration. The soil here was of a totally different character from that at Nutley. The basic soil is a stiff clay, forming a deep, heavy, tenacious mud in very wet weather and baking rather hard during a drouth. In the lower places this clay is overlaid by and more or less mixed with a large quantity of decayed vegetable matter, forming a black muck in rainy weather and a dry powdery mass during a drouth.

Another important difference is that the R A F as well as the fertilizer, was drilled in the rows or deposited in the hills, instead of being sown broadcast as at Nutley.

Finally, the plots were of large size, in no case smaller than one twentieth of an acre and in some cases including several acres. In each case, the land was so selected that all the plots of one crop were approximately of the same character, and in all other respects the conditions were uniformly maintained for all five plots. Owing to one or more or all of these differences, the increases secured by the use of the R A F were nearly double what they were at Nutley. There is, however, a general uniformity in the relative results on the several plots of any one crop. These results are displayed in the following table:

Chrysanthemum plants grown in Phipps conservatory, that at left with R A F at right without.

TABLE II

Results at the Weja Farm

Variety	Am't R-A Earth Per Acre.	Per Cent. Gain Over Control.
Beans, Black String	25 lbs.	27
Cabbage, Early	50 lbs.	68
Corn, Golden Bantam	100+ lbs.	25
Corn, Country Gentleman	100 lbs.	105
Cucumbers	100 lbs.	55.4
Oats	100 lbs.	50
Peas, Early	100 lbs.	51.7
Peas, Late	100 lbs.	45.2
Potatoes, Early	50 lbs.	60
Pumpkins	100 lbs.	135
Radishes	50 lbs.	21.2
Squash	12½ lbs.	24.6
Tomatoes	100 lbs.	50.6
Field Corn	50 lbs.	19.

Altogether, it is fair to assume that the results on this large farm approached more nearly to those to be expected in ordinary agricultural operations than did those at Nutley.

Since the above was placed in type, a correspondent in Mississippi has reported the results of trials with radishes, turnips, beets, lettuce, cabbage, carrots and potatoes as having been entirely negative, the three last being second crops on the same ground. In these trials, the R A F at the rate of about 100 lbs. to the acre, was placed in the alternate rows. No fertilizer was employed and the season was one of severe and prolonged drouth.

Another, in Florida, reports no effects on string beans, but on potatoes 1.4 per cent increase from 50 lbs. to the acre, 4 per cent from 100 lbs. and 13.8 per cent from 200 lbs. In this case each of the different amounts was placed upon an isolated plot of 100 square feet.

H. H. Rusby,
Dean of the College of Pharmacy,
Columbia University

CONFERENCE NOTES FOR NOVEMBER AND DECEMBER

The first conference during the autumn of the Scientific Staff and Registered Students of the New York Botanical Garden was held in the laboratory of the museum building on the afternoon of November 4.

Under the title of "Some Fossil Calcareous Algae," Dr. Marshall A. Howe exhibited and discussed some fossil algæ of the group commonly known to geologists as nullipores and to botanists as corallines. These fossils were from Oligocene and Pleistocene strata in the Panama Canal Zone, where they were collected by D. F. MacDonald and T. W. Vaughan of the United States Geological Survey in 1911. The one from the Pleistocene seemed to the speaker to be identical in genus and species with a living plant found by him in the sea about three miles distant a few years earlier. This Pleistocene fossil was found at a height of five feet above the tide level. The fossil coralline algae of America were said to offer an almost untouched field for research. This collection from the Panama Canal Zone appears to contain three species, all of which were believed by the speaker to be hitherto undescribed. The detailed report is to be published by the United States Geological Survey.

Dr. A. B. Stout then presented results of studies of variations in vegetative progeny and seed progeny of *Coleus*. Plants were exhibited showing types of color patterns and leaf shape. In general it was shown that bud variations involving fluctuating and spontaneous changes were as clearly marked and as widely different in degree in plants propagated vegetatively as are the variations among the members of the seed progeny. It is planned to publish a detailed account of these experiments soon.

At the December Conference, Professor R. A. Harper presented and discussed results of his hybridization experiments with corn under the topic "So-called Mendelian tri-hybrids in corn." The characters discussed pertain to the black, yellow and flinty or sugary conditions of the seed. Facts were presented showing

that while various ratios closely approximated Mendelian results intermediates in respect to black and to flinty qualities were frequent and that selection for these gave decidedly modified ratios with strong tendency for such intermediates to breed true.

Following the discussion of Dr. Harper, the topic "The genus *Marasmius*" was presented by Dr. W. A. Murrill as follows: The genus *Marasmius* was founded by Fries in 1836, with *M. androsaceus* as its type, to include white-spored, membranous, tough, reviving species of gill-fungi having the stipe tubular instead of solid. *Marasmius oreades*, the fairy-ring fungus, is a familiar example of this genus and illustrates well the reviving or "resurrecting" character.

Excluding the sessile species now placed in *Pleurotopsis* and the conspicuously hairy species constituting the genus *Crinipellis*, the genus *Marasmius* as at present limited contains about 140 American species, of which 84 are tropical. The genus has shown great variation in the warmer parts of both the Old World and the New, and a large number of the species as now known are extremely local. This may be partly due, however, to the lack of material. The species are in general so small and inconspicuous as to be overlooked by any one not especially interested in the group. Further collections are greatly desired from most parts of tropical America.

Of the 84 species in our tropics, 44 are described by Dr. Murrill as new, all but one of which are endemic. These are from Bermuda (1), the Bahamas (3), Cuba (6), Porto Rico (8), Jamaica (13), Grenada (1), British Honduras (5), and Mexico (5).

A study of this kind involves good field notes when the material is collected, careful comparison with original specimens in this country and in Europe by one who knows the group and its literature, and a knowledge of related groups to avoid duplication. It further involves continual use of the microscope, a complete description of each species, and the taxonomic arrangement of the group so that it may be readily understood by others.

The genus *Marasmius* is one of a series of tough, reviving gill-fungi beginning with *Schizophyllum* and ending with *Lentinus*. This series, together with the genus *Russula*, of the tribe Lac-

tarieae, will constitute Part 4 of Volume 9 of North American Flora shortly to be published. Part 5, which completes the volume, will contain *Pleurotus*, *Omphalia*, *Mycena*, *Hygrophorus*, and *Clitocybe*, connecting with the *Tricholoma-Amanita* series already published as Part 1, Volume 10, of North American Flora. When Parts 4 and 5 of Volume 9 are completed, the very complex and difficult white-spored series of gill-fungi will be finished and work will then be begun on the rosy-spored, rusty-spored, brown-spored, and black-spored series in the order named.

A. B. STOUT,
Secretary of the Conference.

NOTES, NEWS AND COMMENT

The December issue of the JOURNAL will be devoted entirely to an index of the fifteen volumes which are completed by that number. The amount of work involved in the preparation of such a large index has somewhat delayed the preparation of the index number, and on this account the January number containing this notice has appeared first.

C. A. Schwarze, assistant state plant pathologist of the New Jersey Experiment Station, spent a part of January at the Garden in a study of herbarium material relating to fungous plant parasites of the state of New Jersey.

North American Flora, Volume 34, Part 1, was issued December 31. It comprises 80 pages, and is devoted to a small portion of the Carduaceae; the treatment of this family is to begin in Volume 33. The entire text of the present part is by Dr. Rydberg, except two genera contributed by Professor H. M. Hall of the University of California.

Dr. N. L. Britton, Mrs. Elizabeth G. Britton, Dr. W. A. Murrill, Dr. Marshall A. Howe, Dr. Francis W. Pennell, Dr. Arthur Hollick, Dr. A. B. Stout and Miss Helene Boas of the

Garden staff were in attendance at the scientific meetings of the A. A. A. S. and affiliated societies recently held in Philadelphia.

Dr. J. C. Arthur and Dr. F. D. Fromme of the botany department of the Purdue Experiment Station, Lafayette, Indiana, spent the month of January at the Garden in continuing work on the Uredineae for North American Flora.

The Sullivant Moss Society held its annual meeting on December 30 in Botanical Hall, University of Pennsylvania. An informal session for the exhibition of specimens, photographs, etc., was held in the morning; in the afternoon papers were given in alphabetical sequence by Mrs. Elizabeth G. Britton, Dr. Alexander W. Evans, Dr. Otto E. Jennings, Mr. George B. Kaiser, Miss Annie Lorenz and Mr. G. K. Merrill, relating to various groups of mosses, hepatics and lichens, the mosses of Bermuda, the Mexican species of *Plagiochasma*, the ecological distribution of mosses in the vicinity of Philadelphia, a list of hepatics to be expected in New England and the primitive uses of lichens. Extracts from a letter from Monsieur J. Cardot to J. M. Holsinger were read, stating that all his collections, library and personal property had been destroyed at Charleville and that at present he and his family are devoting themselves to the care of the wounded in France!

Meteorology for November.—The total precipitation for the month was 2.63 inches. The maximum temperatures for each week were *79° on the 5th*, 63° on the 13th, 62° on the 18th, and 61° on the 26th. The minimum temperatures were 30.5° on the 8th, 24° on the 10th and the 19th, and *19° on the 24th*. First ice formed over lake no. 2 on the 19th, and a sheet of ice formed over the three lakes on the night of the 22d.

Meteorology for December.—The total precipitation for the month was 3.57 inches of which 0.1 inch (reduced to rainfall) fell as snow. Maximum temperatures for each week were *66° on the 3d*, 53° on the 14th, 43° on the 20th, and 39° on the 21st.

The minimum temperatures were 30° on the 6th, 22° on the 13th, 11° on the 15th, and *3° on the 27th.*

Meteorology for the Year 1914.—The total precipitation at the New York Botanical Garden for the year was 32.435 inches of which 1.05 inches (10.5 inches snow measurement) fell as snow. The distribution by months was as follows: January, 4.43; February, 2.21; March, 2.395; April, 2.62; May, 2.18; June, 2.36; July, 5.36; August, 2.03; September, 0.20; October, 2.45; November, 2.63; December, 3.57.

The maximum temperature recorded was 97° on August 19th. The minimum was — 3° on January 14. The first hard-killing freeze of the autumn was on the night preceding the 29th of October. A prolonged and severe period of drought extended from the middle of August to October 16th.

ACCESSIONS

MUSEUMS AND HERBARIUM

1 specimen of *Grimmia tenerrima* from Oregon. (By exchange with Dr. George E. Nichols.)

5 specimens of mosses from Arizona. (Given by Professor F. E. Clements.)

9 specimens of mosses from North Carolina. (By exchange with the New York State Museum.)

2 specimens of mosses from Porto Rico. (By exchange with the Porto Rico Experiment Station, Rio Piedras, Porto Rico.)

2 specimens of mosses from Ceylon. (By exchange with Professor Edward B. Chamberlain.)

2 specimens of mosses from Europe. (By exchange with Mr. H. M. Dixon.)

1 specimen of *Funaria* from California. (By exchange with Miss Alice Eastwood.)

1 specimen of *Plagiothecium deplanatum* from Ohio. (Given by Dr. H. S. Jewett.)

6,000 specimens from Porto Rico and islands adjacent. (Collected by Dr. and Mrs. N. L. Britton and Mr. J. F. Cowell.)

11 specimens of mosses from Olympic Hot Springs, Washington. (Collected by Mr. A. S. Foster.)

3 specimens of hepatics from New England. (By exchange with Miss Annie Lorenz.)

30 specimens "Algae Adriaticae Exsiccatae" fascicle 3. (Collected by Dr. Gustav Seefeldner.)

21 specimens of marine algae from St. Paul Island, Alaska. (Given by Mrs. Frank B. Jones.)

2 specimens of acorns from Colombia. (Given by Mr. W. O. Wolcott.)

5 specimens of mosses from Porto Rico. (Collected by Professor J. R. Johnston.)

21 specimens of mosses from North Carolina. (By exchange with the United States National Museum.)

1 specimen of *Fontinalis missourica* from Missouri. (Given by Mr. C. H. Demetrio.)

2 specimens of mosses from Shushan, New York. (Given by Dr. H. D. House.)

9 specimens of mosses from Cuba. (By exchange with Brother Leon.)

7 specimens of mosses from Tobago, West Indies. (Given by Mr. W. E. Broadway.)

30 specimens of mosses from Dominica. (Given by Mr. W. C. Fishlock.)

4 specimens of mosses from Porto Rico. (By exchange with the College of Agriculture, University of Porto Rico.)

1 specimen of *Dicranella heteromalla orthocarpa* from the New York Botanical Garden. (Given by Mrs. N. L. Britton.)

54 mosses from Antigua and St. Domingo, West Indies. (By exchange with the United States National Museum.)

390 specimens of flowering plants from California. (Collected by Dr. A. A. Heller.)

3 specimens of mosses from Kates Mountain, West Virginia. (Collected by Mrs. N. L. Britton.)

150 specimens of mosses from Cape Breton Island, Nova Scotia. (By exchange with Dr. George E. Nichols.)

12 specimens of flowering plants from the vicinity of New York City. (Given by Mr. William T. Davis.)

11 specimens of mosses from Santos, Brazil. (By exchange with Mr. H. N. Dixon.)

1 specimen of *Oedicladium rufescens* from Java. (By exchange with Professor Edward B. Chamberlain.)

5 specimens of *Plumalina*. (Given by Mr. Herbert Ruckes.)

1 specimen of *Taxodium distichum miocenum* from Japan. (Given by Mr. H. Yabe.)

2 specimens of salicified wood from Arizona. (Given by Mrs. Anne S. Kane.)

42 specimens of Pleistocene fossil plants from Canada. (Given by the Geological Survey of Canada.)

23 specimens of crude and refined rubber from Brazil, and implements for gathering rubber. (Given by Dr. Carlos Manuel Asensi, through the American Museum of Natural History.)

32 specimens of sugar and syrup. (Given by the American Sugar Refining Company.)

49 specimens of fibers from the Philippine Islands. (Given by Mr. Theodore Muller.)

29 specimens of crude and refined drugs. (Given by Dr. H. H. Rusby.)

10 specimens of fungi from Scarsdale, New York. (Collected by Mr. Percy Wilson and Dr. F. J. Seaver.)

12 specimens of fungi from Wyoming. (By exchange with Mr. Simon Davis.)

2 specimens of fungi from North Carolina. (By exchange with Mr. E. R. Memminger.)

3 specimens of fungi from Wisconsin. (By exchange with Dr. Lewis Sherman.)

1 specimen of woody fungus from Indiana. (By exchange with Mr. George N. Hoffer.)

200 specimens "Fungi Columbiani," centuries 44 and 45. (Distributed by Mr. Elam Bartholomew.)

1 specimen of fungus from New York. (By exchange with Mr. Stewart H. Burnham.)

1 specimen of woody fungus from New York. (By exchange with Mr. William E. Abbs.)

2 specimens of fungi from Wisconsin. (By exchange with Dr. Lewis Sherman.)

1 specimen of *Aleuria aurantia* from West Virginia. (Collected by Mrs. N. L. Britton.)

27 specimens "Fungi Dakotenses," fasc. 11. (Distributed by Dr. J. F. Brenckle.)

3 cotype specimens of fungi from Utah. (By exchange with Mr. P. J. O'Gara.)

2 specimens of *Gymnosporangium* from Oregon. (By exchange with Mr. P. J. O'Gara.)

2 cotype specimens of fungi, *Colletotrichum solanicolum* and *Phoma rostrata* from Utah. (By exchange with Professor P. J. O'Gara.)

13 specimens of fungi from New Mexico and Missouri. (By exchange with the Smithsonian Institution of Washington.)

255 specimens of fungi from Wisconsin. (Collected by Dr. B. O. Dodge.)

25 specimens "Fungi Utahenses," fasc. 91. (Distributed by Professor A. O. Garrett.)

1 specimen of *Hypholoma aggregatum* from New York. (Collected by Mr. L. Deloney.)

2 specimens of *Pleurotus approximans* and *Pleurotus atropellitus* from New York. (By exchange with New York State Museum.)

1 specimen of *Sparassis crispa* from North Carolina. (By exchange with Mr. E. R. Memminger.)

2 specimens of fungi from Wisconsin. (By exchange with Dr. Lewis Sherman.)

3 specimens of *Diaporthe parasitica* from New York. (Collected by Mr. Percy Wilson.)

2 specimens of *Lycoperdon* from Chile. (By exchange with the U. S. National Museum.)

1 specimen of *Coriolus versicolor* from Chile. (By exchange with the United States National Museum.)

1 specimen of *Crucibulum* from Chile. (By exchange with the United States National Museum.)

1 specimen of fungus from Brooklyn. (By exchange with Mr. Frank H. Ames.)

2 specimens of woody fungi from Louisiana. (By exchange with the State University of Louisiana.)

1 specimen of *Trametes suaveolens* from Ulster County, New York. (Collected by Mr. Percy Wilson.)

3 specimens of *Isoetes* from the United States. (Given by Mr. Macy Carhart.)

66 specimens of hepaticae from Florida. (Given by Mr. Severin Rapp.)

503 specimens of marine algae from Peru. (Given by Dr. Robert E. Coker.)

2 photographs of plants from Illinois and California. (By exchange with the Field Museum of Natural History.)

2,103 specimens of plants from Porto Rico. (Collected by Dr. J. A. Shafer.)

6 specimens of marine algae from Palmyra Island, Oceanica. (Given by Dr. Harold L. Lyon.)

16 specimens of flowering plants from Florida. (Given by Dr. R. M. Harper.)

80 specimens of fungi from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

3 specimens of hepaticae from New Hampshire and Vermont. (By exchange with Miss Annie Lorenz.)

19 specimens of flowering plants from western North America. (Given by Mr. S. B. Parish.)

8 photographs of type specimens of Amaranthaceae. (By exchange with the United States National Museum.)

1 specimen of *Ceramium rubrum* from Newport, Rhode Island. (Given by Mr. F. D. Tansley.)

482 specimens of fungi from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

2 specimens of ferns from Oriente, Cuba. (Given by Professor J. F. Kemp.)

45 specimens of flowering plants for the Local Herbarium. (Collected by Dr. Arthur Hollick and Dr. N. L. Britton.)

10 specimens of flowering plants. (By exchange with the Royal Botanical Garden, Berlin.)

20 specimens of flowerless plants for the Local Herbarium. (Collected by Mrs. N. L. Britton.)

50 specimens, "Phycotheca Boreali-Americana," fascicle XL., for the Columbia University Herbarium. (Distributed by Collins, Holden, and Setchell.)

1 specimen of *Spermathamnion investiens* from Beaufort, North Carolina. (Given by the United States Bureau of Fisheries.)

115 specimens of hepaticae from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

7 specimens of mosses from Colombia. (By exchange with the United States National Museum.)

1 specimen of lichen from Shensi, China. (By exchange with the Bureau of Plant Industry, Washington.)

4 specimens of *Echinodorus radicans* from Louisiana. (By exchange with Mr. W. R. Griffing.)

4 specimens of mosses from Ranchuelo, Cuba. (By exchange with Dr. Eugenio Cuesta.)

1 specimen of *Buxbaumia indusiata* from Cape Breton Island, Nova Scotia. (By exchange with Dr. George E. Nichols.)

2 specimens of mosses from British Columbia. (By exchange with Mr. H. N. Dixon.)

7 specimens of ferns from Jamaica, West Indies. (Given by Mr. Macy Carhart.)

3 specimens of mosses from British Guiana. (By exchange with Mr. H. N. Dixon.)

2 specimens of mosses from the vicinity of New York. (Given by Mrs. N. L. Britton.)

8 specimens of hepaticae from Porto Rico. (By exchange with Professor J. R. Johnston.)

2,853 specimens of algae, fungi, lichens, mosses, ferns, and flowering plants from North America and New Zealand. (From the collection of Dr. M. A. Howe.)

PLANTS AND SEEDS

4 plants for conservatories. (Given by Mr. A. P. Traber.)

1 Gardenia plant. (Given by Mr. W. Louden.)

2 plants of *Sedum Nevii*. (Collected by Dr. N. L. Britton.)

4 plants for conservatories. (Given by Miss E. Billings.)

3 plants of Italian pine. (Given by Mrs. F. L. Sturgis.)

12 plants of *Populus Sargentii*. (Given by Prof. C. E. Bessey.)

1 *Epidendrum*. (Given by Mrs. Fred Hunt.)

2 plants of *Myrtus communis*. (Given by Mrs. H. Oeser.)

6 plants of *Populus italica*. (Purchased.)

1 *Ariocarpus*. (By exchange with S. S. Hordes.)

2 plants of *Citrus* for conservatories. (Given by Mrs. H. W. Nichols.)

47 Cacti from Peru. (Collected by Dr. J. N. Rose.)

175 Cacti from Chile. (Collected by Dr. J. N. Rose.)

12 plants of *Helleborus niger*. (Purchased.)

1 plant for conservatories. (Given by Mrs. Grace H. Korff.)

2 plants of *Echinocactus*. (Collected by Dr. D. T. Macdougal.)

19 plants for conservatories. (By exchange with Mr. A. J. Manda.)

6 plants for conservatories. (By exchange with Mr. V. H. Ries.)

15 orchids. (By exchange with Mr. J. A. Manda.)

316 plants derived from seed from various sources.

53 bulbs of *Amorphophallus haematospadix* and *Arisaema fimbriatum*. (By exchange with Bureau of Plant Industry.)

13,694 bulbs for decorative purposes. (Purchased.)

2 packets of seed. (Collected by Dr. N. L. Britton.)

5 packets of seed. (Collected by Mr. Paul C. Standley.)

1 packet of seed of Chinese Mustard. (Given by Dr. H. H. Rusby.)

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Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 10, part 1, 1914. Agaricaceae (pars).

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22, parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

Vol. 25, part 1, 1907; part 2, 1910; part 3, 1911. Geraniaceae—Burseraceae.

Vol. 29, part 1, 1914. Clethraceae—Ericaceae.

Vol. 34, part 1, 1914. Carduaceae (pars).

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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. In its eighth volume.

RECENT NUMBERS 25 CENTS EACH

169. Some Midwinter Algae of Long Island Sound, by Marshall A. Howe.
170. Notes on Rosaceae—VII, by P. A. Rydberg.
171. A Revision of the genus Vittaria J. E. Smith, by Ralph C. Benedict.
172. Phytogeographical Notes on the Rocky Mountain Region—III. Formations in the Alpine Zone, by P. A. Rydberg.

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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JOURNAL

OF

The New York Botanical Garden

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COLLECTING IN THE MOUNTAIN REGION OF EASTERN PORTO RICO

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: Embarking from New York, July 4, 1914, San Juan was reached on the afternoon of the ninth. From here I went to Naguabo, where I enjoyed the hospitality of Mr. W. A. Simmonds, while awaiting the arrival of my baggage. Arrangements were made for a base at "La Florida," the plantation of Mr. Gustav Preston, of Boston, who had planned for my entertainment during his absence. Here I was very comfortably provided for by Mr. Etienne Lavergne and Mr. William Mack, managers of the estate. La Florida, which is noted for its grape fruit and the hospitality of its proprietor, is situated in the little basin-like valley of the "Rio Blanco," just below where it is joined by the "Rio Cubuy," being practically in a deep notch of the "Sierra de Naguabo" and on the edge of cultivation, it affords a most advantageous base from which to work this rough and trackless mountain region.

From Mr. Preston's plantation, a number of single-day trips were made up the rocky river valley and to some of the nearby hills. Three days were devoted to the ascent and exploration of "Loma la Mina." This precipitous mountain is at the south-western end of the Naguabo range and rises to an altitude of about 3,150 feet. Above 1,800 feet, it is covered with a dense forest of small or medium-sized hardwood trees, mountain palms and tree ferns, with many ferns, mosses and liverworts clinging

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to the rocks and tree trunks. This trip was made with meager camp equipment and without a tent, hence I depended upon overhanging rocks for nightly shelter. A large quantity of material was collected and several days were required to dry and preserve it upon my return to La Florida.

Although there were plenty of men available among the hills as carriers, I was unable to secure a man to look after the camp and do rough cooking, so it became necessary to go over to the island of Vieques in the hope of securing Joseph William, whom I had known and satisfactorily employed in my work on that island. I returned with him the next day and arrangements were made at once to go into camp in the hills.

Camp was established July 30 near Rio Icaco, five and one half miles from La Florida at an altitude of about 1,600 feet, on an obscure and seldom used foot-trail which crosses the entire ridge to the north coast. From here, excursions were made into the adjoining hills and upstream to its source and to the top of Cuchilla Firme. This ridge forms the water-shed between the north and south drainage and has an altitude of 2,700 feet at a point due south of the town of Luquillo which is situated on the north coast. Camp was broken and collections taken to La Florida, where I arrived on the evening of August 6, and where several days were required to dry and preserve the collections on account of the frequent showers.

Camp was next established on Rio Prieto, August 9, in a little cleared space that had once been the site of a native saw-mill, and near a point where the stream separates into a number of branches. The altitude of the spot is 2,300 feet. From this camp excursions were made to the heads of several of the numerous branches which flow into the Rio Prieto and to some of the surrounding peaks to elevations of about 3,000 feet. El Duque was ascended from the northwest side, and the same spot (altitude about 3,600 feet) that was reached by your party last March was revisited by me. Camp was broken and La Florida was reached on the evening of August 15. Again frequent daily showers made the curing of the accumulated material a slow and tedious process.

According to your instructions to report at San Juan about August 19, I arrived there on the 20th, where I learned of your decision to abandon your intended trip to Porto Rico. I also received your instructions to discontinue further exploration and to return to New York as soon as convenient. Accordingly I returned to La Florida where several excursions were made in the neighborhood; one afternoon was spent on the estate of Mt. Ida under the guidance and hospitality of Mr. J. N. Nott. From La Florida the collections which had been made were shipped to San Juan. I sailed from San Juan September 2 and reported with the collections to you at the New York Botanical Garden, September 7.

J. A. SHAFER.

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R. S. WILLIAMS.

NOTES, NEWS AND COMMENT

Dr. and Mrs. N. L. Britton, Mrs. N. Wille, Mr. John F. Cowell, director of the Buffalo Botanical Garden, and Mr. Stewardson Brown, of the Philadelphia Academy of Sciences, sailed on January 30 for Porto Rico, where about six weeks will be spent in further botanical explorations.

Dr. A. G. Johnson, of the University of Wisconsin, spent a day at the Garden recently in a study of herbarium material of the genus *Helminthosporium*.

"The Flora of the Vicinity of New York: A Contribution to Plant Geography," comprising 683 pages and 9 maps was issued January 30, 1915, as volume 5 of the MEMOIRS OF THE NEW YORK BOTANICAL GARDEN, by Norman Taylor, formerly of the Garden staff.

Meteorology for January.—The total precipitation for the month was 4.86 inches of which 5.5 inches (snow measurement) fell as snow. The maximum temperatures for each week of the month were *60° on the 6th*, 50° on the 15th, 53° on the 18th, and 44° on the 26th. The minimum temperatures were 15° on the 4th, 25° on the 13th, 19° on the 22d, and *11° on the 30th*.

ACCESSIONS

MUSEUMS AND HERBARIUM

2 specimens of mosses from Shensi, China. (By exchange with the Bureau of Plant Industry, Washington.)

250 specimens of flowering and flowerless plants from Staten Island, New York. (Collected by Dr. N. L. Britton and Dr. F. J. Seaver.)

21 specimens of lichens from Copake Falls, New York. (Given by Mrs. N. L. Britton.)

3 specimens of hepaticae from New England. (By exchange with Miss Annie Lorenz.)

1 specimen of a moss from Peru. (By exchange with Mr. H. N. Dixon.)

7 specimens of marine algae from Beaufort, North Carolina. (Given by the United States Bureau of Fisheries.)

7 specimens of marine algae from Cuba and Mexico. (Given by the Natural History Museum, Paris.)

790 specimens of flowering plants from California and South Dakota. (Collected by Mr. John Murdock, Jr.)

47 specimens of flowering plants from Florida. (By exchange with the Herbarium of Harvard University.)

93 specimens of lichens from the Gerard herbarium. (Purchased from Dr. Philip Dowell.)

1 specimen of fungus from Copake Falls, New York. (Given by Mrs. N. L. Britton.)

2 specimens of hepaticae from New England. (By exchange with Miss Annie Lorenz.)

1 specimen of moss from Guatemala. (By exchange with Mr. H. N. Dixon.)

4 specimens of hepaticae from New England. (By exchange with Miss Annie Lorenz.)

110 specimens of flowering plants from Staten Island, New York. (Collected by Dr. N. L. Britton and Dr. Arthur Hollick.)

7 specimens of mosseae from Ecuador. (By exchange with Mr. H. N. Dixon.)

198 specimens of mosses from Norway. (By exchange with the University of Christiania.)

1 specimen of fern from Switzerland. (Given by Mr. Macy Carhart.)

3 specimens of mosses from Ranchuelo, Cuba. (By exchange with Dr. Eugenio Cuesta.)

3 specimens of flowering plants from Florida. (Given by Dr. R. M. Harper.

17 specimens of mosses from Copake Falls, New York. (Given by Mrs. N. L Britton.)

47 specimens of mosses from Colombia. (By exchange with the United State National Museum.)

PLANTS AND SEEDS

211 plants, all cacti from Peru. (Collected by Dr. J. N. Rose.)

89 cuttings, *Hedera* and *Abutilon*. (By exchange with Cambridge University Botanic Garden, England.)

168 Bolivian cacti. (Collected by Dr. J. N. Rose.)

4 conservatory plants from Costa Rica. (Collected by Mr. C. R. Riker.)

8 plants of *Rhipsalis*. (By exchange with U. S. Nat. Mus. via Dr. J. N. Rose.

2 plants of *Mamillaria*. (By exchange with Mr. S. S. Hordes.)

2 ferns from Nassau, Bahamas. (Given by Mr. Edward George.)

1 Opuntia. (By exchange with U. S. Nat. Mus. via Dr. J. N. Rose.)

1 plant of *Sedum telephioides*. (Collected by Mr. E. P. Bicknell.)

10 cuttings for conservatories. (By exchange with Mr. J. A. Stevenson, Porto Rico.)

1 plant of "Shamrock." (Given by Mr. P. Fanning.)

1 plant *Azalea Kaempferi*. (Given by Messrs. R. & J. Farquhar & Co.)

2 plants of *Harrisia* and *Epidendrum*. (Collected by Bro. Leon.)

21 plants for Nursery. (By exchange with U. S. Dept. Agric.)

3 plants, 2 cyclamen and 1 *Primula*. (Given by Mrs. N. L. Britton.)

19 plants of *Quercus bicolor*. (Derived from seed.)

1 pkt. of seed of *Phytolacca acinosa* var. *esculenta*. (By exchange with U. S. Dept. Agric.)

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Vol. 3, part 1, 1910. Nectriaceae—Pimetariaceae.

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Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 10, part 1, 1914. Agaricaceae (pars).

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22 parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

Vol. 25, part 1, 1907; part 2, 1910; part 3, 1911. Geraniaceae—Burseraceae.

Vol. 29, part 1, 1914. Clethraceae—Ericaceae.

Vol. 34, part 1, 1914. Carduaceae (pars).

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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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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Fruiting branch of *Ficus interglacialis* Hollick, natural size.

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A NEW FOSSIL SPECIES OF FICUS AND ITS CLIMATIC SIGNIFICANCE[1]

With Plates CLII and CLIII

A little more than a year ago the writer received from Mr. R. W. Brock, Director of the Canada Geological Survey, a communication from which the following is an abstract:

"I have received from Dr. [S. J.] Schofield, one of our field geologists, some plant remains from the interglacial clays and silts exposed in the Kootenay Valley. These are the first plant remains from the Pleistocene of British Columbia. Would you be free to, and would you care to examine these for us?"

The collection was forwarded, examined, and a preliminary report upon the genera represented in it was prepared and transmitted.[2] One particular specimen proved to be an undescribed species of *Ficus*, and appeared to be worthy of separate description and discussion in advance of a final report upon the collection as a whole. The facts in connection with it were submitted to Mr. Brock, who courteously wrote in reply as follows: "I am pleased to approve of your publishing a special article on the fruiting branch of *Ficus* through any medium you may desire."

It was apparent that this specimen, aside from the fact that it possessed unusual biologic interest, was also of significance as an index of the climatic conditions which must have existed at the

[1] Read before the Paleontological Society of America, Philadelphia Meeting, December 31, 1914, and presented at the Conference of the Staff and Students of the New York Botanical Garden on January 6, 1915.

[2] Canada Geol. Survey, Dept. Mines, Summary Rept., 1913: 133–135. 1914.

[Journal for February (16: 33–42) was issued February 28, 1915]

time when the interglacial clays and silts of the Kootenay Valley were deposited; and, inasmuch as remains of any well defined species of *Ficus* would be accepted by all botanists as good evidence of a tropical or sub-tropical climate, the geologic importance of the specimen was at once appreciated.

The generic identification of fossil leaves can not always be relied upon as correct; but well-preserved remains of fruit are generally entirely satisfactory and, if the generic characters include any features that are strikingly characteristic and can not be mistaken, identification is practically conclusive. The fruit of *Ficus* is an example of this kind, and the specimen under consideration is probably the most perfect ever found in a fossil condition and is undoubtedly more complete in characteristic details than any heretofore recorded or described.

Ficus interglacialis n. sp.

Plates CLII and CLIII

Fruit subglobose, striate, about $\frac{1}{4}$ inch in diameter, apparently sessile in clusters, attached to a branch about $\frac{1}{16}$ inch in diameter and 7 or more inches in length.

Plate CLII shows the entire specimen natural size. Plate CLIII shows a part of the same specimen enlarged to twice the natural size. In one of the individual fruits, near the middle of the branch, the incurved apex, characteristic of *Ficus*, may be plainly seen, and on the exterior of the branch, in several places are more or less well defined indications of leaf scars.

This specimen is so remarkably well preserved that it might well be regarded as a defoliated, fruiting branch of one or another of certain living species, such as *F. tecolutensis* Miq. from Mexico, or *F. populoides* Warb. and *F. populnea* Willd. from the West Indies. In any event it is evidently closely allied to species of this general type.

Only four extinct species of *Ficus* in fruit have heretofore been described, so far as I am aware, and these are all either detached or single specimens,[4] although some three hundred species, based

[4] *Ficus prologaea* Heer (non Ettingshausen), Lower Atané, Greenland. Fl. Foss. Arct. 3^2: 108, *pl. 30, f. 5–7.* 1874; "Fruits of *Ficus*" Lesquereaux, Dakota

Part of the branch of *Ficus interglacialis* Hollick, shown on Plate A, enlarged.

upon leaf forms, and ranging, stratigraphically, from lower Cretaceous to upper Tertiary may be found recorded in paleobotanical literature. Doubtless many of these do not belong in the genus *Ficus;* but inasmuch as there are about six hundred living species recognized, which include almost every possible variety of leaf form and nervation, the large number of fossil species referred to the genus is not inconsistent with known facts.

The genus has not heretofore been recorded in America from the Pleistocene; but in Europe remains of the existing *Ficus carica* L. have been found at several localities in Italy and France in deposits of Quaternary age.[5]

The collection transmitted by Mr. Brock contains a large number of fossil plant remains, although but few genera are represented. The matrix is a light gray, friable, sandy clay, in which the specimens are well preserved. Careful handling is necessary, however, on account of the friable character of the matrix. About one third of all the identifiable leaves in the collection belong to *Hicoria*, *Alnus*, *Ulmus*, *Ficus*, *Populus*, *Platanus*, *Vitis* and *Cebatha* or *Cissampelos*. There are also several fragmentary remains of large parallel-veined leaves which are suggestive of *Yucca*, or some species of palm, but they are too ill-defined for either generic or family identification. All apparently represent undescribed species and they are large in size as compared with the Pleistocene leaves from the Don valley in Ontario, of which I have had the privilege of examining an extensive series of specimens. The indications are that the Kootenay Valley Pleistocene flora was of a more luxuriant growth than that of the Don Valley, and the presence of the genus *Ficus* is evidence of a climate which could not have been cooler than that of Florida or Southern California at the present time; whereas the floral elements of the

Group, Kansas. U. S. Geol. Surv. Monog. 17 (Fl. Dak. Gr.): 85, *pl. 10, f. 7, 8.* 1892; *F. neurocarpa* Hollick, Dakota Group, Kansas. Torrey Bot. Club, Bull. 30: 105, *f. Bl.* 1903; *F. Bruesi* Cockerell, Miocene, Colorado. Torreya 10: 223. 1910; *F. ceratops* Knowlton, Lance Formation, Wyoming. Torrey Bot. Club, Bull. 38: 389, *f. 1–4.* 1911.

[5] Gaudin, Soc. Helv. Sci. Nat., Nouv. Mem. 18[7] (Contr. Fl. Ital. pt. 4): 22, *pl. 4, f. 1–4.* 1860; Planchon, Etudes Tufs Montpellier: 44, *pl. 2, f. 4.* 1864; Saporta, Assoc. Franç. Av. Sci., 5[e] Sess. 1876: 648, *pl. 13, f. 3, 4.* 1877; Bleicher & Fliche, Soc. Géol. Franc., Bull. 17: 593, *f. 3. 4.* 1889.

Don valley deposits indicate a temperate climate. The two floras are quite distinct, but no correlation has yet been made between the two series of deposits. In reply to inquiries on this point, Mr. Brock kindly replied, under date of December 17, 1913, as follows: "Dr. Schofield states that there is no evidence except that of the plants bearing on the climatic conditions at that time in the Kootenay Valley. No correlation either structural or paleontologic is possible at present between the deposits of the Don Valley, Ontario, and those of the Kootenay Valley, B. C."

J. W. Dawson, D. P. Penhallow, and other Canadian geologists, in their investigations of the biologic features of the Pleistocene deposits of Canada,[6] recognized three distinct climatic periods:

3. Green's Creek: Mild. About the equivalent of that of the northern United States at the present time.
2. Scarboro: Cold. About the equivalent of that of Labrador at the present time.
1. Don: Warm temperate. About the equivalent of that of the middle eastern United States at the present time.

Of the seventy-five species of fossil plants listed in this report all are living, with one exception (*Acer pleistocenicum* Penh.), and all have a wide geographic and climatic range, with one exception (*Quercus oblongifolia* Torr., confined to California). The species of greatest southern range, which may be regarded as indicating warm-temperate conditions in connection with the Don flora are:

Chamaecyparis sphaeroidea Spach. (= *C. thyoides* (L.) B. S. P.). Mississippi to Massachusetts.

Juniperus virginiana L. West Indies and Arizona to New Brunswick.

Quercus obtusiloba Michx. (= *Q. minor* (Marsh.) Sarg.) Texas to Missouri, and cultivated in the northern states.

Asimina triloba (L.) Dunal. Florida to Ontario.

Fraxinus quadrangulata Michx. Alabama to Ontario.

None of these, however, as may be seen from their respective ranges of distribution, is a strictly southern species and none is

[6] Rep. British Assn. Adv. Sci., Sec. C, Bradford 1900: 328–329. 1901.

represented in the Kootenay Valley flora, although the genera *Populus*, *Alnus*, *Ulmus*, *Hicoria* and *Platanus* are common to both the Don and the Kootenay. On the other hand the genera *Ficus*, *Vitis*, and *Cebatha* or *Cissampelos?* are elements in the Kootenay but not in the Don. The conclusion, therefore, appears to be justified, either that the Kootenay Valley flora represents an interglacial period distinct from and of a warmer climate than either the Don, the Scarboro, or the Green's Creek, or that these latter periods represent colder regional conditions than those which prevailed further west and that the Kootenay flora was merely a regional phase of one of these. And in this connection it is of interest to note that the Cretaceous and Tertiary floras of the Northwest contain a larger number of tropical elements than do the contemporaneous floras of the middle and eastern parts of the Continent; and, finally, we know that at the present time the climatic conditions in British Columbia are milder than those of Ontario, and I am informed, by those who are conversant with the facts, that a critical examination and comparison of their respective living floras shows similar regional differences.

We may have, therefore, in this recently discovered Pleistocene flora in British Columbia, the heretofore missing link of evidence tending to show that contemporaneous regional climatic differences between the west and east on our continent have prevailed more or less continuously ever since Cretaceous time.

ARTHUR HOLLICK

DWARF EVERGREENS

With Plates CLIV and CLV

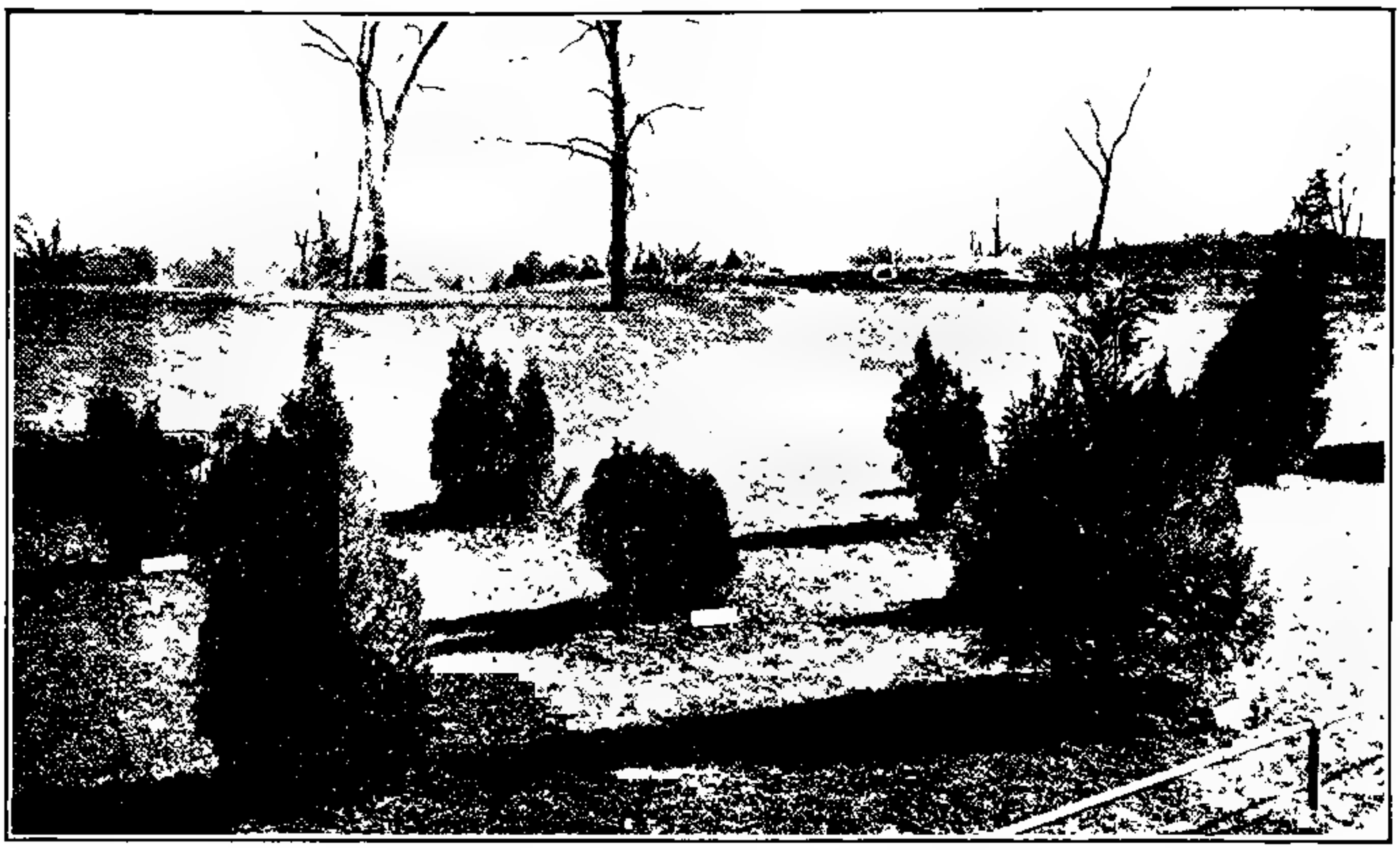
The subject of evergreens is one of increasing interest, as people come to remain more and more in the country the year around. There is no class of plants which adds more to the landscape, especially in winter, when the effect of their coloring of permanent green is enhanced at times by the snow and ice which covers them as a mantle. They form an excellent background for bright colored fruits in the winter and for the flowers of shrubs

and herbaceous plants for the rest of the year. They should form a part of all decorative planting. For those who have extended areas and ample facilities, there is a wide selection, but to those who have but a limited space the subject of dwarf evergreens should make a special appeal. To the thousands who do business in New York City, but who live in the suburbs, often with sufficient land around their homes to permit of decorative planting, this subject should appeal more especially.

Evergreens divide themselves into two groups, known to the horticulturists as coniferous and broad-leaved. In the first class are such plants as pines, firs, spruces, cedars and yews, and in the other andromedas, azaleas, box, daphne, holly, laurel and rhododendrons. A judicious mixture of these will give the maximum of effect, both in winter and in summer.

Before proceeding to an enumeration of the evergreens which may be employed, a few words as to their selection and care may be of service. First, as to selection, choose plants which express character, avoiding those with damaged branches, and also insist that the plants have a well-established mass of active roots, paying more attention to this than to a well-developed top, for the latter will soon come if the roots are properly developed. Also insist that all evergreens have a ball of earth about the roots, when shipped, and that this be wrapped in burlap or some other protecting medium. The roots of all evergreens are delicate, and if exposed to the air soon dry up, resulting in the destruction or serious injury of the plant, which may not appear until some days after it has been set out.

Selection is only the initial step. On the planting much also depends. The holes in which they are to be planted should be dug eighteen inches to two feet deep and considerably larger than the ball of earth about the roots. The soil in the bottom of the hole should be loosened to a depth of five or six inches, and on top of it place the sod, if any, bottom side up, or the top soil removed in making the hole. If the remainder of the soil is poor, discard altogether, and replace with good top soil from some other source. Much depends upon this planting. You can not plunge even a fine strong plant into sterile surroundings



Chamaecyparis thyoides var. *andelyensis* at left; *Chamaecyparis Lawsoniana* var. *Alumii* at right. Along south walk, near the south gate.

Tsuga canadensis var. *pendula*, the dwarf weeping hemlock. One of a group of hemlocks near Power House No. 1.

and expect it to grow well. Do not spend all your money on plants, save some for their planting and care. After the planting is done the plant should be thoroughly watered, making a ring of earth so that the water will be sure to soak down, thoroughly wetting and settling the soil around the roots.

In cultivating, the soil about evergreens should never be disturbed and the roots always protected by a generous mulch, if possible of partly rotted leaves. Thoroughly rotted manure, preferably cow manure, may be used, but under no circumstances use fresh manure; especially must this caution be emphasized when dealing with rhododendrons or other related plants, for such treatment is ruinous to them. The mulch protects the roots from extremes of cold in winter, and from the scorching heat of the sun in summer. If weeds appear they may be pulled out by hand. If insects bother, the plants may be sprayed with arsenate of lead. The most troublesome pest will be red spider, particularly during the dry hot weather. It attacks the older leaves first, turning them a disagreeable brown. We have found that ordinary flour of sulphur is the best material with which to combat this, and the easiest of application. This may be applied by an ordinary bellows or by the naked hand, applying it in the form of a dust. Whale-oil soap may be used for the suppression of mealy bug or other sucking insects. Should scale appear it may be destroyed by some form of petroleum emulsion or other scalecide. Of course the rule holds here as elsewhere in the cultivation of plants, keep plants in perfect health and they will be much less subject to the attacks of insects or fungi.

The following short descriptions of some of the dwarf evergreens, both coniferous and broad-leaved, which may more readily be secured, may aid those making a selection.

Coniferous evergreens

Abies nobilis. Forms a broad head of irregular outline, giving a delightful modulation of shades of green. The leaves are of a dark or grey-green, curving upward. In the Pacific Northwest this is one of the most stately of trees, but the severe winter and the dry climate here make it of slow growth.

Chamaecyparis thyoides, the white cedar. The ordinary forms of this are too large to come within the scope of this article, but the variety *andelyensis* (often known as *Chamaecyparis leptoclada* or *Retinispora leptoclada*) forms a dwarf bluish green plant of erect habit; the leaves sometimes of two kinds, short and closely appressed and longer and loosely spreading. The variety *ericoides* has a dense irregular habit, the leaves lanceolate and spreading, coloring reddish brown in winter.

Chamaecyparis Lawsoniana var. *Alumii.* This is an excellent plant, of columnar habit, and especially desirable where upright lines are wanted. It is of a metallic bluish hue, and much more hardy than the species. It is of relatively slow growth, and it will take some time for it to outgrow the character of dwarf.

Chamaecyparis obtusa, also known as *Retinispora obtusa*. There are several desirable dwarf forms of this, all with short, thick, scale-like closely appressed leaves. Var. *compacta*, with a dense almost globose habit, and bright green color. Var. *nana* of similar coloring as the preceding, but the habit more open and with an irregular outline, giving it much character—the form of this known as *aurea* has the tips of the branches of golden yellow. Var. *pygmaea*, similar to *nana*, but of dwarfer habit with longer spreading branches. Var. *filicoides*, of loose open depressed habit, of slow growth, the branches long and spreading, the flat branchlets borne along their sides in a frond-like or fern-line manner—the form known as *aurea* has the ends of the branchlets golden. Var. *lycopodioides*, the habit very irregular, the branches spreading, the dark green branchlets almost quadrangular, a curious form.

Chamaecyparis pisifera, the Sawara cypress. There are two desirable varieties of this, quite unlike in general appearance. One of these is var. *filifera gracilis*, of dwarf spreading habit, the long branches with the tips very long and drooping—a permanently yellow form of this is known as *aurea*. The other is var. *squarrosa Veitchii*, a dense compact shrub, with the branchlets feathery, the spreading linear leaves silvery below, and becoming a bronzy brown in winter. This latter is of striking appearance and adds a distinctive character to the group.

The genus *Juniperus*, the cedars, contains a number of desirable dwarf evergreens, of which the following is a selection:

Juniperus chinensis. While the taller forms of this cannot be used, there are a number of dwarf varieties which are of great service. Var. *aurea* is usually a low dense shrub with acicular leaves, the young growth yellow. Var. *Pfitzeriana*, an excellent evergreen, with ascending plumose branches, forming a dense shrub of irregular outline, usually depressed in the center and forming a sort of nest-like appearance; it is one of the best of the dwarf evergreens, and should be in every collection. Var. *procumbens* has long prostrate branches, with numerous spreading or ascending acicular leaves—a form with the young growths at first yellow is known as *aurea*—another, variegated with white, is *albo-variegata*—and a third, variegated with yellow, is *aureo-variegata*.

Juniperus communis var. *hibernica*, the Irish juniper. Of upright columnar habit, the branches strictly erect, with short spreading acicular leaves. This is especially useful where upright lines are desired. It is unfortunately subject to the attacks, during the summer, of small caterpillars, but these may be controlled by spraying with a solution of arsenate of lead.

Juniperus canadensis, a spreading evergreen, often depressed at the top, giving it a nest-like appearance, with spreading acicular leaves. Var. *aurea* has the tips of the branches a golden yellow, later in the season turning to green.

Juniperus horizontalis, the Waukegan juniper. A dense spreading prostrate shrub, often forming extensive mats, of a bluish or grey-green color. It is especially useful as a ground cover for banks.

Juniperus Sabina, the Savin juniper of Europe. Branches ascending, usually from about the same point on the stem, the center open. It is of a dark green color, smaller and inferior in every way than *J. chinensis* var. *Pfitzeriana*. Var. *tamariscifolia*, resembling in habit *J. horizontalis*, of a dark green color, and adapted to the same purpose of a ground cover.

Picea Abies, the Norway spruce, often known as *Picea excelsa*, is normally a large tree. There are a number of dwarf forms,

however. Varieties *clanbrasiliana*, *Gregoryana*, *Maxwellii*, and *pumila* are all dwarf dense forms with a spreading habit and seldom over a foot or two high. They are of very slow growth, very dwarf, and take years to form a plant of even moderate size.

Picea canadensis, often known as *Picea alba*, the white spruce, has two horticultural varieties which are dwarf. These are: var. *nana*, of low dense habit, similar to the dwarf forms of the Norway spruce; and var. *coerulea*, with a rather spreading habit, and of a bluish green color.

The pines offer some excellent dwarf forms which are very desirable from the fact that they usually accommodate themselves more readily to unfavorable and varying conditions than do most of the other coniferous evergreens. The following are some of the best of these: *Pinus Peuce* and *P Cembra*, both white pines, while finally attaining the stature of trees, are of slow growth and may be considered as dwarf or semi-dwarf evergreens for a number of years. The former has a more open habit, with a fine modulation of shades in consequence. They are both excellent, thriving in all ordinary conditions, even when exposed to winds; they have a well-defined upright stem and so are useful in bringing upright lines into a group.

Pinus Strobus, the common white pine, has three dwarf varieties, resembling each other and practically the same for horticultural purposes. These are: *brevifolia* with very short leaves, *prostrata* and *umbraculifera*. They are of low spreading dense habit, seldom over a foot or two high. They are of slow growth, so they may be considered in the nature of permanent dwarfs.

Pinus edulis, while forming a tree in western North America, is here a dense spreading shrub. It is of grey-green color.

Pinus densiflora var. *tabulaeformis*. This is a dense spreading symmetrical pine with a rounded top; there are two forms, one with short leaves, known as Bandaisho, the other with longer leaves, known as Tanyosho. These are of slow growth, taking years to reach any size.

Pinus montana var. *Mughus*, known as the knee pine. This is one of the best all-round dwarf conifers, as it is always pleasing in

Group of Dwarf Forms of the Norway Spruce, *Picea Abies*, near plaza, at depot of Harlem Railroad.

Juniperus chinensis var. *Pfitzeriana*, with the prostrate Waukegan juniper, *Juniperus horizontalis* at right.

appearance, and will accommodate itself to a great variety of conditions. It will stand drought well, a very desirable quality in a plant for this latitude where droughts are of common occurrence. It forms a broad spreading shrub, commonly much broader than high. It is an excellent plant with which to cover a bank, where a growth a little higher than the ordinary prostrate evergreens is desired.

The yews are especially valuable for evergreen effects, their dark green foliage making them particularly attractive, winter or summer. There are three species which are hardy.

Taxus baccata, the English yew. This yew does exceedingly well of course in England, where the climate is moist and the cold much less severe than with us here. From the fact that it does so well over there is a pretty clear indication that it is not well adapted to our dryer colder climate. Experience has proved this to be true, for it is tender here except in well-sheltered situations. This objection does not apply to the following species.

Taxus cuspidata var. *nana*. This is a native of Japan and is found in a region which, in climatic conditions, nearly approximates our own. It is therefore the yew to employ in our decorative work here. This variety is an excellent evergreen, the foliage of a striking dark green, the branches ascending, forming a broad spreading shrub of irregular outline, the center usually open. It commonly fruits freely, the bright red berries adding an extra attraction in the fall. There is a peculiar form of this with the branchlets quite irregular in length, producing an odd and characteristic appearance, with a much more open center.

Taxus canadensis, the common American yew. This is a fine shrub of spreading habit, suitable for covering banks, especially in shaded or partly shaded situations. It seldom grows over a foot or two high.

The arborvitae in its normal form is too large for dwarf planting, but there are a number of dwarf forms, the following being a selection: *Thuja occidentalis* var. *dumosa* has dark green foliage and a dense irregular habit. Var. *Ellwangeriana*. A low pyramidal evergreen with two kinds of leaves—a form of this with yellow foliage is *aurea*. Var. *globosa* has bright green foliage

and an almost globular habit. Var. *Hoveyi* is similar to *globosa*, but more ovate in outline. Var. *nana* is also a globose form, but with the branches much flattened, the foliage dark green above, bluish underneath. Var. *pumila* has a dense habit with dark green foliage. Var. *pygmaea* is the smallest form of all, with bluish green foliage.

Thuja orientalis, often called *Biota orientalis*, is a beautiful evergreen, but it is not so hardy as *Thuja occidentalis* and needs a well-sheltered location for its successful cultivation. For this reason it is a slow grower in this latitude, so that most of the forms in cultivation may be employed in limited quarters. The color of the normal form is a bright shining green, quite unlike that of any form of *occidentalis*. Var. *aurea* is of low globose shape with a compact habit, the foliage golden yellow in spring, changing later to bright green a form of this known as *nana* is of very dwarf habit. Var. *elegantissima* is of low columnar habit with bright yellow foliage, changing later to yellowish green.

One of our most desirable evergreens is the American hemlock, *Tsuga canadensis*. There are several dwarf forms of this which always add an individual touch to a group of evergreens. Var. *compacta* has the leaves closely set upon the branchlets, the habit compact and dense. Var. *globosa* is a dense nearly globose form with the tips of the upright branches nodding. Var. *gracilis* has branches which are less divided and somewhat nodding at the apex—it has a more slender habit than the other dwarf forms. Var. *nana* is a depressed form, with spreading branches. Var. *pendula*, often known as Sargent's weeping hemlock, is perhaps the finest and most graceful of all the dwarf conifers; it forms a widely spreading flat-topped shrub with long spreading branches which are pendulous at the tips, the irregularities in the surface of the broad flat branches giving a beautiful modulation of shades of green.

Broad-leaved evergreens

Azalea amoena. A fine shrub of low growth and spreading habit, with flowers of a rosy purple, the leaves assuming a bronze tint in the fall which continues through the winter. Var. *Hinodegiri* is similar to the above, but the flowers are of a bright scarlet and much more attractive—to be preferred of the two.

Buxus sempervirens, any of the dwarf forms. There are also variegated forms.

Calluna vulgaris, the heather. A most charming low shrub, forming a good ground-cover for dry sunny banks, or as edgings for groups of other evergreens. It occurs in several color forms: var. *alba* has white flowers; var. *carnea*, flesh-colored flowers; var. *rubra*, flowers of a rosy-carmine.

Daphne Cneorum. A beautiful trailing shrub, forming large masses and well adapted for a ground-cover. Its pink flowers, which appear in April and May, are deliciously fragrant.

Dendrium buxifolium, often known as *Leiophyllum buxifolium.* A densely branched shrub, with white or pink flowers. Like other members of the heath family, it thrives best in peaty or very sandy loamy soil, and will do well in sun or partial shade. Var. *prostratum* forms dense depressed mats.

Euonymus japonicus. A little tender, except in sheltered situations. An upright shrub of slow growth. Var. *argenteo-variegatus*, leaves edged and marked white. Var. *aureo-marginatus*, leaves margined with yellow. Var. *aureo-variegatus*, leaves blotched yellow. Var. *albo-marginatus*, leaves with a narrow white margin. Var. *medio-pictus*, leaves with a yellow blotch in the center.

Euonymus radicans. A low depressed shrub, the branches finally rooting, and climbing by this means. Leaves usually dull green above, the veins whitish. Var. *argenteo-marginatus*, leaves bordered white. Var. *roseo-marginatus*, leaves margined with pinkish. Var. *reticulatus*, veins of leaves bordered with white. Var. *vegetus*, a low spreading shrub, sometimes four or five feet tall, the leaves broadly ovate or almost round, acutish; fruits freely, the fruit remaining a long time; markedly different from the other varieties of this species.

Gaultheria procumbens, the wintergreen or checkerberry. A low evergreen with creeping stems, suitable for a ground cover in shaded situations, where the soil is sandy or peaty and somewhat moist. The leaves color in winter.

Ilex crenata. This has proved the best foliage broad-leaved evergreen at the Garden. Normally it is a spreading shrub of

irregular outline, the foliage a deep bright green. It is of relatively slow growth, and may be considered under the head of dwarf evergreens. It is especially attractive in the winter with its dark green in contrast with the snow. It will stand trimming.

Kalmia latifolia, mountain or American Laurel, or calico bush. One of the most beautiful of hardy evergreens with showy flowers. It will do well in a sandy or loamy soil, and in sunny or shady locations which are not too dry. It forms a spreading shrub, with leaves dark green above and yellowish green beneath. Var. *alba* has white flowers. Var. *rubra*, also known as *Pavarti*, with deep pink flowers.

Leucothoë Catesbaei. A broad dense shrub of slow growth, rarely exceeding two or three feet tall, with racemes of white flowers which are reddish in the bud. The leaves are glossy green, usually lighter beneath, lanceolate, and take on a beautiful purple hue in the fall which lasts through the winter. Well worth a place in any collection of evergreens.

Odostemon japonicus, often called *Berberis japonica* or *Mahonia japonica*. An upright shrub with compound leaves, the leaflets orbicular or nearly so, coarsely toothed, of a leathery texture, and bright green. It succeeds best in partial shade and in a protected situation, as it is somewhat tender.

Odostemon nutkanus, frequently known as *Berberis Aquifolium* or *Mahonia Aquifolium*. An erect shrub, with coriaceous toothed leaves, varying in color from bright green to dark and grey green, shining or dull. It also prefers a sheltered situation. In winter the leaves turn a deep bronze-purple. It bears terminal clusters of yellow flowers, followed by small purple-black fruit.

Pieris floribunda, or *Andromeda floribunda*. A dense shrub, usually two to three feet tall, with terminal naked panicles of erect racemes bearing nodding white flowers. It flowers in April and *May*.

Pieris japonica, sometimes called *Andromeda japonica*. Similar to the preceding, but more graceful. A spreading shrub, usually two to four feet tall, the white flowers borne in great profusion in pendulous racemes from the axils of the upper leaves. A very striking plant, one of the best, flowering early, late in March to May. It is also very attractive during the winter.

Pachysandra terminalis. A low spreading shrub, less than a foot high, with creeping stems, forming mats. Excellent for a ground cover, doing well in shaded situations.

Rhododendrons furnish some of our best evergreen shrubs. Like all members of the heath family, they like a light or peaty soil, and are very intolerant of fresh manure, which should not, under any circumstances, be placed about them. Well-rotted manure, preferably cow manure, is safe, but the best mulch is composed of partially decayed leaves of deciduous trees, such as the oak. A mulching of fresh leaves may be added each fall, and this gradually rotting down furnishes the conditions best liked by rhododendrons.

Rhododendron arbutifolium. A small shrub with pink or carmine flowers which appear in June or July. It is sometimes known as *Rhododendron Wilsoni*.

Rhododendron carolinianum. A beautiful evergreen of our southern mountains, with pale rose flowers, appearing in late May or early June.

Rhododendron catawbiense. A native of our southern mountains. It is of more compact habit than *Rhododendron maximum*, and will stand sunny situations better. It bears its lilac-purple flowers in June, two or three weeks ahead of those of *Rhododendron maximum*.

Rhododendron maximum. Native of eastern United States. Another desirable shrub, inclined to grow taller than the preceding. Its flowers are of a more pleasing color, usually some shade of rose or pink.

Rhododendron myrtifolium. A low shrub, with small leaves, bronzing in winter, and lavender flowers which appear in June and July.

Rhododendron hybrids. There are many of these, varying much in size and color of flowers. To be thoroughly satisfied it is best to visit the nursery when these plants are in flower and select the color shades preferred. In this way you will get exactly what you want. Some of the dwarfer forms are: *Boule de Neige*, flowers pure white; *Everestianum*, flowers pinkish lavender, with yellowish markings; *Edward S. Rand*, flowers a

rich crimson; *Mrs. C. S. Sargent*, flowers pink; *Mrs. Milner*, flowers crimson; *Sefton*, flowers dark maroon.

Vinca minor, the myrtle or periwinkle. A trailing evergreen, with shining dark green leaves, and commonly blue flowers. It makes an excellent ground cover in shaded situations, and is one of the best for that purpose. It is thoroughly hardy, and prefers shade.

In the following lists suggestions are offered for evergreens for special purposes or conditions:

Coniferous Evergreens

Columnar or Pyramidal Forms, where Upright Lines are Desired

Chamaecyparis thyoides, its varieties.
Chamaecyparis Lawsoniana var. *Alumii*.
Juniperus communis var. *hibernica*.
Pinus Cembra.
Pinus Peuce.
Thuja orientalis and varieties *aurea* and *elegantissima*.
Tsuga canadensis var. *gracilis*.

Broad Dense Forms, Compact Habit

Abies nobilis.
Chamaecyparis obtusa, varieties *compacta*, *nana*, *nana aurea*, and *pygmaea*.
Chamaecyparis pisifera, varieties *squarrosa Veitchii*, *filifera gracilis*, and *filifera gracilis aurea*.
Juniperus canadensis and var. *aurea*.
Juniperus chinensis, varieties *aurea* and *Pfitzeriana*.
Picea Abies, its varieties.
Picea canadensis var. *nana*.
Pinus Strobus, its varieties.
Pinus edulis.
Pinus densiflora var. *tabulaeformis*.
Pinus montana var. *Mughus*.
Taxus cuspidata var. *nana*.
Thuja occidentalis, its varieties.
Thuja orientalis var. *aurea nana*.
Tsuga canadensis, varieties *compacta*, *globosa*, *nana*, and *pendula*.

Broad Forms, Rather Loose and Irregular

Chamaecyparis obtusa, varieties *filicoides*, *filicoides aurea*, and *lycopodioides*.
Juniperus Sabina.
Taxus cuspidata var. *nana*, the form with irregular branchlets.

Prostrate or Low Forms, Forming Mats, Ground Covers

Juniperus chinensis var. ***procumbens***, and its forms.
Juniperus horizontalis.
Juniperus Sabina var. ***tamariscifolia.***
Taxus canadensis.

Very Dwarf Forms

Chamaecyparis obtusa var. ***pygmaea.***
Picea Abies, its varieties.
Pinus Strobus, its varieties.
Thuja occidentalis, varieties *globosa*, *Hoveyi*, *nana*, *pumila*, and *dumosa.*
Thuja orientalis var. ***aurea nana.***

Bright-Colored Forms

Chamaecyparis obtusa var. ***filicoides aurea.***
Chamaecyparis obtusa var. ***nana aurea.***
Chamaecyparis pisifera var. ***filifera gracilis aurea.***
Juniperus chinensis var. ***aurea.***
Juniperus chinensis var. ***procumbens***, forms *aurea*, *albo-variegata*, and *aureo-variegata.*
Juniperus canadensis var. ***aurea.***
Thuja occidentalis var. ***Ellwangeriana aurea.***
Thuja orientalis, varieties *aurea*, *aurea nana*, and *elegantissima.*

Forms Bronzing or Browning in Winter

Chamaecyparis thyoides var. ***ericoides.***
Chamaecyparis pisifera var. ***squarrosa Veitchii.***

Weeping Forms

Chamaecyparis pisifera var. ***filifera gracilis.***
Chamaecyparis pisifera var. ***filifera gracilis aurea.***
Tsuga canadensis, varieties *globosa* and *pendula.*

Broad-Leaved Evergreens

Desirable Mainly for Foliage

Buxus sempervirens and varieties.
Euonymus japonicus and varieties.
Euonymus radicans and varieties.
Ilex crenata.
Odostemon japonicus.
Odostemon nutkanus.
Pachysandra terminalis.

With Showy Flowers

Azalea amoena and var. *Hinodegiri.*
Calluna vulgaris.
Daphne Cneorum.
Dendrium buxifolium.
Gaultheria procumbens.
Kalmia latifolia.
Leucothoë Catesbaei.
Rhododendron, species and hybrids.
Vinca minor.

Ground Covers

Calluna vulgaris.
Daphne Cneorum.
Euonymus radicans and varieties.
Gaultheria procumbens.
Dendrium buxifolium var. *prostratum.*
Pachysandra terminalis.
Vinca minor.

Bronzing or Coloring in Winter

Leucothoë Catesbaei.
Rhododendron myrtifolium.
Azalea amoena and var. *Hinodegiri.*
Gaultheria procumbens.

The greater part of the evergreens mentioned in this article may be seen in the collections of the Garden, which are plainly labeled. The genus *Abies* is located to the west of conservatory range 1. *Chamaecyparis thyoides* will be found along the south walk, near the south gate. *Chamaecyparis obtusa* and *Chamaecyparis pisifera* and their varieties are at the southwest corner of the terrace of conservatory range 1. *Juniperus* groups are at the foot of the terrace southeast of conservatory range 1, and on the eastern end of the area dividing the driving roads in that neighborhood. *Picea*, the dwarf forms, are to the south of the group of *Forsythia* near the Harlem Railroad depot. *Pinus*, the dwarf forms, will be found east of conservatory range 1 and on the ridge west of the herbaceous grounds. *Taxus* occurs on the eastern side of the herbaceous grounds ridge, in the neighborhood of the morphologic garden. The *Thuja* collection is on the western end of area dividing driving roads in the neighborhood

of conservatory range 1, and west of the junipers. *Tsuga* forms a group near the power house in the vicinity of conservatory range 1. The broad-leaved evergreens will be found mostly in the fruticetum collections, north of the lakes, in the various families. Most of the rhododendrons will be found on the banks at the upper lake, and around the fountain at the Museum building.

GEORGE V. NASH.

SPRING LECTURES, 1915

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

Apr. 3. "The Sources of Quinine," by Dr. H. H. Rusby.

Apr. 10. "Growing Seeds for the Farm and Garden," by Dr. A. B. Stout.

Apr. 17. "Botanical and Scenic Features of the Himalayas," by Mr. R. R. Stewart.

Apr. 24. "The Development of the Vegetation of New York State," by Dr. W. L. Bray.

May 1. "The Vegetation of Porto Rico," by Dr. N. L. Britton.

May 8. "Flowers for the Spring Garden," by Mr. G. V. Nash.

May 15. "How to Collect and Study the Local Fungi," by Dr. W. A. Murrill.

May 22. "The Sea Gardens of the Tropics," by Dr. M. A. Howe.

May 29. "Destructive Insects," by Dr. F. J. Seaver.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for cross-town trolley, transferring north at Third Avenue.

CONFERENCE NOTES FOR FEBRUARY

The program presented at the February conference of the scientific staff and the students of the Garden was as follows:

"Some results of a reconnaissance survey of the vegetation of New York State," by Professor W. L. Bray.

"The type of the genus *Peziza*," by Dr. F. J. Seaver.

In this preliminary report by Professor Bray the floristic provinces recognizable in the state were defined as they are believed to be determined by temperature, and their extent and distribution was charted.

It was recognized, as indicated by Merriam,* that in general the area of New York State is part of the meeting ground where the northern or boreal and the southern or austral floristic elements overlap. It was indicated that at an elevation of 200 to 400 feet, more or less, above sea level, the austral elements extend in some strength up the Hudson and Champlain valleys, and along the south margin of the Erie and Ontario basins, becoming rather weaker in the St. Lawrence Valley.

By reason of the fact, however, that much of the area of the State is a dissected plateau whose general elevation varies from 1,200 ft. to 2,000 ft. more or less, with some remnant elevations (hills) rising to 2,000 feet and mountain peaks to 4,200+feet (Catskills) and 5,300+ feet (Adirondacks), temperature conditions are varied enough to call forth floristic elements ranging from strongly arctic on the highest summits of the Adirondacks to well-marked austral (Carolinian) in the region about Manhattan and coastward Long Island and Staten Island, which is approximately at sea level and under ocean influences.

Specifically the following subdivisions were proposed:

* Merriam, C. H. Life Zones and Crop Zones. Bull. U. S. Dept. Agric. 10: 1–73. 1898.

A. A strongly austral element (more or less typically Carolinian) occupying a small region at the mouth of the Hudson, Staten Island and part of Long Island, the more obvious indicator species being sweet gum, sassafras, willow oak, post oak, and in general the maximum number of oak species for the state, tulip, poplar (especially because of its frequence and large growth), and occasional specimens of American holly, persimmon, yellow (shortleaf) pine, and so on.

B. An austral element dominated by oaks, chestnut and hickories occupying in strength the Hudson Valley and adjacent uplands to more or less 1,000 feet elevation and covering especially the Delaware, Susquehanna and Alleghany valleys and adjacent hills and the sand areas between Lake Ontario and the plateau Escarpment (notably between Oswego and Syracuse). This element extends up the Mohawk Valley (especially on the southern exposures), up the Champlain Valley beyond Westport, becoming weaker northward until in the upper Champlain Valley, the St. Lawrence and the east margin of the Ontario basin it is in general quite negligible. Numerous associate austral species accompany this element strongly represented in southern valleys and disappearing northward or on uplands.

C. Typical transition, occupying the Alleghany Plateau and the Catskills to about 2,000 feet and dominated by typical Hard maple-beech-hemlock-white pine-yellow birch, normally climax forest, with more or less characteristic subdominant tree species and a very rich and fairly characteristic ground flora.

D. Canadian transition occuping the Catskills above 2,000 feet (more or less) and the Adirondack Plateau exclusive of mountain slopes above 2,000 feet more or less. This is merely a boreal aspect of *C*, marked by the increasing presence of red spruce, balsam and white-birch in climax forest (the hydrophytic forests here are, of course, dominantly balsam), and the presence of a well-characterized forest floor element.

E. Canadian zone element, occupying the higher mountain slopes (*e. g.*, the Marcy group) from more or less 3,500 feet to the summit or the tree limit where the summit is not timbered. The forest here is a mixture of red spruce, balsam and paper

birch, with mountain ash (*Sorbus americana*) and other species of more boreal affinities. Manifestly by reason of its limitation to steep mountain slopes this element does not exhibit its best expression in a climax society.

F. Arctic element, occupying the summit of Mt. Marcy and several other of the highest peaks. Canadian species are present —the trees chiefly balsam, red spruce, becoming from one to six feet tall—but the unique element consists of a small number of species quite dissociated from the Adirondack flora in general (except for occasional representatives in heath bogs) and largely represented in Greenland, Labrador and Alaska and in certain Arctic alpine regions of Europe and Asia. Such for example are *Savastina alpina* (Sw.) Scribn., *Juncus trifidus* L., *Salix Uva-ursi* Pursh., *Betula glandulosa* Michx., *Empetrum nigrum* L., *Rhododendron lapponicum* Oeder., *Harrimannella hypnoides* (L.) Coville, *Vaccinium uliginosum* L. and *Diapensia lapponica* L.

Dr. Fred J. Seaver spoke of the difficulty of typifying the genus *Peziza* in accordance with the rules of the American code of nomenclature, which rules are followed in our work on *North American Flora*. If the type of the genus *Peziza* falls outside of the order Pezizales as at present used, both the name of the genus and the name of the order would become untenable notwithstanding the fact that they have been used for the cup-fungi ever since these plants came to be studied. If we adhere to the letter of the law in selecting the type of this genus we must take a bird's-nest fungus which belongs to the Gasteromycetes and is far removed from the Pezizales as at present used. Such a course would seem unjustifiable under the circumstances. Unless some of the special provisions in the rules could be found to apply to this case, the type of *Peziza* ought to be selected arbitrarily in order to keep the name for the large cup-fungi as it has been used even in remote times.

Both presentations aroused considerable interest and discussion.

A. B. STOUT,
Secretary of the Conference

NOTES, NEWS AND COMMENT

Dr. Rydberg spent a week during February in Cambridge studying the collection of the Helenioid Composites in the Gray Herbarium, in connection with a preparation of manuscript to be published in a forthcoming part of the North American Flora.

Dr. George G. Hedgcock, pathologist of the United States Department of Agriculture, spent several days at the Garden during February in a study of herbarium material of fungi concerned with forest tree diseases and of mistletoe.

Dr. John K. Small is spending several weeks in tropical Florida, especially in the southern portions of the Everglades and the Florida Keys, in continuation of previous botanical exploration of those regions that have been hitherto practically inaccessible.

Last fall representatives of The American Sugar Refining Company took steps to replenish and enlarge the exhibit of sugars, the bulk of which was presented by them to the Garden some years ago. About the end of the year the specimens reached the museum, and they have now been installed in their proper places.

All specimens discolored by continuous exposure to light and those otherwise impaired in looks were discarded and have been replaced by fresh ones.

The series of crude sugars was augmented by specimens of "Jamaica musco" and "Porto Rico centrifugal," while that of the soft standard refined sugar was much enlarged. The latter series now runs nearly complete, from number 1 to number 14.

The replaced specimens of "fine granulated" and "coarse granulated" and also those of the "cube" and "cut loaf," are particularly showy. However, the most conspicuous of all are the specimens comprising the crystal domino sugars. This series now consists of seven specimens as follows, "crystal domino syrup," "crystal domino plate," which represents the form of the sugar before sawing and breaking into pieces, "crystal domino," half-size pieces, "crystal domino," full-size pieces,

"crystal domino granulated," "crystal domino powdered," "crystal domino confectioners."

Meterology for February.—The total precipitation for the month was 5.02 inches of which 0.30 inches (3 inches snow measurement) fell as snow. The maximum temperatures for each week were *56° on the 6th*, 49° on the 12th, 55° on the 20th, and 54° on the 24th. The minimum temperatures were 17° on the 5th, *13° on the 10th*, 20° on the 18th, and 19° on the 27th.

ACCESSIONS

MUSEUMS AND HERBARIUM

2 specimens of fungi from Long Island. (By exchange with Mr. Roy Latham.)

12 specimens of woody fungi from Pennsylvania. (By exchange with Professor C. R. Orton.)

1 specimen of woody fungus from Montana. (By exchange with Professor C. R. Orton.)

1 specimen of *Nectria episphaeria* from Louisiana. (By exchange with the United States Department of Agriculture.)

4 specimens of hepaticae from Florida. (By exchange with Mr. Severin Rapp.)

1 specimen of *Riccia sorocarpa* from Indiana. (Given by Mr. Fred Donaghy.)

1 specimen of *Riccia sorocarpa* from Alabama. (Given by Dr. Forrest Shreve.)

9 specimens of marine algae from Beaufort, North Carolina. (Given by the United States Bureau of Fisheries.)

4 specimens of *Riccia* from Oregon. (Given by Professor William E. Lawrence.)

287 specimens of flowering plants from the southern United States. (By exchange with the University of Pennsylvania.)

25 specimens of mosses from Pinar del Rio, Cuba. (By exchange with Brother Leon.)

1 specimen of *Nanomitrium synoicum.* (Given by Mr. George B. Kaiser.)

3 specimens of mosses from Sanford, Florida. (By exchange with Mr. Severin Rapp.)

1 specimen of *Hypopterygium japonicum* from Alaska. (By exchange with Dr. T. C. Frye.)

PLANTS AND SEEDS

19 plants for Fruticetum. (By exchange with U. S. Dept. of Agriculture.)

1 *Codiaeum.* (Given by Mr. R. W. Pinckney.)

6 plants of *Limnanthemum Humboldtianum.* (Collected in Porto Rico by Dr. N. L. Britton.)

1 asparagus plant. (Given by Mr. H. W. Becker.)

3 cuttings of *Pedilanthus Smallii.* (Given by Mr. Chas. Deering.)

16 plants *Nephrolepis exaltata* and *Hemionitis palmata.* (Collected in Porto Rico by Dr. N. L. Britton.)

16 seeds of *Cycas media.* (By exchange with Brooklyn Botanic Gardens.)

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Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 10, part 1, 1914. Agaricaceae (pars).

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22 parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

Vol. 25, part 1, 1907; part 2, 1910; part 3, 1911. Geraniaceae—Burseraceae.

Vol. 29, part 1, 1914. Clethraceae—Ericaceae.

Vol. 34 part 1, 1914. Carduaceae (pars).

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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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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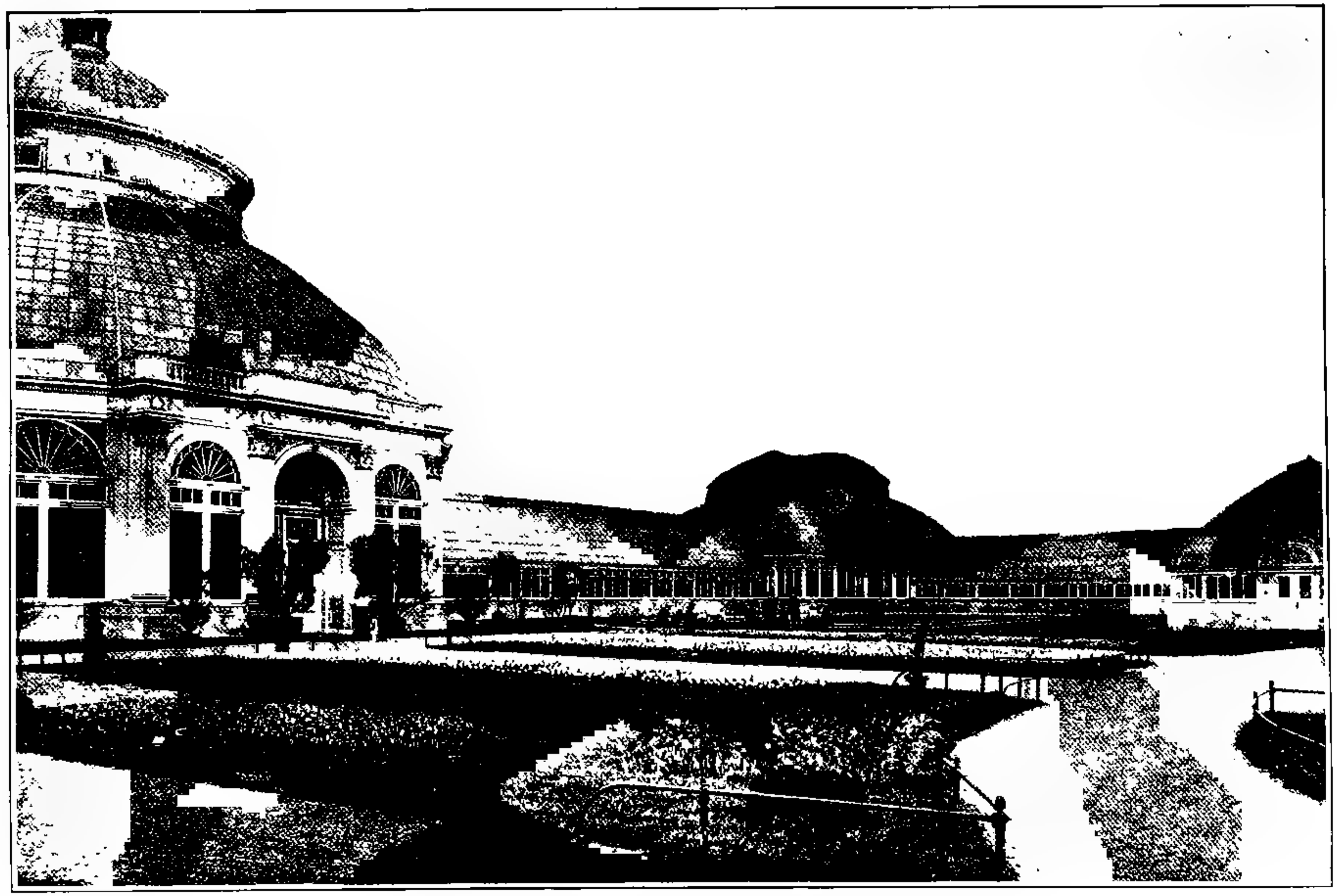

Tulip Beds in Court of Conservatory Range 1.

JOURNAL

OF

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THE DISPLAY OF TULIPS AT THE GARDEN

With Plate CLVI

In late April and May the tulips make their appearance, the early varieties flowering up to the early part of May, the cottage varieties coming a little later, followed by the Darwins late in the month and early June. Nowadays there is a great variety, the bright strikingly colored ones being found among the early and cottage forms while the soft more delicate shades occur among the Darwins.

One of the most striking tulip displays last year was in the court of conservatory range No. 1, an illustration of which is here presented. The tulips used were all of the early flowering sorts, being in perfection the first week in May. Last fall the same kinds of tulips were again planted, and the same color arrangement repeated. The bed to the right in the foreground and the corresponding bed on the other side of the court contained Crimson King. Each of these beds is twenty five feet by eight feet and contains about 1,200 bulbs, the flowers a rich crimson. The bed to the left and the corresponding bed opposite are sixteen and one half by six feet, and hold about 600 bulbs of *Tulipa chrysolora* which has flowers of a rich yellow. The long center bed is fifty nine feet by nineteen feet. A border three and one half feet wide is planted with La Reine, a pure white variety, about 2,300 bulbs being required. The center is filled with Cottage Maid, one of the most beautiful of pink tulips. About 2,800 of these were required. Each lateral bed paralleling the

[Journal for March (16: 43–66) was issued April 10, 1915]

center one is forty eight by ten feet, and contains about 2,400 bulbs of Rose Grisdelin, a pink and white tulip.

When all of these bulbs are through flowering, after the middle of May, they are removed and the best of them reserved for planting the next fall, the smaller bulbs being planted in the shrub borders. Upon the removal of the bulbs the beds are filled with a large collection of desert plants.

The large circular bed in the conservatory plaza is again planted with about 2,800 Keizerskroon, one of the most striking early tulips, a dark red margined yellow. The beds at the fountain, at the foot of the museum approach, are planted as heretofore with Cramoisie Brilliant.

While these displays are the largest and most striking here at the Garden, there are many other kinds of tulips to be found in the various borders. In addition to the large number of kinds already in the decorative collections, those given in the lists below were added last fall. The letters in parentheses indicate the locations: C. B. = conservatory beds, located to the north of conservatory range No. 1, the accompanying numeral being the bed number; L. C. N. = the bed on the north side of the walk from the terminus of the Elevated Railway to conservatory range No. 1; and L. C. S. = bed on the south side of the same walk.

EARLY

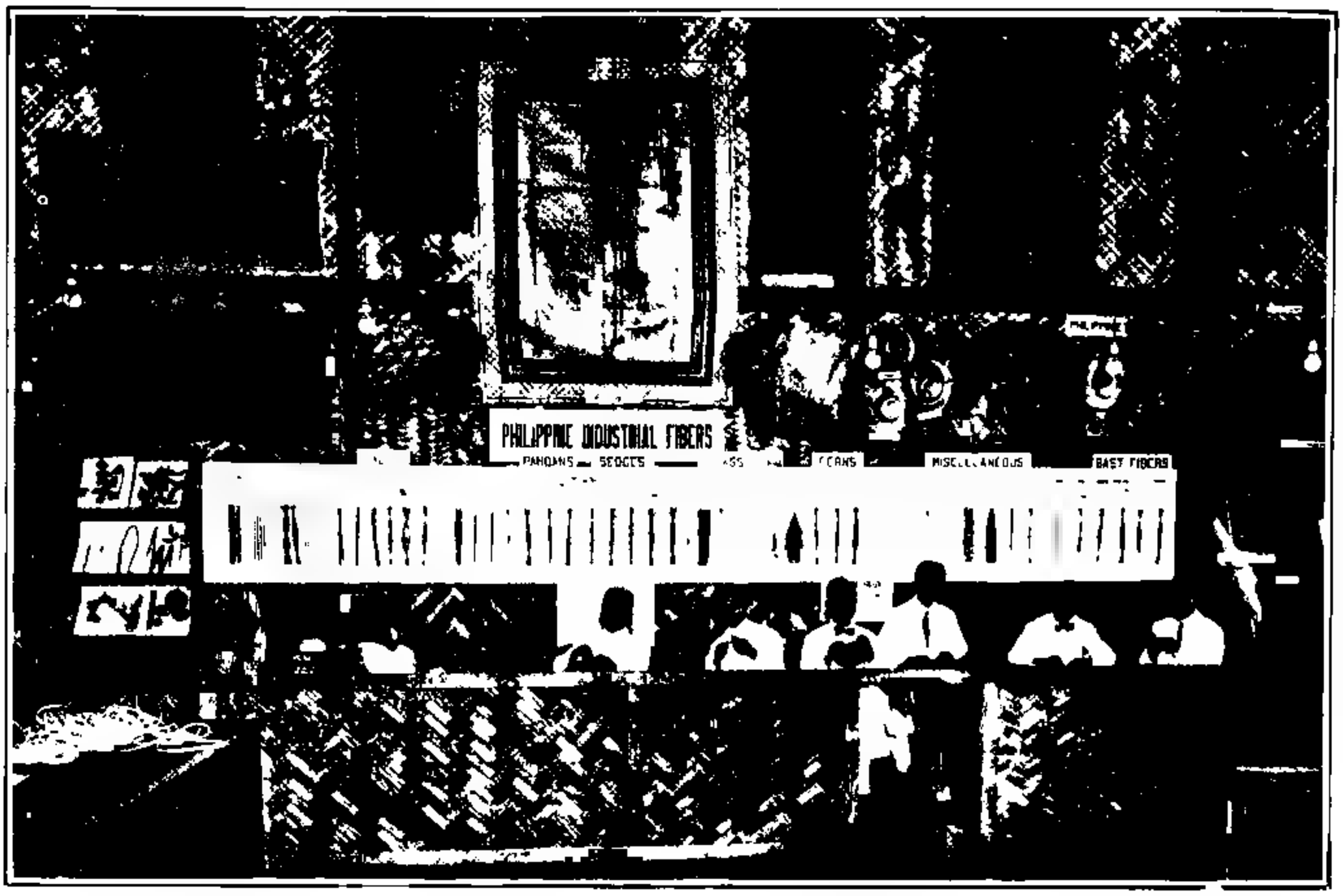
Couleur Cardinal, C. B. 5
Duc Van Tholl, white, C. B. 5
Dusart, L. C. S.
Flamingo, C. B. 2
Golden Queen, C. B. 3
Gold Finch, L. C. N.
Joost Van Vondel, white, C. B. 8
Pottebakker, scarlet, L. C. N.
Pottebakker, yellow, C. B. 5
Princess Marianne, C. B. 8
Queen of the Netherlands, L. C. S.
White Hawk, C. B. 3

DARWIN

Glow, C. B. 1
Harry Veitch, C. B. 1
King Harold, C. B. 7
La Tristesse, C. B. 5
Mme. Krelage, C. B. 5
Mrs. Potter Palmer, C. B. 6
Ouida, C. B. 7
Phillipe de Commines, C. B. 5
Pride of Haarlem, C. B. 3
William Pitt, C. B. 2

In addition to the tulips, many kinds of narcissus and daffodils will be found in the decorative borders.

GEORGE V. NASH



Display of Philippine plant fibers at the Manila Exposition in 1912.

Plants and fibers of abacá or so-called Manila-hemp (*Musa textilis*).

THE INDUSTRIAL FIBER-PLANTS OF THE PHILIPPINES[1]

With Plates CLVII and CLVIII[2]

Although the Filipino people used the fibers of palms, screw-pines and other plants perhaps from times immemorial, it is primarily due to the untiring efforts of the Bureau of Education in those Islands that the Filipinos were brought to a fuller and deeper realization of the wealth of industrial materials abounding in their country for the manufacture of a great variety of articles of economic importance. It is the purpose of this article to describe briefly the important fiber-plants in the Islands and to illustrate how and in what way fibers are prepared and utilized. As a matter of convenience the plants will be grouped under various headings, the classification indicating botanical relationship rather than present economic importance.

Palms

One of the tallest of the palms growing in the Philippines is *Corypha elata*, commonly known in the Islands as the Buri palm and in India as the Talipot palm. The palm is characterized by large orbicular leaves near the apex of its trunk. After reaching maturity, variously estimated at from 25 to 45 years, it flowers and fruits once and then dies. It is interesting to note that the palm develops a much branching inflorescence often 20 feet high. Between the ages of five and twelve years the plant is of the greatest economic value.

The young unopened leaves of the shoot, while still yellow and without chlorophyl, are spread out to dry in the sun and then cut up into strips. Such strips are used for sugar bags and coarse mats. If the strips are to be used for better and finer grade articles, they are bleached more thoroughly by boiling them in water containing vinegar, or in various other ways. These

[1] An exhibit of the chief industrial fiber-plants of the Philippines will soon be ready for public inspection in the Museum Building of the New York Botanical Garden.

[2] Plate CLVIII was furnished through the courtesy of Mrs. Mabel R. Dow, who conducts a basketry store at 173 Madison Ave., N. Y. City.

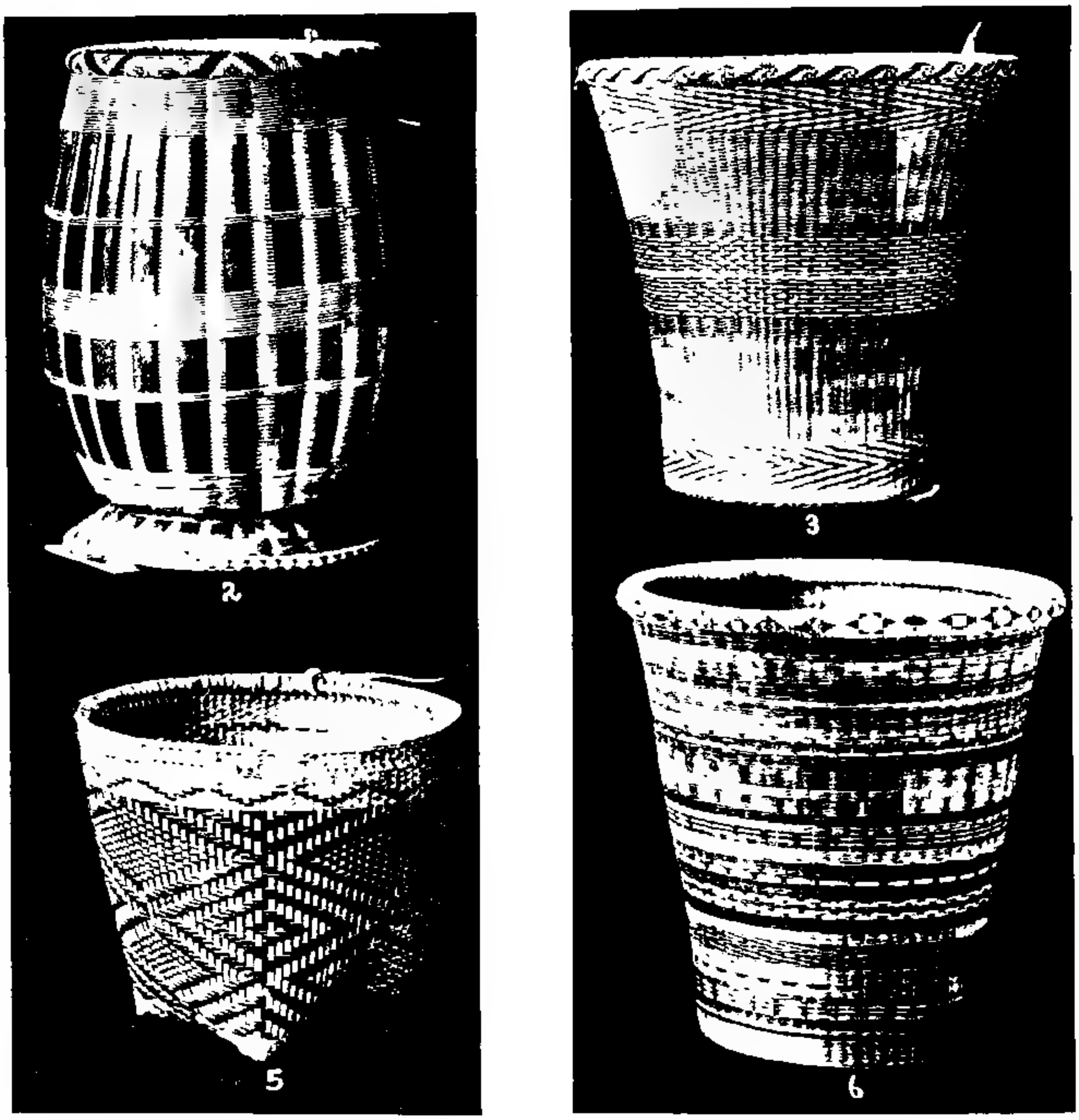
strips are used mainly for hats, baskets, handbags and tobacco cases. The epidermis of the unopened leaflets can readily be removed and is known as raffia. This is equal in strength to the Madagascar raffia which is more commonly found in the U. S. market. In the Philippines raffia is often woven into cloth. The schools have extended the use of raffia to the manufacture of screens, carriage cushions and bags in macramé weave.

The midribs of the unopened leaves, while still yellowish-white in color, are bleached, spliced, and made into very fine hats known in Manila as Calasiao hats and in the Visayas as Pototan hats. Because of their good wearing qualities and dressy appearance they are much admired by Filipinos and have a well-established market.

The petiole of the opened Buri leaf is cut into sections two to three feet long. One end of it is frazzled and the inner fibers, mostly stereome tissue, are pulled out by hand. While the process is apparently simple it requires dexterity and skill to avoid breaking the fibers as they are being pulled out. Another way of getting the fibers is to pound the whole petiole and then pull the fibers out; but on drying it is found that such fibers frequently become discolored. These fibers are made up chiefly into hats, beautiful in texture and appearance, and are known in the Philippines as Buntal hats. In the U. S. market these hats usually unbleached and of medium quality and grade are known as Bangkok hats.* The fibers are also excellent for small baskets.

Within the last few years it was discovered that the petioles furnished an excellent basketry material needing no artificial dyes to enhance the beauty of the natural product. Thus, scraping off the epidermis of an old petiole, splints dark brown in color verging almost to a black may be obtained. Younger petioles yield lighter shades. Still lighter material is obtained by scraping below the darker portions of the petioles. Thus great variations in color are obtainable by proper manipulation, and the colors are permanent. The chief palms so used are *Arenga mindorensis* and *Arenga saccharifera* (sugar palm). T

* Inquiry of the U. S. consul at Bangkok elicited the information that no hats are made in the town except in prison, and that these hats are manufactured only for prison consumption.



Waste baskets made chiefly of bamboo and palm fibers.

sugar palm also furnishes material for rope that is highly resistant to the action of salt water. To a less degree the fibers surrounding the trunk are suitable for bristles of brushes.

The coconut-palm may be mentioned here for its fiber products. The leaves are used extensively for roof-thatching. The fibers surrounding the nut (coir) are employed in the manufacture of door mats. The midribs of the leaves are strong enough for chairs and tables. The central cylinder of the young roots of the coconut-palm can be utilized as basketry material.

The nipa palm (*Nipa fructicans*) plays an important part in the industrial life of the Filipinos, as it is the principal source for the manufacture of alcohol. Its leaves are used even more extensively than those of the coconut-palm for thatching. Some slight use is made of the splints and midribs obtained from the petioles and leaves.

In former times, hats were made in the Philippines from fine splints obtained from species of rattan, especially *Calamus mollis*. Now the weaving of rattan splints into hats has been almost abandoned because of the difficulty in preparing fine splints from the stem and the skill required in weaving the short fibers into a hat. Besides, weaving can only be done, when the air is sufficiently moist. The hats are beautiful and durable and are sold at almost any price from fifteen dollars ($15.00) up.

The little town of San Miguel, Bulacan, is the center of the native rattan chair industry in the Philippines. The chairs are patterned after Vienna chairs.

Screw-pines

Growing usually in profusion along the littoral of the Philippines is the common screw-pine, *Pandanus tectorius*. Very little use is made however of its fiber, although it seems that the epidermis of this pandan leaf, or of one very similar to it, is used extensively in Japan for the manufacture of "Panama hats."

The pandan that enjoys the greatest popularity among the Filipinos because of its flexibility and softness is *Pandanus sabotan* or *Pandanus tectorius* var. *sinensis*. No female inflorescence of this pandan has ever been found and so Philippine

botanists do not agree whether this pandan constitutes a distinct species or is only a more or less cultivated variety of the common sea-shore pandan. No further preparation except the removal of its spines is practised. The strips are sometimes bleached, but with rather indifferent success. The fiber if properly bleached would be excellent for "Panama" hats. This screw-pine is used extensively by Filipinos for hats and for their best quality of mats.

A screw-pine with coarse leaves is *Pandanus utilissimus*. The leaves of this screw-pine must be rolled under heavy logs before they can be used. The strips are utilized for mats and telescope baskets, and are exported in large quantities from Laguna Province to the Manila market.

Another pandan of economic importance, used especially in the southeastern provinces of Luzon, is *Pandanus simplex*. This pandan is not as coarse as *P. utilissimus* and is utilized in the same way as the latter.

Among the pandans used occasionally are *P. copelandii*, *P. dubius*, *P. luzonensis* and *P. radicans*.

Grasses

Bamboo, especially the cultivated species *Bambusa blumeana*, plays a highly important role in the daily life of the Filipino people. The majority of the houses in the Philippines are built of bamboo. Long hollow bamboo tubes serve for carrying drinking water from river or well. The aborigines (Negritos) cook rice, their principal food, in green sappy bamboo over an open fire. The rafts that carry the products up and down the river are made of bamboo. So in a thousand and one ways bamboo enters intimately into the daily economic life of the people. It is not however its general uses that will be considered here, but its use in the making of hats.

The spiny bamboo, *Bambusa blumeana*, is the species usually employed in the manufacture of hats. The bamboo is felled when it is from four to five months old before it has developed any branches. At this age the bamboo is perhaps fifty or more feet high. Only the middle internodes of the stem, fifteen to

twenty in number, are used. Both the upper and lower internodes are discarded, for the former is too weak and the latter too coarse for hat material. The stem, after being cut, is allowed to wilt for about twenty-four hours. Then sections are cut at the nodes, and each cylinder is divided into three or four parts and flattened. Part of the inner surface and of the outer are cut off and thrown away. The remaining portions which are perhaps one quarter to three eighths of an inch thick are then spliced into from four to ten layers. Needless to say it requires experience and skill to obtain these layers, which are often as thin as tissue paper. The layers nearest the green epidermis are considered the finest and best. The material is then boiled in water for about half an hour and bleached in the sun, a strengthening and whitening process. It is then ready to be woven into hats.

A thick-walled bamboo used in constructing houses and bridges, and for other purposes is *B. vulgaris*. Among the thin-walled bamboo used in a variety of ways may be mentioned *Schizostachyum acutiflorum, S. dielsianum, S. fenixii, S. hallieri.*

Turning to grasses herbaceous in structure we find vetiver, *Andropogon zizanioides*. Two varieties of this well-known tropical grass occur in the Philippines. One of these has fragrant roots (var. *genuina*), while the other (var. *nigritanus*) has not. The former variety may be recognized by its terminal dark purple panicles and distinct awns on the spikelets. The var. *nigritanus* has terminal greenish or purple panicles, usually the latter, and the spikelets are either unawned or armed with short awns. The fragrant roots are sold by itinerant vendors in the streets of Manila and are used by the women to put into clothes chests, trunks, etc. Philippine schools are introducing the use of these roots in making fans. Occasionally hats are made from the flower stalks.

Considering the great use of rice straw by the Japanese it is curious to note that the Filipinos hardly make any use of it. The Bureau of Education is encouraging the use of rice straw among the Filipinos.

The panicles of *Phragmitis vulgaris* are used extensively for

making brooms. The best native brooms are made however from the panicles of *Thysanolaena maxima*.

Among the grasses that find more or less use may be mentioned Job's tears, *Coix-lachryma-jobi*. The hard-shelled seeds are used for rosaries or made into curtains, baskets and trays of various kinds. Cogon (*Imperata cylindrica* var. *koenigii; I. exaltata*) is the weed pest in the Islands. The whole plant is used for thatch among the very poor. The flower stalks are occasionally used for hats. A grass that has been found excellent for slippers is "cobboot," *Ischaemum angustifolium*. Often Filipinos decorate their houses with such grasses as *Apluda mutica*, *Eleusine indica*, *Ophiuris corymbosus*, *Erogrostis tenella*, *E. viscosa*.

Sedges

The Filipinos, except the well-to-do, follow the custom prevalent in the east of sleeping on mats which are placed on the floor at night and rolled up and put out of sight in the morning. These mats are made as a rule of pandan or sedges. The sedge most commonly used for this purpose is *Fimbristylis utilis*. This plant is found growing wild and in great abundance in and around the rice paddies in parts of the Visayas and Mindanao. It reaches its greatest economic importance on the islands of Samar, Leyte, Mindanao and Bohol. *F. utilis* may attain a height of three meters but the average is one and a half meters. After the removal of the inflorescence the sedge is dried with proper precautions and manipulated by hand or ruler to make it pliable. Great skill is shown especially in Samar in weaving intricate colored designs into mats. With proper looms this material can be woven into matting. The sedge is also utilized locally for the making of hats.

F. diphylla is also used for mats. The material though finer than that obtained from *F. utilis* is considerably stiffer and shorter and consequently is not considered as good a mat fiber.

In various parts of the Islands occurs *Cyperus radiatus*, which is utilized for mats but to a less degree than the sedges previously mentioned. *C. malaccensis*, common along brackish swamps and tidal streams not only in the Philippines but also throughout the

tropics, is made into slippers. It is interesting to note that the making of slippers from this fiber was started about 1907 or 1908 in a small village in the Islands by two Japanese peddlers who passed through the place selling small rice-cakes. Seeing the abundance of *C. malaccensis* they gave up their cake business and turned to the making of slippers. Now almost every house in the little town is actively engaged in making these slippers which are sold by the thousand throughout the Islands.

The Chinese matting sedge, *Cyperus tegetiformis*, is not found in the Philippines. The Japanese matting rush, *Juncus effusus*, cultivated extensively in Japan for the making of the finest matting is found growing wild in the Philippines but is not used. It seems probable that cultivation would improve the quality of the fiber. Its coarseness in the wild state is the principal objection at present to its use by Filipinos.

Various species of *Scirpus*, such as *S. erectus*, *S. grossus*, *S. lacustris* and *S. mucronatus*, find occasional uses for different purposes. In connection with sedges might be mentioned our common cat-tail, found in abundance in various parts of the Islands, but not used to any great extent.

Vines

Many vines growing in the tropics develop air-roots high above the ground from long, clambering and fleshy stem-structures.

A description of the forest near Puerta Galera, Mindoro, where the writer found air-roots in plenty, should prove of interest to those unfamiliar with the habitat of these aroids. A good half day's journey from town, Araceae with air-roots were found in fair quantity on the sides of heavily wooded mountains, but more plentiful in ravines or gulleys. In these places bird's-nest ferns were very abundant and the bark of many trees was covered with moss. So humid were the surroundings that even the edges of many leaves were covered with fringes of moss. The trees and plants were so close together that only a little of the light of the sun was able to find its way to the ground through the dense mass of foliage. The earth even after a

bright sunny day was found damp late in the afternoon. The ground was covered with decaying vegetation. It was a country in which leeches and mosquitoes were plentiful. The forest trees grew to a great height. The leaves of the aroids were around the upper part of the trunks of the trees and roots of various lengths dangled down from aroid stems.

The tips of air-roots are generally from six to fifteen feet from the ground, and are obtained by simply pulling them down. Depending on the strength of the pull and the luck of the gatherer he will be able to obtain pieces of roots ranging in length from a few feet to sixty or more feet. The epidermis and cortex are readily removed exposing the central cylinder which is used in basketry. While the Filipinos previously employed the roots only for tying purposes their utilization as a basketry material has only come within recent years. The central cylinders of the air-roots on first being removed are yellowish-white in color. In some species, *e. g.*, *Epipremnum elmerianum*, they remain white; in others, *e. g.*, *Raphidophora copelandii*, they are oxidized to a light-brown; while in others, *e. g.*, *R. merrillii*, they turn to a dark-brown or almost black color. The colored air-roots may be bleached by the common bleaching agents.

One of the *Menispermaceae*, *Pericampylus incanus*, has been found very serviceable as a basketry material. After removal of the leaves, the vine is boiled in water for about two hours when the epidermis and the cortical region are easily removed. After sandpapering the material it is ready for use. It is not however as good a basketry material as the air-roots owing to the presence of leaf scars.

Among vines of lesser importance in the Philippines may be mentioned the vegetable sponge, *Luffa cylindrica*, which in the provinces of Abra and Bulacan is used occasionally for children's hats. The use of the vegetable sponge for bathroom articles is unknown to the Filipinos.

Entada scandens, a vine in the family of *Leguminosae*, has an almost universal use in the Philippines as a substitute for soap.

Commercial Leaf or Petiole Fibers

The industrial fiber par excellence, whose successful cultivation has not been found possible outside of the Philippines, is abacá, or Manila hemp, *Musa textilis*. Typical plants of this species together with fiber in the process of drying are shown in plate CLVII. The impression often prevails, however, that its use is restricted entirely to the making of rope; little being known of its employment for braid or for the making of excellent and strong cloth known in the Philippines as "pinolpog." Little is known too outside of the Islands of the making of abacá fiber into a fabric called "abacá sinamay." The schools have extended the use of the fiber to the making of a great variety of articles.

The fibers are obtained by cutting off the leaves and pulling the petioles under a dull knife. Various machines have been invented to do away with this hand labor but none has so far proven very successful.

Instead of removing the individual fibers from the petiole, the whole outer epidermis may be removed and then divided into strips. These strips are known as "lupis" and are very serviceable in the making of coiled baskets.

If the fibers are to be used for braid or cloth they must be tied together. This knotting is very neatly done by hand so that the knots are hardly perceptible in the skein. The braid is known in the millinery trade in the U. S. as "tagal" braid and is imported from Switzerland.

Pinolpog is made by weaving the fibers into cloth and then softening the latter by winding it around a piece of wood and beating it thoroughly with sticks as it is being wound.

Abaca sinamay is a gauzy fabric used by Filipino women for waists (camisas) or like buckram to stiffen the bottom of skirts.

The extension work of the schools utilizes the fiber wholly or in part in the manufacture of slippers, coiled baskets, bags, lace, lamp-shades, belts and furniture.

Several varieties of the banana, *Musa paradisiaca*, are utilized for the manufacture of coarse and fine fabric depending on the quality of the fiber used. The fiber is prepared in the same way as abacá. Greater care is however necessary in its extraction

from the petioles, as the fiber breaks more readily. "Banana sinamay" as the fabric is called is in great demand by Filipino women for dress material.

The very finest cloth in the Philippines, almost as delicate as a spider's web, is made from the leaves of the pineapple plant. The fibers are obtained by scraping the leaves with a blunt object of some kind such as a piece of pottery, bamboo, iron and the like.

In a number of provinces *Agave cantula* is the species of sisal usually cultivated. The fibers are obtained by retting. The fibers of bowstring hemp, *Zansevieria zeylanica*, are occasionally used for commercial purposes.

Miscellaneous Fibers

The kapok tree, *Ceiba pentandra*, is found in all provinces in the Philippines, but its silky cotton-like fibers are gathered for trade or export principally in the Visayas. The fibers are excellent as filling material for mattresses, pillows, cushions and life preservers.

Cotton was cultivated formerly extensively in a number of provinces in the Islands, but its present cultivation is rather limited. While household looms still spin cotton yarn in the Philippines, the bulk of cotton goods used in the Islands is imported.

The stalks of *Dendrobium crumenatum*, an orchid with a fluted and bulbous base, is used as a decorative material in basketry. To make the stalks of an even bright-yellow color they are placed for a short time in boiling water or in water to which a little vinegar has been added. Exposing the cut stalks to the sun produces the same result.

Donax cannaeformis, known to the Filipinos as banban, is found throughout the Philippines, and is used much like the petioles of palms for obtaining light to dark-brown splints in basketry.

Bast Fibers

There are a great many species of plants in the Philippines belonging especially to the family of *Tiliaceae*, *Malvaceae* and

Sterculiaceae that yield bast fibers suitable for the manufacture of rope. It is no uncommon sight to see a Filipino whose cart has broken down draw out his "bolo," hack down a slice of bark of almost any tree, twist the fibers, tie together the broken pieces and go contentedly on his way, smoking the ever present cigarette.

THEODORE MULLER

CONFERENCE NOTES FOR MARCH

At this conference Mr. W. C. Barbour gave an ecological sketch of "The Lichens of West Rock, Connecticut." After a brief description of the location and geology of West Rock, he described in some detail the societies and successions which appear under different conditions, as follows:

1. Vertical or steep faces of trap rock.
2. Nearly level exposures of trap, otherwise bare.
3. Level places of great isolation, but with a slight soil formation.
4. Scrub thickets of oak and sumach.
5. Eastern portion where moisture is supplied by a small brook.
6. Sloping base at eastern side of hill, where mesophyte conditions prevail.

Nearly sixty species were listed for this locality. This work is part of the cryptogamic survey that is being made under the auspices of the Torrey Botanical Club.

Mr. Theodore Muller also discussed the "Fiber Plants of the Philippine Islands," with special reference to their economic uses. The presentation was illustrated by a splendid exhibit of the fiber plants and also by a number of baskets loaned for the occasion by Mrs. Mabel R. Dow, proprietress of a basketry store situated at 173 Madison Avenue. An article by Mr. Muller treating of the subject is printed in this issue of the *Journal*.

A. B. STOUT,
Secretary of the Conference

NOTES, NEWS AND COMMENT

A large specimen of bald-cypress, *Taxodium distichum*, has been installed in the fossil plant museum. This specimen consists of a section of the base of a trunk of a tree from the swamps of southern Louisiana. It stands fully six feet high and measures over six feet in diameter at the bottom and over four feet at the top.

Dr. John K. Small, Head Curator of the Museums, has returned from southern Florida. He spent about four weeks collecting in the little-known parts of tropical Florida, particularly in the unexplored hammocks of the Everglade Keys, with the result that a number of West Indian species are to be recorded for the flora of the United States.

Dr. and Mrs. N. L. Britton, Professor and Mrs. N. Wille, Mr. John F. Cowell, and Mr. Stewardson Brown returned to New York on March 29 after spending a period of several weeks in botanical exploration in Porto Rico.

Dr. William Dana Hoyt of Johns Hopkins University spent a week at the Garden early in March for bibliographic work and for studying marine algae from Beaufort, North Carolina.

Meteorology for March.—The total precipitation for the month was 0.45 inches which fell as snow on the 6th. Slight traces of snow or rain fell on the 23d, the 25th and the 30th. The maximum temperatures for each week were 47° on the 2d, 55° on the 14th, 56° on the 16th, and *63° on the 25th*. The minimum temperatures were *18° on the 4th*, 20° on the 9th, 23° on the 18th, and 21° on the 27th.

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LIBRARY ACCESSIONS FROM OCTOBER 15, 1914 TO MARCH 31, 1915

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Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

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Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

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Vol. 29, part 1, 1914. Clethraceae—Ericaceae.

Vol. 34, part 1, 1914. Carduaceae (pars).

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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NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. XVI MAY, 1915 No. 185

JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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AT 41 NORTH QUEEN STREET, LANCASTER, PA.

THE NEW ERA PRINTING COMPANY

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MAP OF SITE

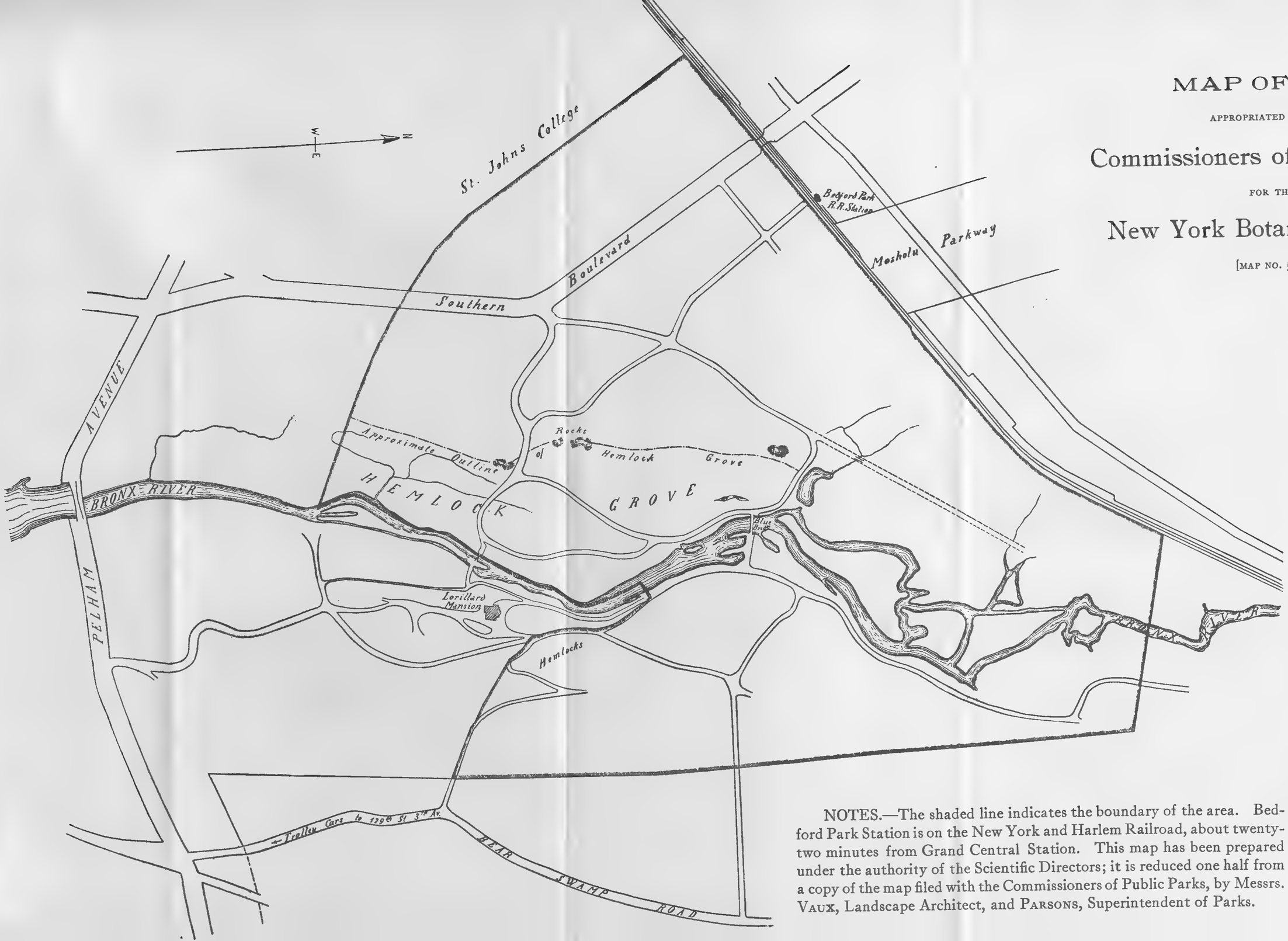
APPROPRIATED BY THE

Commissioners of Public Parks

FOR THE

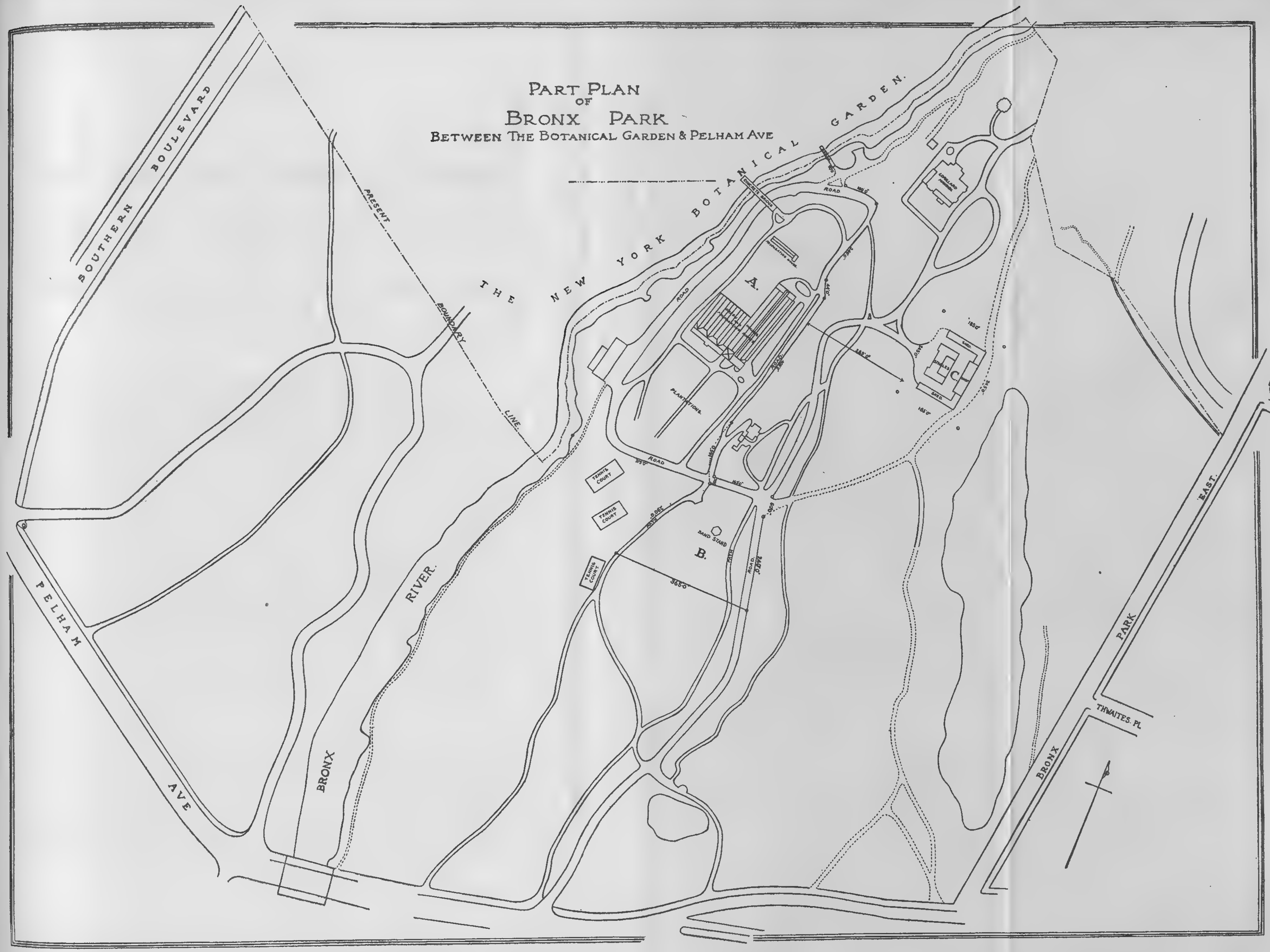
New York Botanical Garden.

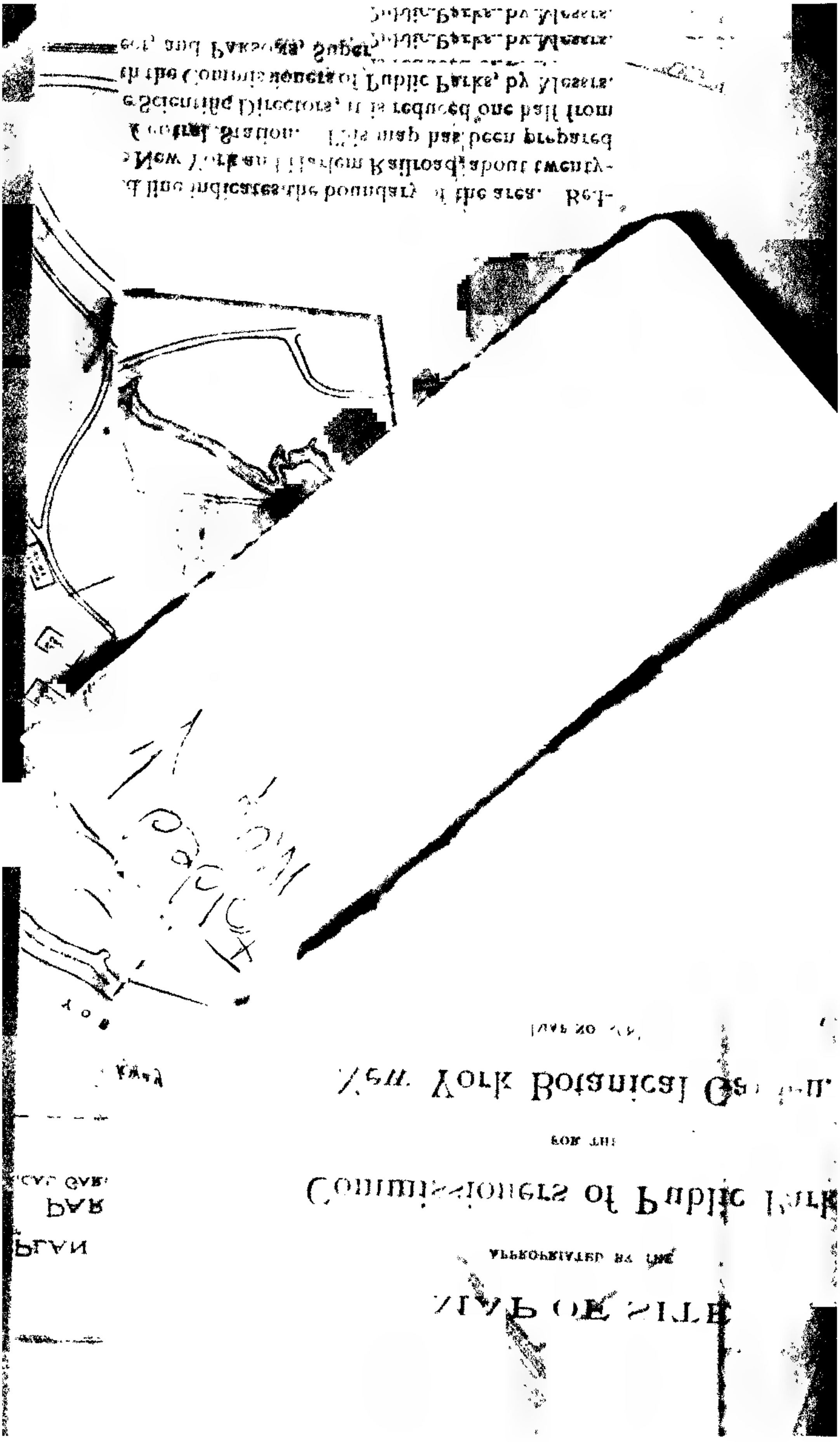
[MAP NO. 568]



NOTES.—The shaded line indicates the boundary of the area. Bedford Park Station is on the New York and Harlem Railroad, about twenty-two minutes from Grand Central Station. This map has been prepared under the authority of the Scientific Directors; it is reduced one half from a copy of the map filed with the Commissioners of Public Parks, by Messrs. VAUX, Landscape Architect, and PARSONS, Superintendent of Parks.

PART PLAN
OF
BRONX PARK
BETWEEN THE BOTANICAL GARDEN & PELHAM AVE





JOURNAL

OF

The New York Botanical Garden

VOL. XVI May, 1915 No. 185

GRANT, BY THE CITY, OF THE USE OF ADDITIONAL LAND IN BRONX PARK

I.

November 9, 1914.

TO THE BOARD OF ESTIMATE AND APPORTIONMENT.

Gentlemen: The Board of Managers of the New York Botanical Garden hereby request, pursuant to the provisions of Chapter 473 of the Laws of the State of New York for 1914, that your Honorable Board will set aside and appropriate, for the extension and development of the work and objects of the New York Botanical Garden, all that portion of Bronx Park shown upon a certain map thereof numbered five hundred and sixty-eight and signed by Messrs. Vaux and Parsons and filed with the former department of public parks of the corporation known as the mayor, aldermen and commonalty of the City of New York (of which map a copy is submitted herewith), situated between the land of Bronx Park heretofore appropriated for the use of the said New York Botanical Garden in Bronx Park and the northern side of Pelham Avenue, upon such conditions as your Honorable Board may deem expedient.

Since the appropriation by the Commissioners of Parks of the present site of the New York Botanical Garden in Bronx Park, by resolution adopted by the Board of Parks July 31, 1895, shown and described on said map No. 568 of the Park Department, the institution has rapidly attained international importance. Through the expenditure of funds derived both from the city

[Journal for April (16: 67-83) was issued May 4, 1915]

and from the public at large, the reservation has been develop
from an area of wild land into an elegant park and garden.
portion of the land has been withdrawn from public use, and t
Board of Managers has conformed in every particular to the p
vision of the act of the legislature establishing the corporati
that the grounds shall be open free to the public daily, includi
Sundays, and that its educational and scientific privileges sh
be open to all alike, male and female. The development inclu
the construction of some four miles of driveways, eight miles
paths, comprehensive systems of drainage and water-supp
the largest greenhouses in America, and the largest botani
museum in the world, which, besides collections open daily
the public, contains laboratories for the use of special studer
and investigators, a large lecture hall, where free public lectu
are delivered on Saturday afternoons and lectures are given
children of the public schools; also a library of selected literatu
on botany, horticulture and related subjects, containing ov
25,000 bound volumes, and the largest herbarium in the Unit
States. The labeled living plants in the grounds and greenhou
include over 13,000 different kinds. The museum of econon
botany, now containing over 8,000 specimens, illustrates t
products of plants utilized in the arts, sciences and industri
A great deal of time and labor has been spent in authenticati
the specimens forming this collection, which is referred to co
tinually as a standard representation of commercial produc
Additions to all the collections are continually being made. T
Garden has published over fifty volumes and parts of wor
containing important contributions to botanical and hortic
tural science and popular accounts of plant life in its varic
phases. Through the expenditure of corporation funds and
gifts from members of the Board of Managers and other frien
over 100 expeditions have been sent to regions little known b
anically and valuable and unique collections have thus be
secured. The expenditure of corporation and private funds,
supplementing city appropriations for development and main
nance of the grounds and buildings, for forming the collecti
of plants, specimens and books, for educational and scient

work and for publication has been $525,482.26, and the total of permanent interest-bearing funds of the corporation, derived mainly from gifts and bequests, now amounts to $522,500. To these may be added a recent bequest of $25,000 by Mrs. Maria DeWitt Jesup, and two other bequests, aggregating $25,000, subject to life interests. The value of the collections of plants, books and specimens already brought together is not less than $400,000.

In the spring and in the autumn, lectures and demonstrations have been given to children from the public schools, accompanied by their teachers, supplementary to the nature-study work of the school curriculum. The total attendance at such lectures since 1905 has been over 115,000, the average attendance at each lecture being about 450. The average attendance at the public Saturday afternoon lectures, which have been given continuously since the museum building was completed in 1898, is about 100. Provision has been made for the further instruction of children and of the general public by detailing assistants to accompany visitors to the grounds, buildings and collections, to answer their questions and to describe the uses and characteristics of plants. Parties of children, from both public and private schools, visit the Garden under the guidance and instruction of their teachers. Very much information is sent by mail, in answer to a constantly increasing number of questions about plants and their uses. The Garden has become one of the chief educational influences of the city, and on account of the scientific work done there attracts many students not only from other educational institutions of the city, but from other parts of the country and from abroad.

In the development of the present reservation, the greatest care has been taken jealously to preserve and retain all natural features, including the forested areas of the Bronx valley and its contiguous hills, and other woodland areas, with special reference to the hemlock forest, and the tracts of meadow at the northern end of the grounds. It has been necessary from landscape considerations also to retain considerable areas in broad lawns. The amount of land remaining available for plantations of trees,

shrubs and other plants has proved insufficient for a satisfactory representation of all kinds of plants which will grow in our latitude, and this is particularly the case as regards trees and shrubs. The greatly increased public interest in trees, and indeed in all plants, during the last few years makes it very desirable that additional space be provided for the further development of the institution.

The land of Bronx Park lying south of the present southern boundary of the Garden reservation and the northern side of Pelham Avenue would furnish this desirable area for expansion. The portion of it now naturally wooded is in direct continuation southward from the forested areas of the present site, and placing the additional land under the control of the Botanical Garden would ensure its uniformity of maintenance and preservation and uniform treatment of the whole of the gorge of the Bronx River, probably the most important and attractive natural feature remaining within the limits of the city. The portions now existing as unplanted and open fields and slopes may be beautified by the planting of trees, and decorative border plantations of flowering shrubs and herbaceous plants may be established along the streets which bound this portion of the park. There would be no need nor desire for the construction of additional buildings on this land, because, when completed, the buildings on the present reservation will be amply sufficient. The buildings now standing on the additional land asked for could be utilized to advantage by the Garden, assuming that arrangements may be made which would not embarrass the Park Department by withdrawing them from their present uses.

In order to avoid the possibility of any embarrassment, the use and control of such buildings as are at present needed by the Park Department might remain with that department until their equivalents might be provided on other park lands. The use of such land about these buildings needed by the Park Department for plant nurseries might also similarly remain with that department.

The appropriation of the additional tract of land would bring the southern boundary of the Botanical Garden south to the

northern side of Pelham Avenue, which avenue would then constitute a natural line of demarcation between the Botanical Garden and the Zoological Park. The area thus added to the Botanical Garden would be subject to all the conditions applying to the present reservation and at all times would be free to the public.

The board of managers of the New York Botanical Garden has referred the presentation of this request to the executive committee and has authorized its signature by the president and the secretary in behalf of the board. If desired the executive committee will appear before your honorable board at such time as may be indicated.

Herewith is submitted a pamphlet containing the act of incorporation, by-laws and other administrative documents, and another pamphlet showing present officers, and membership.

Respectfully submitted,

W. GILMAN THOMPSON,
President,
N. L. BRITTON,
Secretary

II

CITY OF NEW YORK
BOARD OF ESTIMATE AND APPORTIONMENT
Cal. No. 94.

February 3, 1915.

MR. N. L. BRITTON, Secretary,
New York Botanical Garden,
Bronx Park, New York City.

Sir: I transmit herewith certified copy of resolution adopted by the Board of Estimate and Apportionment on January 29, 1915, setting aside and appropriating for the extension and development of the work and objects of the New York Botanical Garden, that portion of Bronx Park situated between the southerly boundary of the land in Bronx Park heretofore appropriated for the use of said The New York Botanical Garden by the board of commissioners of the Department of Public Parks,

and the northern side of Pelham Avenue, as more fully described in the enclosed resolution.

Respectfully,

(Signed) JOSEPH HAAG,

Secretary

(94)

Resolved: That the Board of Estimate and Apportionment, as authorized by Chapter 473 of the Laws of 1914, hereby sets apart and appropriates for the extension and development of the work and objects of The New York Botanical Garden, that portion of Bronx Park in The City of New York situated between the southerly boundary of the land in Bronx Park heretofore appropriated for the use of said The New York Botanical Garden by the board of commissioners of the Department of Public Parks, and the northern side of Pelham Avenue, which is more particularly bounded and described as follows, to wit:

Beginning at a point on the easterly line of the Southern Boulevard, where the said Boulevard intersects the southern boundary line of the Botanical Garden, which point is 1,401 feet north of the northerly line of the Bronx and Pelham Parkway; thence easterly along the line of the southerly boundary line of said Botanical Garden to the middle of the Bronx River, a distance of 1,300 feet; thence northerly along the middle of the Bronx River to a point where the southerly boundary line of the Botanical Garden intersects the said river, a distance of 1,815 feet; thence easterly along the said southerly boundary line to the westerly line of Bronx Park East, a distance of 1,301 feet; thence southerly along the westerly line of Bronx Park East to the northerly line of the Bronx and Pelham Parkway, a distance of 1,393 feet; thence westerly along the northerly line of the Bronx and Pelham Parkway to the easterly line of the Southern Boulevard, a distance of 2,861 feet; thence northerly along the easterly line of the Southern Boulevard to the point of beginning, a distance of 1,401 feet, which said land, including Parcels "*A*," "*B*," and "*C*," excepted and reserved as hereinafter set forth, consists of approximately 150 acres, excepting thereout and re-

serving therefrom, however, all those three certain tracts or parcels of land, respectively bounded and described as follows, to wit:

Parcel "A"—Greenhouses, Propagating Houses and Grounds Adjacent

Beginning at a point on the easterly shore of Bronx River at the intersection of the prolongation westerly of the southerly side of road which forms the southerly boundary of greenhouse grounds; running easterly along said prolongation and said southerly side of road for a distance of approximately 375 feet to the easterly side of road which forms the easterly boundary of greenhouse grounds; thence northwesterly along easterly side of said road for a distance of approximately 165 feet; thence northeasterly along said easterly line of road for a distance of approximately 400 feet; thence northwesterly along said easterly side of road for a distance of approximately 44 feet; thence northeasterly along said easterly side of road for a distance of approximately 240 feet westerly along northerly side of road which forms the northerly boundary of greenhouse grounds for a distance of approximately 100 feet; thence northwesterly for a distance of approximately 90 feet to the easterly shore of Bronx River; thence southerly along the line of the easterly shore of Bronx River to the point or place of beginning.

Parcel "B"—Band Stand and Grounds Adjacent

Beginning at a point 375 feet east of the easterly shore of Bronx River on the southerly side of road which forms the southerly boundary of greenhouse grounds, running thence northwesterly along prolongation southerly of the easterly side of road which forms the easterly boundary of greenhouse grounds for a distance of approximately 20 feet; thence easterly on the northerly side of road which forms the southerly boundary of greenhouse grounds for a distance of approximately 163 feet; thence southerly on the easterly side of main road leading to Pelham Avenue for a distance of approximately 60 feet; thence southeasterly along said easterly side of said road for a distance

of approximately 240 feet; thence westerly for a distance of approximately 365 feet to the westerly side of path; thence northeasterly along westerly side of said path for a distance of approximately 290 feet to the southerly side of road which forms the southerly boundary of greenhouse grounds; thence easterly along said southerly side of said road for a distance of approximately 20 feet to the point or place of beginning.

Parcel "C"—Department Shop and Stables

A rectangular plot 245 feet by 185 feet, lying approximately 285 feet east of the easterly side of road which forms the easterly boundary of greenhouse grounds, and determined by a line distant 35 feet from and running parallel to the four sides of the building known and distinguished as the Department of Parks, Bronx, Stables and Sheds.

The appropriation hereby made is upon the following conditions, to wit:

1. The grounds of the entire tract hereby and heretofore appropriated for the use of said The New York Botanical Garden shall be and continue open and free to the public to the same extent as the grounds heretofore appropriated are now actually open and free to the public.

2. Provision satisfactory to the Board of Estimate and Apportionment shall be made for the accommodation of picnic parties upon the lands hereby and heretofore set apart and appropriated for the use of said The New York Botanical Garden, but not more than ten acres thereof shall be used for such purposes.

3. Upon the direction of the Board of Estimate and Apportionment areas not exceeding five acres in all, within any lands hereby and heretofore set apart and appropriated for the use of said The New York Botanical Garden, may be established for baseball, tennis or other playground uses. The three tennis courts as now laid out may be continued in their present location until substitute locations are agreed upon. If adequate and suitable playground space be made available in Bronx River

Parkway or other park areas, such space within the grounds above set apart and appropriated will not be required. The New York Botanical Garden shall not be subjected to any expense in connection with the provisions of this paragraph.

4. The Commissioner of Parks for the Borough of The Bronx shall retain and have right, power and authority to maintain the existing band stand and may furnish band concerts as heretofore.

A true copy of resolution adopted by the Board of Estimate and Apportionment, January 29, 1915.

(Signed) JOSEPH HAAG,
Secretary

III

At the regular meeting held April 15, 1915, the foregoing communication from the Board of Estimate and Apportionment was presented, and the Managers examined a map accompanying it entitled "Part Plan of Bronx Park between the Botanical Garden and Pelham Avenue," signed by Thomas W. Whittle, Commissioner of Parks, Bronx, showing the three parcels of land reserved for the use of the Park Department, and the inclusion of the Lorillard Mansion and two outbuildings in the land appropriated for the use of the Garden.

On motion of Mr. Stetson, and unanimously carried, the following resolution was adopted:

Resolved: That the Board of the New York Botanical Garden hereby accepts the grant to it by the City of New York, pursuant to the vote of the Board of Estimate and Apportionment, upon January 29, 1915, of the additional land in Bronx Park, as authorized by the Act, Chapter 473 of the Laws of 1914.

A communication was received from the Scientific Directors conveying recommendations relative to the development of the additional land and for uses of the Lorillard Mansion, including proposed necessary repairs to the Lorillard Mansion, the use of its basement for shops and storage and of parts of the upper stories for horticultural laboratories; also the general cleaning up of the tract by the removal of dead trees, stumps and rubbish and the

drainage of stagnant pools, much of which work had already been accomplished during the winter; also that the present use of rooms in the Lorillard Mansion by the Bronx Society of Arts and Sciences be continued, and that the Horticultural Society of New York be permitted to occupy certain rooms in the building as offices. The recommendations were approved and the following resolutions were adopted:

Resolved: That a survey and plans for development of the additional area be obtained from the landscape engineer before any considerable amount of construction or planting be undertaken.

Resolved: That the director-in-chief be, and he hereby is, authorized to continue the permission formerly given the Bronx Society of Arts and Sciences by the Commissioner of Parks of the Borough of the Bronx to occupy a portion of the Lorillard Mansion for museum purposes, until otherwise instructed, it being understood that no expenses directly connected with such museum shall be borne by The New York Botanical Garden.

Resolved: That the director-in-chief be, and he hereby is, authorized to permit the Horticultural Society of New York to occupy rooms in the Lorillard Mansion as offices, until otherwise instructed, it being understood that no expenses directly connected with such occupancy shall be borne by The New York Botanical Garden.

N. L. BRITTON,
Secretary.

IV

This action by the city places the whole of Bronx Park north of Pelham Avenue within the management and control of the New York Botanical Garden, with the exception of three parcels of land east of the Bronx River, on which stand the greenhouses, barn, the old snuff-mill used as a shop, and a band stand, these areas being reserved for the use of the Park Department of the Borough of The Bronx. The original reservation established in 1895 included 250 acres; the present grant adds over 140 acres, making the total area of the Botanical Garden nearly 400 acres, and thus the largest botanical garden in the temperate zones.

The additional land has a frontage of about 1,400 feet on the Southern Boulevard, about 2,860 feet on Pelham Avenue, and about 1,300 feet on the graded but uncompleted Bronx Park East, which bounds the Garden on its entire eastern side, the total frontage on Bronx Park East being about 5,000 feet, or nearly a mile. Both the banks of the Bronx River from Pelham Avenue to Williamsbridge are now included in the reservation, except the portion of the eastern bank extending from the old snuff-mill to a point near the Lorillard Mansion, this stretch forming the western boundary of one of the parcels of land reserved for the Park Department.

The additional land, west of the Bronx River, includes the extreme southern end of the Hemlock Forest, which is now entirely within the Garden reservation; open woodlands in continuation of the deciduous woods west of the hemlock grove southward to Pelham Avenue; and considerable areas of open fields and slopes available for new plantations. East of the Bronx River, there are other well-wooded areas, open fields and glades suitable for plantations, and a fine large lake seated deep among rocky ridges. The natural features of the tract are thus very attractive and the policy of maintaining them as those of the older reservation have been maintained will be followed.

The driveway system of the additional land is, for the most part, already constructed, though an important connection east of the Bronx River remains uncompleted; it will be necessary, however, to construct several miles of paths after a complete plan of development has been adopted, the study of which has already been commenced. Improvements were begun soon after the action of the Board of Estimate and Apportionment by the removal of over 1,000 dead, diseased or otherwise undesirable trees and of a large number of stumps, by gathering together and carting away many cart loads of fallen limbs and rubbish, and by the labeling of over 350 trees; the patrol by Garden keepers has been extended through the tract on both sides of the river; rough banks at the Linnaean Bridge on Pelham Avenue have been graded and planted, and ditches have been dug and opened to drain some mosquito-breeding and unsightly pools.

Much of the forest, grading and drainage work done has been accomplished, in part, through coöperation with the New York Association for Improving the Condition of the Poor, by means of an arrangement entered into with that association early in March, and still in force. The association sends about twenty men to the Garden each day, the same men on alternate days of the week, and supplies funds for their daily wages. The men are scattered around on various pieces of work mixed in with trained laborers and gardeners, work the same hours, and are discharged if inefficient, others sent by the Association taking their places. This experiment has been of the very greatest interest to the officials of the Garden and of the Association for Improving the Condition of the Poor, inasmuch as it has proven to be an effective way of having necessary work done and at the same time distributing money to persons very much in need of it.

The Lorillard Mansion, picturesquely located just east of the Bronx River and high above it, comes to the uses of the Garden with the additional land. The house is well and substantially built of stone and dates from 1856. It needs painting and considerable carpenter work to put it in repair and will be very useful for a variety of purposes. Near it stand a large and fine *Paulownia* tree, probably planted about the time the house was built, and a very fine and interesting weeping beech. There are many other large and fine trees within the new reservation.

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

THE TWENTIETH ANNIVERSARY OF THE NEW YORK BOTANICAL GARDEN

The twentieth anniversary of the appropriation by the City of New York of 250 acres of land in Bronx Park for the use of the New York Botanical Garden will be commemorated at the Garden during the week commencing September 6, 1915. Botanists from all parts of North America are invited to attend. The following program is planned:

Monday, September 6th

Assemble at the Garden as convenient in the morning.

1:30 Lunch at the Garden.

2:30 Addresses of welcome and an account of the history of the Garden.

3:30–5:30 Inspection of a portion of the grounds and buildings.

5:30–7:00 Visit to the Zoological Park.

Tuesday, September 7th

10:30–1:00 Session for the reading of papers.

1:30 Lunch at the Garden.

2:30–4:00 Session for the reading of papers.

4:00–6:00 Inspection of portions of the buildings and grounds.

Wednesday, September 8th

Salt Water Day on Staten Island, for a study of the coastal flora. Lunch at 1:30, with subsequent opportunity for scientific oratory.

Thursday, September 9th

10:30–1:00 Session for the reading of papers.

1:30 Lunch at the Garden.

2:30–4:00 Session for the reading of papers.

4:00–6:00 Inspection of portions of the grounds and buildings.

Friday, September 10th

Visit to the pine barrens of New Jersey, under the guidance of the Torrey Botanical Club.

Saturday, September 11th

Visit to the Brooklyn Botanic Garden and an excursion to some Long Island locality.

Other excursions of more special characters will be organized if opportunity offers.

SPRING INSPECTION OF GROUNDS, BUILDINGS, AND COLLECTIONS

The Spring Inspection of the grounds, buildings, and collections took place on the afternoon of May 6, under ideal weather conditions, when over four hundred members of the Garden and their friends assembled at the Botanical Garden Station Plaza in response to an invitation from the Women's Auxiliary and a Committee of the Board of Managers.

Dr. W. Gilman Thompson, President of the Board of Managers, made the address of welcome at the north entrance to the Main Conservatory Range, after which Dr. N. L. Britton, Director-in-Chief, called attention to the new plantation of rhododendrons purchased with the income of the John Innes Kane Fund and then led the procession through the surrounding gardens and afterwards to the Herbaceous Garden Valley, the Hemlock Forest, the Water Gardens and Lakes, the Fruticetum Plaza, Conservatory Range 2, and the Japanese Cherry Orchard.

The collection of Japanese cherry trees, consisting of one hundred trees of various varieties given by Mrs. Florence K. Sturgis, proved very attractive and it was difficult to assemble the party for the scheduled motor-car trip through the Arboretum and the portion of the Bronx Park, about 150 acres, recently added by the City to the Garden Reservation.

Tea was served in the Museum Building at five o'clock, and plants of tea, coffee, chocolate, and sugar cane were exhibited. The tea table was attractively decorated under the direction of Mrs. George W. Perkins.

The guests were afterwards guided through the museums, library, herbarium, and laboratories by members of the Garden staff.

SUMMER LECTURES, 1915

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

June 5. "A Rose Garden for Every Home," by Mr. Robert Pyle.

A Group of Members Inspecting the Japanese Cherry Collection

June 12. "Dwarf Fruit Trees for Suburban Homes," by Prof. F. A. Waugh.

June 19. "Philippine Fiber Plants and Their Uses," by Mr. Theodore Muller.

June 26. "The Upper Delaware Valley and Its Flora," by Mr. G. V. Nash.

July 3. "Some Interesting Plants of the Rocky Mountains," by Dr. P. A. Rydberg.

July 10. "The Poisonous Plants of the Eastern United States," by Dr. William Mansfield.

July 17. "Botanic and Scenic Features of the Dells of the Wisconsin River," by Dr. A. B. Stout.

July 24. "Botanizing on the Austro-Italian Border," by Dr. W. A. Murrill.

July 31. "The Library of the New York Botanical Garden," by Dr. J. H. Barnhart.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for cross-town trolley, transferring north at Third Avenue.

CONFERENCE NOTES FOR APRIL

The April conference of the scientific staff and registered students of the New York Botanical Garden was held in the laboratory of the museum building, Wednesday, April 7, at 4:00 P. M.

The program presented was as follows:

"The Value of Leaf-hairs in Determining Fern Species," by

Miss Margaret Slosson. After calling attention to the comparatively well-known fact of the constancy of scale-characters, and their consequent value in determining fern species, it was stated that as great a constancy exists in the characters of the leaf-hairs. Citations were given from the recently published first part of Mr. Carl Christensen's "Monograph of the Genus *Dryopteris*," in which characters of both scales and leaf-hairs are employed in delimiting the subgenera. The diversity of leaf-hairs in various species was discussed, and specimens of two groups of species of *Dryopteris*, belonging to the subgenus *Goniopteris*, together with drawings of their leaf-hairs, were shown. It was stated that while in each group the two or three units composing it are so much alike in general appearance as to be almost surely sometimes mistaken for one another, the certain differences in general appearance that distinguish each appear to be constant and have always been found to be correlated with strikingly peculiar and distinctive leaf-hairs, showing each unit to be a good species. It was concluded that cases of this kind render such vague terms as "leaf pubescent" or "stipe hispidulous," commonly found in specific descriptions, practically meaningless, and make it not only advisable but often absolutely necessary, when describing a species, to furnish exact and detailed descriptions or illustrations of the leaf's trichomes, of whatever kind.

"Grasslands of the Montaine and Subalpine Zones of the Rockies," by Dr. P. A. Rydberg. The paper presented by Dr. Rydberg will appear soon in the *Bulletin of the Torrey Botanical Club*.

A. B. STOUT,
Secretary of the Conference

NOTES, NEWS AND COMMENT

Professor H. H. Whetzel, of Cornell University, recently spent several days at the Garden in the study of herbarium material of *Botrytis*.

Mr. J. B. Norton, physiologist in the Bureau of Plant Industry, was at the Garden several days during April for a study of herbarium specimens of *Asparagus* and *Smilax*. From New York Mr. Norton went to Concord, Massachusetts, where he has charge of breeding experiments with *Asparagus*.

Professor and Mrs. N. Wille sailed for Christiania, Norway, on May 1. Dr. Wille has been in America nearly eight months, most of which was spent in a study of the fresh water algae of Porto Rico under the auspices of the New York Botanical Garden.

Dr. Rusby's article on "The Influence of Radioactive Earth on Plant Growth and Crop Production" which appeared in the January issue of the *Journal* has been reprinted in *Radium*, **4**: numbers 4 and 5 and in the *Scientific American Supplement*, **79**: numbers 2048 and 2049.

Meteorology for April.—The total precipitation for the month was 2.67 inches. The maximum temperatures for each week were 57° on the 2d, 72° on the 8th and on the 18th, 92° on the 25th, and 95° on the 27th. The minimum temperatures were 26° on the 4th, 37° on the 8th, and 35° on the 15th and on the 22d.

ACCESSIONS

MUSEUMS AND HERBARIUM

50 specimens, "Phycotheca Boreale-Americana," fascicle XLI, for the Columbia University Herbarium. (Distributed by Collins, Holden, & Setchell.)

1 specimen of *Lepuropetalon spathulatum* from Louisiana. (Given by Mr. W. R. Griffing.)

287 specimens of flowering plants from Alberta. (Collected by Miss M. E. Moodie.)

145 specimens of flowering plants from the Rocky Mountains. (Collected by Mr. L. O. Overholts.)

1 specimen of *Micranthes texana* from Texas. (Given by Mr. D. A. Saunders.)

2 specimens of flowering plants from Florida. (Given by Mr. Severin Rapp.)

840 specimens of flowering plants from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

700 specimens of flowering plants from South America. (Collected by Dr. J. N. Rose.)

10 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

2 specimens of fungi from Missouri. (By exchange with Mr. L. O. Overholts.)

200 specimens "North American Uredinales" centuries 12 and 13. (Distributed by Mr. Elam Bartholomew.)

6 specimens of fungi from Wisconsin. (By exchange with Dr. J. J. Davis.)

3 specimens of fungi from California. (By exchange with Stanford University.)

2 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

25 specimens of fungi from Colorado. (By exchange with Mr. L. O. Overholts.)

4 specimens of fungi from North Carolina. (By exchange with Professor H. C. Beardslee.)

32 specimens of fungi from North Carolina. (By exchange with Dr. W. C. Coker.)

2 specimens, *Fomes putearius* and *Trametes setosus* from Montana. (By exchange with Professor J. R. Weir.)

6 specimens of fungi from Pennsylvania. (By exchange with Professor C. R. Orton.)

2 specimens of fungi from Oregon. (By exchange with Mr. C. E. Owens.)

1 specimen of fungus from California. (By exchange with Mr. L. O. Overholts.)

2 specimens of fungi from North Carolina. (By exchange with Professor H. C. Beardslee.)

4 specimens of fungi from Oregon. (By exchange with Mr. C. E. Owens.)

1 specimen of fungus from New Mexico. (By exchange with Mr. Paul C. Standley.)

1 specimen of fungus from Montana. (By exchange with Dr. J. C. Arthur.)

2 specimens of fungi from Colorado. (By exchange with Mr. Elam Bartholomew.)

1 specimen of *Lachnea Erinaceus* from Ohio. (By exchange with Professor Bruce Fink.)

100 specimens of fungi from the Philippines, "Fungi Malayana." (Distributed by Professor C. F. Baker.)

54 specimens of fungi from California. (By exchange with the University of California.)

2 specimens of fungi from Colorado. (By exchange with Mr. L. O. Overholts.)

14 specimens of fungi from Pennsylvania. (By exchange with Professor C. R. Orton.)

100 specimens, "Fungi Columbiani," century 46. (Distributed by Mr. Elam Bartholomew.)

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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JOURNAL
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The New York Botanical Garden

VOL. XVI June, 1915 No. 186

FURTHER BOTANICAL EXPLORATION OF PORTO RICO

TO THE SCIENTIFIC DIRECTORS.

Gentlemen: In continuation of our botanical exploration of Porto Rico, as a part of the scientific survey of that island undertaken by the New York Academy of Sciences, in coöperation with the insular government, the American Museum of Natural History and other institutions, I left New York on January 30 and returned on March 29, accompanied by Mrs. Britton, by Mr. J. F. Cowell, Director of the Buffalo Botanical Garden, who had been with us in Porto Rico on two previous expeditions,* and by Mr. Stewardson Brown, Curator of Botany at the Philadelphia Academy of Natural Sciences. Our object was to obtain additional knowledge of the wild plants of Porto Rico, their distribution over the island in relation to soil, altitude and rainfall, and to increase our collections of living plants, herbarium and museum specimens. We visited parts of the island which we had not previously explored and collected more than 8,000 specimens represented by 1,925 field numbers. Many duplicates of rare or otherwise interesting species were obtained for use in exchanges with other gardens and museums.

Professor N. Wille, of the University of Christiania, Norway, and Director of the Botanical Garden of Christiania, an expert

* Journ. N. Y. Bot. Gard. 7: 125–139; 15: 95–103.

[Journal for May (16: 85-102) was issued June 12, 1915]

on fresh-water algae, who came to the United States in the autumn of 1914 to attend the 150th anniversary of Brown University and the 25th anniversary of the Missouri Botanical Garden, and who found it unnecessary to return to Norway until the spring of 1915, was commissioned in December to proceed to Porto Rico, to collect and study the fresh-water algae, under an appropriation from the income of the Darius Ogden Mills Fund. During the latter part of December and through January he collected in the eastern part of Porto Rico; Mrs. Wille accompanied us southward and joined him in San Juan and thereafter Professor and Mrs. Wille travelled with us through the western and central parts of the island. The fresh-water algal flora proved to be unexpectedly rich, and Professor Wille made an enormous collection of these minute plants, aggregating probably over 20,000 specimens, included in over 2,000 field numbers; he has taken a set of these to Norway for further study; his preliminary report is submitted with this narrative.

On arriving at San Juan, I called upon His Excellency, Dr. Arthur Yager, Governor of Porto Rico, and expressed our high appreciation of his continued interest in the scientific survey. Field work was at once commenced on February 5 by a visit to the Laguna Tortuguero, on the northern coast near Manati, and the sandy region about it; both the lake, which is the longest body of fresh water on the island, being about 3 miles long, and the silicious sandy country proved exceedingly interesting, there being here a characteristic flora. The borders of the lake are fringed with the West Indian water-snowflake (*Nymphoides*) and by rare sedges and here we found a yellow-eyed grass (*Xyris*) and a minute terrestrial bladderwort (*Utricularia*), reminding us of coastal New Jersey. The silica-sand plain recalled the similar formation enclosing the Laguna Santa Maria in western Cuba. This district should be further studied.

The party proceeded to Mayaguez on February 6, and made that city a base of operations for eighteen days; we gratefully acknowledge aid and advice from Mr. D. W. May, Director of the Agricultural Experiment Station, from Professor R. S.

Garwood, Dean of the Agricultural College, and from Mr. Theodor Holm, a resident botanist. On February 6 we made collections on Monte Mesa; on February 7 we proceeded to La Juanita, an hacienda in the mountains near Las Marias, and explored a considerable tract of primaeval forest, one of the few remaining tracts easily accessible from Mayaguez, rich in ferns, mosses and other cryptogams.

February 9 was given to a visit to Sabana Grande, to see the colony of maguey (*Agave*) on the dry mountain side about two miles northward of that town, at Santa Ana, and to which we were kindly directed by Don Jose H. Torres Velez, of the Sabana Grande School, and his brother; the locality is underlain by serpentine rock, which occupies great areas in western Porto Rico; the Agaves are abundant there and plants and specimens were obtained; they are associated with a dry country flora of considerable variety. Collections were also made along a river between San German and Sabana Grande.

On February 10 we travelled by motor-car to Maricao, in the western mountains, for the purpose of making arrangements for subsequent work at the higher altitudes, making some collections in the river valley there and at the hacienda Camila, on the way.

Guanajibo, a serpentine ridge on the coast south of Mayaguez, was studied on February 11. Four days were then devoted to exploring the mountains in the vicinity of Maricao, at altitudes from 1,500 to 2,500 feet, including the stiff clay slopes near the town, Monte Montoso, a conic mountain of about 2,500 feet elevation, the valley of the Maricao River and the woodlands and slopes of the hacienda La Chiquita. There is considerable original forest in the upper part of the valley, but we were informed that preparations were being made to fell much of it; excepting the Luquillo Mountain forest reserve in eastern Porto Rico, there is now very little forest remaining on the island, and for the future welfare of the colony it is imperative that a policy of conservation and reforestation be adopted; on Monte Montoso it is all destroyed except a few acres on the very summit. Extensive collections of mountain and forest plants were made during this four-day period.

On February 17 we studied the limestone hills between the towns of Cabo Rojo and San German, which were found to be craggy, with a small area of forest of common trees, but among them, on the jagged rocks, is the greatest growth of the giant *Philodendron* (Aroid Family) which we had ever seen, its great elephant-ear leaves over five feet long, the plants forming masses difficult to penetrate, a wonderful sight. February 18 was given to a further study of Guanajibo, proceeding south along the western coast to Joyuda, one of the centers of the Porto Rican palm-hat industry; these hats, for reasons of trade called panamas, are woven by women and girls from the leaf-fibers of the Porto Rico palmetto (*Sabal causiarum*). Near the rocky coast beyond Guanajibo we were delighted to find a very rare tree, whose flowers were hitherto unknown, profusely in bloom; it is the Porto Rican *Badiera*, a genus of trees and shrubs of the Milkwort Family (Polygalaceae), very different from our northern herbaceous Polygalas, and restricted, so far as is known, to the West Indies; one species inhabits Jamaica, there are five or six in Cuba, one in the Bahamas, two in Hispaniola and the one here recorded in Porto Rico; a close study of its flowers will indicate to which of the other species it is most nearly related. A successful search was made here for a species of *Psychotria*, a shrub of the Madder Family, found by a German botanist in the vicinity many years ago, otherwise recorded only from Hispaniola.

Four more days were then given to exploration in the western mountains, Mrs. Britton remaining in Mayaguez to care for the extensive collections already accumulated. Camp was pitched at Indiera Fria, on the mountain road from Maricao to Sabana Grande, at about 1,300 feet altitude, and the forests in this vicinity were studied up to altitudes of about 2,400 feet. Among the many interesting plants collected were three species of the Burmannia Family, living in rich leaf-mould; these are small plants, not over six inches high, related to orchids, noteworthy on account of their rarity, and for being devoid of leaves and of green coloring matter, being typical saprophytes; of the three, one has white flowers, one violet and one blue, and all grow

together in limited numbers of individuals. Our work in the western mountains, here, as at Maricao, was impeded by frequent rains, highly favorable to the growth of fungi, of which many species were collected.

On February 24 the expedition was divided; Mr. Cowell, Mr. Brown and I sailed on the chartered sloop "Dama" for a study of the southwestern coasts, a cruise which extended over seventeen days, ending at Ponce; Mrs. Britton escorted Professor and Mrs. Wille to Arecibo, on the northern coast, and thence to Utuado and Adjuntas in the mountains, rejoining us at Ponce.

Our first landing from the "Dama" was made at Punta Guaniquilla, at the northern side of Boqueron Bay; it was very interesting to observe here the most northern distribution along the coast of some characteristically arid-country plants, among them several fine specimens of the largest cactus of the Porto Rico mainland, *Cephalocereus Royeni.* Good anchorage was had at Salinas de Boqueron on the south side of the bay, where there is an extensive salt industry, and on February 25 the limestone hills above the salt ponds were studied; here the number of kinds of dry country plants becomes noteworthy, Lignum Vitae, for example, being abundant, its beautiful blue flowers conspicuous at this time.

The coastal limestone hills and bluffs from Punta Melones to Punta Casabe, just south of Boqueron Bay, were studied on February 26. Here cacti become abundant, indicating the progressively smaller rainfall as we proceed southward. The Turk's-head or melon cactus, *melon de spina* of the Porto Ricans, has probably given the name Punta Melones. South of these hills are plains of little elevation, *llanos*, with excellent soil, but exceedingly low rainfall, extending to the southern coast, and with characteristic vegetation.

Our next anchorage was under the lighthouse hill of Morrillos de Cabo Rojo, the extreme southwestern point of Porto Rico, and near another extensive series of salt ponds, Salinas de Cabo Rojo; three days were given to studies of this arid region; a considerable shower, here a most unusual event, was welcomed by the inhabitants and by us, for we were enabled to fill one of

our casks with rain water from a cistern. There are here several isolated limestone hills and benches, apparently of different age and origin from the hills south of Boqueron Bay, but we could not find any fossils. Collections of plants were made at Punta Aguila, on extensive low sand dunes bordering the saline plains, on the two hills at the lighthouse and in a patch of the characteristic low forest, the trees averaging only about 20 feet high, which we were fortunate to find back of Playa Sucia Bay. Lichens are very abundant and of many species on the rocks and trees of this region, and many were taken to aid the studies of Professor L. W. Riddle, of Wellesley College.

Sailing westward during the night of March 2, under the full moon, we cast anchor the next morning in the harbor of Montalva, and the three following days were spent in that vicinity, where there are more salt ponds, coastal limestone hills, an area underlain by eruptive rocks, and a second range of limestone hills back from the coast. A crimson morning-glory, seen in small quantities elsewhere in the arid region, was a floral feature at Punta Montalva.

Landing on a small low cayo near the east side of Montalva Harbor, called Islita de la Montalva, on the morning of March 4, we were much interested to find it almost entirely covered by an Indian shell-heap about 400 × 200 feet in area, and delighted to find on the surface many fragments of pottery, some of them characteristically ornamented; the abundance of these fragments indicates that this large shell-heap has not yet been visited by an archaeologist.

Here we also observed a dyke of eruptive rocks apparently about 20 feet wide, with limestone on each side of it, and in the limestone near its contact with the eruptive two species of fossil corals were collected, their structure much distorted by the baking the limestone received from the fluid intrusion. There are many other indications of fossils here, but they are mostly roasted beyond recognition; inasmuch as fossils of any kind appear to be very rare in the limestone of the district, these corals are of scientific value.

The botany of this little island was uninteresting, excepting a

vigorous growth of *Alternanthera portoricensis*, a species of the Amaranth Family, known only on Porto Rico and, as previously found by one of our expeditions, on Anagada.

Our next anchorage was in the fine harbor of Guanica near the great Sugar Mill, where we arrived on March 5 and were cordially received by officials of the sugar company and where we remained until the afternoon of March 8, collecting upon the coastal limestone hills, including a visit to Salinas de Guanica. Further studies were made of the cacti which grow here in such noteworthy abundance, and which we had investigated on a previous visit,* and many other plants of the arid region were collected.

Cayo Muertos, an island situated about 7 miles off the southern coast some 8 miles east of Ponce, was our next point of examination from March 9 to 12, and this work closed the cruise of the "Dama." The island is about a mile and one-half long and averages somewhat less than half a mile wide; its topography is peculiar; the longer axis lies northeast and southwest; from the sea level at the northeastern end a rough limestone hill rises gradually to about the middle of the island, reaching a height of nearly 250 feet, on which the lighthouse is situated, ending abruptly in a nearly vertical cliff and talus over 200 feet high, under which is a level plain half a mile long only a few feet above the sea, the southwestern end being another, smaller limestone hill about 100 feet high, the connecting plain so low and level that from a few miles away the two hills appear as separate islands. Cayo Muertos had not been previously studied botanically; we collected specimens of 130 species and took notes on 42 others; it is one of the most difficult islands to explore that we have seen, the low shrubby vegetation being very dense, impenetrable, for the most part, without continuous use of the machete, and the surface of the hills exceedingly rough. The only inhabitants are the family of the lighthouse keeper and one negro. There are areas of arable land on the plain, some of them bearing a luxuriant growth of guinea-grass. The vegetation is mostly of characteristic low trees and shrubs of the Porto Rico mainlaid arid region, but many of these are wanting, and

* Journ. N. Y. Bot. Gard. 14: 104.

a few very interesting species occur which are not known on the mainland; the large columnar cactus *Lemaireocereus hystrix* is abundant, and very luxuriant; a small yellow-flowered *Portulaca* with globular leaves interested us exceedingly. The density of the vegetation and the difficult walking prevented our making a complete investigation in the time at our command; more organization would be necessary.

We dismissed the "Dama" at Ponce Playa on March 12. Mrs. Britton, with Professor and Mrs. Wille, had arrived at Ponce the previous day, having made considerable collections about Arecibo, Utuado and Adjuntas. She fortunately obtained through the courtesy of Senor Bartolome Barcelo of Adjuntas, nuts and foliage of the Porto Rico walnut, now a very rare tree, and, at Hatillo, living plants and specimens of one of the water-lilies, from a small pond in which the plant was beautifully in flower.

On March 13 the whole party went by motor-car to study the primaeval mountain forest at Arroyo de los Corchos on the road between Adjuntas and Jayuya, a very profitable expedition, which yielded many specimens of ferns, mosses and other cryptogams; the many filmy-ferns growing on tree-fern trunks and on wet rocks of the ravine were especially attractive; here we saw for the first time, with much interest, wild vines of the chocho (*Sechium edule*), *chayote* of the Porto Ricans, a long vine of the Gourd Family, its fruit important as food, widely cultivated in tropical America, but indigenous only in Porto Rico.

A small collection of cryptogams was also made at Corral Viejo, near Ponce. The dry Vigia hill at Ponce was visited on the afternoon of March 14. The following day Mr. Cowell and Professor Wille went by motor to Jayuya, dropping off Mr. Brown and Dr. Britton at the junction of the Jayuya road with the main road from Ponce to Adjuntas, from which point the summit of Monte Cerrote was reached and a considerable area of primaeval forest was traversed, which yielded another large collection of mountain forest species. Mr. Cowell collected in a tract of forest on the Jayuya road. On the afternoon of March 16 studies were made at a limestone hill a short distance east of Ponce. March 17 was given to a visit by motor-car to

Lake Guanica, where we had previously collected, with the especial object of enabling Professor Wille to study its water plants. The trip was under the guidance of Dr. Morse, of Guanica, and we gratefully appreciate his courtesy. One of the limestone hills which rises about 400 feet above the lake was studied, and fine plants of the endemic Porto Rican cycad, *Zamia portoricensis*, were collected, as well as a few other unusual species.

On March 18 a trip was made to the coastal marshes and plains between Ponce and Santa Isabel, where several interesting grasses were obtained and further studies made of cacti and Agaves. One of the villages along the road lies right among these desert plants, with scarcely any other vegetation in evidence and a nearly barren saline plain behind it, a quite extraordinary settlement. In the afternoon we moved our base to Coamo Springs, and gave the two following days to studies of Monte Torrecilla, near Barranquitas in the central part of the island, the base of which was reached by motor-car to a point on the Barranquitas-Barros road at about 2,000 feet elevation, and followed by a steep climb of about 1,300 feet to the summits. This interesting mountain is the highest in the central part of the cordillera; it is composed of exceedingly hard igneous rocks weathered into several peaks with connecting ridges, somewhat suggestive of the remnant of an ancient volcano. Primeval forest, aggregating perhaps 200 acres, recently much reduced for banana planting, remains on the summits, and here we found and collected a number of plants not seen by us on other mountains. The mountain palm, *Acrista monticola*, common in Porto Rican mountain woodlands, is the most abundant tree, but above its zone on the highest point a number of rare and characteristic shrubs, vines and small trees occur, reached by a stiff hand-over-hand scramble up a slope overgrown by the strong mountain grass *Isachne*. An extended and instructive view of Porto Rico is had from this elevation, and the deforested character of the country is painfully evident. During the ascent of the mountain, Mrs. Britton made collections of cryptogams along the small stream at its base. After work in preserving

the collections at Coamo Springs and studies on Agaves and of the beautiful flowering tree *Phlebotaenia Cowellii*, endemic in Porto Rico, we travelled across the island to San Juan on March 22.

The final excursion of the expedition was made on March 23, when we visited the sandy plain at Sabana Abajo, near Carolina, where the large rose-pink *Hibiscus* was beautifully in bloom, its flowers similar to those of our northern coastal rose-mallow; a number of species previously found in the similar sand-formation at Laguna Tortuguero were collected. We also visited Loiza, a very interesting coastal settlement farther east and studied coastal marshes, sand dunes, and low limestone hills under the guidance of Mr. Easterling, of the Loiza School; a large cavern, occupying nearly the whole of one of these little hills, its rocks containing many fossils, will be of especial interest to the geologists of the Survey. During our coastal work, and to some extent inland, geological specimens were collected and notes taken for the studies of Professor Kemp and Berkey; favorable localities for the collection of marine invertebrates were noted for the information of Professor Crampton and other zoologists of the Survey, and considerable collections of land snails were made for the American Museum of Natural History.

Both Mr. Brown and Mr. Cowell carried cameras, and thus many photographs were obtained of plants, landscapes and other features.

The expedition was accomplished without either accident or serious inconvenience, and its scientific results will be important.

Respectfully submitted,

N. L. BRITTON,

Director-in-Chief.

STOKES PRIZE ESSAYS*

The Preservation of Our Native Wild Flowers

Americans are said to be extravagant people, wasting their natural resources. To deny the charge would be useless. Consider how we have destroyed our forests, our native birds, fishes, and our wild flowers. The preservation of forests, of wild birds, of fishes and animals is more readily accomplished by the action of a whole community, but the preservation of wild flowers can be best accomplished by the individual efforts of every nature-lover.

Can you imagine a world when no *Jack-in-the-pulpit* will greet you in the early days of springtime? And indeed, the beauty of nature would be gone without our *trailing arbutus*. Each time you pull up a flower with its tender roots you hasten the day of its extinction. The next year the flower will not be there. With a careless hand you pull it up and with a careless hand you fling it down. Every time you walk through the woods you should think of nature's labor in bringing to life these beautiful creations. But the trouble with us as a nation is that we do not stop to think about it and each year fewer plants push out their shoots from under the winter snow.

If laws were made against picking wild flowers with their roots, would it avail? Connecticut passed a law calling it a misdemeanor for anyone to pick the *trailing arbutus* with its roots. Do you think such a law would avail us anything if we ourselves do not think of it and consider the results of our course?

It is very harmful to pull up the plants by their roots, but it is no less bad to pull off every flower from the plant. No progress is worse than a down-hill course. The plant can not send out seeds each year if it has no flowers left with which to produce them. You may keep the *laurel* or the *dogwood* in a vase on your table, but it will die in a few days. Rather, let it

* These essays were submitted on Arbor Day, May 7, 1915, in competition for the eight colored pictures of "Wild Flowers Needing Protection" framed and presented by the New York Botanical Garden to the High Schools and Public Schools of New York City, through the aid of the Fund for the Preservation of Native Plants, donated by Caroline and Olivia Phelps Stokes.

remain in its native haunts to brighten the lives of many others, and when the time comes to shed its petals it can produce seeds to insure next year's growth.

Now is the time of year when the call of spring enters each heart. The woods, the flowers, the birds and the brook call us from our everyday pastimes. Now is the time to heed the warning of nature, for each year fewer plants of some species are seen than the year before. When you stop to admire the orange and red of the *wild columbine*, stop only to admire and leave it for the next passer-by to also admire. Do not be selfish in your enjoyment of nature. Think of the future. What distinguishes the civilized man from a barbarian or an animal is his outlook for the oncoming generations. If that is the standard of judgment, our treatment of the wild flowers can hardly be called civilized. Some day the *spring beauty*, the *bird's-foot violet* or the *wild azalea* will be a thing of the past, only read about in beautiful poems, unless we wake up and attend to a most needed reform, the preservation of our native wild flowers.

SARAH BARISH.

THE GIRLS' HIGH SCHOOL,
BROOKLYN, N. Y. CITY.
DR. WILLIAM L. FELTER, *Principal.*

TREATMENT OF OUR WILD FLOWERS

We often hear older people say, "Little children love one another." Does this not mean that we should also love Mother Nature's children, the wild flowers of the woods? These little creatures need the protection of all boys and girls, for almost all children claim they are fond of flowers. "Oh, how I love flowers!" is a common expression; but this love is demonstrated in a peculiar fashion. The children who make this remark visit the places where they know the fairies of the woods bloom thickest, they pick numberless quantities of them, pull down lovely branches, and even root up some of the plants. Then it is often impossible for them to reach their destination without being withered, and so they are thrown away. Poor little unprotected children of the woods!

"Were ye born to be
An hour or half's delight,
And so to bid good-night?
'Twas pity nature brought ye forth,
Merely to show your worth,
And lose you quite."

If a child earnestly loves flowers, then let him remember when he visits the woods not to pick every flower in sight, but to take only a few to make his home cheerful. Let him use self-control to help him to keep from picking every blossom within reach. Numbers of them should be left for the development of seeds for the year to come. He should not rob the woods just for the short-lived pleasure it will afford. Let him not take the roots for they are of no use in a bunch of flowers and taking them means the complete extinction of ever so many flower families. There are some flowers that are in need of protection more than others. The spring beauty, wild pink, jack-in-the-pulpit, wild columbine, bird's-foot violet, wild azalea, pink moccasin flower, arbutus, hepatica and laurel will soon be out of existence unless they are carefully guarded. Asters, golden-rods, daisies, buttercups, dandelions and clover are so plentiful and spread so rapidly that they may be gathered without harm.

It would be a good plan for children in New York to unite and form a league to preserve our wild flowers. To those who wish to become members we might put the poet's question,—

"Hast thou
Loved the wood-rose and left it on its stalk?"

then

"Be my friend and teach me to be thine."

JULIA GODSON—6B[3]

P. S. No. 76, Manhattan,
MISS MARY A. MAGOVERN, *Principal*

THE PROTECTION OF THE PARKS

Everybody should try to do something to celebrate Arbor Day. We all know that in a crowded city like New York it is impossible for everybody to plant a tree. But it is possible for everybody to plant some flowers in a small window box.

Our city contains many large and beautiful parks. Everybody

enjoys going to the parks. If you are in the park and wish to eat lunch do not throw any papers or food on the grass. Put it in the nearest waste can, they are numerous in every park. Do not tear the grass, flowers or trees, for they do not belong to you. They belong to every citizen.

Mayor Mitchel insists that the park shall be kept in good condition. If any person tears branches, picks flowers, destroys benches, or throws paper on the grass and walks, he will be arrested. Plain clothes men will be on the lookout for people who violate the law.

SARAH FEINSTEIN.

Public School 65 G, Manhattan,
MISS ELIZABETH S. HARRIS, *Principal*

NOTES, NEWS AND COMMENT

The first annual meeting of the Women's National Agricultural and Horticultural Association, with an exhibit of members' work, was held at the Garden under the auspices of the Horticultural Society of New York on May 7. Very important and interesting addresses were given at the morning and afternoon sessions by Dr. S. E. Persons, Mr. Arthur D. Dean, Mr. D. G. Fuld, Mr. George T. Powell, Mr. Samuel Fels, Miss Louise Klein Miller, and Dr. C. D. Jarvis. The Association was welcomed by officers of the New York Botanical Garden and the Horticultural Society of New York and by the Commissioner of Parks of The Bronx. During the interval for luncheon, excursions were made to various parts of the grounds under the guidance of members of the Garden Staff. The president of the Association, Mrs. Francis King, presided at both the sessions of the Conference. Miss Hilda Loines was chairman of the Conference Committee and Mrs. Florence M. Hill had charge of the exhibit.

Dr. F. W. Pennell, Associate Curator of the Garden, left New York May 29 for plant collecting in the Rocky Mountain region of Colorado, the Wahsatch Mountains of Utah and the Yellowstone National Park. The object of the trip is to study and

collect plants of Scrophulariaceae. *Pentstemon* and *Castilleja* are the principal genera to be found in this region. He also asks the coöperation of collectors throughout the country in respect to this family, as many critical problems can only be solved after the accumulation of ample material. Specimens, living or pressed, or seeds, sent to the New York Botanical Garden will at all times be gratefully appreciated.

The Women's Auxiliary of The Horticultural Society of New York served tea to the members of the Society and of the Garden and their friends on Saturday, June 5th. Mrs. W. K. Draper is chairman and Mrs. Belmont Tiffany vice-chairman of the Auxiliary which was recently organized. Tea was served in the Museum building, under the direction of Mrs. Belmont Tiffany. A number of friends of the Garden and of the Horticultural Society were present, and much interest was manifested in this new influence at work to develope and foster greater activity along horticultural lines in this city and vicinity.

Volume 9, part 4, of *North American Flora*, by Gertrude S. Burlingham, William A. Murrill, and Leigh H. Pennington, appeared April 30, 1915. It contains descriptions of 348 species of gill-fungi belonging to *Russula*, *Marasmius*, *Lentinus*, etc., of which 92 species are described as new. Two new genera are included.

Dr. C. K. Schneider of Vienna, who has recently been engaged in botanical exploration in western China, was a visitor at the Garden on May 11. Dr. Schneider is an authority on woody plants and is well known as the author of the book "Laubholzkunde."

A botanical field meeting of the Brooklyn Institute of Arts and Sciences was conducted by Dr. W. A. Murrill at the New York Botanical Garden on the afternoon of May 22. Eighteen persons were present. After a tour of inspection of conservatory

range 1 and a portion of the grounds, the visitors went in a body to the museum building to attend the lecture by Dr. M. A. Howe, on "Sea Gardens of the Tropics."

Professor Mel T. Cook, of Rutgers College, conducted a party of nineteen students of the College through the Garden on May 15.

Meteorology for May.—The total precipitation for the month was 3.24 inches. The maximum temperatures for each week were 70° on the 1st, 82° on the 11th, 78° on the 22d, and 80° on the 28th. The minimum temperatures were 42° on the 3d, 41° on the 15th, 45° on the 20th, and 39° on the 27th.

ACCESSIONS

MUSEUMS AND HERBARIUM

100 specimens "North American Uredinales" century 14. (Distributed by Mr. Elam Bartholomew.)

38 specimens of flowering plants and ferns from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

1 photograph of *Cypripedium reginae* from Connecticut. (Given by Mr. David George.)

3 specimens of mosses from the Low Archipelago. (By exchange with the United States National Museum.)

1 specimen of *Osmanthus americanus* from Sanford, Florida. (By exchange with Mr. Severin Rapp.)

59 specimens of flowering plants from South America. (Collected by Dr. J. N. Rose.)

1 specimen of *Viola eriocarpa* from Texas. (By exchange with Mr. D. A. Saunders.)

5 specimens of hepatics from Cuba. (By exchange with Brother Leon.)

2 specimens of hepatics from New England. (By exchange with Miss Annie Lorenz.)

30 specimens of flowering plants from the vicinity of New York. (Given by Rev. L. H. Lighthipe.)

70 specimens of plants from Cuba. (By exchange with Brother Leon.)

29 specimens "Fungi Dakotenses" fascicle 12. (Distributed by Dr. J. F. Brenckle.)

1 specimen of *Xylaria* from the West Indies. (By exchange with Professor F. L. Stevens.)

5 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

2 specimens of *Inonotus hirsutus* and *Stereum candidum* from Georgia. (By exchange with the Georgia Experiment Station.)

1 specimen of *Russula ventricosipes* from Massachusetts. (By exchange with the New York State Museum.)

15 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

15 specimens of fungi from Oregon. (By exchange with Mr. C. E. Owens.)

3 specimens of polypores from Connecticut. (By exchange with Dr. G. P. Clinton.)

21 specimens of polypores from various localities. (By exchange with Mr. Elam Bartholomew.)

4 specimens of fungi from Long Island. (By exchange with Mr. Roy Latham.)

1 specimen of *Sporgipellis delectans* from New York. (By exchange with Mr. F. J. McCarthy.)

1 specimen of *Daedalea confragosa* from New York. (Collected by Mr. Percy Wilson.)

18 specimens of fungi from California. (By exchange with Professor W. A. Setchell.)

1 specimen of *Hydnum* from Oregon. (By exchange with Mr. N. L. Gardner.)

31 specimens of fleshy fungi from California. (By exchange with Dr. E. P. Meinecke.)

LIBRARY ACCESSIONS FROM APRIL 1 TO MAY 31, 1915

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EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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PERMANENT FUNDS AND ENDOWMENT

Several inquiries having recently been made relative to endowment and permanent funds of the New York Botanical Garden, at this date the following account is given, by authority of the Board of Managers, of these several funds and the uses to which the income from them is applied; suggestions are also made as to uses to which income from additional endowment might be devoted. The greatly increased area of the Garden made this year, the twentieth anniversary of the first appropriation of land, by the City's action of appropriating nearly 150 acres more of Bronx Park for Garden purposes, the total area being now nearly 400 acres, makes much greater endowment very desirable.

1. **General Endowment Fund,** $304,760.

This consists of the subscriptions made in 1894 and 1895 to the fund of $250,000 required by the City before appropriating the original 250 acres of Bronx Park; to these have been added various gifts for unspecified purposes and all Life Membership and Fellowship fees. The income is used for general purposes, including purchase of collections, library and museum equipment and supplies, lectures, publications, and to supplement City appropriations for maintenance. It is desired that this fund be increased to $1,000,000 or more. Money for the support of expert officers engaged in original investigations and in directing

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the investigations of students is much needed; the members of the curatorial and administrative staff have little time available for such work; much more could be accomplished with additional expert specialists on the staff.

2. **The David Lydig Fund,** $34,149.86.

The will of Judge Charles P. Daly, probated in 1899, contains the following provision:

"All the balance of the said rest, residue and remainder of my estate which shall remain after the payment of the foregoing devises, legacies and bequests in this eighth article of my will specified, I give, devise and bequeath as follows: One-twelfth part thereof to the New York Botanical Garden as and for a memorial of my wife's late grandfather, David Lydig, the amount of said bequest to be used and expended by said corporation in such manner and for such purposes as the Board of Managers thereof may deem for the best interests of the Botanical Garden."

In 1901, the Board of Managers resolved that this bequest be designated "The David Lydig Fund bequeathed by Charles P. Daly," and that its income be devoted to publication. The subsequent publications of the Garden, including its Journal, its Bulletin and its Memoirs, have been aided by the income of this fund, which also enabled the Scientific Directors to inaugurate in 1905 the publication of "North American Flora," and in 1909 the journal "Mycologia," both of which have now become essentially self-supporting through subscriptions from libraries and from students.

Further endowment of $50,000 for publication and for the illustration of publications is desired.

3. **The Olivia E. and Caroline Phelps Stokes Fund,** $3,000.

In 1901, the Misses Phelps Stokes presented $3,000 as a fund for the preservation and protection of native plants. The income has since been used in campaigns of education, especially of children, for the preservation of wild flowers, shrubs and trees, through lectures, pamphlets and prizes for essays, in coöperation with the Wild Flower Preservation Society of America, and much good has been accomplished.

4. **The Students Research Fund,** $3,492.

In 1899, when the first special students were received, the Board of Managers directed that all fees paid by students for privileges be credited to a fund, the income from which should be devoted to grants in aid of the investigations of subsequent students. The first grant was made in 1905, the recipient being Mr. Charles Budd Robinson, then a student, subsequently an assistant curator; grants have since been made to nine other students.

Most of our students pay no fees, and, as a consequence, this fund increases slowly; it would be well to augment it from sources other than fees or to receive a gift of $10,000 as another fund to aid student investigation.

5. **The William R. Sands Fund,** $10,000.

Under the provisions of the will of William R. Sands, a legacy of $10,000 was received in 1909 which was temporarily credited to General Endowment but was subsequently set apart as a special fund for horticultural prizes, which are awarded at exhibitions held at the Garden in cooperation with the Horticultural Society of New York. These prizes have stimulated the exhibition of novelties and specimens of many of the plants shown have been presented to the Garden's collections. The income of this fund is not sufficient to pay as many or as large prizes as is desirable. The income from additional endowment of $30,000 could be advantageously expended.

6. **The Darius Ogden Mills Fund,** $50,000.

In 1910, the Garden received from the estate of Mr. Darius Ogden Mills, who was President of the Board of Managers from 1899 to 1910 and an original member of the Corporation, a legacy of $50,000, which was designated "The Darius Ogden Mills Fund." The income from this endowment has since been expended for educational and scientific purposes, including lectures, purchase of collections, and the expenses of exploring expeditions.

Endowment for the exploration of regions botanically little known is greatly desired, and the income from funds aggre-

gating $250,000 could be expended with great advantage to science.

7. **The Henry Iden Fund,** $10,000.

A bequest of Mr. Henry Iden, received in 1913, was designated "The Henry Iden Fund," and its income directed by the Board of Managers to be applied to resident research scholarships. This provision is very useful, making it possible for officers and students of other institutions to come to the Garden for studies of the large collections here and to make use of our facilities for investigation. These scholarships are in great demand and the income from the fund does not enable us to grant many requests. The income on $50,000 endowment could be advantageously expended for resident research scholarships.

8. **The Science and Education Fund,** $75,455.

During the years 1912 and 1913, the Committee of the Board of Managers on Endowment obtained this fund by subscriptions of eighty-five members and friends of the Garden, in amounts from $5.00 to $5,000, to which was added a bequest of $1,000 received from the estate of Mr. Edward Russ. The income is used for educational and scientific purposes, including the purchase of plants, books, specimens, apparatus and materials and for lectures.

The possibilities for important additions to knowledge and for valuable educational work through the expenditure of the income of this fund are great, and it might be advantageously increased to $200,000.

9. **The John Innes Kane Fund,** $10,000.

In 1913, Mrs. Annie C. Kane presented $10,000 as a memorial to her late husband, John Innes Kane, a member of the Board of Managers from 1896 until his death in 1913, for the specified purpose of the purchase of plants for the grounds and greenhouses. The income was used in 1914 for the purchase of the evergreen shrubs forming the plantation around the bronze fountain in front of the Museum Building, and in 1915 to purchase the rhododendrons planted this spring on the northwestern side of Conservatory Range No. 1.

Other funds for the purchase of plants are much desired; money for this purpose is especially needed for the planting of parts of the tract of nearly 150 acres in Bronx Park added this year by the City to the Garden reservation.

10. **The Addison Brown Fund,** $20,771.

Judge Addison Brown, an original member of the Corporation, a member of the Board of Managers from its organization until his death in 1913, and President from 1910 until 1913, bequeathed this fund to the Garden

"to be known as the Addison Brown Fund, the income and accumulations from which shall be applied to the founding and publication, as soon as practicable, and to the maintenance (aided by subscriptions therefor), of a high-class magazine bearing my name, devoted exclusively to the illustration by colored plates of the plants of the United States and its territorial possessions, and of other plants flowering in said Garden or its conservatories; with suitable descriptions in popular language, and any desirable notes & synonomy, and a brief statement of the known properties & uses of the plants illustrated. The Garden Managers may, from time to time, change the investment of said fund, as necessary, applying the income to said uses."

The income is accumulating, preparatory to commencing publication of the magazine thus endowed; water color paintings of plants are being made for reproduction in it and the accompanying text and descriptions are being written.

11. **The Charles Budd Robinson Fund,** $652.30.

Dr. Charles Budd Robinson, formerly an assistant curator and one of the Garden's first students, lost his life on the island Amboina, Dutch East Indies, in December, 1913, while in the employment of the Bureau of Science of the Philippine Islands, prosecuting comparative studies of the floras of the Philippines and the Dutch Islands. The fund has been subscribed as a memorial to him by the staff of the New York Botanical Garden and other American botanists, by employees of the Philippine Bureau of Science, by residents of Amboina, and by members of

his family and personal friends. It is held open for additional subscription. The income is to be used at intervals to aid botanical explorers in difficult regions.

12. **The Maria DeWitt Jesup Fund,** $25,000.

In the will of Mrs. Maria DeWitt Jesup, admitted to probate June 24, 1914, a bequest of $25,000 is provided for the New York Botanical Garden. The ninth clause of Mrs. Jesup's will contains the following conditions:

"NINTH: As to all legacies herein bequeathed to and for the benefit of Institutions of whatsoever kind, I direct that the same shall in each case constitute a permanent fund (except as I have specially provided otherwise), the principal to be invested and kept invested and called the 'Morris K. or Maria DeWitt Jesup Fund,' the income to be applied and appropriated, except where I have made other special provisions, to the general purposes of the Institutions respectively, other than alterations, additions, repairs or erection of buildings and purchase of land or the payment of debts, and also other than the payment of salaries to executive and other officers."

At the meeting of the Board of Managers held April 15, 1915, these conditions were considered, and it was resolved to apply the income of this legacy to the increase of the Garden's collections, including plants, books or specimens. And, at the meeting of the Board of Managers held June 17, 1915, it was further resolved to designate the legacy "The Maria DeWitt Jesup Fund."

There have been two other bequests announced, subject to life interests, aggregating $25,000.

As regards parts of the Garden's work for which no special endowment has yet been supplied, mention may be made of the following:

Library Funds.

In order to secure all current botanical and horticultural literature not obtainable by exchanges and to purchase desired older literature when offered, the expenditure of about $3,000 annually is required, being the income on about $75,000. The

present collection of books, about 27,000 bound volumes and many thousand pamphlets, has largely been brought together by contributions solicited during the past fifteen years and by gifts, but it is by no means complete. Endowment would make the growth of this important library certain; it is consulted by students from all over the country.

Botanical Prize Funds.

To stimulate and reward botanical discovery and investigation, funds aggregating $10,000 could be held, and the income awarded at intervals by the Scientific Directors to students who accomplish investigations of merit and make discoveries of utility.

Horticultural Experimentation and Display.

Studies in plant genetics have yielded most important results in recent years, and promises many more; the income from endowment for such purposes could be advantageously expended, and many of the plants resulting from such experimentation used in the establishment of decorative plantations, at the Garden and elsewhere. Endowment aggregating $100,000 would establish and support such investigations.

Museum Funds.

The collections forming the public museums have been brought together from all parts of the world, mainly by gifts and by exchanges with other institutions. It has not been possible to purchase many specimens, and provision for such purchases would greatly enhance the value and usefulness of the museum. Permanent museum funds aggregating $50,000 could be administered advantageously.

Laboratory Funds.

The laboratories play an important part in the work of the Garden, and in them technical and scientific discoveries of significance may be made. They continually require equipment, apparatus and supplies, and for them an endowment of $20,000 is desirable.

Herbarium Funds.

Endowment for the increase of the herbarium by the purchase of specimens and of materials used in herbarium work would

ensure the growth of this important collection, to which recourse must be had to answer many questions continually arising. Funds aggregating $50,000 would supply sufficient income.

Research Funds.

Endowment aggregating $100,000, with income applicable to special researches in the various phenomena of plant life would, doubtless, add greatly to knowledge. The collections of plants, specimens and books already brought together provide abundant material for scientific investigation.

SUMMARY OF ADDITIONAL ENDOWMENT DESIRED

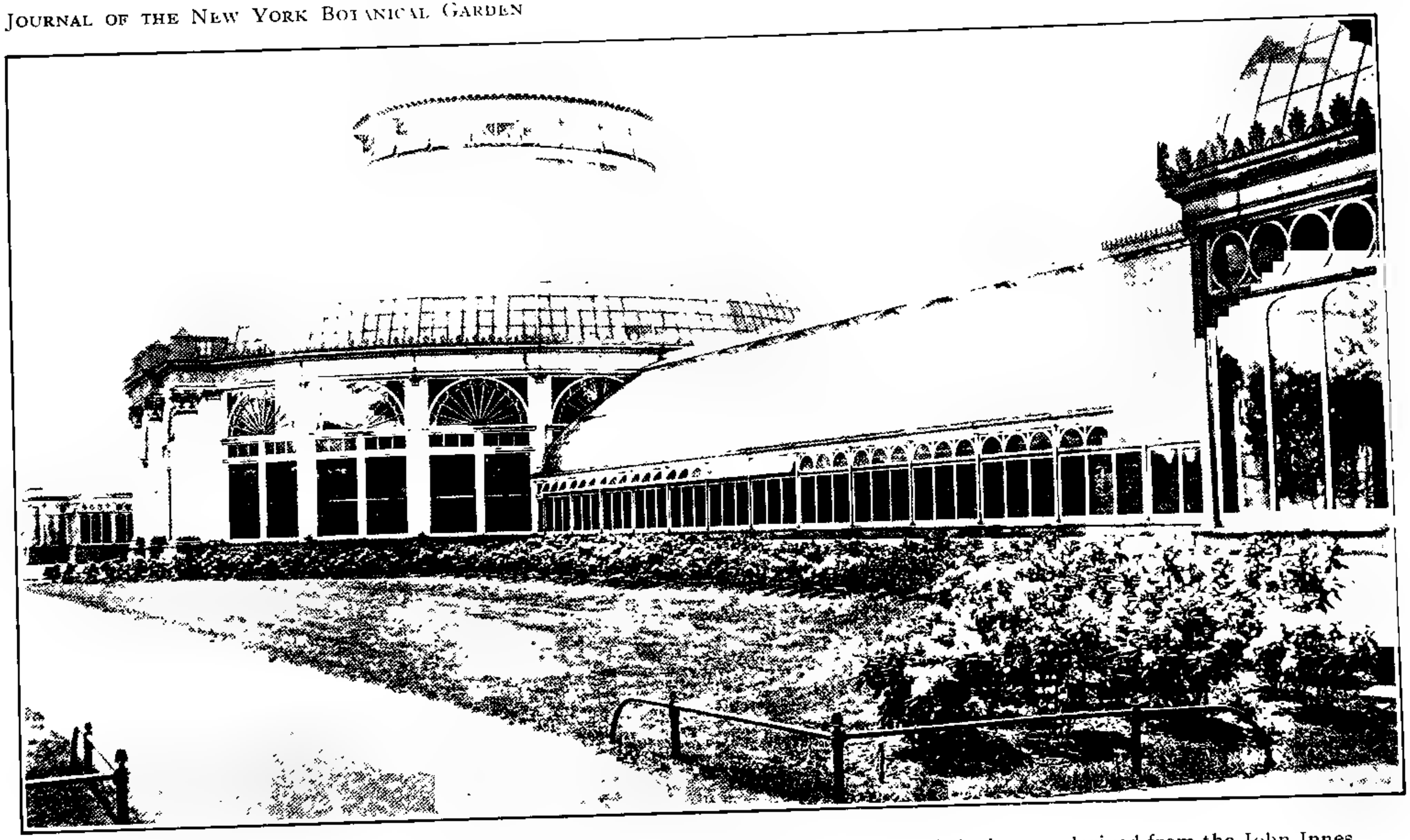
Increase of General Endowment	$700,000
Publication and Illustration	50,000
Increase of Students Research Fund	10,000
Horticultural Prizes	20,000
Botanical Exploration	200,000
Research Scholarships	50,000
Purchase of Plants	40,000
Increase of Science and Education Fund	125,000
Library	75,000
Botanical Prizes	10,000
Horticultural Experimentation and Display	100,000
Museum Funds	50,000
Laboratory Funds	20,000
Herbarium Funds	50,000
Research Funds	100,000
Total	$1,600,000

JULY 1, 1915.

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

NEW PLANTATION OF RHODODENDRONS

With the aid of the income derived from the John Innes Kane Fund a new planting of rhododendrons was established on the north side of conservatory range no. 1, west end. The planting of the rhododendrons was started on May 6, on the occasion of the spring inspection of grounds, buildings and plantations.



New Plantation of Rhododendrons at Conservatory Range 1, established by means of the income derived from the John Innes Kane Fund.

Dr. Britton in a few words described the rhododendrons, the hybrid origin of many of the forms used in horticultural work, and the method of preparation of the soil best suited to them.

An area averaging 8 to 12 feet wide was selected for the plantation, extending from the north entrance of the large central palm house, along houses 2 and 3, to house 4. The exterior border of the area was made undulating, no attempt being made to follow exactly the outline of the building. The general planting scheme was arranged to place the darker colored forms in the center, the lighter on either end. The rhododendrons were planted in irregular shaped masses, mainly a dozen of each, some few being in groups of six or ten. A selection of sixteen kinds was made, giving a total of one hundred and seventy-six plants. The following varieties comprise this selection, named in the order of their arrangement, beginning with the east end: *Lady Armstrong*, pale rose; *roseum elegans*, soft silver rose, in background; *giganteum*, very bright rose, in foreground; *delicatissimum*, white delicately tinted pink, in background; *General Grant*, bright rosy red, in foreground; *Charles Bagley*, bright red, in foreground; *Caractacus*, purplish crimson, in background; *Parsons' grandiflorum*, bright purplish rose, in the foreground; *purpureum elegans*, purple, in foreground; *Charles Dickens*, very brilliant crimson, in background; *Kettle drum*, brilliant crimson, in foreground; *catawbiense album*, white, in foreground; *album elegans*, soft lavender white, in background; *Everestianum*, pinkish lavender, in foreground; *Parsons' gloriosum*, pale lavender, in background; *catawbiense grandiflorum*, bluish lavender, in foreground.

The accompanying illustration is a view of this new plantation looking toward the dome from the west end of the rhododendrons. The group of plants in the foreground is *catawbiense grandiflorum*. The bed for these rhododendrons was prepared by trenching to a depth of about two feet, all of the poor soil being removed and replaced with good topsoil, and also with a good proportion of leaf mould, thoroughly incorporated with the remainder of the soil. After the planting was completed, a top-dressing of rotted leaves was placed over the whole bed

to protect the soil from the direct rays of the sun, thus conserving the moisture and giving the rhododendron roots the cool conditions which they require for the best development of the plants and acidity of the soil.

GEORGE V. NASH

REPORT ON AN EXPEDITION TO PORTO RICO FOR COLLECTING FRESH-WATER ALGAE

DR. N. L. BRITTON, *Director-in-Chief:*

Sir: The fresh-water algae of Porto Rico have hitherto been little known. P. Sintenis collected during his botanical travels in Porto Rico, 1884–87, some Characeae and other more conspicuous fresh-water algae at different places on the island. The Characeae were later determined and described by O. Nordstedt and the other algae by M. Möbius. Among the materila of *Utricularia*, collected by Sintenis, G. Lagerheim found intermixed a larger number of species of algae than those contained in the alga collection proper. In all, only seventy-seven species of Characeae and other fresh-water algae have been hitherto known from Porto Rico.

It was therefore with great pleasure and great expectations that I accepted from you, Dr. Britton, the offer of a three months' commission to collect fresh-water algae in Porto Rico for the New York Botanical Garden.

I arrived at San Juan in the evening of the 23d of December and stayed at Santurce to the 5th of January. During this time I made daily excursions in the vicinity and found algae on the most diverse collecting grounds, as for instance on old walls in San Juan, on the barks of different trees, on old woodwork, etc. Of special interest were a pool of water with Characeae, Desmidiaceae, etc., near Borinquen Park, and pools at Rio Piedras. At the last mentioned place, a ditch close by the Agricultural Station contained a great multitude of a fresh-water species of the Florideae, viz., *Compsopogon*, and slime-balls of *Stigeoclonium* as large as walnuts.

Still more interesting were the artificial water basins at Rio

Piedras, both the large reservoir east of the Agricultural Station, from which San Juan receives its water supply, and the many smaller ones west of the station. On the walls of the former was a rich vegetation of algae, consisting of *Oedogonium*, *Rhizoclonium*, *Lyngbya*, and other genera.

Among these were found a large species of *Rivularia*, which formed sausage-like, sometimes slightly branched, masses of slime 1–2 cm. in diameter. Among the algae was found the only fresh-water bryozoan that I could find in Porto Rico.

In the brook which runs down to the small water basins west of the Agricultural Station, I found on the water plants thick threads of a probably new genus of algae, which externally reminded me somewhat of *Schizomeris*. I have found it also at other places on the island, as at Humacao, Mayagüez and Utuado, and at one of these places I found lying in the cells two oval aplanospores surrounded by a very strong membrane; it has, therefore, not any close relationship to *Schizomeris* and the resemblance is wholly superficial.

In the basins themselves, the alga-vegetation was very rich, consisting of species of the genera *Oedogonium*, *Spirogyra*, *Phormidium*, *Lyngbya*, *Rhizoclonium*, etc.; at many places there were also growing species of Characeae. On the walls and earthen banks around these basins there was, as is usual in similar localities, a rich vegetation of *Scytonema*, *Trentepohlia* and species of Chroococcaceae.

From January 5th to the 15th, I stayed at Coamo Springs, where I collected algae at several places. Specially interesting was the vegetation of Myxophyceae, both as to species and as to individuals, which existed wherever the water of the warm springs came to the light, whether in a natural or an artificial way. But there was also a rich vegetation of algae on wet soil, on outcropping rocks, on walls and on the bark of trees. Among the aerophilous Chlorophyceae may be mentioned a probably new genus, which was found as a thick green covering on branches and roots in the dark forest behind the Bath; later I also found the same on limestone in a cave between Arecibo and Hatillo. This alga consists of much-branched rows of cells, which remind

one of certain species of *Trentepohlia*, but I have not been able to find either zoöspores or gametes. As far as I have been able to find, it propagates itself altogether by deciduous thin-walled cells (propagating akinetes) and very thick walled resting akinetes.

Behind the Bath a brook has excavated a narrow valley with steep walls, resembling a canyon. On the leaves of several species of trees in this valley there was found a rich epiphyllous vegetation of *Cephaleuros* and *Phycopeltis* with all transitions to lichen gonidia.

Among the longer expeditions which were undertaken from Coamo Springs may be mentioned one excursion to the place where the military road crosses the river, about five kilometers east of Coamo. Here in the river bed, partly in the river itself and partly in small pools along the side thereof, there was a very rich vegetation of Chlorophyceae, consisting of *Pithophora*, *Cladophora* (swaying in the whirlpools of the river), *Oedogonium*, *Mougeotia*, and *Spirogyra*. In the small pools were found masses of slime of *Anabaena* and *Tetraspora*, and not a few desmids.

Characeae were found at several places in the Coamo River.

In the town of Caguas I stayed from January 15 to 20 and collected algae at several places. In the very streets of the town there is a conspicuous abundance of species of *Phormidium*, which certainly is not a great indication of cleanliness. In the river near the town there is a rather rich vegetation of Chlorophyceae on the water plants, besides the Myxophyceae found everywhere. Old cow dung near the river exhibited an unusual red color; on a microscopic examination, this was found to be due to a great abundance of a red species of *Pleurococcus*. As far as I can decide, by a preliminary examination, it is the same species as I have collected again and again, also on old cow dung, in the Norwegian high mountains.

As it was of interest to find how the alga-vegetation would present itself in a syenite region, I went to the town of San Lorenzo. On the way I had a chance to collect a multitude of aerophilous Myxophyceae on rock and dirt-declivities, *Com-*

sopogon and several Chlorophyceae in brooks; but the stay at San Lorenzo became a failure. The river bed consisted of fine sand from integrated syenite and this made an altogether very poor ground for algae, probably because the grains of sand are easily moved and do not give a solid substratum to which the algae can attach themselves. I have also made the observation that only where the sand has become mixed with clay, so that the bottom becomes more solid, do algae arise in great number.

Besides, my investigations at San Lorenzo were soon enough interrupted, as a police officer arrested me as a suspicious character. I was, however, readily discharged after a short examination at the police station, but the publicity which attended the arrest in the little town hindered me from going undisturbed at my work; hence I found it best to leave the place.

Around Humacao, where I stayed from January 20 to 25, the alga-vegetation was about the same as at Caguas. A waterpool near the wagon road had a strong green color which proved to be due to the existence therein of *Pandorina Morum*. Over the large rocks which lay distributed over the landscape there were often found a rich vegetation of *Gloeocapsa*, *Scytonema*, and *Stigonema*, and sometimes *Trentepohlia*.

During my stay at Fajardo, January 25–28, there was a heavy rainstorm which washed down masses of red clay, so that the river and the brooks looked like a red soup. Under such circumstances it was naturally impossible to see the algae in the dirty water, and I have reason to believe also that such conditions, which will occur at every rainstorm, must make the chances of life very unfavorable, the result being a poor alga-vegetation in the rivers and brooks of that side of the island. It was therefore mostly aerophilous algae that I collected around Fajardo, where especially the old stone bridges showed themselves very richly covered with Myxophyceae and *Trentepohlia*.

Along the road to Fajardo Playa there were found, however, partly in the ditches, partly in small water pools, some Chlorophyceae and among these especially desmids. Near the Playa on a flat which lay so near the sea that it must contain much salt in the ground, was found a rich vegetation of *Phormidium* and *Lyngbya*.

From the town Palmer, I rode up to Hacienda Catalina, which is situated perhaps at about 1,500 feet altitude on the eastern slope of El Yunque. This is in one of Porto Rico's rain centers, where the annual rainfall exceeds 3,000 mm. The alga-vegetation also bears the impress thereof. There were growing algae, especially Myxophyceae, everywhere where the light was tolerably sufficient; this was, however, not always the case in the dark primeval forest, where one could find places with so little light that not a single liverwort or fern could live there.

But otherwise there were algae everywhere. On the tree trunks were species of *Trentepohlia* very common, and on dirt, stones, and old tree trunks in the woods the Myxophyceae were predominant. On the red sticky clay, which forms the soil here, there were found, for example in the ditches along the road, on the court-yard of the Hacienda, etc., a very rich vegetation of *Phormidium*, *Scytonema*, and *Stigonema*, sometimes mixed with Chlorophyceae, as for instance *Zygogonium* and *Mesotaenium*. When these can live on dirt banks, it is evidently due to the fact that it rains so often that the soil never has time to dry, i. e., that it contains moisture enough to keep the algae alive until the next rain-shower.

In a little waterfall, formed by a brook over the cliffs, the latter appeared dark red; this was due to a thick covering of a fresh-water species of Florideae, viz., a species of *Hildenbrandtia*. Probably it is *H. rivularis* (Liebm.) J. Ag., which is found in Europe in similar locations, besides also in Africa, and has been collected at two localities in the United States, in the Susquehanna River at Harrisburg, Pennsylvania, and at New Braunfels, Texas.

The large rocks, which as at Humacao, partly singly, partly in larger masses, are scattered over the landscape, were covered almost wholly by a brown vegetation of *Scytonema*, *Stigonema*, *Gloeocapsa*, and *Chroococcus*.

On my way down to Palmer, I found, February 1, in the neighborhood of the town, on the stones in the ford across a brook, a very rich vegetation of a fresh-water species of Florideae, *Caloglossa Leprieurii* (Mont.) J. Ag., earlier known from the Luquillo Mountains.

After my return to Santurce, I visited on February 3 the same pools near Borinquen Park which I had investigated earlier on the 25th of December. The conditions were somewhat changed. The pools had dried up considerably, so that the former water edge was now high on dry ground. There I discovered a great number of *Utricularia* plants which I had not observed the first time, and among these was a very rich alga-vegetation which presented a somewhat different character from that previously seen. *Spirogyra* and *Oedogonium* appeared commonly with zygotes. The Myxophyceae there were less conspicuous and there was a much less number of Desmidiaceae and Protococcoideae; among the last mentioned, *Pediastrum* and *Coelastrum* were noticed.

On the fifth of February an excursion in company with Dr. N. L. Britton was undertaken to Laguna Tortuguero in the neighborhood of Manati on the north side of Porto Rico. On the way a few algae were collected on water plants in a brook at Candelaria, near Bayamon. The Laguna contained perfectly fresh water and had a very rich vegetation of phanerogams as well as algae.

Along the beach lay a *Chara* that had been washed ashore and which evidently grew in deeper water. Between the water plants small flakes consisting of *Tolypothrix*, *Phormidium*, and *Lyngbya* were floating, and sometimes *Oscillatoria* also was found, and where decay had begun *Spirulina* occurred. In the lagoon and perhaps in some of the water courses which led down to it were found *Cladophora*, *Rhizoclonium*, *Spirogyra*, *Zygnema*, and *Oedogonium*. Among the filamentous algae one also found larger or smaller masses of Chroococcaceae and Protococcoideae. Of special interest was the fact that a *Zygogonium* found there had zygotes, which very seldom happens.

Of aerophilous algae there was a great multitude, as everywhere in Porto Rico. On earth, stones, and rocks there was plenty of *Stigonema*, *Scytonema*, and sometimes *Symploca;* besides *Hormidium*, *Ulothrix flaccida*, species of *Gloeocapsa*, and at a few places a species of the genus *Mesotaenium*, which often appears as aerophilous in Porto Rico in regions where there is plenty of rain.

On the surface of bamboos, palm trunks, and the bark of several trees there were found everywhere *Trentepohlia*, *Scytonema*, *Stigonema*, *Gleocapsa*, and *Chlorella*. On the leaves of several trees and bushes were spots of *Phycopeltis* and *Cephaleuros*, very common.

The departure for Mayagüez took place on the sixth of February and on the same day an excursion along the road to the mesa was undertaken. Some days later I walked farther over the mesa. The only algae to speak of here were almost wholly aerophilous ones on the dry slopes, which consisted partly of disintegrated serpentine rocks, partly of yellowish or red clay; this clay was sticky and smooth during the rain, but in drought it became almost as solid and hard as slate. There was nearly everywhere a rich vegetation consisting of Myxophyceae, as *Scytonema*, *Stigonema*, *Symploca*, and *Phormidium;* sometimes a *Mesotaenium* also grew here on the red clay. On the rocks were found quite often *Chlorella* and *Trentepohlia*.

With Mayagüez as a center, a series of excursions were undertaken in different directions, usually in the company of Dr. N. L. Britton. But even in the town itself rich collections were made, especially of aerophilous algae on the wall of the hotel garden and on tree barks, house-walls, etc., at the Agricultural Station. In the last-named locality also were found, besides a *Cephaleuros* on the leaves of a *Ficus* which climbed the walls, a *Spirogyra* with zygotes in a ditch, and perhaps a new species of *Chlorella* on tree bark.

On the ninth of February an automobile trip was undertaken to Sabana Grande, which is situated in a dry region where the annual rainfall is given as 1,000–1,800 mm., which in Porto Rico is comparatively low. With the exception of algae in the Rio Grande and water pools along the same, there were essentially only aerophilous algae to be found; but of these there were a great multitude, as for example on the walls of the church in the town, on earth, rocks and cliffs along the road north of the town. Besides the aerophilous genera already mentioned, there was found also *Porphyrosiphon*. On the bark of the trees there grew, of course, species of *Trentepohlia* very abundantly.

It was strange to find on grass-covered sand-flats near the ford over the Rio Grande great numbers of a flat dried-up *Nostoc* which had lived and spread over a large part of the at present very dry sand-flat. I suppose that it has its period of principal growth when it rains so much that the river rises and covers the flat at least partly.

On an excursion on the 11th of February to the sugar fields south of Mayagüez, I found in the ditches which were partly or wholly filled with water a rather rich vegetation of Chlorophyceae, as *Spirogyra* (with zygotes), *Pithophora*, *Stigeoclonium*, as species of *Gongrosira*, *Characium*, *Oedogonium*, and the *Uronema*-like alga which Dr. T. E. Hazen has investigated in the greenhouses of Columbia University, but the original locality of which was unknown. I have found this alga at several places in Porto Rico.

Most interesting, however, was the stay at Maricao, which was one of the best localities for algae on Porto Rico. I collected algae there twice, viz., February 12 15 and 19–22, during which time I traveled through the region in several directions.

Maricao is situated in one of the rain centers of Porto Rico, with an annual rainfall of over 3,000 mm. Perhaps it was as the result of this that here many algae, as for instance species of *Zygnema* and *Oedogonium* lacked resting stages, and *Spirogyra*, which was found very commonly, was seen scarcely at any place with zygotes. On the contrary, both *Zygnema* and *Spirogyra* had a very frequent vegetative propagation by individual cells, which separated themselves from each other and as propagative akinetes gave origin to new filaments. I suppose that these conditions depend upon the fact that the conditions of life nearly the whole year round are practically unchanged. The temperature is rather constant and at a place where the amount of rainfall is so great and rather equally distributed throughout the year, there will scarcely arise times when the algae need resting stages in order to carry them over a period of drought.

There also was found an unusual abundance of aerophilous algae in the vicinity of Maricao. Especially were the larger or smaller declivities of red clay very often colored green or

brown bv a thick vegetation of Chlorophyceae or Myxophyceae. Walls, rocks, stones, the bark of trees, old woodworks, etc., were nearly always wholly covered by algae; even an old iron can, which had been thrown into the river, had a bright green covering of a species of *Chlorella*.

In a little waterfall in a brook, which empties into Maricao River, a little south of the town, there were found not only *Hildenbrandtia*, but also a species of *Chantransia*. In all there have now been found four fresh-water Florideae in Porto Rico.

A rather rich vegetation of Chlorophyceae was found in some fresh-water pools about 4 km. south of Mayagüez very near the coast. Among the genera growing there, may be mentioned *Spirogyra*, *Pithophora*, *Gonatonema*, *Rhizoclonium*, *Oedogonium*, *Nitella*, *Scenedesmus*, *Ophiocytium*, and *Nephrocytium*, and several desmids. There were also there several Myxophyceae, among which *Merismopedium* was of special interest, as this genus was otherwise not common in Porto Rico.

An excursion to Laguna Joyuda, south of Mayagüez did not give so good results as expected, for it showed that this lagoon had brackish water, the alga-vegetation of which I paid no attention to on this journey, as its components belong rather to the salt-water algae.

The twenty-sixth of February, I went to Arecibo and collected aerophilous algae on the walls in the town itself. The following day an excursion was made to Hatillo, on which algae were collected both in water pools along the road and especially in a pond bear Hatillo with a *Nymphaea*-vegetation. Besides the common genera of Myxophyceae and Chlorophyceae were found in this pond rather numerous desmids, *Pandorina Morum*, *Euglena*, and on the water-plants epiphytic genera such as *Gongrosira*.

Of special interest was the alga-vegetation on the limestone cliffs, which I investigated on this excursion and later, on the seventh of March, on one to Hato Arriba, which is situated 6 km. southwest of Arecibo, and on the fourth of March, on the first part of the journey to Utuado. The alga-vegetation on the limestone cliffs had considerable resemblance to the vegetation

on the walls of the old fortifications in San Juan, which to an important part consists of calcareous rocks and offers similar conditions for vegetative life.

In the limestone mountains mentioned above, were found larger and smaller caves, where according to the depth reigned the most diversified intensity of light from full daylight to complete darkness. The different genera of algae grew in the places where the intensity of light was most suitable. In somewhat moderate daylight the roofs of the caves showed themselves covered with a layer several millimeters thick of an olive-colored mass of slime which belonged to a species of *Gloeocapsa;* at the margins this shaded off into a strongly bluish-green covering, which consisted of a species of *Chroococcus*. Just the same algae were found later under the same conditions in a half-dark walled passage in Fort San Cristobal in San Juan.

Among aerophilous alga-genera which commonly are found on limestone in Porto Rico can be mentioned the following Chlorophyceae: *Chlorella*, *Pseudendoclonium*, *Trentepohlia*, and *Rhizoclonium*. Of Myxophyceae I have found the following genera in the several families: of Chroococcaceae, *Chroococcus*, *Gloeocapsa*, *Gloeothece*, *Aphanothece*, and *Microcystis;* of Lyngbyaceae, *Phormidium*, *Microcoleus*, and *Schizothrix;* of Nostocaceae, *Nostoc;* of Rivulariaceae, *Calothrix;* of Scytonemataceae, *Scytonema;* and of Stigonemataceae, *Stigonema*. Besides I found *Chroothece*, which belongs to Glaucophyceae, very common. It was, however, more common on old walls than on natural limestone cliffs.

Unfortunately, I have not had chance to investigate the limestone mountains so thoroughly as they probably deserve. The cause was an illness which hindered me from doing any work for several days during my stay at Arecibo.

On the journey to Utuado on the fourth of March, I collected algae practically as long as the limestone lasted. There were so many different localities to investigate higher up in the district of eruptive rocks that I found it more advantageous to make a return here from Utuado in order to make a more thorough investigation.

Utuado, which evidently has a very great annual rainfall, even if it is a little less than at Maricao, showed itself a very excellent locality for algae. Especially along the river, along the road to Arecibo, there was an extraordinary abundance. Here were found numerous Myxophyceae on the dirt or rock-declivities along the road, where one could see large flat rocks red from *Porphyrosiphon*, or brown from *Scytonema*. Wherever the water rippled down over the cliffs these were blotched by green masses of slime which contained several species of algae belonging to the following genera of Myxophyceae: *Aphanothece*, *Gloeocapsa*, *Gloeothece*, and *Chlorococcus;* and of Chlorophyceae: *Oocystis*, *Coccomyxa*, *Stichococcus*, and *Ulothrix* (*flaccida*); and Desmidiaceae.

In the numerous small pools along the river, which evidently became replenished with water during the rainy season, there was an abundance of water plants, and on or among these many different genera of algae which did not exist in other places, as *Glaucocystis*, *Tetrapedia* and *Botrydiopsis*. Desmids and numerous species of Characeae also were found here.

A somewhat similar but less rich alga-vegetation was found on the journey between Utuado and Adjuntas on the tenth of March.

Between Adjuntas and Ponce, algae were collected at several places, especially at Corral Viejo, about 12 km. north of Ponce. A brook makes a little waterfall here and on the rocks were found some of the Myxophyceae-vegetation characteristic of the eruptive rocks, such as *Aphanothece*, *Scytonema*, *Phormidium*, and *Calothrix*. In a reservoir of cement at the same place was found a large quantity of *Rhizoclonium*.

The nearer environments of Ponce may be called poor in algae. There were cultivated sugar fields nearly everywhere and there was very little chance for aerophilous algae to find a suitable place to grow, and in the ditches filled with water, which often were found, existed a rather monotonous vegetation of *Rhizoclonium*, *Spirogyra*, *Pithophora*, *Lyngbya*, *Anabaena*, and *Phormidium*. Among plants of *Ceratophyllum*, *Oedogonium*, *Scenedesmus*, and Desmidiaceae were found in one place.

From Ponce long excursions in automobile were made, first on the thirteenth of March to Arroyo de los Corchos and on the fifteenth still farther on the same road to Jayuya.

Arroyo de los Corchos is a dark wooded valley with an exceedingly rich forest-vegetation, through which a little brook wound its way. Near the road the brook formed a little pond along the margins of which numerous water-plants grew. Among and on these were found several algae, as *Stigeoclonium*, *Gongrosira*, and *Calothrix*. In the forest itself, the brook was, on the contrary, conspicuously poor in algae, probably because at most of the places where it ran there was too little light. Only at one place where it made a fall over a small rock were the latter and the stones red with *Hildenbrandtia*. In the dark wooded valley there were found epiphyllous algae, as *Trentepohlia* and *Phycopeltis*, especially on the fronds of ferns, but on the more lighted earth and rock slopes along the road there existed a rich vegetation of the Myxophyceae characteristic of such localities.

At Jayuya, which is situated in the syenite region, the valley was rather flat, and there are, therefore, a number of larger or smaller collections of water along the river and the road. In the pools which were richer in organic matter were found *Phormidium*, *Euglena*, and *Chlamydomonas;* in the others, *Nitella*, *Rhizoclonium* with an epiphytic *Chamaesiphon*, *Compsopogon*, *Oedogonium*, *Ulothrix*, *Vaucheria*, *Pithophora*, and *Anabaena*, besides desmids. On the stones in the brook were growing *Stigeoclonium*, *Gongrosira*, *Hyella*, and *Pleurocapsa*.

In a rather high waterfall made by a little brook on the road to Jayuya grew a great quantity of a species of *Nostoc*, which had a warty surface and the size of peas or even of hazel-nuts.

On the earth or rock-slopes along the road to Jayuya were found besides *Trentepohlia* and the common Myxophyceae-vegetation, representatives of *Oocystis*, *Mougeotia*, and the desmids.

In general the vicinity of Jayuya may be regarded as a very good locality for algae.

All the places which I had visited hitherto had comparatively great annual rainfall and consequently also in general a con-

siderable moisture in the air, which explains the extraordinary abundance of algae on nearly all kinds of substratum, even on old tin cans and barbed-wire. It was of interest, therefore, by way of contrast to visit places where there was little annual rainfall and little moisture in the air.

Such a place is Ensenada (Guanica Centrale) in the south-western part of Porto Rico. The substratum here consists of limestone rocks, and the annual rainfall is given as being under 1,000 mm. In 1907, during the whole year, it rained but twenty eight days in Guanica. That the ground is very dry here is seen also from the cactus-vegetation, which is found around Guanica and above to Laguna Guanica.

Notwithstanding that the landscape here was dishearteningly dry, I succeeded in finding a few aerophilous algae. On the small stone bridges in Ensenada (Guanica Centrale) were found on the shore *Chroococcus*, *Gloeocapsa*, and *Scytonema*, which grew also on the limestone rocks in the vicinity. Even among the hairs on the leaves of *Tillandsia recurvata* I succeeded in finding a *Gloeocapsa*, and on the surface of *Cephalocereus Royeni*, *Chlorella* and *Trentepohlia* were found to be comparatively common.

Laguna Guanica is situated a little higher than the sea, and contains therefore at least on the upper side fresh water. On the stones *Oedogonium* and *Stigeoclonium* were growing, which are typical fresh-water algae. On the rhizomes of species of grasses *Lyngbya*, *Calothrix*, and *Anabaena* grew in shallow water.

On the southern beach of the lagoon, however, grew here and there halophytic phanerogams and the soil contained so much salt as to crystallize into a crust in the water-filled depressions when the water had evaporated. This was evidently why the algae showed distinct characters of brackish water vegetation. A few meters above the lagoon there existed rather plentifully in ditches a couple of species of *Enteromorpha* and in the small pools were found *Lyngbya* and *Nodularia*, of which at least the latter is a typical brackish water genus. But in other places pools were found which contained water fresh enough for a *Closterium* species to grow in.

On the way to Coamo Springs, I collected a few algae on the

18th of March, among these *Tetraspora* and *Chlamydomonas* in the Descalabrado River, and near the bank plenty of *Cephaleuros* on the leaves of a tree.

In Coamo Springs several places were visited where I had collected algae in the beginning of January, as for instance 5 km. above the town of Coamo. Several changes had taken place in the alga-vegetation. *Pithophora* existed with akinetes, *Spirogyra* and *Oedogonium* with zygotes. The development of these resting stages resulted naturally from the fact that the water level in the river as well as in the pools along the same had sunken considerably after a period of little rain.

A similar condition showed itself in the reservoirs at Rio Piedras, which I visited anew on the twenty-third of March. The alga-vegetation had changed considerably since my former visit in the latter part of December; more resting stages appeared, certain species which at my first visit were predominant had disappeared or become rare and new species had appeared.

The last day I stayed in Porto Rico, the twenty-fourth of March, I used for the collection of aerophilous algae on the walls of the old Fort San Cristobal in San Juan. Nothing important was contained in this collection, however, for it turned out that the alga-vegetation on the old walls of limestone was about the same everywhere in Porto Rico. The same Myxophyceae appeared everywhere, as do *Chroothece*, *Trentepohlia*, and *Rhizoclonium*, which cover the surface unless this is already occupied by lichens or mosses.

If one should, in short, characterize Porto Rico's vegetation of fresh-water algae, one could call it the Land of Aerophilous Algae, for such are found on nearly every spot which is not occupied by cultivation; especially is this the case in the northern and central parts of the island, which have a great annual rainfall and intense humidity of the air. There is also found a rich and interesting alga-vegetation in the few fresh-water lakes and pools on the island, while its many brooks and rivers are comparatively poor in algae.

It is especially the Myxophyceae that are predominant, while the Chlorophyceae occupy a less prominent place, and the

Desmidiaceae, which usually elsewhere furnish the largest number of species, here appear comparatively seldom and in comparatively few species.

I am certain that among the 2,000 numbers of fresh-water algae collected in Porto Rico, there are several new species and genera, but they need to be made the object of a more thorough study than I have had time to give them as yet.

Respectfully,

N. WILLE

THOMAS HAMLIN HUBBARD

General Thomas Hamlin Hubbard, a member of the Corporation since 1909 and a member of the Board of Managers of the New York Botanical Garden since 1910, died at his home in New York on May 19, 1915.

General Hubbard was much interested in the development and work of the Garden and served for over four years as Chairman of the Membership Committee. He visited the institution at intervals, gave valued advice, and was a regular attendant at meetings of the Board of Managers. He contributed liberally to special funds when they were needed, and did much to advance educational and scientific work.

Resolved: That by the death of General Hubbard, the New York Botanical Garden has lost a valued adviser and friend.

Resolved: That the Managers deplore their loss and direct that this preamble and resolutions be entered on the minutes of the Board and that a copy be sent to his bereaved family.

Memorial and resolutions adopted by the Board of Managers June 17, 1915.

N. L. BRITTON,
Secretary

FLOWER SHOWS

The following exhibitions have been held in the museum building by The Horticultural Society of New York in cooperation with the Garden. The premiums are offered by the Garden to

be awarded by the exhibition committee of the Council of the Horticultural Society. At the close of the flower shows such flowers as are fit are given to hospitals in the neighborhood of the Garden.

May

This exhibition was held on Saturday and Sunday, May 8th and 9th. Premiums were offered for cut blooms of herbaceous plants, shrubs and trees, tulips, narcissi, orchids, bulbous plants, *Campanula*, and for plants of *Pelargonium* and *Calceolaria*. In the open-to-all classes for cut blooms the following premiums were awarded. Mr. George D. Barron took second prize for a collection of flowers of herbaceous plants. A large and unusual collection of the flowers and shrubs and trees gave the first prize to Mr. T. A. Havemeyer, the second prize being won by the F. R. Pierson Company. Mrs. H. Darlington received a first prize for a collection of tulips, F. R. Pierson Company, second. Mr. Barron also secured first prize for a collection of narcissi, the second going to Mrs. Ethel Anson S. Peckham. Lager & Hurrell were winners of the first prize for a collection of twenty-four vases of cut orchid blooms.

The following prizes were awarded in the classes for cut blooms for non-commercial growers. Mrs. H. Darlington exhibited an interesting collection of flowers of bulbous plants for which she received first prize. Mrs. H. I. Pratt, A. J. Manda, gardener, secured first prize for a collection of twelve vases of cut orchid blooms. Mrs. F. A. Constable, James Stuart, gardener, won first prize for six plants of *Calceolaria*, George D. Barron, second.

The following special prizes were awarded: George D. Barron, for a vase of gladioli and a vase of carnation Alma Ward; F. C. Littleton, Samuel Batchelor, gardener, for vase of carnation Baroness de Brennen, diploma; George Schlegel, S. G. Milosy, gardener, for a plant of *Epidendrum atropurpureum album*, diploma; William Shillaber, J. P. Sorenson, gardener, for a vase of *Passiflora Banksii;* Mrs. H. Darlington, for three plants of *Spiraea rubens* and a basket of pansies.

A display of cut blooms of shrubs and trees and of herbaceous

plants, not for competition, was made by the New York Botanical Garden.

Special May Exhibition

On the fifteenth and sixteenth, a special exhibition was held for the purpose of showing to the public a fine collection of cut blooms of lilacs which Mr. T. A. Havemeyer offered to display. On his estate at Glen Head, Long Island, Mr. Havemeyer has a large collection of lilacs, one of the best in the country, and this is the second time he has made a special display of the flowers through the Horticultural Society. The exhibit, covering one of the long center tables, was indeed a wonderful sight. The beauty of the flowers elicited expressions of admiration freely on all sides. All of the lilac colors were represented, white, pink, lavender, violet and the deepest black-purple, in single and double forms. Leon Gambetta has large trusses of double lilac flowers which were especially admired. The branches of the flower clusters were thickly covered with masses of flowers, giving the whole flower cluster a characteristic appearance. Clean and crisp in its pink coloring was Madame Buchner, one of the best of the double-flowered forms. There is a freshness to this variety which is very attractive.

As an expression of its appreciation for this display, and of Mr. Havemeyer's desire to have the public share in his great collections, the council of The Horticultural Society of New York awarded the Society's gold medal to Mr. Havemeyer for this exhibit.

On the corresponding table at the other end of the exhibition hall there was a large collection of Darwin and cottage tulips, exhibited by John Scheeper & Company, Inc., through the influence of Mr. Havemeyer. The tulips were planted nearly at the close of 1914 at Mr. Havemeyer's place at Glen Head, and were cultivated by him. In this collection there were sixty-nine vases of Darwin tulips and twenty-four of cottage. The Darwins presented a wonderful range of color—almost white with faint flushes of lavender and violet, lavender, violet, salmon pink, red, purple, and a series of the deepest black-purple represented by Zulu and Velvet King, the latter with a

beautiful satiny luster. A new Darwin tulip was called Katherine Havemeyer, in honor of the wife of the president of the Society. This was described as a purple-carmine, edged with buff, quite different from any other Darwin exhibited.

The cottage tulips have brighter colors than the Darwins and often have the flowers long and pointed. They and the Darwins bloom at about the same time. The Darwins are in soft colors, giving them a great value as cut flowers for the decoration of the home.

June

There were two exhibitions held during the month of June. The first took place on the fifth and sixth. The premiums offered were for roses, peonies, flowers of hardy flowering shrubs and trees, flowers of hardy herbaceous plants, and cut orchid blooms. This exhibition was held in coöperation with the American Rose Society which offered three of its medals, one silver and two bronze, as sweepstake prizes. The unusually cold weather preceding the date of the show so retarded the roses and peonies that the usual large display of these flowers was absent this year. The following prizes were awarded: For a vase of hybrid teas, Gen. E. A. McAlpin, J. Woodcock, gardener, took the first prize, Willian Tricker the second. This vase of roses exhibited by Gen. McAlpin also was awarded a bronze medal of the American Rose Society for the best vase of hybrid tea roses exhibited. Gen. McAlpin was also the first prize winner for twelve vases of hybrid tea roses.

Mr. T. A. Havemeyer, A. Lahodny, gardener, took first prize for each of the following classes of peonies: three white, three light pink, three rose, three crimson, a collection of singles, and a general collection.

Mr. Havemeyer as usual displayed an interesting collection of the flowers of shrubs and trees, in which his general collection of plants is very rich. He was awarded first prize for his exhibit, the second going to G. D. Barron. A fine collection of the flowers of herbaceous plants brought the first prize to Mrs. W. G. Nichols, George N. Sullivan, gardener, Mrs. L. S. Chanler, E. Wilson, gardener, securing the second prize. Mrs. Chanler's

collection contained a number of very interesting alpines. Lager & Hurrell won the first prize for twenty-four vases of cut orchids, Clement Moore receiving the second. In the class for orchid cut blooms, for non-commercial growers only, the first prize was awarded to Mrs. Harold I. Pratt for twelve vases.

The following special prizes were awarded: J. A. Manda, for *Swainsonia Mrs. Joseph Manda*, certificate of merit; Mrs. F. A. Constable, for a collection of flowers of herbaceous plants; Bobbink & Atkins, for a collection of irises, silver medal, for a collection of flowers of herbaceous plants, silver medal, for a collection of flowers of rhododendrons, silver medal, for a collection of flowers of shrubs and trees, special mention; Mrs. Marie Cullen, for two vases of roses, special mention; John Lewis Childs, for a collection of forms of *Iris germanica*, silver medal, for a vase of *Paeonia Mad. Coste*, special mention; A. N. Pierson, Inc., for a display of hothouse roses, silver medal; William Shillaber, J. P. Sorenson, gardener, for a vase of sweet peas, special mention; Miss M. T. Cockcroft, Adam Paterson, gardener, for a vase of Spencer sweet peas, silver medal; William Tricker, for miscellaneous collection of flowers of herbaceous plants, cash, for water lily *Mrs. Woodrow Wilson*, certificate of merit; Mrs. F. A. Constable, for a group of Pelargonium plants, and for a group of plants of *Calceolaria*, *Spiraea* and *Fuchsia;* William Ziegler, Jr., A. Bieschke, gardener, for a sport of *Dorothy Perkins*, special mention.

A display of flowers of shrubs and trees was made by the New York Botanical Garden.

The second exhibition was held on the twenty-sixth and twenty-seventh, and was to take the place of that usually held in the early part of July. The premiums offered were for hardy roses, Japanese irises, sweet peas, flowers of herbaceous plants, flowers of shrubs and trees, and vegetables. In the open-to-all classes, the following prizes were awarded: For six vases of sweet peas, Adrian Iselin, Jr., Joseph Tiernan, gardener, took the first prize, the second going to Mrs. Benjamin Stern, H. Gold, superintendent. William Shillaber secured first prize for a vase of one hundred sweet peas, one or more varieties. Mrs. William G.

Nichols was awarded the first prize for a collection of the flowers of herbaceous plants, the display containing twenty-one kinds of annuals and forty-eight of perennials. Mr. T. A. Havemeyer was again a first prize winner for a group of flowers of shrubs and trees. His display of twenty-two vases contained a number of choice and unusual flowers. The second prize in this class was awarded to Mrs. H. Darlington, for a collection of eighteen vases. The collection of Mrs. William G. Nichols was worthy of a prize in the estimation of the Exhibition Committee and so a special third prize was awarded to it. This collection contained twenty-eight vases.

The first prize for a collection of twelve different vegetables was awarded to Mrs. Benjamin Stern. Mr. Adrian Iselin, Jr., secured the first prize in the class for six different vegetables. In the class for non-commercial growers, Mr. Adrian Iselin, Jr., won the first prize for three vases of sweet peas, three varieties, twenty-five of each variety.

The following special prizes were awarded: Lager & Hurrell for a specimen plant of *Cattleya Gigas*, a fine variety; Adrian Iselin, Jr., for twelve vases of sweet peas, cash, for a collection of *delphiniums*, a bronze medal; Mrs. William G. Nichols, for a collection of outdoor roses; Mrs. F. A. Constable, for two vases of hybrid perpetual roses; James A. MacDonald, R. Hughes, gardener, for two vases of *delphiniums;* John Lewis Childs, for a collection of lilies and callas, certificate of merit, for a collection of Japanese irises, special mention; Mrs. H. Darlington, for a collection of *Delphinium* hybrids, silver medal, for a display of *Allamanda Schottii*, cash; Bobbink & Atkins, for a collection of flowers of hardy perennials, silver medal, for a collection of *delphiniums*, certificate, for a collection of dwarf Polyantha roses, special mention, for a collection of climbing roses, special mention, for a collection of hybrid tea and tea roses, silver medal; Mrs. Benjamin Stern, for a fine collection of sweet peas, thirty-six vases; William Shillaber for a display of hardy rambler roses, silver medal and cash.

The display of hardy rambler roses, staged for Mr. Shillaber by his gardener, J. P. Sorenson, was the most attractive feature

of this exhibition, owing to the unusual character of the display. The exhibit represented a miniature rose garden, the ground being covered with layers of moss, the vases of hardy rambler roses being used to define the limits of the Garden, with scattered vases in the interior. A small receptacle representing a pond in the center contained gold fish. The display was very creditable and might be taken as a suggestion to other exhibitors to get away from the formalities usually imposed upon flower shows.

The New York Botanical Garden made a display of the flowers of herbaceous plants and of shrubs and trees.

GEORGE V. NASH

NOTES, NEWS AND COMMENT

Dr. John K. Small, of the Garden staff, spent several weeks during June and July in Florida in further botanical exploration of the southern portions of the Everglades and the Florida Keys.

Professor E. M. Gilbert, of the botany department of the University Wisconsin, spent a week at the Garden recently in the study of herbarium material of *Tremella* and other related gelatinous fungi.

Dr. F. D. Fromme, formerly a student at the Garden, has accepted the position of mycologist at the Virginia State Agricultural Experiment Station.

Five small and compact volumes by Dr. W. A. Murrill on the Polyporaceae and Boletaceae of North America have recently been issued. Each volume, in addition to complete keys, contains descriptions of all of the species known to occur in the region covered in each respective case. The treatment of the Polypores known in different sections of the country in separate volumes is a convenient arrangement since it will enable the worker to locate the species in his own section of the country without being compelled to "wade" through the literature of

the species which do not occur in his particular region. The five volumes are as follows:

Northern Polypores, *issued in December, 1914.*

Including species found in Canada and the United States south to Virginia and west to the Rockies.

Southern Polypores, *issued in January, 1915.*

Including species found in the United States from North Carolina to Florida and west to Texas.

Western Polypores, *issued in March, 1915.*

Including species found in the states on the Pacific coast from California to Alaska.

Tropical Polypores, *issued in June, 1915.*

Including species found in Mexico, Central America, southern Florida, the West Indies, and other islands between North America and South America.

American Boletes, *issued in December, 1914.*

Including all the species found in temperate and tropical North America, both on the mainland and on the islands, south to South America.

Dr. Marshall A. Howe, curator, returned on July 19 from Porto Rico, where he devoted three or four weeks to collecting and studying the marine algae. Ensenada (Guanica Centrale), on the southern shore of the island, was made the base of operations. Special attention was given to dredging work, which was carried on with the coöperation of Dr. Raymond C. Osburn, of Columbia University, representing the New York Academy of Sciences.

Meteorology for June.—The total precipitation for the month was 2.55 inches. The maximum temperatures for each week were 83° on the 1st, 89° on the 12th, *90° on the 14th*, 83° on the 21st, and 85° on the 29th. The minimum temperatures were *46° on the 3d*, 55° on the 9th, 56° on the 21st, and 49° on the 25th.

ACCESSIONS

MUSEUMS AND HERBARIUM

3 specimens of flowering plants from Texas. (By exchange with Mr. D. A. Saunders.)

1 specimen of *Urtica chamaedryoides* from Missouri. (Given by Mr. B. F. Bush.)

29 specimens of North American Lithothamnieae. (By exchange with the Trandhjems Museum.)

3 specimens of hepatics from New England. (By exchange with Miss Annie Lorenz.)

1 specimen of *Vaccinium corymbosum* from New York. (Given by Professor W. L. Bray.)

13 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

1 specimen of fungus from Java. (By exchange with the United States National Museum.)

53 specimens of fungi from California. (By exchange with the University of California.)

2 specimens of fungi from Oregon. (By exchange with Mr. C. E. Owens.)

3 specimens of *Mycosphaerella ontarioensis* from Ontario. (By exchange with Professor R. E. Stone.)

2 specimens of ascomycetes from Ohio. (By exchange with Professor Bruce Fink.)

27 specimens of fungi from various localities. (By exchange with Professor James R. Weir.)

1 specimen of *Lycoperdon* from South America. (By exchange with the Smithsonian Institution.)

1 specimen of *Agaricus subrufescens* from Long Island. (By exchange with Mrs. W. Bensel.)

1 specimen of *Humaria hepatica* from Colorado. (By exchange with Professor Ellsworth Bethel.)

25 specimens, "Ustilagineen," fascicle 13. (Distributed by Mr. Paul Sydow.)

100 specimens, "Uredineen," fascicles 52 and 53. (Distributed by Mr. Paul Sydow.)

2 specimens of fungi from New Jersey. (By exchange with Mr. C. A. Schwarze.)

150 specimens, "Fungi Exotici Exsiccati," fascicles 7, 8, and 9. (Distributed by Mr. Hans Sydow.)

1 specimen of *Stictis radiata* from Ohio. (By exchange with Professor Bruce Fink.)

112 specimens of rusts from Porto Rico. (By exchange with Professor F. L. Stevens.)

2 specimens of fungi from Colorado. (By exchange with Professor Ellsworth Bethel.)

3 specimens of fungi from New York. (Given by Mr. Percy Wilson.)

1 specimen of *Lachnella flammea* from Colorado. (By exchange with Professor Ellsworth Bethel.)

227 specimens of fungi from Porto Rico. (By exchange with Professor F. L. Stevens.)

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ARLOW BURDETTE STOUT

Director of the Laboratories

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VOL. XVI August, 1915 No. 188

REPORT UPON THE CULTIVATION OF DRUG AND DYE PLANTS

DR. W. GILMAN THOMPSON, PRES.,

Sir:—I have the honor to submit the following report, on behalf of the Scientific Directors:

Upon being notified by the Director-in-Chief that the Board of Managers had referred to the Scientific Directors for investigation the general subject of the cultivability for commercial purposes, in the vicinity of New York, of standard medicinal and dye plants, I prepared a list of all the foreign and domestic drugs which are pretty certain to do well under cultivation in the region in question, and which at the same time show some possibility of being sufficiently important and valuable to justify the procedure.

Another list was made of those which, although not certain to grow here, appeared likely to do so.

These lists were submitted to the Bureau of Plant Industry of the United States Department of Agriculture, to ascertain whether their studies and experience counter-indicated any of my assumptions, and I was informed that they did not.

Following a general discussion of the subject of drug production, each of these plants was discussed briefly, as to its importance and value and the proper soil and other conditions for its

[Journal for July (16: 123–154) was issued Aug. 7, 1915]

growth. At the end of each item was added a reference to the publication or publications of the Department of Agriculture and the page thereof where that subject is treated.

A list was then secured of all publications of the Department of Agriculture which bear on this general subject and an attempt was made to secure them. All that were available for free distribution were asked for and obtained. Those which could be obtained only by purchase were ordered from the Bureau of Publications and were paid for in advance. Most of them have been received and the others are promised as soon as the stock is renewed. These publications, together with the list of those still to be obtained, were placed in the library for deposit in a pamphlet box devoted to this subject. This list was supplimented by a rather complete bibliographical list compiled by Mr. F. B. Kilmer of the scientific staff of Messrs. Johnson & Johnson, New Brunswick, New Jersey. Most of those not obtainable are already in the library as parts of the regular series of Department publications, so that the references to them in the list referred to will make it possible for them to be consulted. An attempt was also made, and is now in progress, to secure other documents on the subject, and these will be placed in the same file.

It now seems desirable to continue this study during the summer, and also to follow the experiments which are being made by several of our managers, and to present an illustrated lecture based thereon, on the cultivation of medicinal plants in the vicinity of New York, in our fall or winter course of public lectures.

Public interest in the cultivation of drugs in the United States is steadily and rapidly increasing. It affects various classes of people and is dependent upon various considerations, some of which are sound, while others are quite the reverse. Among the large number of persons who have communicated with me on this subject during the past decade, by far the greater number are those who have had little or no personal acquaintance with agriculture, although many of them have carried on small horti-

cultural operations at their homes. They include pharmacists, physicians and business men with country places, but mostly people who have lived in the city and have removed thence to the country, and desire to engage in some form of cultivation of the soil. They would not think of engaging in the production of ordinary farm crops, because of the much labor involved and the smallness and uncertainty of the returns. Very often, too, they disdain so commonplace an occupation as "farming." They would be glad to engage in fruit-raising, but realize that it requires knowledge and experience that they do not possess. What they desire is some form of soil tillage that means quick and large profits, with no risk and just enough light and pleasant labor to constitute a rural recreation.

All such persons may count upon a certain failure from their attempts to grow drugs for profit. It must be understood that methods for the cultivation of each drug have to be worked out by painstaking experiment, based upon a thorough knowledge of the habits and requirements of the plant in its natural habitat. Success in the cultivation of ordinary farm-crops, the methods of which have been established by centuries of experience, requires personal knowledge, experience and care, and this is true to a much greater extent of the cultivation of drugs of which comparatively little is known by anyone.

On the other hand, there are excellent reasons why the cultivation of certain drug plants should be developed in this country, and there is good reason to believe that in some cases this can be done with profit to those undertaking it. Those who engage in this work must select drugs with knowledge of the following subjects:

1. That there is a steady and reasonably large demand for the product.

2. That the soil and climate where it is to be cultivated are adapted to its growth.

3. That they are sufficiently familiar with its individual requirements to be able to grow it successfully.

4. That its market price is such as to leave a profit over the cost of producing and marketing it.

Upon the last consideration, the following facts have an important bearing.

The enforcement of modern federal and state drug statutes have put an end to the use of spurious, adulterated and badly collected, cured and preserved drugs. This has had the effect of generally advancing prices. It has had the more important effect of compelling the dealer and manufacturer to be cautious in his acceptance of stocks offered him, and has largely increased the possibility of his becoming saddled with something that he cannot use. Both his convenience and safety are thus promoted by being able to purchase an article of the identity, purity and quality of which there is no question. This gives to the cultivator a great advantage over the collector of the wild product in finding a sale and in getting a good price.

The supply of wild product is always uncertain. Crops often fail, owing to natural conditions of growth, some new condition that directs the labor of collectors into new lines, an unsatisfactory result in the preceding season and a variety of accidents. This establishes conditions favorable to a speculative market, which always works to the disadvantage of the regular merchant or manufacturer. For this reason again, the cultivator of drugs would be given the preference, since it would be possible to contract with him for supplies in advance of production.

Again, there are good reasons for believing that by the same processes of selecting, hybridizing, breeding and cultivating that have done so much for other vegetable products, the medicinal activity of drugs may be increased, so that a given amount will bring a higher price.

At such a time as the present, when the European war has interefered very seriously with the supply of many drugs, our attention is specially drawn to the above facts. In the notes which follow regarding particular drugs, all these considerations have received due attention. Besides the drugs proper, I include a number of products which are rather condimental than medicinal in their general use.

Products Known to be Capable of Easy and Successful Culture near New York

BURDOCK ROOT, *Arctium Lappa* L., and other species of *Arctium*.

Has an enormous medicinal use, notwithstanding that it is practically inactive; to be grown in rich soil, where ordinary root crops would thrive. Grow from seed; the rows 2 feet apart and plants a foot apart in the row; gather in the fall. (Farmers' Bull. 663: 16; Bur. Plant Industry, Bull. 107: 64.)

CIMICIFUGA, *Cimicifuga racemosa* (L.) Nutt.

Seeds probably cannot be bought, and must be collected in the fall from our woodlands, where the plant abounds. Cultivate in rich sandy loam, plants 2 feet apart. It is not likely that the results would be financially profitable. The underground portion is used. (Bur. Plant Industry, Bull. 107: 35.)

SYMPHYTUM or COMFREY, *Symphytum officinale* L.

Plant in rows 2 feet apart, plants 1 foot apart in row; requires rich light soil; profit doubtful; demand light. The underground portion is used. (Bur. Plant Industry, Bull. 107: 57.)

SENEGA, *Polygala Senega* L.

Seeds must be collected, as they are not commercial. Plant in light loamy soil, rows a foot apart, plants 3 inches apart in row, would probably be profitable. The roots are used. (Farmers' Bull. 663: 33.)

DANDELION, *Taraxacum Taraxacum* (L.) Karsten.

The wild plant in this country does not produce roots of good size and quality. Cultivation would probably do so, but the price is so low that it is doubtful if it would pay. Should be grown about like carrots. (Farmers' Bull. 663: 22; Bur. Plant Industry, Bull. 107: 60.)

DIGITALIS, *Digitalis purpurea* L.

Very largely used and fair prices paid; demand for drug of fine quality strong. Plant seed in drills and transplant to field when well established; set in rows 2 feet apart, plants 18 inches apart in rows; gather leaves when plant is beginning to bloom

and dry carefully in shade. (Eli Lilly Sci. Bull. 1: 202 and 206; Farmers' Bull. 663: 22.)

ACONITE, *Aconitum Napellus* L.

Very largely used, but price rather low; a fair return might be expected. Plant in rows 2 feet apart, six inches apart in rows; collect tubers in fall of second year; dry carefully, to avoid mouldiness; rich, light loam preferable.

CRAMP BARK, *Viburnum Opulus* L.

The common Snow-ball shrub is the cultivated form of this species, which is common in a wild state in the northern United States and Canada, and known as "High-bush Cranberry." The bark is largely used. For years the entire market supply has been spurious (*Acer spicatum* Lam.): The drug authorities will certainly stop the use of the latter and a demand for the genuine will grow up. An article known to be authentic should find a good market, at a fair price, the collection of the wild bark in quantity being difficult. It grows best in swamps where spring freshets overflow the land. It is a tall shrub, forming thickets.

CHENOPODIUM or AMERICAN WORMSEED, *C. ambrosioides* L. or *C. anthelminticum* L.

Would probably pay well; seeds easily obtained and plants would grow well in almost any soil. Cultivate about like bush beans; seeds must be threshed off like grain. (Farmers' Bull. 663: 37; Yearbook, U. S. Dept. Agric. 1905: 535; Bull. U. S. Dept. Agric. 26: 4.)

CANADIAN HEMP, *Apocynum cannabinum* L.

It is almost impossible to get the genuine and pure drug from wild sources. Demand is moderate, but there would be sale for a fair amount. Plant 1 foot apart, in rows 2 feet apart. The underground portion is used. (Bur. Plant Industry, Bull. 107: 55.)

ANGELICA, *Angelica Archangelica* L.

This is a very profitable crop in Europe, but I do not know of any attempts to grow it here. It is worth a trial. Seeds easily

obtained from Europe; plant in rich soil, in rows 3 feet apart, plants one foot apart in row. Both the underground portion and the fruits are used. (Farmers' Bull. 663: p. 14.)

LOVAGE, *Levisticum Levisticum* (L.) Lyons.

Remarks made concerning *Angelica* apply to this, but only the roots are used. (Farmers' Bull. 663: p. 28.)

AMERICAN GREEN HELLEBORE, *Veratrum viride* Ait.

A profitable industry could probably be developed. Seeds esaily collected; requires deep, moist soil; swamp-lands could be utilized for the purpose. The underground portion is used. (Bur. Plant Industry, Bull. 107: 18.)

BLUE FLAG, *Iris versicolor* L.

It is so abundant and cheap that it is doubtful if its cultivation would pay, but it could be grown similarly to the last preceding. The underground portion is used. (Farmers' Bull. 663: 16.)

UNICORN ROOT, *Aletris farinosa* L.

Largely used; wild supply abundant and cheap, but very liable to admixture of other things. It is doubtful if it would pay. Plant 3 inches apart, in rows a foot apart. Collect rhizomes with roots, in fall. (Farmers' Bull. 663: 13; Bur. Plant Industry, Bull. 107: 19.)

CONVALLARIA, *Convallaria majalis* L.

Very easily grown in any light soil. Allow it to form a dense bed and then uproot it, leaving enough roots for reproduction. The underground portion is used. Largely used and would probably pay.

VALERIAN, *Valeriana officinalis* L.

Would probably pay well; is enormously used; grow in any good soil; plant a foot apart in rows 2 feet apart. The underground portion is used. (Farmers' Bull. 663: 36.)

CAULOPHYLLUM, *Caulophyllum thalictroides* (L.) Michx.

Not very much used and very cheap and abundant. Would probably not pay, but easily grown, like cimicifuga. The underground portion is used. (Bur. Plant Industry, Bull. 107: 37.)

HYDRASTIS, *Hydrastis Canadensis* L.

Largely used, extremely scarce and very high-priced; difficult to grow and requires great care, by methods already well-defined by the Bureau of Plant Industry. One willing to take the necessary amount of trouble, would probably make very large profits. (Farmers' Bull. 663: 25; Yearbook, U. S. Dept. Agric. 1905: 534; Bur. Plant Industry, Circular 6; Bull. 107: 31).

GINSENG, *Panax quinquefolius* L.

Remarks concerning *Hydrastis* apply to this also. (Farmers' Bull. 663: 24; Bur. Plant Industry, Bull. 107: 49; Farmers' Bull. 551.)

FRANGULA BARK, *Rhamnus Frangula* L.

Can be easily grown in swamp lands, replacing ordinary brook-alder; bark abundant and cheap, but very liable to admixture with other barks which are hard to distinguish. Manufacturers would probably welcome supplies from cultivators, of known quality.

PEPPERMINT and SPEARMINT, *Mentha piperita* L. and *M. spicata* L,

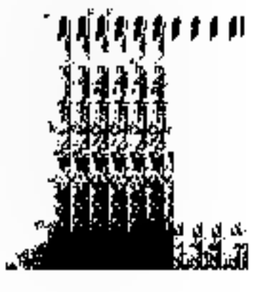
Already established in cultivation on a large scale in this country. (Farmers' Bull. 663: 31 and 34; Bur. Plant Industry, Bull. 90; 19; 219: 28 and 29.)

MUSTARD, *Sinapis alba* L. and *Brassica nigra* (L.) Koch.

European supplies so abundant and cheap that cultivation here is a matter of close competition, but there is no good reason why it should not succeed. (Bull. U. S. Dept. Agric. 26: 6. and 7.)

STRAMONIUM, *Datura Stramonium* L.

Grows readily in waste-lands, on ash dumps and in similar places; demand large, but price very low. It is worth a trial. The leaves should be collected in the late summer and dried in the shade. (Journ. Indust. & Eng. Chem. 5: (Dec. 1913); 8th Int. Cong. Appl. Chem. 17: 57; Eli Lilly Sci. Bull. 1: 156 and 108: Farmers' Bull. 663: 35; Yearbook, U. S. Dept. Agric. 1905: 535; Bull. U. S. Dept. Agric. 26: 13; Bur. Plant Industry Bull. 219: 30.)



HOREHOUND, *Marrubium vulgare* L.

Imported in enormous quantities; grows easily in almost any soil and would probably pay fairly well; plant a foot apart, in rows 3 feet apart; collect the entire above-ground portion of the plant when in full flower and dry quickly. (Farmers' Bull. 663: 26; Bur. Plant Industry Bull. 219: 23.)

SERPENTARIA or VIRGINIA SNAKEROOT, *Aristolochia Serpentaria* L. and *A. reticulata* Nutt.

Since this region formerly yielded considerable of this drug in a wild state, there is no doubt that it would flourish here. There is a large demand for it at good prices, and it is very apt to contain other roots, as it is received from the native collectors. It should be grown in a sandy loam. Seeds are probably not purchasable, and must be collected. (Bur. Pl. Ind. Bull. 107: 26; Farmers' Bull. 663: 34.)

Promising Drugs

The following could probably be cultivated successfully about New York, though there is not sufficient evidence to justify a positive statement.

BELLADONNA ROOT and LEAVES, *Atropa Belladonna* L.

These are exceedingly important drugs, being used in enormous quantity and being indispensable in medicine. Even before the European war, it was quite difficult to secure them in sufficient supply, and they are now almost unobtainable. Efforts to grow them in the neighborhood of San Francisco have met with perfect success, the product being of superior quality, bringing a high price and yielding a handsome profit. Efforts to grow it at New Brunswick, New Jersey, have not been found commercially successful up to the present, although the attempt has not been abandoned. The plants should have an ordinary light rich soil, and should be set 2 feet apart in rows 4 feet apart. (Yearbook, U. S. Dept. Agric. 1905: 538; Journ. Agricultural Research No. 2 (Nov. 20, 1913); Jour. Indust. & Eng. Chem. **6** (June 1914); Am. Jour. Phar. **79**: 523; Proc. A. Ph. A. **57**: 833; Pac. Phar. **5**: 157; **6**: 159; **7**: 332; Eli Lilly Sci.

Bull. 1: 169; Farmers' Bull. 663: 15; Yearbook, U. S. Dept. Agric. 1905: 538; Journ. Agric. Res. No. 2. (Nov. 20, 1913.)

SPIGELIA or PINK-ROOT, *Spigelia Marilandica* L.

Most of that supplied is either wholly spurious or largely adulterated. The spurious is so closely similar to the genuine as to cause extreme difficulty in the trade, microscopical examination being necessary to identification. A brand of known purity and good quality would sell readily and at a high price. This is the northern limit of its natural home, but it could doubtless be cultivated successfully. It should be grown in a light sandy loam. Seeds are probably not purchasable and must be collected. The underground portion is used. (Bur. Pl. Ind. Bull. 100: 5; 107: 52; Farmers' Bull. 663: 31.)

COLCHICUM, *Colchicum autumnale* L.

This is very largely used, both the seeds and the corm, and could be sold in almost any quantity, although the price is low. It is cultivated hereabout as a garden flower, and seeds and bulbs, both of which are used medicinally, are readily obtainable. It requires a rich light soil.

SAGE, *Salvia officinalis* L.

New York is rather far north for this plant to do well, but it could doubtless be grown with fair success. The demand for it, rather as a condiment than a drug, is unlimited, and it could probably be grown at a profit. It requires a light rich soil. The seeds could readily be obtained abroad, even if not in this country. (Farmers' Bull. 663: 33.)

THYME, *Thymus vulgaris* L.

The same remarks may be made regarding common garden thyme as about the last mentioned. (Farmers' Bull. 663: 35.)

Origanum hirtum Link and *O. Onites* L.

Both of these have the odor and taste of thyme, and both are enormously imported and used as condiments, mostly under the name of "thyme," although largely also as "origano." If they can be grown hereabout, the business should be profitable. They

come from Austro-Hungary and Italy, so it is somewhat doubtful if they would grow here. They do well in almost any soil.

ARNICA, *Arnica montana* L.

Both the rhizomes and flowers, but mostly the flowers, are enormously used. The plant would doubtless grow well in this section, in almost any soil, but the cost of labor would be liable to prevent a profit. (Farmers' Bull. 663: 15.)

CASCARA SAGRADA, *Rhamnus Purshiana* DC.

This shrub grows well in the vicinity of Washington, D. C., and does fairly well in the severe climate of Detroit. It would doubtless do very well in the sandy soil of Long Island or New Jersey. The amount of the bark that is annually used is almost incredible, and the native supplies are being rapidly exhausted. It must ultimately be cultivated. Seeds can readily be obtained in the northwest, in August or September. It will grow well in any soil. (Bur. Pl. Ind. Bull. 139: 38 and 39; Yearbook, U. S. Dept. Agric. 1905, 534; Farmers' Bull. 663: 20.)

CAPSICUM or CAYENNE PEPPER, *Capsicum fastigiatum* Blume.

It is somewhat doubtful if this could be grown with a profit in the vicinity of New York, but it could be made very profitable in Florida, where it bears continuously. There is a limitless demand for it. The native sources, in Zanzibar, as a result of political and other changes, have become depleted, and there will be an opportunity for others to supply it.

PYRETHRUM or INSECT FLOWERS, *Chysanthemum cinerariifolium* (Irev.) Bocc.

The value of this crop is beyond question, if only we could cultivate it successfully. At present the project is not practicable, although some success has been attained in California. (Farmers' Bull. 663: 26.)

CONIUM or POISON HEMLOCK, *Conium maculatum* L.

The fruit of this plant is used and is an important medicine. The plant is grown in the field like wheat or rye, and is cut and threshed like ordinary grain. Its culture in this country has probably never been attempted. The commercial drug is very

liable to admixture and a clean and well-preserved article would be well received. The great difficulty experienced in securing conium of full activity would give a great advantage to the producer of a perfectly reliable article. (Bull. U. S. Dept. Agriculture 26: 11; Farmers' Bull. 663: 21.)

ANISE, *Pimpinella Anisum* L.

This is a similar fruit to the last, closely related and grown and harvested in the same way. It is rather doubtful if it would do well so far north as New York.

ASPIDIUM or MALE FERN, *Dryopteris Filix-mas* (L.) Schott.

This is a very important drug, and is largely used. The commercial article is very poor, in most cases. A brand known to be genuine and good would probably be taken, even at a high price. It is a large fern, growing usually in rich mountain soil. It would doubtless grow in any rich soil in this vicinity. (Bur. Pl. Ind. Bull. 107: 11.)

SANTONICA, *Artemisia pauciflora* (Ledeb.) Weber.

This is the immature flower heads of *Artemisia pauciflora* of Turkestan. It is rather doubtful if it will grow in this immediate vicinity, but the experiment is worth trying, if seeds can be obtained, which will be a matter of great difficulty. The drug is used in enormous quantities for the extraction of its active constituent, santonin. For two years past, the genuine has been very scarce and high. Large shipments of a spurious variety have been rejected and ordered reshipped out of the country. The subject is one of great interest.

ERGOT, *Claviceps purpurea* (Fries) Tulasne.

This is a parasitic fungus, replacing the grain of rye. A pound of it is worth about as much as two bushels of rye. The practicability of getting it established upon rye in this country is problematical, although not very doubtful. Experiments are well worth making.

CANNABIS INDICA, *Cannabis sativa* L.

This is a very largely used drug, but at present the use is permitted of only that grown in the East Indies. The question

of authorizing the use of that grown in the United States is now being debated. Should this be done, its cultivation here should be experimented with (Eli Lilly Sci. Bull. 1: 93; Farmers' Bull. 663: 19.)

CONE FLOWER, *Brauneria pallida* (Nutt.) Britton.

This hardy perennial of the Kansas plains yields a root that has come into enormous use during the last decade. The natural supplies have become greatly reduced and the price high, and cultivation would doubtless become profitable. It requires a rich deep soil. The plants should be set about a foot apart, in rows 2 feet apart. (Farmers' Bull. 663: 23.)

LARKSPUR, *Delphinium*, sps.

There is a steady, large and permanent demand for larkspur seed for the destruction of body parasites. The plant grows well in such soils as those of central Jersey and Long Island, but the soil should be fairly well fertilized. Plant in rows 2 feet apart. Harvest the pods before they burst open, or many seeds will be lost.

CARAWAY, *Carum Carni* L.; CORIANDER, *Coriandrum sativum* L.; DILL, *Anethum graveolens* L.; and FENNEL, *Foeniculum Foeniculum* (L.) Karsten.

All these fruits (so-called seeds) are used in enormous quantities and can hardly be produced in excessive amounts. They are to be grown in drills, like grain, and similarly harvested. Their cultivation is old and extensive and they are to be regarded as staple farm crops. (Farmers' Bull. 663: 20, 21, 23, and 24).

Drug Plants the Cultivation of Which is Not Recommended

The following drug plants, although readily grown, would probably be unprofitable, owing to the slight demand, to their great abundance as weeds with a consequent low price, or to some other factor.

CATNIP, *Nepeta Cataria* L., is a very common weed, is not largely used, and sells at a very low price.

HENBANE, *Hyoscyamus niger* L., is very subject to the attacks

of insects. Since the herbage is the medicinal part, the use of insecticides is not permissible.

ROMAN CHAMOMILE, *Anthemis nobilis* L., is now very little used and the cost of production in this country would probably be prohibitive.

GERMAN CHAMOMILE, *Matricaria Chamomilla* L., is very largely used, but the cost of harvesting would doubtless be too great.

CALENDULA or MARIGOLD, *Calendula officinalis* L. The last statements will apply to this drug, also.

TANSY, *Tanacetum vulgare* L., is a common roadside weed and can be collected at a price that would render profitable cultivation very doubtful.

AMERICAN PENNYROYAL, *Hedeoma pulegioides* (L.) Pers., is a common weed. The amount used as a drug is small, but great quantities of the oil are used. This oil can be produced much more cheaply abroad, so the cultivation of this plant is not likely to be remunerative.

ELECAMPANE, *Inula Helenium* L., is so abundant in wet rocky pastures and woodlands that it can be gathered in a wild state more cheaply than it could be cultivated.

CALAMUS, *Acorus Calamus* L., is so very abundant in swamps that not the slightest hope of successful competition with the wild product can be entertained.

ORRIS ROOT, *Iris Germanica* L., *I. pallida* Lam. and *I. florentina* L., does well here but the curing and preparation of the crop is a very critical and expensive process.

ALTHEA or MARSHMALLOW, *Althea officinalis* L., also requires a large amount of expensive labor for its preparation, and would probably not be produced at a profit.

BONESET or THOROUGHWORT, *Eupatorium perfoliatum* L., is of very easy cultivation, but so very common and abundant as a weed that its profitable cultivation is impossible.

LAVENDER, *Lavandula angustifolia* (L.) Miller, can be made to grow in this section, but only with great care, and is liable to be entirely destroyed by severe winter weather.

LOBELIA, *Lobelia inflata* L., grows well here but it is a common weed. The demand is so small as to be readily met, at a very low price, by natural supply.

POKEROOT, *Phytolacca decandra* L., is such a common and abundant weed, and in such light demand, that it could not be cultivated with advantage.

WINTERGREEN, *Gaultheria procumbens* L., is in very great demand, but the wild supply is abundant, and its cultivation is very difficult.

Dye Plants

A careful consideration of this field fails to reveal any dye plant of value or importance that is likely to do well in this region. The trial of alkanet (*Alkanna tinctoria* (L.) Tausch.) is suggested and appears to be advisable. I doubt, however, if the product would be good, even if it could be grown. A tropical or subtropical climate appears to be requisite for the free formation of vegetable coloring matters.

Publications of the United States Department of Agriculture on the Subject of Drug Plants, etc.

The following publications on drug plants and closely related subjects have been issued by the Department of Agriculture. The editions of nearly all of these are entirely exhausted at the Department, but it may be possible to obtain copies by purchase from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices specified.

Cultivation of Drug Plants in the United States. By Rodney H. True. In Yearbook of the Department of Agriculture for 1903, pp. 337–346, 3 pls. (Yearbook Separate No. 325.) Price, 5 cents.

The Adulteration of Drugs. By Lyman F. Kebler. In Yearbook of the Department of Agriculture for 1903, pp. 251–258. (Yearbook Separate No. 331.) Price, 5 cents.

Goldenseal. By Alice Henkel and G. Fred Klugh. In Bulletin 51, Bureau of Plant Industry, pp. 35–46, 2 pls. 1904. Price, 5 cents.

Weeds Used in Medicine. By Alice Henkel. Farmers' Bulletin No. 188. 45 pp., 31 figs. 1904.

Peppermint. By Alice Henkel. In Bulletin 90, Bureau of Plant Industry, pp. 19–29, 3 figs. 1905. Price, 5 cents.

Progress in Drug-Plant Cultivation. By Rodney H. True. In Yearbook of the Department of Agriculture for 1905, pp. 533–540, 3 pls. (Yearbook Separate No. 401.) Price, 5 cents.

The Drug Known as Pinkroot. By W. W. Stockberger. In Bulletin 100, Bureau of Plant Industry, pp. 41–44, 6 figs., 2 pls. 1906. Price, 5 cents.

Growing and Curing Hops. By W. W. Stockberger. Farmers' Bulletin 304. 39 pp., 20 figs. 1907.

American Root Drugs. By Alice Henkel. Bulletin 107, Bureau of Plant Industry. 80 pp., 25 figs., 7 pls. 1907. Price, 5 cents.

The Use of Suprarenal Glands in the Physiological Testing of Drug Plants. By Albert C. Crawford. Bulletin 112, Bureau of Plant Industry. 32 pp. 1907. Price, 5 cents.

The Cultivation and Handling of Goldenseal. By Alice Henkel and G. Fred Klugh. Circular 6, Bureau of Plant Industry. 19 pp., 7 figs. 1908. Price, 5 cents.

The Sources of Arsenic in Certain Samples of Dried Hops. By W. W. Stockberger. In Bulletin 121, Bureau of Plant Industry, pp. 41–46. 1908. Price, 5 cents.

American Medicinal Barks. By Alice Henkel. Bulletin 139, Bureau of Plant Industry. 59 pp., 45 figs. 1909. Price, 15 cents.

Harmfulness of Headache Mixtures. By L. F. Kebler, F. P. Morgan, and Philip Rupp. Farmers' Bulletin 377. 16 pp. 1909.

The Necessity for New Standards of Hop Valuation. By W. W. Stockberger. Circular 33, Bureau of Plant Industry. 11 pp 1909. Price, 5 cents.

Habit-Forming Agents: Their Indiscriminate Sale and Use a Menace to the Public Welfare. By L. F. Kebler. Farmers' Bulletin 393. 19 pp., 5 figs. 1910.

The Source of the Drug Dioscorea, with a Consideration of the Dioscoreae Found in the United States. By Harley Harris Bartlett. Bulletin 189, Bureau of Plant Industry, 29 pp., 8 figs. 1910. Price, 10 cents.

Camphor Cultivation in the United States. By S. C. Hood and R. H. True. In Yearbook of the Department of Agriculture for 1910, pp. 449–460, 3 pls. (Yearbook Separate No. 551.) Price, 5 cents.

American Medicinal Leaves and Herbs. By Alice Henkel. Bulletin 219, Bureau of Plant Industry. 56 pp., 36 figs. 1911. Price, 15 cents.

Wild Volatile-Oil Plants and Their Economic Importance: I.—Black Sage; II.—Wild Sage; III.—Swamp Bay. By Frank Rabak. Bulletin 235, Bureau of Plant Industry, 37 pp., 5 figs. 1912. Price, 5 cents.

The Diseases of Ginseng and Their Control. By H. H. Whetzel and J. Rosenbaum. Bulletin 250, Bureau of Plant Industry. 44 pp., 5 figs., 12 pls. 1912. Price, 15 cents.

Some Effects of Refrigeration on Sulphured and Unsulphured Hops. By W. W. Stockberger and Frank Rabak. Bulletin 271, Bureau of Plant Industry. 21 pp. 1912. Price, 5 cents.

Individual Variation in the Alkaloidal Content of Belladonna Plants. By Arthur F. Sievers. In the Journal of Agricultural Research, November, 1913, vol. 1, No. 2, pp. 129–146, 1 fig. Price, 25 cents.

American Medicinal Flowers, Fruits, and Seeds. By Alice Henkel. Bulletin 26, U. S. Department of Agriculture, 16 pp., 12 figs. 1913. Price, 5 cents.

The Cultivation of American Ginseng. By Walter Van Fleet. Farmers' Bulletin 551, 14 pp., 3 figs. 1913.

Goldenseal under Cultivation. By Walter Van Fleet. Farmers' Bulletin 613, 15 pp., 5 figs. 1914.

Other References

The Improvement of Medicinal Plants. By F. A. Miller. The Lilly Sci. Bulletin 1: 25–43.

Propagation of Medicinal Plants. By F. A. Miller. Bull. Torr. Bot. Club 41: 105-129.
Breeding of Medicinal Plants. By F. A. Miller. The Lilly Sci. Bull. 1: 117–119.
Commercial Possibilities of Growing Medicinal Plants. By F. A. Miller. The Lilly Sci. Bull. 1: 163–172.
The Cultivation of Medicinal Plants. By F. B. Kilmer. Nat. Assoc. in Mfrs. of Med. Products. Feb. 8, 1915.
(See also bibliographical list of F. B. Kilmer, Sci. Dept. Johnson & Johnson.)

H. H. RUSBY,
Chairman

EXPLORATION IN WESTERN SOUTH AMERICA

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF:

Sir: In order to carry forward our original plan of exploring the cactus regions of America under the joint auspices of the Carnegie Institution of Washington and the New York Botanical Garden, I sailed from New York City, June 10, 1914, accompanied by Mrs. Rose, on the United Fruit Company's steamship "Santa Marta". The first stop was made at Kingston, Jamaica, where we took advantage of the few hours' stay to visit the Hope Botanical Gardens, where the very genial Director, Mr. William Harris, showed us the various native cacti of this island, which he has brought together. In some of the large trees of the Gardens fine specimens of 2 native species, *Hylocereus triangularis* and *Selenicereus grandiflorus*, were seen which grew to their very tops. Along the public road to the Gardens several species were seen in their native surroundings. *Lemaireocereus hystrix*, so much used as a hedge plant in Jamaica, was in full bloom.

Five days were spent in Panama where, in company with Mr. Henry Pittier, we visited old Panama. From here living material of a *Hylocereus* and an *Acanthocereus* were sent back to the New York Botanical Garden.

We sailed from Balboa June 22, and made our first landing on the South American coast at Paita, Peru. This port came as near being in the absolute desert as any place I had ever seen. John Ball stated at the time of his visit in about 1875 that he found 13 species of plants growing along the coast at that point; but I was able to find only 3, and these very scarce. The disappearance of some of the plants is doubtless due to the fact that many flocks of sheep and goats are brought down from the mountains to Paita, which devour practically everything in their path.

On June 26 a stop was made at Pacasmayo, also on the Peruvian coast, where the town is at the mouth of a small stream. Above the town are the orchards and gardens, but the hills, which are old elevated sea-beaches, are perfectly barren. Along the stream and sides of the valley are a few straggling shrubs which have to contend against not only the aridity but also the ever encroaching sand dunes which cross the valley and climb over the hills. One acacia plant which I saw, almost covered with sand, was about 100 feet in diameter.

We stopped the next morning at Salaverry; but the dry plain and drier hills showed not a single green plant to entice the botanist away from the town. A few algae were picked up on the rocks near the landing.

On June 28 we arrived at Callao, the port of Lima, and the principal one on the Peruvian coast. Here we were met by a representative of W. R. Grace & Company, who was very kind to us, helping us to pass our baggage and starting us on our way to Lima. Throughout our South American trip we were in touch with this firm, which makes a specialty of looking after the interests of American travelers. It is not surprising that such a firm has made a great success in South America. For the next month we made Lima our base from which were made various trips, especially along the central railway of Peru. Collections were made at Santa Clara, Chosica, Matucana and at Oroya. We found the Cactaceae extended from the low hills near the coast up to about 4,200 meters' altitude, but the greatest

distribution was found between Chosica and Matucana, at an altitude of 850 to 2,370 meters.

From Lima we went by steamer to Mollendo, Peru, and from there by train to Arequipa, which we made our base for nearly six weeks. Arequipa is the center of a most wonderful display of cacti. We made frequent excursions both above and below the city. From Arequipa we also went inland as far as La Paz, Bolivia, from whence we made trips to Comanche and Oruro, Bolivia. From Arequipa we made another trip to Cuzco, Peru, stopping *en route* at Juliaca.

After finishing our work in southern Peru, we went to Valparaiso, Chile, and then to Santiago, where considerable time was spent in studying the cactus types of the late Rudolph Philippi, which are now deposited in the Museo Nacional de Chile. From Santiago a long excursion was made up along the Longitudinal Railway of Chile, and collections were made at Los Vilos, Choapa, Illapel, Coquimbo, La Serena, and Copiapo. Professor Francisco Fuentes was detailed by the Chilean Government to accompany me on this expedition. We then made an expedition from Santiago to La Ligua and on to Los Molles. This was made chiefly for the purpose of collecting at the type locality the very rare species known as *Cereus castaneus*. The venerable Director of the Jardin Botanico, Mr. Johannes Söhrens, was delegated by his Government to accompany us on that trip.

Upon completion of our work in central Chile, we spent 8 days at Antofagasta, Chile, obtaining a number of interesting cacti on the hills above the town. Some very interesting seaweeds from near the beach were gathered, one of which is an undescribed species. A trip was made from here along the railway through the nitrate pampas as far as Calama.

Leaving Antofagasta, one day was spent at Iquique, where specimens were obtained of *Cereus iquiquensis* at the type locality.

Our departure from Iquique closed our collecting work, and we returned to the United States, arriving in Washington November 28, 1914, after an absence of almost six months.

J. N. Rose

LATE SUMMER LECTURES, 1915

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

Aug. 7. "Flowers of Late Summer," by Dr. N. L. Britton.

Aug. 14. "Fighting the Gypsy Moth," by Dr. W. E. Britton.

Aug. 21. "Fungous Diseases in the Flower Garden," by Dr. Mel T. Cook.

Aug. 28. "The Agriculture of the North American Indians," by Dr. A. B. Stout.

Sept. 4. "The Possibilities of Nut Growing in New York," by Dr. W. C. Deming.

Sept. 11. "The Use of Mushrooms for Food," by Dr. W. A. Murrill.

Sept. 18. "Flowers That Should Be Planted in the Fall," by Mr. George V. Nash.

Sept. 25. "Some Economic Uses and Possibilities of Sea-weeds," by Dr. M. A. Howe.

NOTES, NEWS AND COMMENT

Dr. Winifred J. Robinson recently spent several days at the Garden in looking up material and equipment for a course in botany at the Women's College of Delaware of which she is dean. She will spend some time at Newfane, Vermont, with Dr. Gertrude Burlingham in collecting Russulae, after which she will go to San Francisco to attend the meetings of the Western Science Association and the Association of Collegiate Alumnae.

Miss Friedolina Jud and Mr. Roy C. Faulwetter have each been granted a scholarship for one month during the summer for assisting in the investigations in plant breeding.

During the spring and summer "pine mice" have been very destructive especially of herbaceous plants growing in the experimental plots. In response of inquiries to the Biological

Survey of the United States Department of Agriculture, it is learned that this mouse has of late been especially destructive of garden vegetables, bulbs, and shrubbery over a considerable area of eastern United States. On this account the Department of Agriculture has just issued Farmers' Bulletin No. 670, describing the habits of injurious meadow and pine mice together with practical methods of destroying them.

Meteorology for July.—The total precipitation for the month was 3.49 inches of which 1.75 inches fell on the night preceding the 1st. The maximum temperatures for each week were 88° on the 10th, 85° on the 18th, *95° on the 18th*, and *95° on the 31st.* The minimum temperatures were 54° on the 9th, 59° on the 13th, *53° on the 25th*, and 62° on the 27th.

ACCESSIONS

MUSEUMS AND HERBARIUM

55 specimens "Taraxica Scandinavica Exsiccata," fascicle IV. (Distributed by Dr. Hugo Dahlstedt.)

45 specimens of algae, chiefly marine, from Chile and Peru. (Collected by Dr. and Mrs. J. N. Rose.)

7 specimens of hepatics from Texas. (Given by Dr. Frederick McAllister.)

21 specimens of mosses from Sanford, Florida. (By exchange with Mr. Severin Rapp.)

1 specimen of *Philadelphus* from California. (By exchange with the University of California.)

12 specimens of flowering plants from Indiana. (Given by Dr. H. H. Rusby.)

1 specimen of *Tetracarpum* from Salvador. (By exchange with the United States National Museum.)

5 specimens of flowering plants from Indiana. (Given by Mr. C. C. Deam.)

1 specimen of *Stomoisia cornuta* from Canada. (Given by Miss Sarah B. Stevens.)

1 specimen of *Tissa rubra* from Long Island, New York. (Given by Mr. W. E. Mackenna.)

1,017 specimens of lichens from the Underwood herbarium. (Purchased from the Underwood Estate.)

1 specimen of *Sarcodes sanguinea* from Lake Tahoe, California. (Given by Mrs. Wendell T. Bush.)

197 specimens of fungi from New Mexico. (By exchange with the United States National Museum.)

3 photographs of herbarium sheets. (By exchange with Mr. Earl E. Sherff.)

30 specimens of polypores from New York City and vicinity. (Collected by Mr. Percy Wilson.)

10 specimens of fungi from New York. (By exchange with the New York State Museum.)

2 specimens of fungi from Oregon. (By exchange with the New York State Museum.)

1 specimen of *Hapalopilus rutilans* from New York. (Collected by Mr. Percy Wilson.)

1 specimen of *Inonotus radiatus* from New York. (Collected by Mr. Percy Wilson.)

1 specimen of *Fomes ungulatus* from the New York Botanical Garden. (Collected by Mr. Percy Wilson.)

1 specimen of *Russula Morgani* from Pennsylvania. (By exchange with Dr. D. R. Sumstine.)

1 specimen of *Clathrus cancellatus* from Remedios, Cuba. (By exchange with Brother Leon.)

1 specimen of *Lactaria glyciosma* from North Carolina. (By exchange with Mr. E. R. Memminger.)

6 specimens of polypores from California. (By exchange with Dr. E. P. Meinecke.)

1 specimen of *Hypodendrum flammans* from California. (By exchange with Dr. E. P. Meinecke.)

1 specimen of woody fungus from Washington. (By exchange with Mr. Henry Schmitz.)

1 specimen of fleshy fungus from New York. (By exchange with Mr. F. J. McCarthy.)

57 specimens of plant rusts within one hundred miles of New York City. (Collected by Mr. Percy Wilson.)

1 specimen of *Pleurotus geogenius* from Minnesota. (By exchange with the Minnesota Mycological Society.)

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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 34 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. 3, part 1, 1910. Nectriaceae—Fimetariaceae.

Vol. 7, part 1, 1906; part 2, 1907; part 3, 1912. Ustilaginaceae—Aecidiaceae (pars).

Vol. 9, parts 1 and 2, 1907; part 3, 1910; part 4, 1915. Polyporaceae—Agaricaceae (pars). (Parts 1 and 2 no longer sold separately.)

Vol. 10, part 1, 1914. Agaricaceae (pars).

Vol. 15, parts 1 and 2, 1913. Sphagnaceae—Leucobryaceae.

Vol. 16, part 1, 1909. Ophioglossaceae—Cyatheaceae (pars).

Vol. 17, part 1, 1909; part 2, 1912. Typhaceae—Poaceae (pars).

Vol. 22, parts 1 and 2, 1905; parts 3 and 4, 1908; part 5, 1913. Podostemonaceae—Rosaceae (pars).

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Director of the Laboratories

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CULTIVATED VARIETIES OF PHLOX DRUMMONDII

Varieties of *Phlox Drummondii* are among the most popular of the annual plants cultivated in flower gardens. They are all easily started from seed, grow rapidly, soon bloom and continue in flower for a considerable time. They have many conspicuous flowers which make brilliant individual and mass effects.

There are numerous varieties or races of the annual phloxes all included within the single species. The seed catalogue of Haage and Schmidt of Erfurt, Germany, for the year 1914 lists by name 173 varieties of *Phlox Drummondii*. Still others are referred to in garden publications, making a total of about two hundred varieties. The colors have a wide range from pale yellow and white through pink, lilac, rose, blue, purple, red to almost black, both in solid colors and in various combinations of eyed patterns. The same coloration of flower is often associated with different habits of growth and with different size of flowers. For instance, of the dark purple-flowered kinds there are several distinct varieties such as tall small-flowered *atropurpurea*, tall grandiflora *atropurpurea*, dwarf *atropurpurea*, half-double *atropurpurea*, etc. Still in spite of such repetition there is, as already noted, a large number of flower colors and patterns. There are many varieties in which the so-called "eye" of the flower (the part of the corolla immediately surrounding the tube or throat) is only a little deeper in shade than

the rest of the corolla and these varieties are grouped together by Brand (*Pflanzenreich* IV, p. 70) under the heading concolored. There are other sorts that Brand groups together under the title bicolored, that have the center or "eye" markedly different from the rest of the corolla, or that are chiefly of one color striated with another. There are even tri-colored sorts having a colored flower with a white eye with spots of a different color included within the eye. Glancing again over the long list of varieties, we can see that on the basis of flower size they fall into two groups, one large-flowered (*grandiflora*) and the other small-flowered. The former has a corolla diameter of 2 cm. or over; the latter has one of 1.5–2.0 cm.

From the standpoint of flower form there are three distinct types: (1) the type with corolla margins plain and the lobes wide enough to touch or overlap; (2) the type known as *radiata* whose plain corolla-lobes are narrow and acute; (3) a type with the margins of the corolla-lobes fringed or toothed (*cuspidata*). There commonly has been placed with *cuspidata* another group called *fimbriata;* but the breeding work done by the writer at the New York Botanical Garden on certain varieties of *Phlox Drummondii* indicates that *fimbriata* types are hybrids between *cuspidata* and unindented forms, that they do not breed true, and so should not enter any scheme for the classification of stable varieties.

Concerning the habit of growth of the cultivated races of *Phlox Drummondii*, there are varieties that are from 12–20 inches tall, and in this respect are similar to the wild species. Then there has arisen since 1835 many dwarf varieties which are about one-half as tall. The *hortensiaeflora* type and perhaps also the *Heynholdii* phloxes are semi-dwarf, but both of these are also distinguished from other varieties of the species by other characteristics. *Hortensiaeflora* varieties have a modified inflorescence which is rounded and very dense, reminding one of that in *Hydrangea hortensis*. The *Heynholdii* varieties are very bushy plants and have small flowers and leaves.

A summarized classification of the cultivated varieties of *Phlox Drummondii* can be given as follows:

Phlox Drummondii, cultivated varieties.

A. Forms having corolla lobes plain.

a. Large-flowered, *grandiflora* forms.

1. Tall varieties, 12–20 inches tall.

2. Dwarf varieties, 6–8 inches tall.

b. Common or small-flowered kinds.

1. Tall varieties.

Single flowered.

Double flowered.

2. Semi dwarf varieties.

Heynholdii.

Hortensiaeflora.

3. Dwarf varieties.

c. With narrow corolla lobes (*radiata*).

1. Dwarf only.

B. Forms with corolla lobes toothed.

a. *Cuspidata.*

1. Tall varieties.

2. Dwarf.

b. *Fimbriata?*

The occurrence of such a large number of well-defined groups and varieties within a single species is not uncommon among plants that have long been cultivated and it illustrates the possibility of variability in plant life. The production of varieties that breed relatively true is a matter of much interest both to the practical horticulturist and to the more special student of heredity. The history of the origin and development of such variations as have arisen in *Phlox Drummondii* yields much valuable data regarding the way new races arise and hence has a direct bearing on conceptions of heredity, besides giving guidance in horticultural and experimental practice.

The history of *Phlox Drummondii* is fairly well known since its introduction into cultivation. The species was unknown to science prior to 1835. In the spring of that year seed of a new species of wild *Phlox* was sent from Texas to Great Britain by the botanical collector, Thomas Drummond. The plants raised from this seed were described the same year by Hooker (*Curtis's Botanical Magazine*, 1835, p. 3441), who named the species *Phlox Drummondii*. With this first description there was a colored plate showing the flower color as rose-red or purple, with some variation in the intensity. The "eye" of the flowers was deep crimson and was darker than the rest of the flower.

Two years later John Lindley (*Edward's Botanical Register* **23**: 1949) remarked that "a bed of this plant has hardly yet been seen; for it is far too precious and uncommon." He saw this phlox also only in its reddish colors as a plate accompanying his article shows. Asa Gray (*Synoptical Flora of North America*, 1878), describing the wild *Phlox Drummondii*, says that the corolla is red, varying to rose, purple or white. From Hooker's and Lindley's statements we may infer that Drummond sent home no seeds of plants bearing the lighter flowers or that Drummond did not see flowers of that type.

Mr. H. Ness, State Horticulturist of Texas, informs the writer that in a limited area near College Station, Texas, he has "never noticed any other color of flower except dark red with a darker tinge toward the center."

Dr. F. McAllister recently made observations on a large number of wild plants of this species near Austin, Texas. He describes the flower as "purplish, lilac or lavender." He did not observe any that were red or white.

Professor W. L. Bray, who for several years was connected with the University of Texas, makes the following statement: "During the early spring of April, 1899, in the course of a collecting expedition across Texas, I had occasion to traverse via railway an area of the sandy lands known as the Fayette Sands, from Cuero part way to Port La Vaca, Texas. For the first ten miles or so, soon after leaving Cuero, the (then) open lands were quite brilliant over large patches with *Phlox Drummondii*. My impression of this color display is that it was a mixture of colors varying from nearly dark red to very light pink. I could not now specify that any plants bore really red flowers, and certainly recall seeing none that bore pure white flowers, but the impression is vivid of a great abundance of this species along several miles of the railway, and that the color scheme varied as above indicated."

It appears then that there is, at the present time, some variability exhibited by the wild species in respect to the flower color and that, undoubtedly, this existed in some degree in Drummond's time. Yet the variations in the wild species are slight compared

with the assemblage of races developed since the plant came into cultivation. There is, we may note, no evidence that there was an importation of seed of this species for horticultural purposes other than that of Drummond's, and we may conclude that the numerous varieties arose in the one strain.

According to *Hovey's Magazine* for September 1838, seeds of *Phlox Drummondii* were obtained from London in 1836 by Buel and Wilson, nurserymen at Albany, and later distributed by them to various growers in the United States. It is noteworthy that in 1838 Hovey states (*Hovey's Magazine* 4: 323) that he had seen six varieties. One of these was dark velvet crimson, evidently much like if not identical to the varieties now known as *atropurpurea;* another was a very dark scarlet crimson and the others were described as of various shades of rose or lilac. A statement as to the variability of these types at that time would be very interesting.

In 1845 the *Journal d'Horticulture Pratique* gave an account of a new variety "*alba kermesina*" described as "blanc par le centre des petales nuance de carmine." The article is vague; one cannot be sure that the author is writing of Drummond's *Phlox*, but there is a probability that it was the sort of *Phlox Drummondii* now cultivated under the name "*stellata splendens.*"

The first reference to a pure white-flowered variety appeared in *Paxton's Magazine*, 1846, p. 142. Later in the same volume (p. 191), it is stated that this sort reproduces itself with certainty from seed. The *Journal d'Horticulture* for 1847 (p. 367) under the title "Nouveautes" also mentions *Phlox Drummondii alba* as a pure white-flowered variety.

The varieties *alba oculata* and *Leopoldii* were mentioned as novelties in *Hovey's Magazine* for July, 1848. The former is described as pure white with a violet eye just like the familiar *alba oculata* now in cultivation. The *Leopoldii* was described as having a rosy violet flower with a white eye.

A glance at the beautiful colored plate in *Ann. Soc. d'Agric. et Bot. de Gand.* for 1848, page 337, will show that the "eyes" or center markings of some of the early Drummond's Phloxes

varied so that they presented many regular and pleasing figures. One variety, then called *Phlox Drummondii lilacine*, had a large and complex eye, the innermost part of which was a white ring; the latter was skirted by two rods of blue on each corolla-lobe, radially arranged; an arch of two white loops on each lobe, capped by a triangle of blue, formed the outermost part of this eye. Another variety, the Princess Marie, had a distinctly star-like "eye" with ten blackish markings at its center, symmetrically arranged. All these "eyes" make one think of the varying rose-window effects perceptible in looking through a kaleidoscope. Such marked variation so early soon gave the growers opportunities for obtaining new varieties through selection.

Decaisne, in the *Revue Horticole* for 1851, alludes to the large range of color in the species and gives a colored plate showing three kinds of flower color (magenta, lilac and rose). As to heritability, he said that the varieties obtained up to that time did not invariably come true to type.

Varieties with streaked or flaked flowers began with the appearance of *Phlox Drummondii Mayi variegata*, described in 1852 in the *Journal d'Horticulture Pratique* (page 235). The flower had a red "eye" or center and white blades with large streaks of a reddish violet. The variety with flaked flowers now known as *Radowitzii* was first mentioned and described in the *Gartenflora* of 1865 (p. 225). The flowers are pinkish-rose in color, spotted or streaked with white especially toward the center. The same sort of white streaks and dots characteristic of *Radowitzii* also occur on a crimson ground color in the variety *Wilhelm I.* of the German catalogues (Guillaume I. of the French catalogues); and on a purplish or violet ground in *Princess Royal.* Both these latter varieties appeared about 1870.

In the *Gartenflora* for 1865 (pp. 225, 226) occurs what is doubtless the first allusion to a chamois-rose variety as a "lachsfarbenen" phlox is there mentioned.

Of the early notices, one of the most interesting is found in the *Revue Horticole* for 1868 (p. 191). A colored plate shows six varieties and the text describes three others. It is expressly

stated that all nine varieties reproduce true to type through seed. The nine varieties named are: (1) *chamois-rose;* (2) *variabilis* (somewhat violet, reddish eyed); (3) *écarlate*, which is a synonym of *coccinea;* (4) *rosea oculata alba;* (5) *Prince Leopold* (apparently same as *Leopoldii*); (6) *pourpre foncé* (dark purple, perhaps identical with *atropurpurea*); (7) *Radowitzii;* (8) *alba oculata;* and (9) *alba*.

Les Fleurs de Pleine Terre (3d ed., 1870) is careful to recommend only the sorts of *Phlox Drummondii* which "se reproduisent assez identiquement de semis," and we find in it all the last named nine varieties except the *atropurpurea*, and in addition one more, *lilacea alba oculata*. This last and *rosea oculata alba* are white-eyed varieties. The listing of *variabilis* is to be noted, for it seems to be quite variable; but it is always bluish, violet, or grayish in flower color.

The *Florist and Pomologist* for 1872 gives as one of the "continental novelties of the present year" *Phlox Drummondii Heynholdii cardinalis*, and I think it rightly condemns it as being inferior to other *Phlox* varieties, for it appears to be *Heynholdii*, a slow grower and a bearer of comparatively few flowers.

The beautiful group, known as the *grandiflora* phloxes, were first referred to in *Gartenflora* for 1875 as *Phlox Drummondii grandiflora* Heinemann. Varieties of this group have large flowers 2 cm. or more in diameter with the corolla-lobes markedly overlapping. When we learn of the years F. C. Heinemann spent in hybridizing and selecting in this species, it seems that it would have been more appropriate and appreciative if the group to-day still bore the name *Heinemann.*

In order to determine to what extent, if any, the hybridization by Heinemann and others influenced the formation of new varieties of Drummond's *Phlox*, careful search has been made of much garden and other literature. The following are the only references to such work discovered: In the *Gartenflora* for 1853 (pp. 33–35) are records of crosses by Heinemann in which the following small-flowered varieties were used: *alba*, *alba oculata*, *atropurpurea*, *stellata* (possibly *kermesina splendens*), and a fifth lilac-colored form. His cross between *stellata*

and *alba oculata* did not produce pleasing results from the viewpoint of the amateur flower-lover. The hybrid showed the red blade of *stellata*, but in place of the latter's striking white eye was the dark eye of the *alba oculata* parent; my first generation hybrids between *kermesina splendens* and *alba oculata* show the same results. With his *alba* and *atropurpurea* hybrids he apparently obtained variation in the first generation. Many of his hybrids had the general dark ground color of the corolla "punctuated" or "streaked" with small markings of white. Our *alba* and *atropurpurea* hybrids are all uniform and concolored. Vilmorin's observations (1852. *Sur les panachures des fleurs.*) throw an interesting light on these contradictory results. He states that ten cases of streaking in flowers arose under his eyes and always under the same chain of circumstances: a plant with uniformly colored flowers gave one with pure white flowers rather suddenly; when the white variety was almost fixed the streakings made their appearance in offspring of this variety. "Streakings" indicate instability or incomplete fixity. Vilmorin also remarked that dots or "punctuations" issue from plants with colored flowers. Heinemann may have used plants with just such lack of complete fixity which might help explain his results. Further, this suggests that *alba* and *atropurpurea* were less constant formerly than they are now and that selection has increased fixity.

Heinemann states that *alba oculata* fertilized with pollen of lilac flowers gave some pretty hybrids, one of which was blue flowered; but he does not give detailed descriptions.

For twenty-two years Heinemann worked on the improvement of *Phlox Drummondii;* he used the method of almost wholesale pollination followed by selection. It is stated explicitly that his *Phlox* flowers of 1853 were only half as large as his "grandiflora" ones of 1875 and were not brilliant and we must attribute his success undoubtedly to both selection and hybridization. At the time of his death (1876) ten *grandiflora* varieties were known (*Hamburger Garten und Blumenzeitung*, 1876, p. 149). One was *Phlox Drummondii grandiflora atropurpurea alba oculata*, which originated, we suspect, in a cross; he

had a concolored *atropurpurea* at the start; he had a white-eyed one also and it looks as though a recombination had been effected through hybridizing. Investigations by the writer have shown that a peculiar and characteristic white eye on a flower of a rose color can appear after hybridization on a flower of another color; and that the odd white striations (on a rose-colored flower) seen in the variety *Radowitzii*, may appear on a light purple ground color. (How constant will be these forms representing simply rearrangements of colors or patterns known before, I cannot as yet say.)

Scheidweiler (*Journal d'Horticulture Pratique*, p. 367, 1847) summarizes briefly the results of crossing *alba* and a red variety. He says he obtained various white-eyed forms. The writer gets no such result with the modern "*alba*" and *red* varieties.

The only other report on cross breeding between varieties of Drummond's *Phlox* is that of Halsted (*Report, Bot. Dept., N. J. Agr. Coll.*, 1909). His remarks refer to the second hybrid generation of a cross between a fringed form and a plain-edged kind. Dr. Halsted, in a communication by letter, says that there was nothing in the results of value to a student of heredity. Apparently, the seed had been distributed among amateurs, who were requested to report on what they had obtained on growing the seed.

The hybridization work of Scheidweiler, Heinemann, and Halsted just summarized, was done with varieties of the single annual species, *Phlox Drummondii*. This species was, however, only a short time in cultivation when attempts were made to hybridize it with the longer known perennial species of *Phlox*. Of only two such interspecific hybrids is there reference (*Journal d'Horticulture Pratique* **6**: 161, and *Gartenflora* **2**: 220 and **7**: 335). One, *Phlox Leopoldiana*, is described as probably a hybrid of *Phlox Drummondii* and the well-known *Van Houtte* phlox. Seeds of *Leopoldiana* did not always give offspring that resembled the typical *Leopoldiana* parent. The second, *Phlox Criterion*, is listed by Brand (*Pflanzenreich* IV, p. 72) as a distinct species of the genus *Phlox*, which implies that it must come true through seed. It is without doubt a hybrid between *Phlox Drummondii* and a perennial species.

In 1876, the year following the announcement of the *grandiflora* phloxes the *Gartenflora* (**24**: 248) states that there were already ten varieties of the *grandiflora* class. This publication at the same time announced to flower-lovers a white-eyed *atropurpurea* and also a dwarf form of *coccinea*.

In 1882 we read of *Phlox Drummondii hortensiaeflora* (*Gartenflora* **31**: 140) as entering the trade. This type was at that time represented by at least four color varieties; viz., the white, violet, rose-red, and fiery red *hortensiaeflora* phloxes.

The first mention of a variety of *Phlox Drummondii* with half-double flowers was in the *Gartenflora* for 1886, and it arose in *coccinea;* in 1890 a semi-double form of *atropurpurea* was announced. In 1887 in the *Gartenflora* we read of *Phlox Drummondii alba flora pleno* as the first really double-flowered sort. It was pure white.

It may be noted that *Phlox Drummondii* when introduced possessed flowers with corolla-lobes rounded and entire. All the varieties referred to thus far were similar in this particular. The first marked variation in shape of the flowers was recorded in the *Gartenflora* for 1888. Here it is stated that the German Association for the Promotion of Horticulture, on August 25, 1887, bestowed the "certificate of merit" on the firm of Martin Grashoff for two novelties in *Phlox Drummondii.* They were considered as starting an entirely new race of this species. These two novelties were pictured and described as *Phlox Drummondii cuspidata* and *Phlox Drummondii fimbriata* on pages 1 3 of the *Gartenflora* for 1888. They represent a variation in corolla form, as both have the lobes fringed or toothed. In *cuspidata* there is a central projecting tooth on each corolla-lobe that is four or five times as long as the teeth to either side of the central one, and in *fimbriata* the central tooth is only a little longer than the adjacent side teeth. On page 426 of the same volume, Sprenger stated that he know of two localities, one in Italy and one in North America, where *cuspidata* had arisen spontaneously. By 1889 a rather dwarf *cuspidata* variety, Fireball, was to be had of seedsmen.

Gartenflora for 1903 (p. 27) gave a notice of the appearance of

another new type of *Phlox Drummondii*, the *radiata*, in which the flower presents the appearance of a five- or six-pointed star due to the lobes being long-lanceolate and acute. A tendency to produce something like this type must have been present as far back as 1848, for in that year a beautifully engraved plate of Phlox varieties appeared in the *Ann. Soc. d'Agric. et Bot. de Gand.*, 1848, p. 337, and six of the eleven kinds shown had corollas with their lobes "écartées," *i. e.*, with lobes so narrow as to leave distinct angles between them.

The first generation of *Phlox Drummondii* grown in cultivation was in 1835. It came from a rather simple wild plant with a limited variability. That first lot showed rose-red or purple flowers which varied in intensity; and the corollas showed a star-shaped dark crimson "eye." In the seventy-nine generations which bring the species down to the present, heritable differences arose which give about two hundred varieties. By 1870 there were only nine varieties of which the Vilmorins said "se reproduisent assez identiquement de semis" (*Fleurs de Pleine Terre*, 3d edition). Then came in the new class of the *grandiflora* phloxes and in 1876 the *Hamburger Garten und Blumenzeitung* (p. 149) announced that there were twenty distinct forms and varieties. The finding or development of new varieties appears to have been much more rapid in the last half of its cultivated existence, which is to be expected, for we may assume it was being grown in larger and larger numbers and observed by an increasing number of workers. The special interest which growers and horticulturists have taken in the annual *Phlox* has induced them, we may well assume, to preserve any striking variations that were observed. The literature shows that these variations were not infrequent and have given numerous varieties now in cultivation.

All these two hundred varieties do not possess unique and widely distinguishing characteristics. For example, among the many tall small-flowered varieties is *atropurpurea;* among the many half-double varieties is *semi-plena atropurpurea;* among the large-flowered sorts is *grandiflora atropurpurea*, etc. The varieties all group themselves about certain types and it is very

probable that crossing such as that carried on by F. C. Heinemann accounts for the repetition of one color in many different types.

Some of the forms such as *cuspidata*, *radiata*, *grandiflora*, *hortensiaefolia* and *Heynholdii* it would seem, are sufficiently well marked and distinct to constitute elementary species in the sense of de Vries. It would appear that numerous of the varieties exhibit characteristics which in comparison to the wild species are decidedly new. Others and perhaps the greater number of varieties, differ from the parent species in slight degree as if there had been a loss of certain characteristics.

The variability of wild species at the present time, especially in the Cuero and Victoria districts of what is called the Fayette Sands formation in southern Texas, offers at the present time a field for interesting and highly profitable investigation especially to students of botany in that vicinity.

It seems unlikely that hybridization with other species has played a part in creating the large number of varieties of *Phlox Drummondii.* It is certain, however, that crosses were freely made between varieties in the work of developing new ones. This method was used especially by Heinemann who was the most important experimenter with *Phlox Drummondii*, but it is not stated specifically from what and how he derived his new varieties. Growers of Phlox for seed at the present time practice rigid selection and there is reason to believe that in seventy-nine years of such practice many of the varieties have become more constant.

From a rather simple wild plant with a comparatively limited range of variability all the present varieties of *Phlox Drummondii* have been derived. Various differences in vegetative habit have arisen giving large, dwarf, and semi-dwarf groups. Wide differences have appeared in the size of the flowers and in the shape, the number and the coloration of the flower parts, and in numerous instances these differences have been paralleled in the different groups.

The development of the numerous and widely different varieties of *Phlox Drummondii*, the history of which is fairly well

chronicled in botanical and horticultural literature, illustrates very well the possibilities of variation among wild species when submitted to intensive cultivation, to crossings between types that arise, and to continued selection.

The data here presented were compiled in connection with experimental work conducted at the New York Botanical Garden, the results of which were presented as an essay in partial fulfillment of the requirements for the degree of M.A. at Columbia University.

JAMES P. KELLY.

JOHN FRANCIS COWELL

The death of Mr. Cowell, who was Director of the Buffalo Botanical Garden in South Park, Buffalo, for over twenty years, on May 2, 1915, has removed a prominent and useful figure in American horticulture and botany. The Buffalo Botanical Garden, one of the largest establishments of the kind, was built up by him from very small beginnings. At its inception he was closely associated with Mr. David F. Day, a prominent public-spirited citizen of Buffalo, and between them the plans and general features of the Garden were determined and the authority obtained from the city for its foundation and development; he published a memorial of Mr. Day in *Botanical Gazette* **30**: 347, 348. 1900. There has now been brought together there one of the most important collections of exotic plants anywhere in America, and the usefulness of the institution has been continually expanding, both educationally and as a delightful resort for many thousands of people; his accounts of the progress of his work are published in Annual Reports of the Buffalo Park Commissioners.

My association with Mr. Cowell dates from the earliest conception of the Buffalo Garden, and I have watched its growth with great interest and appreciation. It would be most fitting that some permanent feature of the Buffalo Garden should bear his name, as a memorial to his services to the City of Buffalo

and to horticultural science. Mr. Day's services to the institution have been commemorated by the herbarium of the institution being designated "The David F. Day Herbarium." In addition to his work on the Garden, Mr. Cowell contributed largely to knowledge of the local wild flora of the vicinity of Buffalo, and was a valued and highly esteemed member of many American horticultural associations and of the American Association for the Advancement of Science. He was frequently called upon to serve as a judge of plants shown at floral exhibitions.

He made many trips to tropical America, for the purpose of increasing the collections of the Buffalo Garden and for obtaining additional knowledge relative to tropical plants, and his contributions to science along these lines were noteworthy.

The first of his tropical expeditions was made to Jamaica; he transversed a considerable part of that island and made very extensive collections, which formed the basis of the West Indian series of plants cultivated at the Buffalo Garden. During the period from August 29 to October 12, 1901, he made his first West Indian trip with me, to the island of St. Kitts, and on this trip we obtained a good general knowledge of the flora of that island and brought back about two tons of living plants and herbarium specimens of about 750 species, which were divided between the Buffalo Botanical Garden and the New York Botanical Garden, including two interesting species of *Carludovica* which he subsequently described (*Torreya* 3: 103, 104. 1903). On this trip we also touched at the islands St. Croix and St. Martin, and made small collections on both of them. In February 1905, Mr. Cowell proceded to the Isthmus of Panama, under joint commission again from the two institutions, and obtained a representative collection of the wild plants of the Canal Zone; he published an account of this trip in *Journal of the New York Botanical Garden* **6**: 86–88.

He was a member of another joint expedition from January to April, 1906, engaged in the botanical exploration of Porto Rico, at which time large collections were made. Cooperation was again organized in the winter of 1911 for exploration of

stern and central Cuba during the latter part of February and e whole of March, on which occasion a cruise along the south ast of the Province of Pinar del Rio as far west as the Bay Corrientes was carried out successfully and many interesting ants obtained and divided between the gardens at New York d Buffalo. Cuban exploration was again taken up in the nter and early spring of 1912, at which time Mr. Cowell ac- mpanied me to eastern and central Cuba, most of the time ing spent along the southern coast of Oriente Province. In bruary, 1914, he returned with us to Porto Rico for further ploration of the western part of that island, which included a o weeks' cruise in the Mona Passage for a study of the islands esecheo and Mona. A third joint trip to Porto Rico was made the late winter of the present year and a considerable part the island was then traversed, including a cruise from Maya- ez around the western and southern coasts to Ponce, the party turning to New York at the end of March. Mr. Cowell is mmemorated in West Indian botany by the beautiful flowering e *Phlebotaenia Cowellii*, of the Polygala Family, confined to rto Rico, first seen by him in bloom near Coamo Springs ring our expedition of 1906, and again at the same place this ar, and also by the Cuban shrubs *Jacaranda Cowellii* of the gnonia Family and *Anastraphia Cowellii* of the Thistle Family. Mr. Cowell was born in Wrentham, Massachusetts, March 3, 52, and was educated there and in Boston, where he studied d practiced law, and subsequently continued his law practice St. Paul, Minnesota. He moved to Buffalo in 1874, and for 1 years was a school principal in that city, and became director the Buffalo Botanical Garden in 1894. He served for a num- r of years as Professor of Forestry in the University of Buffalo, d delivered lectures on forestry, botany and horticulture in ffalo and elsewhere.

N. L. Britton.

SOME MODERN VARIETIES OF THE BOSTON FER AT THEIR SOURCE

WITH PLATES CLXI AND CLXII

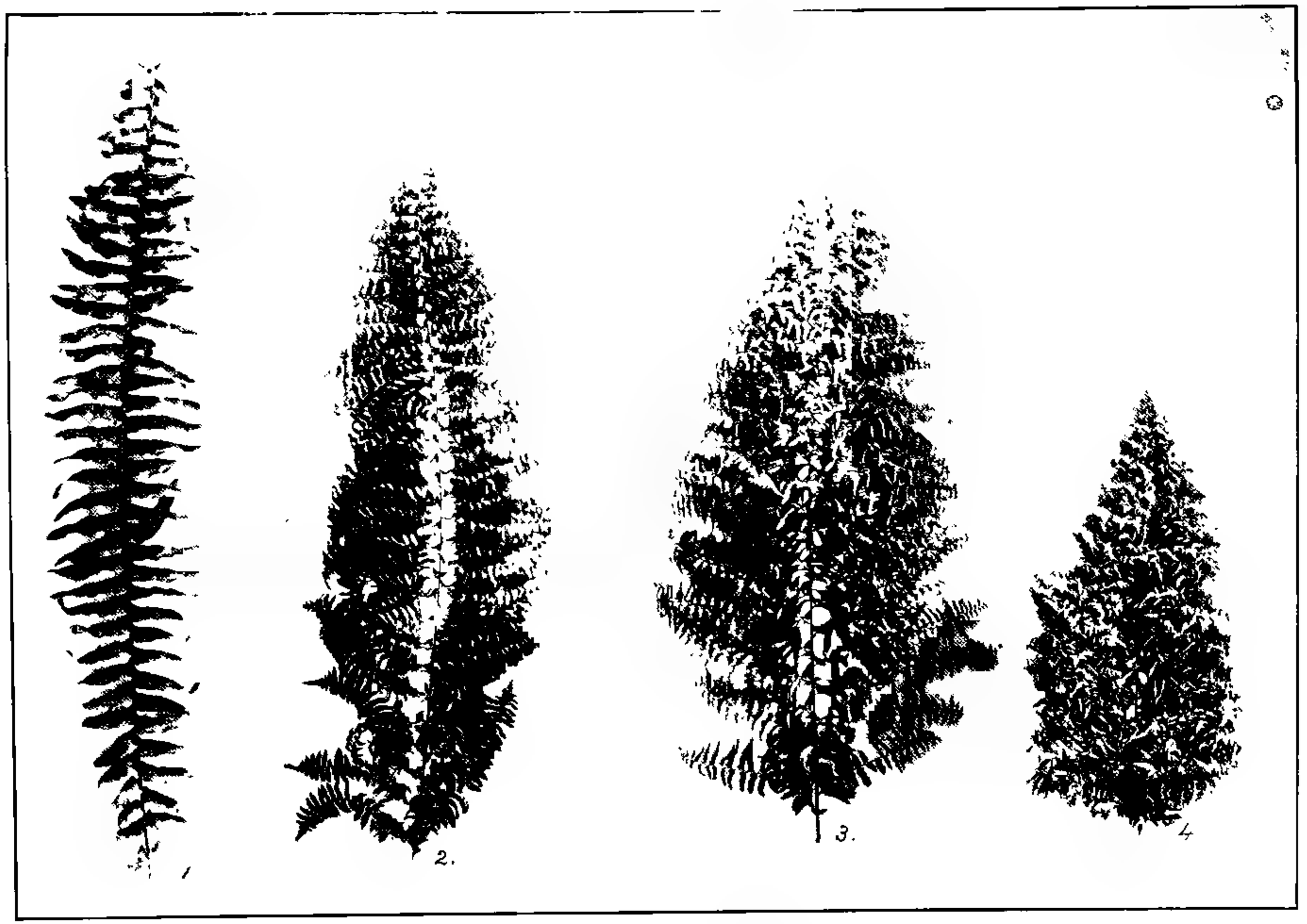
The most popular house plant in the United States for a the year around is the Boston fern or some one of its varietie There are probably half a dozen commercial growers in the Ea who produce over 100,000 plants of some of these varieties eve year, and a larger number who produce 50,000 or more.

The original Boston fern arose as a sport of the commo tropical species, *Nephrolepis exaltata*, and appears to have com into being in the greenhouses of Craig of Philadelphia. It wa first recognized as different from *exaltata* by F. C. Becker Boston who obtained it in a shipment of 200 plants of *exalta* from Craig. Becker, however, thought it was the species the called *davallioides*, and sold over 50,000 plants under this nam before his attention was called to his mistake by G. W. Olive of Washington. Then in 1896, it was given the name of *Nephr lepis exaltata* var. *bostoniensis* which it has since borne.

Nowadays the "old" Boston fern forms but a small pr portion of the stock of most large growers and, indeed, is n to be found at all in some of the establishments. Its pla commercially has been taken by numerous varieties which ha arisen from it. The source of many of these varieties is in t establishment of F. R. Pierson, of Tarrytown on the Hudso The purpose of the present article is to give a brief accou of the various forms developed at Tarrytown, as an unde standing of these will serve to give a general idea of the types variation of these forms in general.. An investigation of a the forms is under way and the results will be published later.

am largely indebted for the information given here to C. Edg Trevillian, who has had charge of the ferns at the Pierson pla since the first new form appeared there and who seems to have more thorough understanding of these plants than anyone el whom I have met in connection with a general study of the varieties.

Nephrolepis exaltata and its first sport, *bostoniensis*, were bo



1. *bostoniensis.* 2, *Piersoni.* 3, *elegantissima.* 4, *eleg. compacta.*

growing ferns with once-pinnate leaves. Most of the ern varieties, if modern may be used to mark the passage of decades, are two- to four-pinnate and more or less dwarfed. original twice-pinnate form came into being twelve to fifteen s ago at Tarrytown and was named *Piersoni* or Tarrytown

It was distinguished by having a part of its leaves twice ed. Its defect lay in the fact that only part of its leaves so divided and also in the fact that it frequently tended to ack to the original Boston form. It was unstable. This e it an uneven and mixed sort of a plant. For purposes of parison its name may be written in full as follows: *Nephro-exaltata bostoniensis Piersoni.*

ne original *Piersoni* was soon replaced by a somewhat smaller compact and more regularly divided form which was called *hrolepis exaltata bostoniensis Piersoni elegantissima.* It ld be said that in the trade it is generally called merely *egantissima* but its full name is as above. This also had the fault of reverting to the original Boston form and was re-ed after further selection by *elegantissima* "improved," o give it its full name for comparison, *Neph. exaltata bos-nsis Piersoni elegantissima* "improved." *Neph. exaltata niensis Piersoni elegantissima compacta* next appeared, and s name indicates, it was a sport from *elegantissima*, of similar acters in cutting but considerably more dwarf. Both these r forms are from three- to four-divided, and have dense firm es with closely packed divisions. The original *Piersoni elegantissima* are no more in the trade and exist only as ts in some private or public collections.

nese two forms constitute the bulk of the *Nephrolepis* uct of the Tarrytown greenhouses nowadays but they are the only new forms which have appeared there. Besides *ntissima* the original *Piersoni* gave rise to another entirely rent type of variation which was called by the uneuphonious e of *superbissima*. This form has three- or four-divided es but its most noticeable characteristic is found in its ularity; its leaves and separate pinnae are twisted and gnarled nat a single leaf is not a thing of beauty although a whole

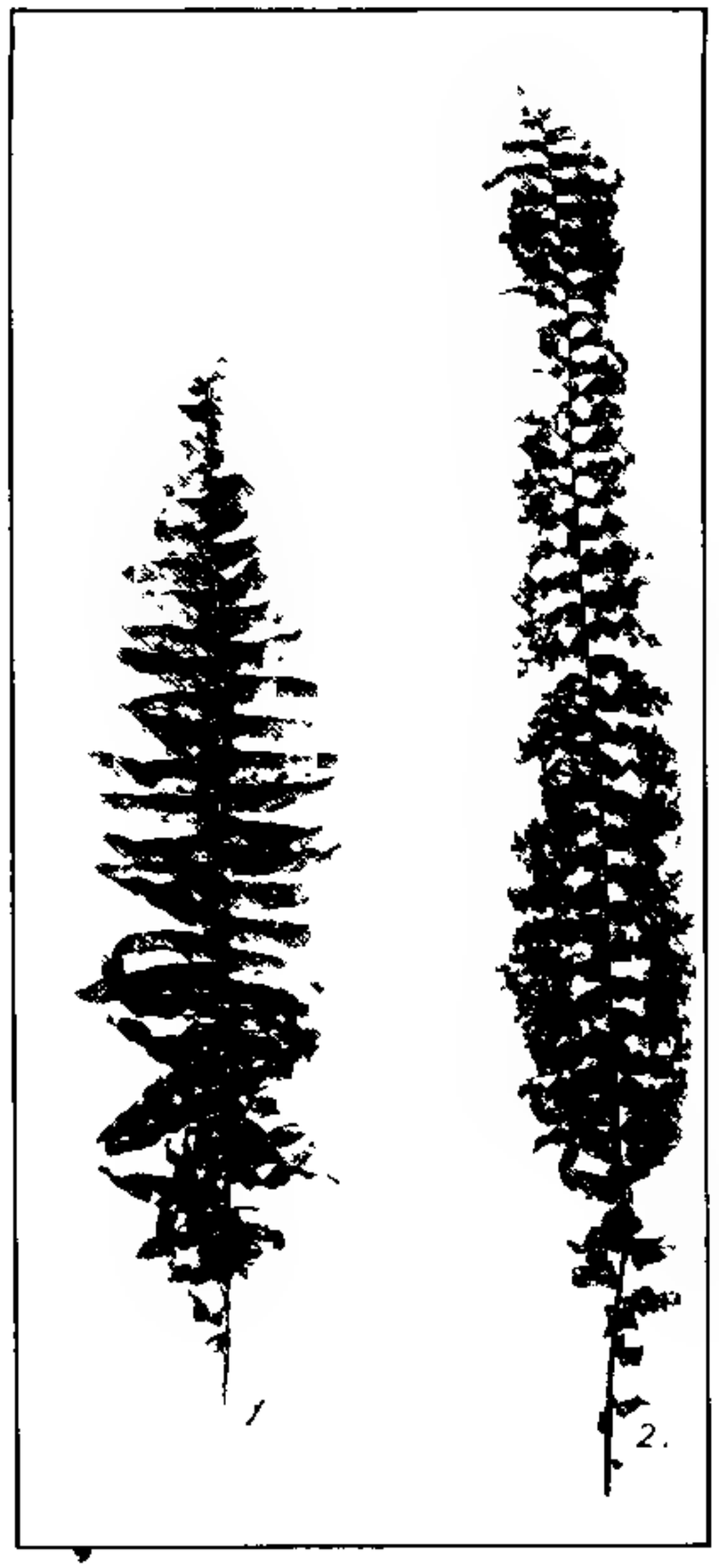
plant may be fairly symmetrical. *Superbissima* was unstable but it soon threw a still more compact form which proved also to be more stable and this was called *muscosa*. When reversions are spoken of I mean the appearance of once-pinnate leaves. In the case of the reversions of *superbissima* the reverting leaves retained the irregularity and small size of *superbissima* so that they represented a further new form which was given the name of *viridissima*. A comparison of the names of these three forms will give a clear idea of their relationships.

Nephrolepis exaltata bostoniensis Piersoni superbissima.
Neph. exaltata bostoniensis Piersoni superbissima muscosa.
Neph. exaltata bostoniensis Piersoni superbissima viridissima.

Whenever a larger much divided form like *elegantissima* reverts the reverting leaves are like the original Boston form. When, however, a dwarf divided form reverts, the reverting leaves seem to retain the dwarf character. This has happened in the case of *elegantissima compacta*, and a form has appeared and is grown at Tarrytown under the name of "dwarf Boston." Technically it should be known as follows: *Nephrolepis exaltata bostoniensis Piersoni elegantissima compacta "dwarf Boston."* This form should not be confused with other dwarf Boston forms such as *Scotti* which are of different origin and appearance.

The forms described above are not all of the new types which have appeared at Tarrytown but are all those which have been put on the market. At present there are a number of others which are being grown tentatively till they prove or disprove their commercial value. Some of these are of unquestioned beauty but by reason of too slow development or other cultural fault are of doubtful commercial value. An especially interesting one of these is illustrated in Pl. CLXII, f. 2. "Dwarf Boston" so-called is a completely once-pinnate reversion of *eleg. compacta*. The unnamed form here referred to is a partial reversion of *compacta*, i. e., its typical leaves are almost 2-pinnate. Another point of interest lies in the fact that an almost identical form but of different origin is being introduced under the name of "John Wanamaker" by Craig of Philadelphia.

Tarrytown has been referred to as the source of many of the



1, "Dwarf Boston." 2, unnamed sport of *eleg. compacta.* 3, *superbissima* 4, *viridissima.* 5, *muscosa*

present day varieties of Boston ferns. Some of the best-known exceptions may be mentioned as follows: *Scotti*, *Giatrasi*, *Harrissi*, *Scholzeli*, *Roosevelti*, and "Teddy Jr." These forms are noted as exceptions because they did not come originally from *Piersoni* but are products of independent lines of variation from *bostoniensis*. Of the other named forms now on the market or discarded, it is probably safe to say that practically all if not all are to be traced to *Piersoni* as the original source, although they have appeared in different establishments. These other forms are not left unnamed and undescribed because of any necessary inferiority to those treated above but merely because it does not lie in the scope of the present paper to deal with them. The writer is engaged in studying all the *Nephrolepis* forms for the purpose of description and presents this merely as a preliminary paper.

The complete study of these ferns is difficult for two reasons: In the first place it is hard to get accurate information about many of them. Some of the forms have been discarded, the growers do not always know certainly their source, and printed descriptions are very inaccurate. In the second place, there has been so much variation that many new forms have arisen which are so close as almost to defy accurate discrimination. To meet these difficulties I am assembling at the Brooklyn Botanic Garden all the forms which I can obtain, and am getting these as far as possible from their original producers. The collection now includes about forty different forms.

It may be noted first that all these varieties of *Nephrolepis* have arisen as far as is known from bud variations or vegetative sports. It appears that the spores are inviable; when planted no growth results. A similar condition occurs in the potato which, as is well known, is propagated almost entirely from cuttings of the tuber. Although the potato flowers freely, it rarely sets seeds. One of the special problems is to determine whether all of the varieties are sterile, or whether this is a feature only of the more highly developed forms.

R. C. BENEDICT.

DEPT. OF BIOLOGY,
H. S. COMMERCE, N. Y. CITY.

NOTES, NEWS AND COMMENT

Professor William C. Coker spent a part of August at the Garden in the study of the literature and herbarium material relating to the higher fungi of North Carolina.

Professor A. Le Roy Andrews was at the Garden for nearly two weeks in August pursuing studies of various genera of mosses in preparation for publication in *North American Flora*.

North American Flora, Volume 34, Part 2, was issued July 28. It continues the treatment of the family Carduaceae, completing the tribe Helenieae and including a considerable part of the tribe Tageteae. It is all by Dr. Rydberg, except two brief contributions by Professor H. M. Hall of the University of California.

Dr. W. A. Murrill, Assistant Director, spent the last week in August at Camp Kanosa on the Upper St. Regis in the Adirondacks collecting fleshy fungi, which were unusually abundant there this season. With the assistance of Mr. and Mrs. N. H. Luttrell and their guests, he secured about 500 numbers, many of them of special scientific interest. Of the 300 species obtained during the week, 35 were used as food, several methods of cooking being tried. One dish was entirely spoiled by a few plants of *Collybia maculata*, which proved to be very bitter even after thorough cooking. A dish of escalloped *Clavaria* was much enjoyed.

Species Used for Food

Boletinus pictus
Ceriomyces scaber
and several other species
Chanterel infundibuliformis
Chanterel umbonatus
Clavaria, several species
Collybia acervata
Collybia dryophila
Collybia radicata
Lactaria lignyota
Lactaria subdulcis
and several other species
Lepiota clypeolaria
Lycoperdon gemmatum
Lycoperdon pyriforme
Lycoperdon Wrightii
Paxillus involutus
Rostkovites granulatus

Cortinarius lilacinus
Cortinarius semisanguineus
Craterellus cornucopioides
Hygrophorus coccineus
Hygrophorus miniatus
Laccaria laccata
Russula compacta
Russula lutea
and several other species
Vaginata strangulata
Vaginata vaginata

Principal Poisonous and Bitter Species Collected

Ceriomyces ferruginatus
Collybia maculata
Lactaria torminosa
Melanoleuca albissima
Russula emetica
Russula foetens
Suillellus luridus
Tylopilus felleus
Venenarius muscarius
Venenarius phalloides

Meteorology for August.—The total precipitation for the month was 6.93 inches. Of this amount 2.90 inches fell in about four hours during the forenoon of the 6th; the remainder of the total for the month was quite evenly distributed throughout the month giving an unusually heavy rainfall for the month. The maximum temperatures for each week were 88° on the 2d, 91° on the 13th, *92° on the 16th*, and 83° on the 25th. The minimum temperatures were 59° on the 4th, 61° on the 12th, *51° on the 19th*, and 52° on the 28th.

ACCESSIONS

PLANTS AND SEEDS

2 cacti for conservatories. (By exchange with U. S. National Museum via Dr. J. N. Rose.)

1 plant of *Vinca major*. (Given by F. R. Pierson & Co.)

2 plants of *Pyxidanthera barbata*. (Given by Dr. W. L. Bray.)

4 cacti. (By exchange with Mr. S. S. Hordes.)

3 plants of *Fraxinus Americana*. (By exchange with Carnegie Experiment Station.)

32 plants for Herbaceous Grounds. (Collected by Mr. P. Wilson.)

3 plants for Herbaceous Grounds. (Collected by K. R. Boynton.)

1 Cycas for Conservatories. (By exchange with Sander & Son, St. Albans, Eng.)

1 Opuntia for Conservatories. (By exchange with Mr. J. C. Jones? via Dr D. T. MacDougal.)

1 *Selenicereus fulgidus*. (U. S. National Museum via Dr. J. N. Rose.)

7 plants for Conservatories. (By exchange with Bureau of Plant Industry.)

2 plants of *Rhipsalis*. (By exchange with U. S. National Museum via Dr. J. N. Rose.)

1 plant, *Limnobium spongia*. (Given by Mr. Henry Natho.)
11 plants for Nurseries. (Given by Miss E. M. Kittridge.)
13 plants for Herbaceous Grounds. (Given by Miss E. M. Kittridge.)
3 plants for Conservatories. (By exchange with U. S. National Museum? via Dr. J. N. Rose.)
13 plants for Conservatories. (Given by Prof. James F. Kemp.)
3 plants for Herbaceous Grounds. (Vicinity.)
2 plants for Herbaceous Grounds. (Collected by Dr. F. W. Pennell.)
1 plant, *Hydrangea scandens*, for Nursery. (By exchange with Mr. Henry Natho.)
1 plant, *Saxifraga umbrosa*, for Herbaceous Nursery. (By exchange with Mr. Henry Natho.)
9 Orchid plants. (By exchange with Lager & Hurrell.)
7 plants for Nursery and Herbaceous Grounds. (Given by Miss E. M. Kittridge.)
3 Cactus plants. (Bureau of Plant Industry via Mr. W. H. Long.)
1 Oleander for Conservatories. (Given by Mrs. Mary Nitsch.)
255 plants for Rose Garden. (Purchased.)
176 plants for Rhododendron Border, Cons. No. 1. (Purchased.)
954 plants for Collections and Decorative Work. (Purchased.)
281 plants for Herbaceous Grounds and Conservatory Beds. (Purchased.)
26 plants for Fruticetum. (Purchased.)
402 plants for American Wood Garden and Conservatory Beds. (Purchased.)
20 plants for American Wood Garden. (Purchased.)
1916 plants for American Wood Garden and Herbaceous Grounds. (Purchased.)
1066 plants for Herbaceous Grounds and Conservatories. (Purchased.)
105 plants for Collections. (Purchased.)
536 plants. (Derived from seed, from various sources.)
2 packets of seed. (Given by Dr. H. H. Rusby.)
51 packets of seed. (By exchange with Leiden Botanical Garden.)
17 packets of seed. (By exchange with Trinity College Botanic Garden.)
12 packets of seed. (By exchange with Utrecht Botanical Garden.)
1 packet of spores of *Cyathea Brooksii*. (Collected by Dr. N. L. Britton and Prof. J. F. Cowell.)

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ARMSTRONG, MARGARET, & THORNBER, JOHN JAMES. *Field book of western wild flowers.* New York, 1915. (Given by Dr. N. L. Britton.)

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MATTHEWS, FERDINAND SCHUYLER. *Field book of American trees and shrubs.* New York, 1915.

MEYER, J. G. *Meyer's immerwährender Garten-Kalender.* Ed. 5. Berlin, 1915.

MURRAY, JOHN. *A descriptive account of the Palo de Vaca, or the cow tree of the Caracas.* Ed. 2. London, 1838.

MURRILL, WILLIAM ALPHONSO. *Tropical polypores.* New York, 1915. (Given by Dr. W. A. Murrill.)

NEUMAN, JULIUS JOHN. *The Polyporaceae of Wisconsin.* Madison, 1914. (Given by Dr. W. A. Murrill.)

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NEW YORK BOTANICAL GARDEN
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JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

CONTENTS

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Group of botanists in attendance at the Twentieth Anniversary Celebration of The New York Botanical Garden, September 7, 1915.

JOURNAL

OF

The New York Botanical Garden

VOL. XVI OCTOBER, 1915 No. 190

THE TWENTIETH ANNIVERSARY CELEBRATION OF THE NEW YORK BOTANICAL GARDEN

The twentieth anniversary of the setting apart by the City of New York of 250 acres of land in Bronx Park for use as a botanical Garden was commemorated during the week of September 6–11, 1915. Invitations to participate had been sent out by the New York Botanical Garden early in June to members of the Garden and also to members of the Torrey Botanical Club, the Botanical Society of America, the New England Botanical Club, the Connecticut Botanical Society, and to other professional and amateur botanists of the United States and Canada. The response was gratifying and 145 persons were in registered attendance at the various meetings of the week. Many congratulatory messages were received from botanists who were unable to attend. Exclusive of several who were present on field excursions and at other meetings without the formality of registration, those in attendance were the following:

PROF. J. F. ADAMS, Pennsylvania State College, State College, Pennsylvania.

MR. S. ALEXANDER, Detroit, Michigan.

MR. OAKES AMES, Harvard University, Cambridge, Massachusetts.

PROF. GEORGE F. ATKINSON, Cornell University, Ithaca, New York.

PROF. IRVING W. BAILEY, Bussey Institution, Harvard University, Jamaica Plain, Massachusetts.

[Journal for September (16: 179–202) was issued Sept. 24, 1915]

PROF. H. J. BANKER, Eugenics Record Office, Cold Spring Harbor, New York.

MR. W. C. BARBOUR, De Witt Clinton High School, New York City.

MRS. W. C. BARBOUR, 149 Newark Avenue, Bloomfield, New Jersey.

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MR. C. H. BISSELL, Southington, Connecticut.

PROF. CAROLINE A. BLACK, New Hampshire College, Durham, New Hampshire.

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DR. ARTURO BOSQUE Y TORRALBAS, Jardin Botánico, Habana, Cuba.

DR. WILLIAM T. BOVIE, Harvard Medical School, Boston, Massachusetts.

MR. KENNETH R. BOYNTON, New York Botanical Garden, Bronx Park, New York City.

MISS LAURA M. BRAGG, Charleston Museum, Charleston, South Carolina.

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Dr. J. M. Greenman, Missouri Botanical Garden, St. Louis, Missouri.
Miss Garnet E. Gretter, Kansas City, Missouri.
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Miss Sarah H. Harlow, New York Botanical Garden, Bronx Park, New York City.
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MRS. PERCY WILSON, 2779 Briggs Avenue, New York City.
MR. CECIL YAMPOLSKY, Columbia University, New York City.
MRS. CECIL YAMPOLSKY, 433 West 124th Street, New York City.

During the anniversary week, the following program was carried out:

MONDAY, SEPTEMBER 6

9:00–1:30 Registration in the Library. Inspection of Museums, Laboratories, Library, and Herbaria, with special reference to the Lucien Marcus Underwood Fern Herbarium, and the Timothy Field Allen collection of Characeae.

Exhibition, in the Herbarium, of paintings of plants

by Mary E. Eaton, for reproduction in the magazine founded by the late Addison Brown.

Exhibition, in the Library, of the Charles Finney Cox Collection of Darwiniana.

Exhibition, in the Library, of the publications of the Garden, issued by the aid of the David Lydig Fund bequeathed by Charles P. Daly.

1:30 Lunch in the Museum Building.

2:30 Welcome on behalf of the Board of Managers by W. GILMAN THOMPSON, *President*.

Welcome on behalf of the Scientific Directors by HENRY H. RUSBY, *Chairman*.

Welcome on behalf of the Department of Parks by THOMAS W. WHITTLE, *Commissioner of Parks for The Bronx*.

History of the New York Botanical Garden by N. L. BRITTON, *Director-in-Chief*. This address was printed for distribution among those in attendance.

3:30–5:00 Inspection of the Pinetum, Flower Gardens, Conservatory Range 1, and of part of the additional 140 acres of land recently added by the City of New York to the New York Botanical Garden.

5:00–6:30 Visit to the New York Zoological Park.

7:00 Dinner at the Rocking Stone Restaurant, New York Zoological Park. About sixty persons were present.

TUESDAY, SEPTEMBER 7

10:30–1:00 Session for the reading of papers, under the chairmanship of R. A. HARPER.

The following papers were presented:

D. T. MACDOUGAL.

"Mechanism and conditions of growth." The paper was discussed by G F. Atkinson, R. A. Harper, and N. L. Britton.

W. P. THOMPSON and IRVING W. BAILEY.

"Are *Tetracentron*, *Trochodendron* and *Drimys* specialized or primitive types?" The paper was presented by Irving W. Bailey, and was illustrated by remarkable photomicrographs shown by the lantern. Discussion by N. L. Britton, R. A. Harper, and D. T. MacDougal followed.

ELIZABETH G. BRITTON.

"Mosses from Florida." Discussion by R. A. Harper and D. T. MacDougal.

ARTHUR H. CHIVERS.

"Directing factors in the teaching of botany."

JOHN H. BARNHART.

"The genera of Lentibulariaceae." Discussion and remarks by R. A. Harper and G. F. Atkinson.

R. ELLSWORTH CALL.

"Flora of Mammoth Cave, Kentucky." Illustrated by lantern slides. Remarks by N. L. Britton and M. A. Howe.

CECIL YAMPOLSKY.

"Observations on sex relations in *Mercurialis annua*." Discussion by G. F. Atkinson and R. A. Harper.

EDWIN W. HUMPHREYS.

"Triassic plants from Sonora, Mexico."

NORMAN TAYLOR.

"A white-cedar swamp on Long Island and its significance." Illustrated by lantern slides. Discussed by N. L. Britton and R. A. Harper.

A. F. BLAKESLEE.

"Types of Rudbeckias." Illustrated by specimens. Remarks and discussion by D. T. MacDougal, J. B. S. Norton, N. L. Britton, and E. W. Humphreys.

Seventy-four persons were present at this morning session.

1:30 Lunch in the Museum Building.

2:30–4:00 Session for the reading of papers, under the chairmanship of C. STUART GAGER.

R. A. HARPER.

"On the nature of types." Illustrated by lantern slides. Discussed by E. W. Sinnott.

MARSHALL A. HOWE and W. D. HOYT.

"Notes on some marine algae from the vicinity of Beaufort, North Carolina." Presented by Marshall A. Howe. Illustrated by lantern slides. Remarks by E. G. Britton.

MICHAEL LEVINE.

"Reduction division in the pollen mother-cells of some species of *Drosera*." Illustrated by charts.

HARRY B. SHAW.

"Self, close, and cross pollination of beets." Illustrated by lantern slides.

C. STUART GAGER.

"Present status of the problem of the effect of radium rays on plant life." Discussed by R. A. Harper.

EDMUND W. SINNOTT.

"Endemism as a criterion of antiquity in a flora." Discussion by Norman Taylor, P. A. Rydberg, and D. T. MacDougal.

ARTHUR H. GRAVES.

"A botanical trip to North Wales in June." Illustrated by lantern slides.

C. R. ORTON.

"*Allodus* in North America."

GEORGE V. NASH.

"The Van Brunt collection of colored lantern slides of plants." Read by title.

MARGARET SLOSSON.

"Notes on some American filmy ferns." Read by title.

MEL. T. COOK.

"Rhizoctonia a cause of weak germination of the potato." Read by title.

B. SHIMEK.

"Native groves in the Lake Okoboji (Iowa) region: their ecological significance." Illustrated by lantern slides. Discussion by N. L. Britton and R. E. Call.

Eighty-six persons were in attendance at this afternoon session.

4:00–6:00 Inspection of the Herbaceous Garden Valley, Deciduous Woodlands and Hemlock Forest, Fruticetum, and West Border to Elevated Railway.

WEDNESDAY, SEPTEMBER 8

Salt Water Day on Staten Island in Cooperation with the Staten Island Association of Arts and Sciences

Most of the members of the excursion party on this occasion left Manhattan by the Staten Island Ferry at the foot of Whitehall Street at 10 A. M., connecting at St. George with a train for Great Kills. From the Great Kills station, under the leadership of Dr. Arthur Hollick of the Staten Island Association of Arts and Sciences, the party walked to the coastal meadows east of Great Kills. Later, sixty-three persons sat down to the ample "shore dinner" at Sauer's Restaurant. Afterwards, by use of motor boats, the sand dunes and salt marshes of Crooke's Point were visited, and various characteristic types of littoral vegetation were observed and discussed.

THURSDAY, SEPTEMBER 9

10:30–1:00 Session for the reading of papers, under the chairmanship of D. T. MACDOUGAL.

S. ALEXANDER.

"New species of *Helianthus*." Illustrated by specimens and lantern slides.

GEORGE F. ATKINSON.

"Development of *Lepiota cristata* and *L. seminuda*." Illustrated by lantern slides.

J. ARTHUR HARRIS.

"A tetracotyledonous race of *Phaseolus vulgaris*." Illustrated by lantern slides. Discussed by E. W. Sinnott and I. W. Bailey.

FRANK D. KERN.

"Japanese species of *Gymnosporangium*."

W. A. MURRILL.

"*Collybia* in North America." Illustrated by lantern slides.

CLIFFORD H. FARR.

"Cell-division: bipartition and quadripartition in pollen mother-cells." Illustrated by lantern slides.

CHARLES B. LIPMAN.

"Ecology and the new soil fertility." Read, in absence of author, by R. C. Faulwetter.

R. S. WILLIAMS.

"Philippine Island mosses collected by J. B. Leiberg."

ORLAND E. WHITE.

"Studies of inheritance in *Pisum*." Illustrated by specimens of seeds. Discussed by D. T. MacDougal and A. B. Stout.

ARTHUR H. GRAVES.

"Chemotropism in *Rhizopus nigricans*."

A. B. STOUT.

"Self and cross fertilization in *Cichorium Intybus* with reference to sterility." Illustrated by lantern slides.

J. B. S. NORTON.

"Variation in *Tithymalopsis*." Illustrated by charts and specimens.

OLIVER A. FARWELL.

"Notes on the genus *Hippochaete* in North America."

ARTHUR HOLLICK.

(a) "A fossil fern monstrosity."

(b) "A new fossil *Coccolobis* from Alaska."
(c) "Cretaceous and tertiary cycads of Alaska."
The second and third of these papers were illustrated by photographs.

Seventy persons were present at this morning session.

1:30 Lunch in the Museum Building.

2:30–4:00 Session for the reading of papers, under the chairmanship of W. A. MURRILL.

BENJAMIN HOROWITZ and WILLIAM J. GIES.
"The chemistry of plant pigments." Read by title.

WILLIAM J. GIES.
"A review of the chemical researches at the New York Botanical Garden." Read by title.

JOHN K. SMALL.
"Recent exploration in southern Florida." Illustrated by lantern slides.

H. HUS.
"A new interpretation of fasciation." Read by title.

P. A. RYDBERG.
"Life zones in the Rocky Mountains." Illustrated by lantern slides.

KATHARINE DOORIS SHARP.
"A missing biography." Read by title.

FRED J. SEAVER.
"Bermuda fungi." Read by title.

WILLIAM J. BEAL.
"Some things learned in managing a botanic garden." Read by title.

KARL F. KELLERMAN.
"Coöperation in the control of plant diseases." Discussed by W. A. Murrill.

EDGAR ALTENBERG.
"Inheritance of certain spike-characters in

cereals." Read by title.

CAROLINE A. BLACK.

"Morphological studies on *Pyrus Malus*."

Questions and discussion by N L. Britton.

B. O. DODGE.

"Influence of the host on the morphology of the roestelia." Illustrated by charts and lantern slides.

J. J. TAUBENHAUS.

"A contribution to our knowledge of scurf of white potato." Illustrated by blackboard sketches and by specimens.

FRANCIS E. LLOYD.

"Pollen grain and embryo-sac as colloidal systems." Read by title.

N. L. BRITTON.

"The vegetation of Anegada." Illustrated by lantern slides.

At the conclusion of this program, which brought to an end the sessions for the reading of papers, Dr. Britton, in behalf of the management of the Garden, expressed his appreciation of the attendance upon the various meetings of the anniversary week.

Fifty-six persons were present at this Thursday afternoon session.

4:00–6:00 Tea at the Mansion. Inspection of Nurseries, Arboretum, Propagating Houses (exhibition of South American cacti collected by J. N. Rose with the aid of the Darius Ogden Mills Fund), Conservatory Range 2, and Bronx River Valley to Hemlock Forest and Elevated Railway Station.

8:30 Smoker at Faculty Club, Columbia University, as guests of the Department of Botany of the University. This smoker was well attended and much enjoyed.

FRIDAY, SEPTEMBER 10

Visit to the Pine Barrens of New Jersey

On Friday, September 10, the visiting botanists and friends were guests of the Torrey Botanical Club on a visit to the pine barrens of New Jersey. Under the guidance of Mr. Percy Wilson, chairman of the field committee of the Club, the party of about fifty persons left New York on the Atlantic City express at 9:50 A. M. and at 12:20 reached Tom's River, where luncheon was served. The day was clear and warm, with a pleasant breeze. With coats and other impedimenta left at the hotel, the party was soon in the barrens among the small pines, scrub oaks, and huckleberry bushes. A brief account of some of the plants observed has been compiled from notes furnished by Mr. Percy Wilson and Dr. William A. Murrill.

Of all the plants, the curly-grass (*Schizaea pusilla*) was the one most eagerly sought for by members of the party, some of whom were unfamiliar with this rare little fern in its natural environment. During the early afternoon a large swamp containing many white cedars was visited, where, after a careful search in the sphagnum moss along its margin, a few *Schizaea* plants were collected. Other specimens were discovered later in the day, when a visit was made to a large cranberry bog.

Two species of club-mosses were found in the moist sand bordering one of the bogs; one of these, *Lycopodium alopecuroides*, with its large club-like heads, was quite abundant.

Orchids, which at certain seasons are among the most showy plants of our southern New Jersey swamps, were little in evidence. All that remained of this interesting group were fruiting specimens of the rose pogonia (*Pogonia ophioglossoides*) and several much withered plants of the orange-fringed orchis (*Blephariglottis ciliaris*).

In some of the moist sandy depressions and along the margins of some of the bogs, three species of sundew were collected.

Towards the center of the swamp, the poison sumac, with its drooping clusters of white fruits, was common everywhere.

In the dry sandy regions, the pitch pine was the most striking

feature of the vegetation. Scrub oaks were here abundant and represented by several species, many of which were only a few feet in height.

Large-fruited tangleberries (*Gaylussacia frondosa*) formed scattered colonies among the pines, while members of the thistle family were present everywhere.

Several members of the party, under the leadership of Professors Atkinson and Harper and Doctors Murrill, Seaver, Levine, and Dodge, gave particular attention to the fungi. The soil being chiefly sand and the water level low, the fleshy fungi were observed to develop lower down in the soil than is usually the case. The following agarics and boletes were collected and were named by Dr. W. A. Murrill:

Venenarius phalloides, *Boletus luteus*, *Lactaria* sp., *Ceriomyces* sp., *Laccaria laccata*, *Laccaria ochropurpurea*, *Venenarius solitarius*, *Venenarius muscarius*, *Ceriomyces viscidus*, *Cortinarius* sp., *Russula delica*, *Ceriomyces frustulosus* (?), and *Melanoleuca equestris*.

Saturday, September 11

Visit to the Brooklyn Botanic Garden and to the Cedar Swamp of Merrick, Long Island

The forenoon of this day was devoted to inspecting the laboratory building, plant houses, and grounds of the Brooklyn Botanic Garden. Fifty visitors were in registered attendance. At noon they were guests of the Brooklyn Botanic Garden at a luncheon, which was served in the laboratory building.

At 1:30, a party of twenty-five left by train and by automobile for Merrick, under the guidance of Norman Taylor, to examine the flora of the salt marsh and white cedar swamp at that place.

The dominant tree of this swamp is *Chamaecyparis thyoides*. Mr. Taylor has furnished the following note on the flora of the region:

"The swamp extends for nearly a mile north and south of the Long Island railroad. The fringe of trees near the salt marshes shows evidences of the encroachment of sea-water, many of them being already dead, others very much denuded. Among the characteristic species observed during the trip were *Potamogeton*

Oakesianus, *P. epihydrus*, *Acer carolinianum*, *Vaccinium atlanticum*, *Aronia atropurpurea*, and *Iris prismatica*. At the contact of the salt marshes and the cedar swamp, the commonest plants are *Solidago sempervirens*, *Argentina littoralis*, *Plantago maritima*, and other salt marsh species."

This excursion to Merrick completed the arranged program in connection with the Twentieth Anniversary of the New York Botanical Garden.

MARSHALL A. HOWE,
Secretary of the Twentieth Anniversary Meetings

REPORT ON A VISIT TO PORTO RICO FOR COLLECTING MARINE ALGAE

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Dear Sir: I beg to present herewith a brief account of a recent visit to Porto Rico, undertaken for the purpose of continuing studies and collections of the marine algae of that island. My first visit to Porto Rico for this purpose was in the summer of 1903 and was briefly reported upon in the *Journal of the New York Botanical Garden* for October of that year. The second was in February and March, 1906, when I had the pleasure of accompanying you and others on an expedition of a wider scope, an account of which you have published in the *Journal* for May, 1906. The present expedition was under the leadership of Dr. Raymond C. Osburn, of Columbia University, and was one of the several recently organized by the New York Academy of Sciences, the American Museum of Natural History, and the New York Botanical Garden, with the financial coöperation of the insular government of Porto Rico, for the object of making a general scientific survey of the island. Professor Osburn is especially interested in a study of the bryozoa, which are very commonly found attached to marine algae, so that our collaboration in this work proved eminently natural and mutually beneficial. It has doubtless been too much the custom for specialists in marine botany to "flock by themselves" when

on collecting expeditions and for specialists in marine zoology to do likewise. The loss and waste from this lack of coöperation is perhaps particularly manifest in expensive and difficult dredging operations when the zoölogist working alone is likely to throw overboard as "only a seaweed" material of much scientific interest, while the botanist, under similar conditions, treats rare and valuable zoölogical material in the same unappreciative and wasteful fashion. Professor Osburn's wide experience in biological dredging in connection with the work of the Marine Biological Laboratory at Woods Hole and of the United States Bureau of Fisheries contributed much to the success of our recent work in Porto Rico.

We left New York on June 12 and reached San Juan on the afternoon of the 16th, in season to pick up a few seaweeds that were found washed ashore near the suburb of Santurce. Twelve years before, a little earlier in the season, I had spent three weeks in making collections of marine algae in the region of San Juan and Santurce, so was not anticipating the discovery of any striking novelties at this point. However, it was a pleasure to find here again a gelatinous red alga of the genus *Trichogloea*, a plant that I have not collected elsewhere in Porto Rico and not, I believe, on any of the other West Indian islands that I have visited. *Haloplegma Duperryi* and unusually good specimens of *Neurocarpus Justii* were among the more interesting seaweeds that were being washed up on the beach at this time.

June 17 was devoted in part to presenting our credentials to the government officials in San Juan, and on the 18th we went by rail, a day's journey, to Ensenada, a town that has grown up within the last thirteen years around the plant of the Guanica Centrale, which operates here one of the largest sugar mills of the world. Through the courtesy of Mr. F. T. Maxwell, the manager of the Guanica Centrale, we were provided with living quarters and laboratories in buildings belonging to the sugar company, and for the three weeks during which we made Ensenada the base of operations we enjoyed comforts and conveniences quite unusual in scientific expeditions to the tropics. At the suggestion of Mr. W. V. D. Kitchin, electrical engineer of the

Guanica Centrale, we secured the use of the sloop Canario of Guanica, Dario Morcilio captain and owner, for a period of three weeks. This sloop we found well adapted for the purposes of dredging and the captain's knowledge of the nature of the sea-bottom and of other local conditions was found most useful.

On June 19, 20, and 21, collections were made along the shore and in shallow water in Guanica Harbor and at Ballena Bay. Guanica Harbor, the more exposed adjacent shores, and the outlying reefs offer unusually favorable habitats for representatives of the genus *Caulerpa*, nine or more species of which are found in this region. *Caulerpa taxifolia*, *C. crassifolia*, *C. sertularioides*, *C. prolifera* and *C. verticillata* occur in abundance, often in association with the red mangrove (*Rhizophora Mangle*). Near the mouth of the harbor and on the reefs, *Caulerpa racemosa* and *C. clavifera*, which most recent writers have considered to be varieties of a single species, occur in similar habitats and often side by side or intermingled yet maintain their distinctive characters. I have observed the same association without intergrading in many other islands of the West Indies and as a result I incline to the opinion that *Caulerpa racemosa* and *C. clavifera* are entitled to rank as distinct species. It must, however, be admitted that on the roots of *Rhizophora* and occasionally in other situations plants occur that may at first sight seem to be somewhat intermediate in character, but perhaps such ambiguity is apparent rather than real. *Halophila Baillonis*, a small creeping plant bearing a superficial resemblance in habit to certain Caulerpas, but really a spermatophyte of the family Hydrocharitaceae, forms extensive mats on the sea bottom in Guanica Harbor, ranging in depth from 3 dm. to 10 m. of water. In certain other places along the south shore of the island this was dredged up from a depth of at least 18 m., at which depth also another species of the genus, *H. Aschersonii*, was found. The marine vegetation on the rocks near the mouth of Guanica Harbor is rich and varied. Among the brown algae, species of *Sargassum*, *Padina*, and *Dictyota* are conspicuous elements in the flora. Among the red algae, the more prominent are several

species of *Galaxaura* and *Gracilaria*. **Bryothamnion triquetrum**,* a plant that is very common in some parts of the West Indian seas and is apparently wanting in other parts, is here an important element in the algal flora. *Amphiroa Tribulus*, a coralline alga, a specimen of which from this locality was figured in a former report,† is another red seaweed that finds an unusually good development at the mouth of Guanica Harbor.

Along the northern coast of Porto Rico the sea-bottom drops off abruptly to ocean depths, but along the southern coast there is a sublittoral shelf from one to eight miles broad and covered for the most part by from eight to fifty meters of water. Our dredging operations were confined to this shelf and were carried on chiefly within a radius of two miles from the mouth of Guanica Harbor. On June 25, we visited the Bay of Guayanilla and Tallaboa Bay, ten or fifteen miles eastward from the mouth of Guanica Harbor. Shore collections were made at the Guayanilla Playa and on Cayo Maria Langa and dredgings were made at various points from the vicinity of Cayo Maria Langa to Cayo Caribe. On the evening of June 26, Mr. W. V. D. Kitchin of the Guanica Centrale kindly took us to Parguera, about twelve miles west of Ensenada, on his large power-boat "Colleen." The following day was devoted to making shore collections in Parguera Cove, on Cayo Don Luis, and Salinas Cove, and dredge hauls were made in the region of Margarita Pass and in Salinas Cove. On the return voyage late in the afternoon of that day strong head winds and a rather turbulent sea were encountered, and a temporary indisposition on the part of the motor gave an opportunity for the auxiliary sail of the "Colleen" to vindicate the foresight that led to its incorporation in the vessel's equipment.

In Salinas Cove, as has been my experience at various other points in the West Indies, *Halimeda tridens*, *H. Monile*, and *H.*

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* *Fucus triqueter* S. G. Gmel. Hist. Fuc. 122. *pl. 8. f. 4.* 1768. (Not *Fucus triqueter* L. Mant. 312. 1771.)
Fucus trifarius Swartz, Prod. 148. 1788.
Fucus triangularis J. F. Gmel. Syst. Nat. 1383. 1791.
Bryothamnion triangulare Kütz. Sp. Alg. 842. 1849.

† Jour. N. Y. Bot. Gard. 4: 173. *f. 19.* 1904.

simulans were found growing closely associated and without any intergrading, and this experience was repeated four days later along the *Rhizophora*-lined shore just east of the entrance to Guanica Harbor. In the latter locality on July 1 two copiously fertile specimens of *Halimeda tridens* were found growing in shallow water among hundreds of wholly sterile ones. On March 22, 1906, as previously reported,* the writer was so fortunate as to find two fertile plants of this species near Tallaboa, which is about fifteen miles east of the locality just mentioned. Previously to that, so far as I am aware, the species had been known from sterile specimens only, though the species is of common occurrence in the West Indies, southern Florida, and Bermuda, and was first described as long ago as 1786. On November 28, 1907, the writer collected a few fertile plants of this species on Watlings Island in the Bahamas. This range of dates, March 22, July 1, and November 28, would seem to indicate that there is nothing narrowly seasonal in the production of spores in *Halimeda tridens* and that the remarkable rarity with which fertile plants seem to occur is not to be associated with any failure of collectors to be in the field at the right time of year. Professor J. Lloyd Williams has shown that in Great Britain *Dictyota dichotoma*, one of the brown seaweeds, has a fortnightly periodicity in the maturation and discharge of its sexual cells and that this periodicity bears a definite relation to the tides. Dr. W. D. Hoyt has observed a similar periodicity in the same species on the coast of North Carolina, but finds the periods separated by monthly instead of fortnightly intervals. Whether the development and maturation of the sporangia in *Halimeda tridens* have any discoverable relation to the fluctuations of the tides is a question yet to be answered, but a reference to calendars fails to show that the three dates mentioned above have any obvious and definite relation to phases of the moon, which are correlated with the tides. Moreover, the tides in the Caribbean region where these collections were made have a range of only about three decimeters, and, furthermore, the periodicity in *Dictyota* has been observed in the development of the sexual cells only,

* Bull. Torrey Club 34: 493. 1907.

while the highly microscopic motile reproductive cells of *Halimeda* are not known to be sexual in character. A single fertile *Halimeda* plant, like those collected on July 1, must produce a colossal multitude of microscopic zoöspores and it is conceivable that a single fertile plant out of thousands of permanently sterile ones might be quite sufficient to maintain the species.

On the afternoon of July 6 we went to Ponce by stage and rail and met the "Canario" in Ponce Harbor early the following morning, with the intention of sailing out to the island known as Caja de Muertos, lying about eight miles southeast. But the arrival of several larger vessels led to an unexpected delay in securing our clearance papers and the visit to Muertos Island was postponed. The remainder of the day was devoted to making collections in the vicinity of the new pier, the "Muelle de Ponce." An hour before daylight on the morning of the 8th we were on our way to the Caja de Muertos, the early start being made both to economize time and to avoid the heavy head wind which was to be expected later in the morning. The Caja de Muertos was visited by you last March and has been so recently described by you* that nothing need now be added as to the general topographical and floral features of this attractive and interesting island. The algal flora of the island was found to be rich and varied. A striking feature of this flora along the northwestern shores was the abundance of *Cymopolia barbata*, an attractive, more or less calcified green alga that I have elsewhere seen in only limited quantity. It was here growing profusely in shallow tide-pools and from low-water mark down to a depth of one or two meters on gently sloping rocks that were exposed to a moderate surge. On a rocky shore with a southeastern exposure at the western end of the island, where a heavy surf was breaking, several sorts of interesting algae were found in the masses of debris that had been tossed up on the rocks. These included large mats of *Chamaedoris Peniculum* and a considerable number of specimens of the apparently rare *Rhipilia tomentosa*, the latter often growing attached to its darker-colored and differently organized relative, *Avrainvillea Rawsoni*. In the afternoon, on

* Jour. N. Y. Bot. Gard. 16: 109. 1915.

the return voyage to Ensenada, a distance of about thirty miles, the dredges and tangles were dropped several times, the most successful haul being made in about eighteen meters of water northwest of Ratones Island. Dredgings off the north side of the Caja de Muertos had shown that the bottom was of clean white sand, with little or no vegetation.

On July 10, as on several previous days for which our activities have not been specifically described, dredgings were made off Pt. Brea, in Pardas Bay, and at other points near the mouth of Guanica Harbor. This practically completed the collecting work of the expedition. The marine algae secured on this visit to Porto Rico are represented by 736 field numbers, comprising nearly 3,000 herbarium specimens, besides material preserved with the aid of formaldehyde. The dredging operations, in particular, resulted in bringing to light a considerable number of species that are new to the flora of Porto Rico and it is possible that further studies may show that some of these are new to botanical science.

On the return voyage we left San Juan on July 14 and reached New York on July 19.

Respectfully submitted,

MARSHALL A. HOWE,

Curator

BEQUEST OF JACOB LANGELOTH

The Garden has received one thousand dollars from the executor of the will of Jacob Langeloth, and this legacy has, by order of the board of managers, been credited to the principal of the Endowment Fund for Science and Education, increasing this fund to $76,455. The income of this fund is used for educational and scientific purposes, including the purchase of additions to the collections of plants and specimens, the purchase of books for the library, of apparatus for the laboratories, and for lectures.

Mr. Langeloth was an annual member of the Garden from 1901 until his death in 1914; Mrs. Langeloth continues his membership.

N. L. BRITTON,

Secretary

GIFT OF HEPATICAE BY MISS CAROLINE C. HAYNES

In connection with the Twentieth Anniversary Celebration of the New York Botanical Garden, Miss Caroline Coventry Haynes presented to the Garden the collection of Hepaticae formerly belonging to Dr. Marshall A. Howe, from whom she purchased it in 1909. This collection is especially rich in Californian material and includes most of the specimens described or cited by Dr. Howe in his memoir on "The Hepaticae and Anthocerotes of California," published in 1899. The collection includes, besides, a considerable amount of foreign material received in exchanges with Schiffner, Levier, Heeg, and other European students of the Hepaticae. The pockets of specimens now turned over to the Garden number 1,174. The Ricciaceae of this herbarium had already been despoited at the Garden. Certain specimens belonging to groups in which Miss Haynes is especially interested are being retained by her for a time, making the total number of pockets of specimens that are eventually to come to the Garden about 1,851.

AUTUMN LECTURES, 1915

Lectures will be delivered in the Lecture Hall of the Museum Building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

October 2. "Collecting Fleshy Fungi on the Upper St. Regis," by Dr. W. A. Murrill.

October 9. "Explorations in Haiti, the Negro Republic," by Mr. G. V. Nash.

October 16. "Ten Weeks in the Rockies," by Dr. F. W. Pennell.

October 23. "The Fossil Plant Collections of the New York Botanical Garden," by Dr. A. Hollick.

October 30. "Correlations between Animals and Plants," by Dr. F. J. Seaver.

November 6. "The Sources of Quinine," by Dr. H. H. Rusby.

November 13. "European Influences in American Botany," by Dr. J. H. Barnhart.

November 20. "The Diatoms," by Dr. M. A. Howe.

The lectures, which occupy an hour, will be illustrated by lantern slides and otherwise. Doors closed at 4:00; late comers admitted at 4:15.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railroad 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. Those coming by the New York, Westchester and Boston Railway change at 180th Street for crosstown trolley, transferring north at Third Avenue.

NOTES, NEWS AND COMMENT

Mr. F. S. Collins of North Eastham, Massachusetts, who was in attendance upon the Garden's Twentieth Anniversary exercises, gave a considerable part of his attention during the week to an examination of Bermuda algae in the Garden herbarium.

Mr. Charles Piper Smith, of the Maryland Agricultural College, College Park, Maryland, spent a few days at the Garden in the latter part of September, engaged in a study of certain lupines in the Garden herbarium.

Mr. L. C. Griffith, of the Bureau of Entomology of the United States Department of Agriculture, recently spent a part of two days, in company with Dr. Seaver, inspecting the grounds of the New York Botanical Garden with special reference to insects destructive to ornamental trees and shrubs.

The presence of the European pine-shoot moth in New York and vicinity adds one more to the long list of harmful insects

which must be guarded against. The moth attacks various species of pine, especially the dwarf ornamental varieties, depositing its eggs in the buds of the terminal shoots. The presence of the insect is evident in the spring by the dying of the shoots after making a short growth. Infected branches should be cut and burned before the adults emerge.

Mr. Paul Weidemeyer Graff, of Bridgeport, Connecticut, will devote the present school year to graduate studies at Columbia University and the New York Botanical Garden. Mr. Graff is a graduate of the Connecticut College of Agriculture in the class of 1907; was Austin teaching fellow in botany at Harvard University, 1907-'09; assistant in botany in the Kansas State Agricultural College, 1909–'11; mycologist of the Bureau of Science of the Philippine Islands, 1911–1914. His major work will be with the fungi and more especially with the Perisporiaceae.

Group photographs were taken at various times during the exercises of the Garden's Twentieth Anniversary week, and copies of these will be distributed, as souvenirs, to the persons in registered attendance.

Meteorology for September.—The total precipitation for the month was 1.89 inches. The maximum temperatures for each week were 90° on the 4th, *93° on the 9th*, *93° on the 16th*, 74° on the 24th. The minimum temperatures were 52° on the 1st, 61° on the 11th, 59° on the 19th, and *43° on the 23d*.

ACCESSIONS

MUSEUMS AND HERBARIUM

7 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)
1 specimen of *Cephalotaxus* from Florida. (Given by Dr. R. M. Harper.)
7 specimens of crude drugs. (Given by Dr. H. H. Rusby.)

87 specimens of flowering plants from Canada. (By exchange with the Geological Survey of Canada.)

19 specimens of *Euphrasia*. (By exchange with the University of Upsala.)

1 specimen of *Cirsium arvense* from Ohio. (By exchange with Mr. F. K. Mathies.)

2956 specimens of marine algae from Porto Rico. (Collected by Dr. M. A. Howe.)

17 specimens of hepatics from New England. (By exchange with Miss Annie Lorenz.)

3 specimens of flowering plants from Porto Rico. (Given by Dr. Theodore Holm.)

10 specimens of flowering plants from Stockbridge, Massachusetts. (Given by Dr. N. L. Britton.)

140 specimens from Berks County, Pennsylvania. (Given by Dr. N. L. Britton.)

1 specimen of fleshy fungus from Missouri. (By exchange with Mr. L. O. Overholts.)

2 specimens of *Ustilago* from New Jersey. (By exchange with Mr. C. A. Schwarze.)

1 specimen of *Physotheca Halstedii* from Colorado. (By exchange with Professor T. D. A. Cockerell.)

52 specimens of fungi from New York. (Collected by Dr. W. A. Murrill.)

29 specimens, "Fungi Dakotenses," fascicle 13. (Distributed by Dr. J. F. Brenckle.)

1 specimen of fungus from New York. (Collected by Mr. R. S. Williams.)

5 specimens of fungi from New York. (By exchange with Mr. Frank H. Ames.)

2 specimens of fungi from Idaho. (By exchange with Professor J. R. Weir.)

2 specimens of fungi from Indiana and California. (By exchange with Dr. J. C. Arthur.)

2 specimens of fungi from New York. (By exchange with Mr. Stewart H. Burnham.)

2 specimens of fungi from Florida. (By exchange with Mr. Edgar Nelson.)

1 specimen of fungus from Iowa. (By exchange with Dr. Mary Whetstone).

1 specimen of fungus from Minnesota. (By exchange with Dr. Mary Whetstone.)

8 specimens of *Cercospora beticola*. (By exchange with the United States Department of Agriculture.)

15 specimens of fleshy fungi from Virginia. (Collected by Dr. W. A. Murrill.)

1 specimen of *Pyropolyporus conchatus* from New York. (By exchange with Miss F. A. Mulford.)

6 specimens of fungi from Pennsylvania. (By exchange with the Pennsylvania State College.)

1 specimen of *Elfvingia megaloma* from China. (By exchange with the United States Department of Agriculture.)

2 specimens of fungi from Pennsylvania. (By exchange with Mr. John I. Mercer.)

1 cotype specimen of *Claudopus depluens* from New York. (By exchange with Professor H. M. Fitzpatrick.)

1 specimen of *Polyporus squamosus* from New Jersey. (By exchange with Mr. O. P. Medsger.)

1 specimen of *Panaeolus solidipes* from Missouri. (By exchange with Mr. L. O. Overholts.)

1 specimen of *Daedalea Aesculi* from North Carolina. (By exchange with Dr. H. D. House.)

20 specimens of polypores from Pennsylvania. (By exchange with the Pennsylvania State College.)

5 specimens and photographs of fungi from Missouri. (By exchange with Mr. L. O. Overholts.)

5 specimens of fungi from New York. (By exchange with Mrs. Leonard Irving.)

197 specimens of fungi, mainly from New Mexico. (By exchange with the United States National Museum.)

2 specimens of *Peziza vesiculosa* from Missouri. (By exchange with Mr. L. O. Overholts.)

6 specimens of fungi from Utah. (By exchange with Professor A. O. Garrett.)

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OF

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JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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THE MANSION

JOURNAL

OF

The New York Botanical Garden

VOL. XVI NOVEMBER, 1915 No. 191

THE MANSION

The large stone residence built by the Lorillard family in 1856 above the Bronx River near the waterfall is included in the additional land granted the Garden by the City in January, 1915. During the period from the establishment of Bronx Park until this time it had been used at intervals for various purposes by the Park Department, for a series of years as a police station, and, more recently, some of its rooms have been used for museum purposes by the Bronx Society of Arts and Sciences by permission of the Park Department. When it came under the control of the Garden last January, it was in need of much repairing and cleaning and a heating plant was found to be necessary. It has four floors and a commodious basement. Its stone walls are substantially built and it contains forty-five rooms.

At the meeting of the Board of Managers held April 15, 1915, recommendations were received from the Scientific Directors relative to proposed uses of rooms in this building, including shops and storage in its basement and horticultural laboratories in certain rooms in the upper story, and these recommendations were approved. At this meeting, the following resolutions were adopted:

Resolved: That the Director-in-Chief be, and he hereby is, authorized to continue the permission formerly given the Bronx Society of Arts and Sciences by the Commissioner of Parks of the Borough of The Bronx to occupy a portion of the Lorillard Mansion for museum purposes, until otherwise instructed, it being understood that no expense directly connected with such museum shall be borne by the New York Botanical Garden.

[Journal for October (16: 203-230) was issued Nov. 2, 1915]

Resolved: That the Director-in-Chief be, and he hereby is, authorized to permit the Horticultural Society of New York to occupy rooms in the Lorillard Mansion as offices, until otherwise instructed, it being understood that no expenses directly connected with such occupancy shall be borne by the New York Botanical Garden.

Resolved: That the Director-in-Chief be, and he hereby is, authorized to equip and maintain meeting and board rooms in the Lorillard Mansion.

At the meeting of the Board of Managers held June 17, 1915, it was reported that the Bronx Society of Arts and Sciences had contributed $100 toward the expense of renovating rooms for its use and that in one of these rooms on the second floor a collection of paintings by American artists, loaned by the Metropolitan Museum of Art to the Bronx Society of Arts and Sciences, had been installed. It was also reported that the Horticultural Society of New York had accepted the permission granted at the meeting of April 15 to occupy rooms in the Mansion as offices in a resolution adopted by the Council of that Society on May 8, as follows:

Resolved: That the offer of the Board of Managers of the New York Botanical Garden, to permit the Horticultural Society of New York to occupy rooms in the Lorillard Mansion as offices, as expressed in the resolution passed by that body on April 15, 1915, and transmitted by the Secretary of the Board of Managers in a letter dated April 17, 1915, be and is hereby accepted, with full appreciation of its value, and that the thanks of the Horticultural Society of New York be and are hereby extended to the Board of Managers of the New York Botanical Garden for this generous action on their part.

The Horticultural Society of New York has also purchased office furniture for the rooms set apart for its use on the second floor and had contributed $250. A steam heating plant has been installed and was successfully put into operation early in October. The porch on the south side of the building has been repaired. Carpenter, painter and plumber shops have been established in the basement, and the laboratory work of preparing labels for plants has been established in rooms on the second story. No work has yet been done on any rooms above the second story other than to make them waterproof. The roof has been made watertight and new leaders provided.

The Board Room on the first floor was opened to members at the autumn inspection of grounds, buildings and collections on the afternoon of October 21, and cards admitting all members

of the Garden, members of the Horticultural Society of New York, and members of the Bronx Society of Arts and Sciences, and their friends, to the Board Room have been issued. Tea will be served there every afternoon until December 21, at a charge of thirty-five cents. At the end of this period of two months, it will be determined whether the Board Room will be kept open for members during the winter or not, depending upon the use that is made of it.

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

NATURE STUDY WITH CHILDREN

The Bedtime Stories Club of *The Globe* held its first meeting at the Garden on the afternoon of September 30, with about 10,000 children in attendance. The first hour was devoted to Conservatory Range 1 and the flower beds adjoining, after which the party assembled in the large open area south of the Herbaceous Garden Valley and listened to brief addresses by Mr. Jason Rogers, manager of *The Globe*, Mr. Horace S. Tibbs, editor of the Bedtime Stories Club, Mr. Thornton W. Burgess, and Mr. Ernest Thompson Seton. The appearance of "Peter Rabbit" (Mr. J. H. Woodward) in person at 2 o'clock was the signal for beginning the march to the Zoological Park. All the speakers, including the last mentioned, were enthusiastically received.

The weather was ideal in every respect and nothing occurred to mar the perfect enjoyment of the day. Several visitors were heard to remark that they had never seen such attractive and well-behaved children. To manage them was a pleasure, and in this we were ably assisted by the Advisory Committee, the Volunteers, and a large number of Boy Scouts. Several thousand adults accompanied the children.

The following outline of exercises for the first hour appeared in the Souvenir Magazine of the Club, a copy of which was placed in the hands of every member on entering the Garden:

Program of Exercises at the New York Botanical Garden

The New York Botanical Garden occupies about 400 acres in the northern part of Bronx Park, and contains a large Museum Building, two large ranges of Conservatories, an old Mansion in the hemlock forest on the Bronx River, and many plantations of herbaceous plants, shrubs, and trees. You will go through only one corner of the Garden, but you will be able to see the Museum Building at a distance and will enter one of the large conservatory ranges and see the tropical plants growing there.

On the way from the train to the conservatories, and after leaving the conservatories, you will see many deciduous and evergreen trees as well as a number of flower beds filled with herbaceous plants. A deciduous tree drops its leaves on the approach of winter. "How do deciduous and evergreen trees usually differ in shape?" "Do their leaves also differ in shape?"

On entering the Garden, you will notice at once a large range of conservatories, or glass-houses, devoted to tropical or tender plants; and, as you march toward them behind your group banners, you may try to answer the following questions: "Why are conservatories built of glass?" "Why is this large range, which is 512 feet long and 90 feet high at the central dome, divided into 15 smaller compartments, or houses?"

Entrance to the Conservatory Range will be made at three separate points and the routes kept distinct until they come together at the steps on the south side of the conservatory court. A man will be stationed on each route to give a brief description of some of the plants that will be seen. The route used by any particular child will be purely accidental, but each route will keep you busy and interested.

If you have to wait at the entrance of the conservatories, you will find hundreds of interesting flowers all about you with their names on little labels stuck in the ground beside them. This may give you a chance to learn the correct names of flowers which you have often seen without knowing what to call them.

Route 1

Enter at house 4, at the northwest corner of the range, and turn to the left, passing coffee trees, a sarsaparilla vine, a cinna-

mon tree, an allspice tree, chocolate trees, papaw trees in flower, a mango tree, and a pandanus tree. Mr. George V. Nash will speak briefly of tropical plants in general and some of these trees in particular. You must keep your eyes open and watch the labels.

Leaving house 4, you will pass through several houses containing cacti and other desert plants, when you may try to answer these questions: "How do desert plants differ from other plants?" "Do you notice anything about these plants that would keep them from drying up quickly in the hot sun?"

Route 2

Enter at house 1, at the center of the range on the north side, and keep to the left, passing directly through the house to the conservatory court. Mr. Percy Wilson will point out and briefly describe the cocoanut palm, the palmetto, the date palm, the sago palm, the climbing palm, the Panama hat palm, and the Chinese bamboo; all of them interesting and useful trees of the warmer regions. "How do palm trees differ from other trees?" "Name three ways in which palm trees are useful."

Route 3

Enter at house 13, at the northeast corner of the range, and keep to the left, passing the desert palm, cabbage palmetto, edible fig, tea plant, orange tree, lemon tree, and pandanus, all of which have their names in full view. Then go straight through house 11, on the left side, and enter house 10, the banana house, where Mr. Kenneth R. Boynton will point out several kinds of banana trees, the manila hemp plant, the traveler's tree, ginger plants, and pineapple plants.

Passing through the next house, where many of the plants are growing in the air, without any soil, we reach the beautiful aquatic house, mostly filled with plants that grow in the water. Here, on the right, will be seen the water poppy, the water snowflake, the water hyacinth, and the sugar cane; and on the left the bamboo, several water lilies, and the famous paper plant, from which paper was first made by the Egyptians. "How

do you explain the different kinds of tea, all coming from the same plant?" "How many kinds of banana fruits have you seen?" "Write a composition on the history of paper."

The Conservatory Court

Whatever route is taken will lead to the court on the south side of the range where there are two large tanks, the one on the east containing the lotus and many varieties of hardy water lilies, while the western one is filled with tender water lilies, or those from tropical countries. These are all labeled and will prove exceedingly interesting. "Which one has the largest leaves?" While waiting for the groups to form in line, the orange trees and fig trees in the court may also be examined. These are not taken inside until some time in October.

Directions for Leaving the Conservatories

Follow the path eastward around the conservatory wing, keeping on the upper level until the rose bed is reached, and then turning northward past the rose bed. Follow your banner to the path west of the herbaceous garden valley, and cross the lower end of this valley.

The smaller children, who are not able to take the walk through the beautiful herbaceous grounds, will descend the steps to the lower level, where the motor-cars will be waiting.

W. A. MURRILL,
Assistant Director.

AUTUMN INSPECTION OF GROUNDS, BUILDINGS AND COLLECTIONS

The first autumn inspection of the grounds, buildings, and collections took place on the afternoon of October 21, with over two hundred members and friends of the New York Botanical Garden, the Horticultural Society of New York, and the Bronx Society of Arts and Sciences in attendance.

The Main Conservatory Range was first inspected, with special

attention to palms and desert plants. Mr. George V. Nash, Head Gardener, described features of the Palm Collection, with especial reference to the two elegant plants of *Phoenix reclinata* recently presented by Mr. C. F. Dieterich, of Millbrook, New York. His assistant, Mr. Boynton, remarked upon several of the large aroids in house No. 4, and Mr. Percy Wilson, Associate Curator, described noteworthy desert plants in house No. 6. An excursion was then made through the collection of firs, spruces, and pines adjoining the conservatory range. Dr. Britton demonstrated the botanical characteristics of these trees at several points during the walk.

From the Pinetum, the party proceeded by motor-cars to the site of the new Rose Garden soon to be established in cooperation with the Horticultural Society of New York, where a brief stop was made.

Tea was served in the Mansion between 4:30 and 5:30, and a number of interesting plants and flowers exhibited, among them *Peresteria elata*, the Holy Ghost orchid, *Abelia chinensis*, *Aconitum autumnale*, *Aconitum Fischeri*, *Xanthisma texanum*, *Cimicifuga simplex*, *Asteromea indica*, and *Polygonum polystachyum*.

The enjoyment of the occasion was enhanced by ideal weather and an unusual display of autumn colors, which made the grounds exceedingly attractive.

A CUBAN JOURNAL OF NATURAL HISTORY

The "Sociedad Cubana de Historia Natural 'Felipe Poey'" has commenced publication of its *Memorias*, as a bimonthly magazine in octavo, and four issues have appeared, and have been received by the Garden in exchange for its *Bulletin*. The society is dedicated to the work and memory of the distinguished Cuban naturalist Poey. Botanical papers are contributed by Professor Gomez de la Maza, of the University of Havana, and by Dr. Juan T. Roig, of the Agricultural Experiment Station at Santiago de las Vegas; in the fourth number these authors publish a very interesting article entitled "Elementos para el

Estudio de la Flora Cubana" (pp. 203–207), including references to herbaria containing specimens of Cuban plants and to publications on the Cuban Flora, and accounts of Cuban botanical gardens and agricultural establishments. The exploration work of the New York Botanical Garden in Cuba is alluded to. In this connection it may be remarked that the herbarium of the New York Botanical Garden now contains collections of Cuban plants aggregating over 30,000 sepcimens, our own explorations alone having brought in over 17,000 field numbers.

We cordially tender all information which this vast collection supplies to the use of La Sociedad Poey.

N. L. BRITTON.

NOTES, NEWS AND COMMENT

Dr. C. H. Farr, who holds a Cutting Traveling Fellowship at Columbia University for the present school year, sailed on October 22 for Jamaica where he will spend about two months in the study of tropical plants, especially ferns.

Dr. J. N. Rose has recently spent several weeks at the Garden in continuation of the study of *Cacti* collected in South America.

Meteorology for October.—The total precipitation for the month was 1.90 inches. The maximum temperatures for each week were 67° on the 6th, 75° on the 15th, *76° on the 21st*, and 70° on the 27th. The minimum temperatures were 33° on the 10th, 42° on the 18th, *29° on the 24th*, and 36° on the 28th. A very slight and extremely local frost occurred on the night preceding the 10th, but the first killing frost of the season was during the night preceding the 24th.

ACCESSIONS

MUSEUMS AND HERBARIUM

1,174 specimens of miscellaneous hepaticae from the herbarium of M. A. Howe. (Given by Miss Caroline C. Haynes.)

1 specimen of *Hormiscia tetraciliata* from Puget Sound. (Given by Professor T. C. Frye.)

3 specimens of *Drosera* from New Jersey. (Given by Dr. Michael Levine.)

3 specimens of *Ceanothus* from Michigan. (Given by Mr. O. A. Farwell.)

6 specimens of flowering plants from South Carolina. (Given by Dr. D. S. Martin.)

1,000 specimens of North American freshwater algae, preserved in liquids. (Collected by Professor E. N. Transeau.)

1 specimen of *Hudsonia ericoides* from Connecticut. (Given by Dr. George E. Nichols.)

200 specimens "American Grasses." (By exchange with the United States National Museum.)

3 specimens of ferns from Yonkers, New York. (Given by Mr. Percy Wilson.)

2 specimens of *Psilocarya* from New Jersey. (Given by Mr. K. K. Mackenzie.)

22 specimens of flowering plants from Lakehurst, New Jersey. (Given by Mr. Percy Wilson.)

17 specimens of fungi from New York. (Collected by Mr. Percy Wilson.)

16 specimens of fungi from New York. (Collected by Dr. Fred J. Seaver and Mr. Percy Wilson.)

1 specimen of *Amanita abrupta* from Alabama. (By exchange with Dr. R. P. Burke.)

10 specimens of fleshy fungi from New Jersey. (Collected by Dr. N. L. Britton.)

3 specimens of fungi from British Guiana. (By exchange with Dr. F. E. Lutz.)

3 specimens of *Ganoderma Curtisii* from Georgia. (By exchange with Dr. B. D. Higgins.)

3 specimens of *Thelephora* and *Clavaria* from Massachusetts. (Collected by Dr. N. L. Britton.)

3 specimens of fungi from New Jersey. (Collected by Mr. Percy Wilson.)

14 specimens of fungi from New York. (Collected by Dr. Fred J. Seaver and Mr. Percy Wilson.)

6 specimens of fungi from Ohio. (By exchange with Professor Bruce Fink.)

7 specimens of fungi from Alabama. (By exchange with Dr. R. P. Burke.)

1 specimen of *Ascophanus testaceus* from Massachusetts. (By exchange with Mr. L. O. Overholts.)

2 specimens of fungi from Pennsylvania. (By exchange with Dr. D. R. Sumstine.)

3 specimens of discomycetous fungi from Washington, D. C. (By exchange with Mr. E. G. Arzberger.)

500 specimens of fungi from New York. (Collected by Dr. W. A. Murrill.)

32 specimens of fungi from the pine barrens, New Jersey. (Collected by Dr. W. A. Murrill and Dr. F. J. Seaver.)

3 specimens of fungi from Colorado. (By exchange with Professor T. D. A. Cockerell.)

19 specimens of fungi from Alabama. (By exchange with Dr. R. P. Burke.)

2 specimens of fungi from New York. (By exchange with Mr. Lex R. Hesler.)

2 specimens of fungi from Canada. (By exchange with Mr. John Dearness.)

1 specimen of fungus from Washington, D. C. (By exchange with Mr. E. G. Arzberger.)

2 specimens of *Gyromyces semisupinus* from Michigan. (By exchange with Professor George F. Atkinson.)

2 specimens of fungi from Pennsylvania. (By exchange with Mr. L. O. Overholts.)

4 specimens of fungi from New Mexico. (By exchange with Mr. W. H. Long.)

141 specimens of fungi from Porto Rico. (Collected by Professor F. L. Stevens.)

4 specimens of fungi from Minnesota. (By exchange with Dr. Mary S. Whetstone.)

4 specimens of fungi from Long Island, New York. (By exchange with Mrs. Leonard Irving.)

1 specimen of *Leotia lubrica* from Wisconsin. (Collected by Dr. A. B. Stout.)

15 specimens of fungi from Alabama. (By exchange with Dr. R. P. Burke.)

3 specimens of fungi from Long Island, New York. (By exchange with Mrs. Leonard Irving.)

1 specimen of fungus from Virginia. (By exchange with Mrs. N. H. Luttrell.)

4 specimens of fungi from New York. (By exchange with Mrs. Fred S. Boughton.)

2 specimens of fungi from Ontario, Canada. (By exchange with Professor John Dearness.)

3 specimens of fungi from New Jersey. (Collected by Mr. Percy Wilson.)

8 specimens of fungi from Long Island, New York. (By exchange with Mrs. Leonard Irving.)

4 specimens of fungi from New York. (By exchange with Mr. Frank H. Ames.)

1 specimen of fungus from New York. (By exchange with Mr. F. J. McCarthy.)

11 specimens of lichens from Newfoundland. (By exchange with Harvard University.)

2 specimens of flowering plants from Staten Island, New York. (Given by Dr. Arthur Hollick.)

15 specimens of marine algae from Sequim, Washington. (Given by Mr. J. M. Grant.)

20 specimens of mosses from Banao Hills, Cuba. (Collected by Brothers Leon and Clement.)

6 specimens of mosses from Monticello, Florida. (Given by Mr. Edgar Nelson.)

6 specimens of mosses from San Marcos, Texas. (Given by Professor S. W-Stanfield.)

2 specimens of flowering plants from Staten Island, New York. (Given by Dr. N. L. Britton.)

12 specimens of mosses from St. Thomas, West Indies. (By exchange with the Botanical Museum, Copenhagen.)

3 specimens of mosses from Kansu, China. (Given by Mr. Frank N. Meyer.)

13 specimens of mosses from Wisconsin. (By exchange with Dr. C. F. Mills. paugh.)

4 specimens of flowering plants for the local herbarium. (Given by Mr. Percy Wilson.)

10 specimens of flowering plants for the local herbarium. (Given by Miss E. M. Kittridge.)

157 specimens of ferns and flowering plants from Cuba. (By exchange with Brother Leon.)

133 specimens of flowering plants from Jamaica. (Collected by Dr. J. Arthur Harris and Mr. John V. Lawrence.)

7 specimens of hepaticae from New England. (By exchange with Miss Annie Lorenz.)

32 specimens of flowering plants from Canada and the western United States. (Given by Dr. H. H. Rusby.)

85 specimens of marine algae from Newfoundland, Chile, and the Murray Islands. (By exchange with Harvard University.)

63 specimens of fungi from Newfoundland and Mexico. (By exchange with Harvard University.)

26 specimens of mosses from San Bernardino, California. (Given by Mr. S. B. Parish.)

16 specimens of mosses from Porto Rico. (By exchange with Professor F. L. Stevens.)

178 specimens of hepaticae from Quebec. (By exchange with Dr. A. W. Evans.)

69 specimens of mosses from Panama. (By exchange with the United States National Museum.)

6 specimens of mosses from Berks County, Pennsylvania. (Given by Dr. N. L. Britton.)

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182. Notes on Rosaceae—X, by P. A. Rydberg.

NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

Vol. XVI DECEMBER, 1915 No. 192

JOURNAL

OF

The New York Botanical Garden

EDITOR

ARLOW BURDETTE STOUT

Director of the Laboratories

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JOURNAL

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VOL. XVI December, 1915 No. 192

THE SUCCESSFUL REMOVAL OF TWO LARGE PALMS

Last spring Mr. C. F. Dieterich, through the late Mr. Samuel Thorne, offered two large palms of *Phoenix reclinata* to the Garden. These were in the conservatory of Mr. Dieterich at Millbrook, New York, nearly one hundred miles from this city. Plants of this size, when in tubs, can be readily removed, the problem being one of a truck sufficiently strong to transport them. But when such large plants are planted out, the problem becomes much more difficult, not only on account of the physical difficulties in removing the plants from the soil, but of the added danger to the future of the plants in the unavoidable destruction of a large part of the roots in the removal of the plants. Upon investigation they were found to be such fine specimens that it was decided to attempt their removal, although the cost of preparing them for transportation and the transportation itself would be considerable.

There is probably not a better pair of plants of this species in this part of the country. The larger plant, the other being slightly smaller, is about twenty-five feet from the soil to the tip of the uppermost leaf and has a spread of about thirty feet. It was estimated that there were between 150 and 200 leaves, the larger of which measured a little over seventeen feet long. The trunk exceeded eight feet in height and three feet in diameter at the largest part, the lower half being devoid of leaves.

The palms were planted in a solid bed raised about two feet above the floor of the conservatory. This bed was surrounded by a cement coping protecting the heating system, and in

[Journal for November (16: 231–241) was issued Nov. 2, 1915]

removing the plants it was necessary to carefully protect this coping, thus considerably increasing the difficulties. Each plant was in a receptacle made of stones, between five and six feet in diameter, the receptacle being bottomless. This stone enclosure was removed and the roots at the bottom, which had penetrated far into the soil, were cut. This reduction in the amount of roots necessitated the removal of some of the foliage, to reëstablish the equilibrium between the roots and leaves; about thirty of the lower leaves were removed. The ball of earth and roots, which was over five feet in diameter and about three feet thick, was then protected with burlap, securely fastened with rope. The plants were then raised by large jacks and tipped on their side. In this position the leaves were gathered in and tied securely to a central support, making of the foliage a large central column. The larger plant, thus packed, was estimated to weigh between four and five tons.

Elevated runways were prepared, the longer about seventy feet long, to convey the plants on rollers to the exits. There they were loaded on large motor trucks and conveyed directly to their new home, where one arrived on July third, the other on July fifth, and were safely installed. They occupy a position on the north side of the central portion of the large dome, known as house No. 1 of conservatory range No. 1, one on each side of the entrance. They are at present in excellent condition and give every indication of continuing their vigorous growth, having suffered very little by removal and transportation.

They are certainly two fine specimens and add much of value and interest to the large collection of palms already occupying this house. It would be difficult to duplicate them, and in their present ample quarters they have room for expansion for many years. In their old home they were fast outgrowing their surroundings. The size of these plants and the diffculties surrounding them have made their successful removal a very unusual undertaking. The mechanical part of the removal was under the direction of Mr. Arthur J. Corbett, superintendent of buildings and grounds, while the horticultural details of preparation for removal and packing were under the supervision of the writer.

GEORGE V. NASH

THE NATIONAL ACADEMY OF SCIENCES

The one hundred and third meeting of the National Academy of Sciences of the United States of America was held in New York on Monday, Tuesday, and Wednesday, November 15, 16, and 17. Business and scientific sessions were held at the American Museum of Natural History. The Garden took part in the scientific program by a paper by Dr. Marshall A. Howe on "Fossil Calcareous Algae from the Panama Canal Zone with reference to Reef-building Algae" and a paper by Dr. A. B. Stout on "Sterility in Plants and its Inheritance." Dr. J. N. Rose, of the Carnegie Institution of Washington, spoke on "Recent Explorations in the Cactus Deserts of South America," being a portion of the investigation of cacti conducted by him in cooperation with Dr. Britton. The department of botany of Columbia University was represented by a paper by Professor Harper, entitled "Some Studies in Morphogenesis," and one by Professor Herbert M. Richards on "The Respiration Ratio of Cacti in Relation to their Acidity."

Wednesday afternoon was given to a visit to the New York Zoological Park and the New York Botanical Garden, the members being taken by motor-cars from the Museum of Natural History to the Administration Building of the New York Zoological Park, where lunch was served at 1:45, and after an inspection of portions of the zoological collections, the motor-cars proceeded at 3:30 to Conservatory Range No. 1, and the members passed through houses Nos. 1–8 for an inspection of tropical and desert plants, thence to the Museum Building, where the library, laboratories and herbarium were inspected, and thence to the Mansion, where tea was served in the board room at 4:30 by Mrs. Marquand and Miss Billings, of the Women's Auxiliary, Mrs. Thompson and Mrs. Britton. The weather was perfect.

A GIFT OF BRAZILIAN ORCHIDS

The Garden has received from Dr. Y. de Oliveira Botelho, Brazilian Delegate to the Panama-American Scientific Congress,

a valuable collection of orchids, selected from plants grown in his fine garden at Rio de Janeiro. Dr. Botelho brought the collection north with him on the S. S. "Verdi," which was met by the Collector of the Port in New York Harbor, and the trunk containing the collection was immediately transmitted to the Garden and the plants were received in excellent condition; they number about one hundred specimens and have been placed in one of the propagating houses; after they have resumed growth they will be incorporated in the public orchid houses.

Dr. Botelho visited the Garden on the afternoon of November 21 and was escorted through portions of the large greenhouses, the museum building, and was entertained at afternoon tea at the Mansion, after having been shown the extent of the grounds in a motor-car.

FREDERICK'S EDUCATIONAL BOTANICAL GARDEN

The city of Frederick, Maryland, has established, on a small area, a collection of plants, selected for their educational significance, under the enthusiastic direction of Mr. Frank C. Hargett. In response to a request for aid in forming this collection, received from Hon. Lewis H. Fraley, mayor of Frederick, duplicate plants of forty-seven species were selected last August and shipped to the new garden; letters subsequently received from Mr. Hargett and from Mayor Fraley convey warm appreciation of this contribution. The newspaper accounts of this new garden indicate wide local interest in it and record contributions of plants from many sources, as well as an approaching effort to secure a larger area of land for its development, which we hope will be successful, and we wish the new institution an extended sphere of usefulness.

CONFERENCE NOTES FOR NOVEMBER

The November conference of the scientific staff and registered students of the Garden was held in the main laboratory of the museum building on the afternoon of November 3.

Mr. E. W. Humphreys reported on "Some Fossil Plants from Florissant, Colorado, Including Some New Species," as follows:

Florissant is a little town in Colorado, situated at an elevation of 8,000 feet in an open valley or "park" to the west of Pikes Peak. It has for many years been noted for its well-preserved fossils; such delicate tissues as those of the petals, stamens and pistils of flowers having there been impressed on the fine-grained muds with much detail by the fine volcanic ash which entombed them. Those who may be interested enough to wish to know more about the locality and its fossils will find a very full and interesting account written by Professor T. D. A. Cockerell, of the University of Colorado, in an article entitled "Florissant; A Miocene Pompeii," which appeared in *The Popular Science Monthly*, volume 74, August, 1908.

The collection from this section that has recently been studied at the Garden consists of two parts: one, by far the larger, sent in by Professor Cockerell for study; the other and smaller part sent in by Mr. Fred K. Vreeland. It consists largely of flowers, floral organs, and fruits.

As aids in determining the botanical relationships of the various specimens included in the collection, enlarged photographs of the more interesting ones were made. These in some cases showed details that might otherwise have passed unnoticed. The binocular microscope was also a useful aid in ascertaining the characters of the fossils.

Among the more noteworthy forms are a new fossil fruit belonging to some member of the Dioscoreaceae or Yam family; an interesting seed belonging to the Cruciferae or Mustard family; several grass seeds belonging to the genus *Stipa* and some other long-awned grass; seeds resembling those of *Sparganium;* another specimen of the fossil flower described by Dr. Hollick as *Phenanthera petalifera;* some new Composites represented, most unfortunately, by the rays only; and a number of other forms which are more or less common to the locality and so need no special mention. Besides these there are a number of well-preserved new species whose botanical affinities cannot apparently be accurately determined.

Many of the more interesting of the specimens above mentioned were exhibited at the Conference.

Following the discussion of this paper Mr. Cecil Yampolsky reported on "Inheritance in *Matthiola* with Reference to Doubleness and Flower Color."

A. B. STOUT,
Secretary of the Conference

NOTES, NEWS AND COMMENT

Mr. A. S. Hitchcock, Systematic Agrostologist, United States Department of Agriculture, visited the Garden in November for the purpose of studying the West Indian grasses in the Garden herbarium.

Mr. W. W. Eggleston, Assistant Botanist, Bureau of Plant Industry, United States Department of Agriculture, spent several weeks at the Garden in November and December, studying lupines and other poisonous plants, and also making investigations on the genus *Amelanchier*.

A striking example of how plants become introduced through the impurity of grass seed is now in evidence near the Garden. Last spring about two acres of newly filled land along the north side of Mosholu Parkway was sown with grass seed. During the summer and autumn, thousands of vigorous plants of the Long-rooted Cat's-ear (*Hypochaeris radicata*) have sprung up and come into flower. Numerous plants of the Smooth Hawksbeard (*Crepis virens*) have also appeared. As neither of these species is found in the neighborhood, from which the soil used in filling was obtained, it seems conclusive that the introduction was through the impurity of the grass seed sown on the area.

Dr. Edward L. Greene, a distinguished botanist, died in Washington, D. C., on Nobember 10. He was born in Hopkin-

ton, R. I., in 1843, and soon after graduation from Albion College, Wisconsin, became a missionary in the far west and southwest, where he acquired an extensive field knowledge of plants and made large collections. From 1885 to 1895 he was professor of botany in the University of California, and from 1895 to 1904 he held the same position in the Catholic University of America. In 1904, he became connected with the Smithsonian Institution and held this position until very recently, when he was called to the botanical department of Notre Dame University. Dr. Greene has described a large number of species of flowering plants. When *North American Flora* was inaugurated by the Garden, he was one of six prominent American botanists who consented to act as an advisory committee in planning and prosecuting this work.

Professor Bruce Fink is devoting a year of absence from his work at Miami University to the study of fungi. In the prosecution of these studies he left New York on the 17th of November for Porto Rico where he will spend about two months.

The library has recently acquired the parts thus far issued of the *Index algarum universalis*, compiled and edited by Prof. Josephine E. Tilden, of the University of Minnesota. The cards have been separated into an author and subject catalog and placed in the case on the west side of the main reading room.

It is interesting to observe the gradual addition of new elements in the fungous flora of the Garden as the introduction and development of new shrubs and trees prepares the way for them. Several years ago, a single hymenophore of *Boletus luteus* was found under a young pine tree east of the large range of public conservatories. The past autumn, about the middle of October, a large basketful of very fine specimens was gathered there and many more were found under the pines to the north of the range.

A number of specimens of crown-gall donated by the New Jersey Agricultural Experiment Station have recently been added to the museum. Within the last few years it has been conclusively proven that this disease is caused by *Bacterium tumefaciens*. Crown-gall is of popular interest because it is the nearest approach in the vegetable kingdom to the cancer of the human body. The disease which causes swellings of various kinds is sometimes known as "vegetable cancer." The specimens are temporarily installed with the fungous collections.

Last summer, Dr. F. W. Pennell, of the Garden staff, spent three months in the Rocky Mountains collecting in Colorado, southern Wyoming, northern Utah, eastern Idaho and the Yellowstone National Park. He was especially interested in plants of the Figwort Family (Scrophulariaceae). He brought home a very valuable collection amounting to about 790 numbers, representing about 3,500 specimens which Dr. Pennell is just now busy labelling. When this work is finished the principal set will be incorporated in the Garden collections and serve as a part of the basis for a monograph of the family, which Dr. Pennell has been assigned to prepare for the *North American Flora*.

Professor F. W. Clarke, chief chemist of the United States Geological Survey, visited the Garden on November 18 to obtain samples of calcareous marine algae for chemical analysis. As one of the manifestations of the increasing recognition of the geological importance of the algae in the formation of limestones, the United States Geological Survey is now carrying on a series of chemical investigations of the inorganic constituents of living and fossil corals, calcareous algae, and other lime-secreting organisms.

Meteorology for November.—The total precipitation for the month was 1.16 inches. The maximum temperatures for each week were *68° on the 1st*, 62° on the 9th, 55° on the 19th, and 60° on the 28th. The minimum temperatures were 29° on the 7th, 31° on the 11th, 23° on the 18th, and *20° on the 23d.*

ACCESSIONS

PLANTS AND SEEDS

9 plants of *Pentstemon*. (Given by Miss E. Luquer.)

35 plants for herbaceous grounds. (Collected by Mr. Percy Wilson and Mr. K. R. Boynton.)

18 cacti, for conservatories. (By exchange with U. S. Dept. of Agr. via W. H. Long.)

4 plants for conservatories. (By exchange with Mr. Henry Natho.)

64 plants for conservatories, *Sarracenia*. (Purchased.)

7 plants, *Pulsatilla patens*. (Given by Miss M. E. Eaton.)

1 plant of *Castalia odorata minor*. (By exchange with Mr. Henry Natho.)

5 plants for herbaceous grounds. (Given by Mrs. L. Chanler.)

10 plants for conservatories. (Given by Mrs. F. A. Constable.)

3 plants, *Spiraea obtusa*. (Given by H. Darlington, Esq.)

6 plants, *Araucaria imbricata*. (By exchange with Prof. R. B. Thompson.)

10 plants of *Sedum*, for conservatories. (By exchange with Mr. R. Lloyd Praeger.)

2 plants, *Commelina*, for conservatories. (Given by Mr. E. J. Palmer.)]

360 plants for conservatories. (Collected by Dr. J. N. Rose.)

10 plants for herbaceous grounds. (Purchased.)

1 plant of *Cynthia virginica*. (Collected.)

53 plants for American wood garden. (Collected by Miss F. A. Mulford, and Mr. Percy Wilson.)

1 orchid for conservatories. (Collected by Dr. J. K. Small.)

2 palms, *Phoenix reclinata*, for conservatories. (Given by Mr. C. F. Dieterich.)

3 cacti for conservatories. (By exchange with U. S. Dept. of Agr., via Mr. W. H. Long.)

6 plants of *Commelina*. (Collected by Dr. J. K. Small.)

15 plants for conservatories. (Given by Mr. John Sommer.)

8 cacti for conservatories. (By exchange with Bot. University of Geneva, via Prof. R. Chodat.)

1 *Opuntia* for conservatories. (By exchange with Univ. of Nevada, via Mr. J. C. Jones.)

10 plants for American wood garden. (By exchange with Mr. Henry Natho.)

4 plants of *Agave neglecta*. (By exchange with Royal Palm Nurseries, via Father Jerome.)

1 *Opuntia* from Brazil. (Given by Mr. G. K. Cherrie, via Mr. B. F. Van Nostrand.)

1 plant of *Nymphoides nymphaeoides*. (Collected, by Dr. N. L. Britton.)

12 plants of *Chalcas exotica*. (Derived from seed.)

212 plants of Himalayan region. (Derived from seed.)

391 plants for collections. (Derived from seed from various sources.)

1 packet of seed. (Given by Mr. W. L. Jepson.)

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