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CAROL H. WOODWARD

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TABLE OF CONTENTS

VOLUME 47

1946

(Exclusive of Notes, Current Literature, and Book Reviews)

COVER ILLUSTRATIONS

1946

JOURNAL

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PAGES
1—24

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

Events of the Month

DURING the current year it is planned to publish in each Journal a schedule of the month's events. Announcements of Members' Day, Saturday programs, broadcasts, and courses will be found this month on the last page of the Journal.

* * *

Intermission Speaker

AN event of special interest in February is the appearance of Dr. William J. Robbins as the intermission speaker on The New York Philharmonic Symphony Society's program to be broadcast over WABC at 3 p.m. some Sunday afternoon soon. The date is tentatively set for February 10. Dr. Robbins' address, which will be on the subject of "Growth," is one in a series of intermission talks by leading scientists, sponsored by the United States Rubber Company.

TABLE OF CONTENTS

JANUARY 1946

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Seaweed Products And Their Uses in America

By C. K. Tseng
Scripps Institution of Oceanography

WHEN we regard the list of things produced with the help of algae, these seaweeds seem to be essential to much that we eat, as well as to medicines from the druggist's shelves, cosmetics and other toiletries, paints and varnishes, tungsten bulbs, and such a host of other articles that the imagination is staggered. Yet, relatively few years ago, practically the only uses for algae (outside of the Orient where they have always been accepted as food) were in the scientific laboratory and in the manufacture of iodine and potash. Most of these thousand-and-one new uses have arisen in the present century; the majority in the past few years. One of the leading men in the application of the science of botany to American industry tells here the story of some of the many products which today depend at least in part on these long-neglected seaweeds or which consist entirely of algae themselves.—C.H.W.

PART I

BACKGROUND OF THE SEAWEED INDUSTRIES IN THE U.S.A.

DURING World War I there was a serious shortage of potash in the United States, because the supply of this chemical, so vitally important in modern scientific agriculture, then came entirely from Germany. However, through the co-operation of the United States Government with

Contributions from the Scripps Institution of Oceanography, University of California, La Jolla, California. New Series, No. 276.

home industry, several domestic sources of potash were developed. One of these was the California seaweed known as the giant kelp (*Macrocystis pyrifera*). For the duration of the war, kelp remained second only to natural brines as a source of American potash (Tressler, 1923).[1] During that time, acetone and calcium acetate, both needed for the manufacture of smokeless powder, also were derived from *Macrocystis* through a unique fermentation process. Iodine and a bleaching carbon known as "kelpchar" were two other valuable kelp products.

The Pacific kelp industry thus prospered for a few years, with as many as ten factories engaged in the production of potash, acetone, kelpchar, and iodine from *Macrocystis,* but immediately upon the cessation of hostilities, all of the kelp factories suspended operation. Since then the American potash-from-kelp industry never has been revived; most probably it will never return, since potash and acetone can now be obtained more cheaply from sources other than seaweeds. But the Pacific kelp industry has come back for other purposes. Since the late 1920's it has been engaged in making a totally different kind of product, ALGIN, a valuable colloidal substance occurring in many brown algae (Phaeophyceae), especially kelps. Besides serving as a source of algin, the Pacific kelp *Macrocystis,* as well as the bull or bladder kelp (*Nereocystis Luetkeana*) of the Puget Sound region, Washington, is dried and powdered to make kelp meal for animal feeds and kelp pills for human consumption. On the Atlantic seaboard, the algin industry was initiated in the late 1930's, using as raw materials the two common seaweeds, *Laminaria digitata* (horsetail kelp) and *L. saccharina* (broadleaf kelp) (Tseng, 1945-6).

In the recent war, there was no longer a shortage of potash or acetone. There was however, a shortage of another important material, AGAR, which is vital in public health work. Agar is extracted chiefly from *Gelidium* and also from other members of the red algae (Rhodophyceae). Prior to the outbreak of war in the Pacific, most of the agar came from Japan. Although it has been manufactured in this country since 1919 (Tseng, 1945a), the domestic agar production amounted to only a small percentage of the total American consumption. Until recently, America's agar industry was not successful, principally because of the keen Japanese competition. Since 1941, however, the industry has greatly expanded and is now able to supply practically all of the essential needs of this country. The principal agarophytes (agar-bearing seaweeds) are *Gelidium cartilagineum* var. *robustum* (agarweed) from southern California and Baja California, Mexico, and *Gracilaria confervoides* from Beaufort, North Carolina, and Indian River, Florida. Other Pacific species of *Gelidium,* such as *G. arborescens* and *G. nudifrons* (both known as hair-agar), are also occasionally used in this relatively new industry.

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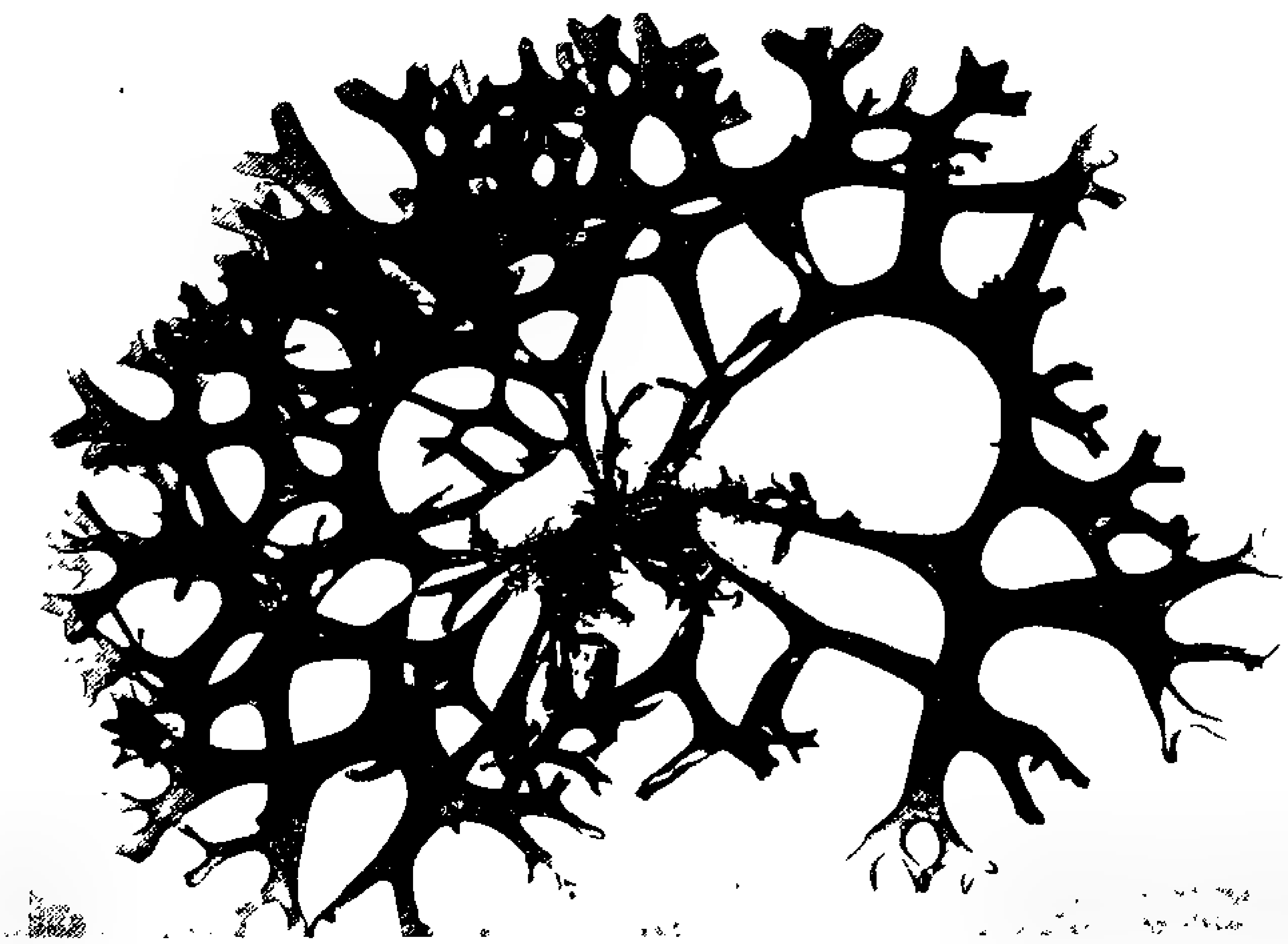
[1] See footnote 3 (page 5), also the list of citations at the end of Part III, to be published next month.



The collecting of Irish moss, or carrageen (*Chondrus crispus*), constitutes the oldest seaweed industry in the United States For a century it has been harvested and sold, chiefly for making blancmange. Lately, a commercially useful extract, CARRAGEENIN, has been prepared from it, to serve as a stabilizer in chocolate milk, salad dressings, soda fountain syrups, cough syrups, tooth paste, hand lotions, and other products. (Illustration through the courtesy of William Randolph Taylor, University of Michigan, and the Scientific Monthly, where it first appeared in print.)

The oldest seaweed industry in America was established on the Massachusetts coast about a century ago, for the gathering of Irish moss. Botanically called *Chondrus crispus,* a member of the red algae, Irish moss is also known as CARRAGEEN, a name derived from the coastal town of Carragheen in the Irish Free State. Until recently, the industry amounted mainly to gathering and preparing the seaweed to sell as a crudely cured and partially bleached "moss." The buyer boiled the seaweed, and it served various purposes, including making a milk dessert. At present, besides the crudely cured "moss" for kitchen use, a highly purified extract of this plant, called CARRAGEENIN, is made available in large quantities. Such a product has been in great demand in recent years by the food, drug, and other industries in this country. Irish moss is now being processed in Massachusetts and Maine, as well as in Canada's Maritime Provinces, especially Prince Edward Island (Anonymous, 1942; Fraser, 1942; Needler, 1944).

Thus, the production of algin, agar, and carrageenin now comprise the three principal seaweed industries in America. There are, besides, two smaller and relatively little known ones, the purple laver industry of California and the dulse industry of the East Coast, both kinds of seaweed being used for food. Purple laver, which is botanically known as *Porphyra,* has been gathered by the Chinese residents in California since the latter part of the last century. The species commonly utilized is *Porphyra perforata,* although others of the same genus are also harvested. Prior to the outbreak of war in the Pacific, a moderate quantity of the California laver was exported to China (Bonnot, 1931). American dulse (*Rhodymenia palmata*) comes mostly from the Canadian Maritime Provinces, especially in the Bay of Fundy (Wilson, 1943).

On the basis of the processing methods, American seaweed products of today may be classified in the following three groups:

1. *Whole seaweed*: Irish moss, purple laver and dulse, which are merely dried in the sun, sometimes partially bleached, and are utilized in the form of whole plants.

2. *Ground seaweed*: Kelp meal and pills, prepared by grinding certain of the algae.

3. *Seaweed extract*: Agar, algin and carrageenin, extracted from seaweeds either by water or by alkali. They are hydrophilic colloids, commonly but erroneously called seaweed "gums"; recently the term "phycocolloid" has been introduced to designate these colloids (Tseng 1945c, 1946).

* * * * *

Parts II *and* III *of this article will deal in detail with the uses of algae, first in food and drugs, and second in scientific research and in industry.*

* * * *

PART II

USES IN FOOD AND DRUGS

CURRENT uses [2] of these marine plants, the algae, have extended far beyond the expectations of the scientists of even a generation ago. This is especially true of the phycocolloids, which have proved their usefulness as gelling, suspending, emulsifying, thickening, and body-producing agents. Because of their unique colloidal properties, they have found various applications in food, pharmaceutical, cosmetic and other industries,

[2] Smith (1905) and Tressler (1923) give comprehensive discussions on the utilization of American seaweed products up to that time. This Journal for January 1917 also contains the report of a lecture by the late Dr. M. A. Howe, former Director of the New York Botanical Garden and an outstanding American authority on the algae, on "Some economic uses and possibilities of the seaweeds."

From west and east coasts, purple laver (left) and dulse (right) are gathered as occasional items of food. Indians of the Pacific coast like the laver (*Porphyra perforata*), and the Chinese use it in their seaweed soup. Dulse (*Rhodymenia palmata*) is sold in eastern metropolitan markets to be eaten raw as a relish.

as well as in scientific and medical laboratories.[3] These are in addition to the uses of certain algae as food in themselves.

Seaweeds as Food

Three species of algae are dried for food in America, though they are by no means as popular as these or similar species are in the Orient. However, there seems to be an increasing interest here in seaweed food in recent years. Since the outbreak of the last war, for instance, the writer has received more inquiries concerning seaweeds for food than for industrial purposes. The species already used in this country are Irish moss, or carrageen (*Chondrus crispus*), dulse (*Rhodymenia palmata*), and purple laver (*Porphyra perforata*). The seaweeds are actually rather poor for human consumption, however, because of their low digestibility. They should be considered as an adjunct rather than as an energy-building substance.

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[3] Among the recent contributions that have been published on the uses of American seaweeds and seaweed products in general are those by Chase (1942), Scheffer (1943) and Tseng (1944b, 1946). Papers dealing with specific seaweed products include those by Tseng (1944a, 1944c, and 1945a) on agar, by Wohnus (1942) and Tseng (1945b) on algin, and by Ausmann (1942) Fraser (1942), and Needler (1944) on carrageenin. For full citations see the end of Part III.

In both Europe and America, Irish moss is undoubtedly the best known and most extensively used food-seaweed, for it is the one employed in making the well-known blancmange, especially in the New England states. The following directions were given by Smith (1905) for its preparation:

> "Soak half a cup of dry moss in cold water for five minutes, tie in a cheesecloth bag, place in a double boiler with a quart of milk and cook for half an hour; add half a teaspoonful of salt or less, according to taste, strain, flavor with a teaspoonful of lemon or vanilla extract if desired, and pour into a mold or small cups, which have been wet with cold water; after hardening, eat with sugar and cream."

Dulse is the only other food-seaweed utilized in northeastern America. This one is eaten raw and dry as a kind of salad or relish. It has adopted the modern dress of cellophane packing (Wilson 1943) and during early summer months it is found occasionally in markets of Boston, Philadelphia and Vancouver and at almost any time in New York City. Commercially, it is employed as a thickener in soups, sauces, and gravies.

Purple laver is utilized as a food article only by the Chinese, so far as the information of the writer goes. According to Bonnot (1931), as much as 300,000 pounds of the dried *Porphyra* were harvested by the Chinese in California in 1929. The laver is used by Chinese restaurants in America as an ingredient of seaweed soup.

The Indians of the Pacific coast still use some seaweeds, especially *Porphyra,* for food, but they gather them only for their own use and do not offer them on the market. The Japanese in America formerly imported "kombu" or Japanese kelp (*Laminaria japonica*) from Japan for food. American kelps, in general, are not as delicious as the Oriental forms. Moreover, in normal times, imported "kombu" would be cheaper than local laminariaceous kelps which have to be harvested and dried with relatively expensive American labor.

As Roughage

An important use of the seaweed extract, agar, in the United States is as roughage. Agar is not digestible in human systems. Therefore, when taken in the form of powder or flake, it serves as a bulk-producer, or "roughage." The problem of bulk supply is one that only civilized men, accustomed to highly refined food, have to encounter, and agar flakes successfully take the place of the coarse materials that their ancestors ate normally with every meal.

As Stock Feed

In northern Europe, seaweeds have long furnished provender for domestic animals. During the winter months, and occasionally even in the summer, thousands of sheep and other cattle on the coast of Ireland wander freely and eat seaweeds even when grass is still available. Experiments in France, Germany, Norway and Ireland all unanimously point to the nutritive value of seaweeds, especially the kelps, as food for domestic animals.

In America, whole seaweeds are not commonly fed to animals, but processed kelp products are quite extensively used as stock feeds. Analyses of kelp meal show presence of large amounts of various minerals, as well as vitamins A, B, F and G. One company in California produces a meal consisting of dried and ground kelp (*Macrocystis pyrifera*). Another concern is devoted entirely to the manufacture of animal feeds which contain kelp meal, fish meal and fish presswater concentrate, fortified with various beneficial substances. These are all supplementary feeds to be mixed with grains and other established rations.

Generally speaking, seaweeds should, if used *in toto,* be rinsed in fresh water to leach out the excessive salts which, if taken in large quantities, may have an adverse effect on the health of the animals. It has also been found that animals may require from a few days to a week or more to readjust their food habits from an ordinary ration to a predominantly seaweed diet. The value of seaweeds as stock feed differs with the kind of plants used, with the season of harvesting, with the different animals feeding on them, and with the individual preferences of the animals for the kind of seaweeds offered as food.

In Bakery Products

Because of its moisture-holding ability, agar is extensively used in making fruit cakes. These are generally prepared weeks before they reach the consumers, and the addition of agar helps to keep them in good condition for long periods.

In icings, both agar and algin are used as stabilizers. One of the chief problems in making icings for layer cakes and sweet yeast dough products, such as buns, is to prevent the adhesion of the sugar coatings to wrappers, especially on humid summer days. Adhesion is caused primarily by the presence of excessive moisture, causing dissolution of a considerable quantity of sugar. Substances such as agar and algin have great affinity for water, and are able to form gels, thus holding large amounts of water and making it inaccessible to the sugar crystals. Therefore by the addition of such colloids the adhesion of icings to wrappers may often be prevented, and the icings are also kept more soft and mellow.

Agar is also used in making chiffon pies, and both agar and algin in meringues and fillings. Generally speaking, where a rigid gel is desired, agar is used, whereas algin is preferred if a softer product is wanted. There are also occasions when a combination of both colloids gives the best results. Carrageenin has recently been adopted for similar uses.

In Dairy Products

Most of the phycocolloid production in the United States is serving the dairy industry. It has been estimated that more than one-half of the fac-

This gigantic bull or bladder kelp (*Nereocystis Luetkeana*) was photographed on a dock at Puget Sound by Dr. Robert H. Tschudy. When dried and ground, the plant is used for making kelp pills for humans and kelp meal for livestock rations.

tory-made ice creams in this country are stabilized with algin. Stabilizers are needed to impart smooth body and texture to the ice cream. They also prevent coarsening of the product during storage from the formation of large ice crystals. Ice cream mixes made with efficient stabilizers whip fast and produce sufficient overrun. Such ice creams show a smooth clean meltdown without any serum drainage or wheying off. Previously, gelatin was the sole standard ice cream stabilizer, but since algin was introduced about ten years ago, it has been rated by most experts as a better material than gelatin.

Until very recently, orange and lemon ices have been stabilized almost exclusively with gums, but algin is now successfully used here as well.

Algin also fills the role more satisfactorily in stabilizing sherbets, where the more costly agar, which required a higher temperature to dissolve it, previously was used.

Carrageenin has been introduced as a stabilizer for all these frozen desserts, but is used more extensively in chocolate milk.

In cream cheese of the Neufchatel type, agar reduces the tendency of this product to exude whey at warm temperatures, it improves slicing qualities, and produces a firmer body. Agar is also added to such dairy drinks as malted milk and acidophilus milk.

Algin is put into cream cheese and cheese spreads and also whipping creams for decorating fancy cakes, to reduce serum drainage. In milk puddings, algin serves as a gelling agent.

In Sweets and Other Foods

Agar is widely used in making confectioneries, chiefly in jelly candies and marshmallows. Algin and carrageenin also serve as fillers to give body to candy bars and similar confections.

In making jelly desserts, phycocolloids are very useful. In fact, agar was originally introduced to the European countries and America to serve as a gelatin substitute in making jellies. Agar, algin and carrageenin are all used in preparing various kinds of salad dressings, aspic salads, and desserts, besides fruit butters, jams, and preserves.

Agar serves both as a thickening and as a gelling agent in the canning of pickled tongues, poultry and the softer types of meat and fish. Carrageenin makes a base for soda-fountain syrup, and agar and algin have been suggested as stabilizers and bulk-producers in making fruit juice powders. These phycocolloids also appear sometimes in sausage casings.

In Pharmaceutical Emulsions, Ointments and Jellies

A well-known use of agar in pharmaceutical preparation is in making petrolatum-agar emulsions. Agar in such preparations does not serve as a laxative, as the public is led to believe, since this colloid is present in too small a concentration, generally less than 1.5%, to be effective. It serves primarily as an emulsifier and helps to make the preparation easier to take.

In England carrageenin is used in similar petrolatum preparations and in cod-liver oil emulsions.

"Decoction Chondri" prepared from carrageen is probably the best known phycocolloid pharmaceutical emulsifier. The *National Formulary* recommends a 3% *Chondrus* solution for the "Mucilago Chondri," which is used by itself as a demulcent and frequently as a vehicle for other medicaments.

Because of its chemical reaction, algin is not generally employed as an emulsifier, but is useful as an auxiliary agent.

These seaweed colloids have been used occasionally in emulsions to carry medicinals such as vitamins and sulfa-drug compounds. Algin is especially valuable as a base for greaseless, water-soluble ointments and lubricating jellies, replacing tragacanth and other gums, because it is compatible with most of the ingredients in the official formulas. In making sulfanilamide ointments for surface wounds, algin is employed in emulsifying the petrolatum base.

Agar serves as a vehicle for lactic acid to combat toxicogenic bacteria in the intestines. Irish moss, when employed as the base of cough medicines, is said to give the medicine body and to produce a slight soothing effect. It is reported that in Irish bar-rooms in New York, the carrageen is soaked in whisky and the resulting liquor offered to patrons as a cough remedy. Carrageenin helps to make smooth glycerine jellies for chapped hands.

In Medicinal Pills and Tablets

An interesting use of agar in medicinal preparations is in the so-called "seal-ins" for pills, a type of coating which regulates the rate of solution of the capsule and consequently the timing of its opening. The agar is added in tiny particles and distributed in the waxy material of the coating. By virtue of its water absorption, agar assists in the release of the coated medicinal preparation in the desired place. Agar is used in the coatings of certain gentian violet capsules employed in the treatment of infection with *Oxyuris vermicularis*. It is also a constituent in a preparation for the treatment of *Coccidioides* infection in chickens.

Carrageenin and sodium alginate are both useful as granulating agents in such preparations as aspirin tablets. These colloids are also incorporated as binding agents in the preparation of numerous pills.

Kelp tablets are made to supply certain mineral compounds needed by human systems. Both *Macrocystis pyrifera* and *Nereocystis Luetkeana* are dried and powdered for this purpose.

(*Part III will follow in the February Journal.*)

The Banyan Tree of Bandar 'Abbas

By Mary F. Barrett

"The usual amusement of [the city of] Bandar is to walk under the tree of the Banians and have little collations there." (Translated from Jean-Baptiste Tavernier, seventeenth century traveler.)

ALL day the April sun had shone through a cloudless sky upon the narrow Strait of Ormuz, at the mouth of the Persian Gulf, and upon the bare sand and the plastered buildings of the coastal town of Bandar 'Abbas, (formerly Gombroon or Gamron), which then, in the 17th century, was an important trading center of Persia as it is today for Iran. The heat radiating from sea and land was increased by the hot wind which always appeared in the late afternoon, and made the city unbearable. And so a party of men on horses and mules rode through the narrow streets, past the flat- or terraced-topped houses with their wind-towers for ventilation, past the palaces of Persian officials, the bazaar, the mosques and synagogues, the French, Dutch and English "factories" (trading posts), and a fortress, seeking the most comfortable place in the vicinity. This was a grove about three miles from town. Here abundant leaves provided a cooler shade, and wells contained purer water than that found in the city.

There were domestic and small wild animals in the grove, and many people wandering under the long horizontal branches or leaning against the great tree trunks; but the members of the party at first paid them little attention, for they were attending a business men's picnic, given by local merchants to celebrate the end of the trading season. The guests were ship masters and agents from the vessels which crowded the roadstead and exhibited the flags of almost all the maritime nations of the day. With them were a few caravan leaders whose camels had brought carpets, silks, cottons, perfumes, and spices over the various routes which converged in Bandar 'Abbas. These supplies now were stored in the holds of the anchored ships, taking the place of the vessels' cargoes, which would soon be loaded upon protesting camels and would start on land journeys to various parts of Asia.

The company first partook of a collation—an elaborate meal of local fish, mutton and game, as well as vegetables, fruits and wines brought in by ship and caravan. Most enjoyed by many of the guests were the coffee and sherbets, the latter being drinks of cold water flavored with fruit juices. While they were eating the men discussed the weather. The English "factor" explained to newcomers that because of the intense heat all residents of Bandar 'Abbas betook themselves for the six months of summer to the mountains which could be seen in the distance. The city then was abandoned to jackals, and to caretakers who spent most of their time in "ditches" or tubs of water, in the attempt to keep cool.

It can not be said that the feast was enjoyed equally by all members of the group. Some of them were Banians (or Banyans) from the comparatively near-by region of West India, who were considered rather unsociable because their religion forbade the eating of animal food and the drinking of red wine, which resembled the blood of animals. Their name, or nickname, was derived from the Sanskrit word VANIYA and the Hindu title BUNYA or BANYA, meaning merchant or clerk. It had come to have an unflattering connotation among the other nationals, since it was applied to men who had a bad reputation in trading. Fryer, in 1698, characterized them as "a Compound of the greatest Cheat in the World, the fittest to make Brokers and Merchants of."

After the meal the party strolled through the grove, commenting upon what they saw. The most surprising thing to the Europeans was the grove itself, which was made up not of many trees, but of a single tree. Many years previous to this time, they learned, an Indian fig-tree had been planted there. It had grown with astonishing rapidity in height and diameter and had produced numerous cord-like filaments, really air-roots, from its branches. When these had reached the ground they had rooted and thickened, and finally had become trunks which supported the greatly lengthened branches.* This explanation, supported by observation of different stages in the evolution of the secondary trunks, disproved the theory of some of the company that the branches had bent down of their own weight and had rooted.

There existed no record of the origin of the slip which had produced this giant. However, an elderly Persian merchant recalled a Portuguese name, DE GOA, for this particular tree, and stated that he believed it to be a part of a famous old tree of the same kind which used to grow near the city of Ormuz on the island of that name across the Strait from Bandar 'Abbas. Ormuz had been captured in 1514 by the Portuguese adventurer Albuquerque, who had come to it from Goa in Portuguese West India and probably had brought a young plant with him. It was native to many parts of India, but not to that part of Persia. The old merchant reminded the others that the stone of many buildings in Bandar 'Abbas had been brought over from the ruins of Ormuz after Shah Abbas, with the help of the English, had conquered the island from the Portuguese in 1622 and had laid waste the city. He thought that a slip of the old tree had been brought across the Strait at the same time, and planted in this favorable spot.

A Banyan ship-master from Surat, north of Bombay, then told of the Kabir Bar, or Cubbeer Burr, a celebrated fig-tree of the same kind, which

* Thomas Herbert, who saw this tree in 1628, reported that it had a circumference of 109 paces and could shade several hundred men.

grew on the bank of the Narbada (Nerbudda) River in the Surat district. He declared that it had several hundred large trunks and thousands of potential ones and could shelter an army of many thousand men. He said that in times of flood people would take to the branches of this tree in company with monkeys, bats and birds. Some of the group seemed skeptical of these statements; and the story-teller felt much insulted when he overheard someone ask under his breath whether they always could distinguish the people from the monkeys.

To appease the Indian (whose figures on the size of the tree have been confirmed by several writers), the company lighted torches, for by now it was quite dark. Then they all went to see a little temple which Banyan traders had erected there, "to adore and adorn" with silk streamers as they did at home in India underneath this same species of trees. The English factor murmured to one of his compatriots that it was just as well that it was too dark to see the images in the temple.

On the way home the men discussed other names for the great tree. The Persians liked to call it LUL, the Portuguese and the Dutch preferred their own equivalents for ROOT-TREE; but the English and the French declared that they intended to use the word BANYAN, since the plant had such close association with the Hindu traders.

Today the name BANYAN is applied not only to this common Indian tree, which Linnaeus in 1753 called both *Ficus indica* and *Ficus bengalensis* (originally spelled *benghalensis*), but also to other species of fig-trees which have the same habit of aerial roots.

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Control of Chrysanthemum Diseases

By A. W. Dimock, Cornell University

THE FOLLOWING SUMMARY *of chrysanthemum disease-control practices is taken from a mimeographed circular prepared by Professor Dimock for distribution at the Chrysanthemum Show at the Garden in October. Details of symptoms, causes, and control of each disease were given in the body of the paper. In this summary he has attempted to outline two programs, either of which will give good practical control, not of just one disease, but of all the common and important diseases of garden chrysanthemums. One program (A) is designed for the gardener who lacks either the special interest or the time for the more complete program. The other (B) is designed for the chrysanthemum hobbyist or specialist who can and will give more time to the job.*

PROGRAM A

For the gardener who lacks the time and equipment for propagation, spraying, and other special treatment of the plants.

1. Do not attempt to grow varieties which are highly susceptible to verticillium wilt unless they have unusual merit. For varieties in this category, rogue out all plants showing definite verticillium symptoms at flowering time so that divisions will not be taken from them in the spring.
2. After the tops have died in the fall, cut off all stems at the ground line and remove all plant debris from the beds. It is on this material that many disease organisms and pests pass the winter.
3. If divisions are taken in the spring, clean them up very thoroughly, removing any diseased leaves, before replanting. Be sure that any newly acquired plants are thoroughly cleaned up.
4. As soon as new plants or divisions are planted and as soon as new growth starts from plants left in place, apply a heavy mulch (an inch or two thick) of peatmoss, tobacco stems, or other similar material which is not too loose nor yet so compact as to prevent air and water from penetrating freely.
5. Keep on the lookout for chrysanthemum rust and mildew and apply a good dusting sulfur or wettable sulfur spray at the first appearance of either disease. Repeat applications once a week until good control is obtained.

The above program will, during an "average" season, give good control of nearly all the common and serious 'mum diseases, but may fall down in an excessively wet season.

PROGRAM B

For the chrysanthemum hobbyist or commercial grower who wants near-perfect disease control regardless of weather - and who is able and willing to employ the necessary control practices.

1. Rogue out verticillium-infected plants at flowering time. Diseased plants will yield diseased cuttings, and adequate roguing can not be done in spring or early summer.

2. Make a thorough garden clean-up in the fall, removing all old stems and plant debris.

3. Carry stock plants for propagation either in frames or the greenhouse or at least make provision for good overhead protection prior to and during the propagating period. (Temporary roofs of celloglass or parafined cheesecloth could be made to serve the purpose.)

4. If at all possible, use subirrigation for the stock plants, or at least use extreme care in watering. The foliage must be kept as dry as is humanly possible.

5. Spray the developing foliage of the shoot growth with either 2-2-50 Bordeaux mixture, or, better, with Fermate at 1 lb. per 100 gal., at least 2 or 3 times before propagating. The *lower* leaf surface must be covered.

6. *Do not use runners or divisions for propagation—use only rooted cuttings.*

7. Do not propagate until long vigorous shoots are available, then take only short tip cuttings from these. If earlier propagation is necessary give the stock plants some heat and use electric lights to prevent budding.

8. Immerse the cuttings in Fermate suspension (1 level tablespoonful per gallon, with spreader) just before sticking in the propagation medium.

9. Subirrigate the propagating bench if possible.

10. Again immerse the plants in Fermate suspension, roots and all, just prior to potting up or planting out.

11. Set new plantings on new areas each year so far as possible.

12. Spray during the growing season with either 2-2-50 Bordeaux or Fermate (1 lb. to 100 gal.), making applications often enough to keep all new growth covered and applying so as to get coverage of the lower leaf surfaces.

13. Apply a heavy mulch (1 to 2 inches thick) on the soil of all beds left in place for a second season and of all replanted beds which held 'mums the preceding year. Mulching is of less value (so far as disease control is concerned) on new soil, but is still a good idea for reducing splashing, controlling weeds and conserving soil moisture.

14. Watch for the appearance of powdery mildew and use a sulfur dust or add wettable sulfur to the spray (1 lb. per 100 gal.) if and when this disease appears.

15. In acquiring new material, *reject any plants which are diseased.* We now know how to control all of the common and important chrysanthemum pests and diseases so that *there is no longer any excuse for the distribution of infected material.*

If the above program is adopted it should be possible to come through almost any season, wet or dry, with almost no disease development. There are two diseases, verticillium wilt and chrysanthemum yellows (the same insect-carried virus disease as aster yellows), which cannot be completely controlled in garden plantings by any practical means. Soil sterilization and clothhouse protection would be needed for these. Fortunately, however, the former disease severely attacks only a few garden varieties, and the latter disease is not very common. But the other more common and destructive diseases can be almost 100 per cent controlled by the practices advocated.

BROADCAST

By Vincent W. Cochrane

MOLDS *are able to manufacture certain products better than man has ever been able to do by chemical means.*

In a radio program given over WNYC *by the New York Botanical Garden Sept. 21, Dr. Vincent W. Cochrane of the Lederle Laboratories (now in the Department of Plant Pathology at the Connecticut Agricultural Experiment Station) described a few of these products and the methods by which man obtains them from specific fungi. The paragraphs below represent excerpts from his talk.*

THE FUNGI that are used as manufacturers are typically microscopic thread-like organisms, similar in appearance to the green mold on bread or on oranges, the white cottony mold on spoiled vegetables, or the molds of various colors which develop on cotton cloth or leather goods, or even woolen clothing, stored under moist conditions.

While molds destroy a great many things, some of them are able, in their life processes, to produce substances of indispensable use to man. Many of the commercial and medicinal acids, for example, are the end-products of fungi. In fact, some of them have never been so efficiently produced by any other means.

Probably most important of the acids made commercially by molds is citric acid. Ever since this method was developed 30 years ago, the product that is used in flavorings, drinks, and confectionery is derived chiefly from the fungus *Aspergillus niger*. It is also employed in the manufacture of inks and dyes, but its greatest use is in medicine, in salts of citric acid, such as citrate of magnesia.

Citric acid is made from *Aspergillus niger* in much the same manner as other acids are produced by other kinds of mold. You start with a sugar solution—a sort of weak syrup—in a shallow aluminum pan. You seed this by sprinkling the black spores of *Aspergillus* over the surface of the solution. These spores germinate and grow into a mature mold, consisting of many fine white threads which bear black fruiting bodies. As it grows, the energy from the sugar is used up, and the mold gives off its end-product into the syrup. This product is citric acid, which is chemically identical with the acid found in oranges and lemons. It requires a week or ten days to obtain the acid after the spores have been sown on the sugar solution.

Gluconic acid, used in calcium gluconate, is made in a similar manner and is produced in large amounts by another mold of the *Aspergillus* group. Some of the other familiar acids that can be produced by molds are lactic, oxalic and gallic acids.

Gallic acid comes generally from the galls on oak trees (sometimes sumac), but it takes a fungus to produce it. If these galls are picked and piled up and left for a while, they will ferment naturally by the action of a fungus, and thus gallic acid is formed. This used to be the only method of manufacture. Now, however, the proper fungus, which is still another species of *Aspergillus*, is applied scientifically to produce the acid. A clear tannin extract is sterilized and inoculated with the fungus; under controlled conditions the conversion to gallic acid is almost complete. In the manufacture of ink, gallic acid is used as a principal ingredient, along with the iron salts and the necessary dye. It is also used in medicine, particularly in the treatment of skin diseases.

Enzymes, which are extremely complex substances, produced by all living cells, and which bring about chemical changes without undergoing change themselves, are also sometimes manufactured by fungi. One of the commonest and most useful of these is DIASTASE, which has the ability to change starch to sugar. It is widely utilized in food technology, medicine, and industry. The best source of mold diastase is another one of the *Aspergillus* group, *Aspergillus oryzae*.

A large number of commercial diastase preparations are manufactured in this country. The partially purified enzyme has a wide variety of uses: (1) in medicine for relief of certain gastric disturbances; (2) in the clarification of fruit juices; (3) in removing sizing from fabrics which are to be dyed; (4) in the manufacture of pectin.

In theory, diastase from fungi could be used to replace malt in the preparation of industrial alcohol, but it would be unsuitable for beverage alcohol because of its unpleasant flavor. In this country neither molds nor mold diastase has been used, but in both Asia and Europe a mold of the *Mucor* group, called "Chinese yeast," has been used in the production of alcohol. In this case the mold is able to replace both the malt and the yeast used in conventional methods.

There are innumerable other enzymes produced by molds. One is concerned with the tanning of leather; others are used in removing hair from rawhides, in the manufacture of glue, in removing gums from silk fibers before spinning, in preparing flax for weaving, and even in the making of chocolate candies. In these the soft centers are prepared by a method involving use of the enzyme INVERTASE made from either yeasts or molds, generally the former. The candy center is originally firm enough to be molded and dipped. The enzyme is added just before dipping; action of the enzyme converts part of the cane sugar present to more soluble sugars. The net effect is to cause partial or complete liquefaction of the originally firm fondant, after the chocolate on the outside has hardened.

Future developments in the use of molds are, of course, impossible to predict, but the enormous variety of chemicals elaborated by molds guarantees that there will be progress. Some compounds that are synthesized by fungi have not yet been made by man in the laboratory; others are manufactured only at high cost or with great difficulty. It is likely that today we are probably only at the beginning of our use of molds as manufacturers.

Notes, News, and Comment

Journal Subscription. Beginning January 1, 1946, the price of the annual subscription to the Journal of the New York Botanical Garden is increased to $1.50. Single copies remain at 15 cents apiece. All subscriptions and renewals that were received before the end of 1945 will be entered at the former rate of $1 for the year.

Resignation. Pierre Jay, Honorary Chairman of the Fiduciary Trust Co. resigned from the Board of Managers of the New York Botanical Garden November 27. He was elected to the Board September 16, 1938, to fill the vacancy left by the death of the Garden's former President, Henry W. de Forest. Mr. Jay served on the Board's executive committee from January 1940 to March 1943; on the finance committee from January 1938, before his election to the board, until his resignation; and on the pension committee from November 1940 also until November 1945. Mr. Jay will remain with the Corporation of the New York Botanical Garden, of which he had been a member since 1935.

Visitors. Dr. Y. Carmon of the Agricultural Research Station at Rehovoth, Palestine, visited the Garden Nov. 20 to consult with Dr. A. B. Stout on the possibility of new seedless grapes for culture in his country. Dr. Carmon is spending a year in the United States, during which he will inspect horticultural plantings, especially in Florida and California, in respect to methods and materials of value in Palestine.

Dr. Martin Cardenas of the University of Cochabamba in Bolivia spent several days at the Garden in mid-November studying the literature on potato varieties. Dr. Cardenas did some of his first botanical work with Dr. H. H. Rusby in Bolivia in the early 1920's.

Other November visitors have included Karl C. Hamner of Cornell; Caryl P. Haskins, author of "The Amazon" and other books; Pierre C. Houard of Révue Horticole, Paris; Henry de Boer of Brooklyn and Surinam; Father Philip J. O'Neill of Fordham University; Sister Mary Thais, teacher of biology in Nova Scotia; J. B. S. Norton, University of Maryland; Walter H. Snell, Brown University; Chester M. Southam, College of Physicians and Surgeons; and M. A. Chrysler, Rutgers University.

Harold J. Humm of the Duke University Marine Laboratory at Beaufort, South Carolina, and Louis G. Williams, also of Duke, arrived at the Garden Dec. 17 to study algae for a few days. Dr. A. J. Grout stopped in on his way to Florida.

Volunteer. Charles Beall, who was a Brown University student before entering the armed services three years ago, is working as a volunteer in the plant pathology laboratory, assisting Dr. B. O. Dodge in his studies of the pink bread-mold, *Neurospora*. He plans to resume his studies in mycology at Brown next March.

Conference. The December conference of the Garden's scientific staff was devoted to a talk on "Cinchona Populations in Southern Ecuador" by Dr. W. H. Camp.

Meetings. Dr. William J. Robbins attended meetings of the American Philosophical Society and the National Academy of Sciences in Philadelphia and Washington in November.

Lectures. Joseph F. Burke spoke on "Early Days of the New York Microscopical Society" at a meeting of the group Dec. 21. Dr. E. E. Naylor spoke at the Nature Center at Julia Richman High School Dec. 5 on "Bulbs for Mid-Winter Flowering." Dr. W. H. Camp described experiences as an explorer in Ecuador before the Men's Garden Club of New York Dec. 5.

Foreign Periodicals. Scientific bulletins published abroad, which have been held up since early in the war, are beginning to arrive from foreign countries. Among the first to reach the library of the New York Botanical Garden are three series from France dating from 1939 and 1940: *Bulletin du Muséum National d'Histoire Naturelle*, *Bulletin de la Société Botanique de France*, and *Bulletin de la Société Mycologique de France*, the last of which is illustrated in color.

Current Literature. The column entitled "Current Literature at a Glance," which has appeared intermittently in the Journal for the past 14 years, will be prepared, beginning this month, by Harriet K. Morse. Mrs. Morse is the author of "Gardening in the Shade" (1939) and "Garden Easily" (1942), both published by Scribner. During the war she served with the New York Civilian Defense Volunteer Office in the interest of victory gardening. Mrs. Morse has appeared several times as a speaker for the Botanical Garden, both on the Saturday programs and on the radio, and in April 1943 she contributed an article to the Journal on "Gardening in the City."

Notices and Reviews of Recent Books

(All publications mentioned here may be consulted in the Library of The New York Botanical Garden or may be purchased on order through the Library.)

12,000 *Word Elements Used in Biology*

A SOURCE-BOOK OF BIOLOGICAL NAMES AND TERMS. Edmund C. Jaeger. 256 pages, illustrated. Charles C. Thomas, Springfield, Ill. 1944. $3.

Biological names and terms have always been the delight of the biologist (unlettered as he often is) and the despair of his students. The appearance of a "source-book" of these words is therefore an event of some importance. When one recalls that the words are derived chiefly from classical Latin and Greek, with frequent recourse to Anglo-Saxon, Arabic, Sanskrit, Japanese, and Choctaw, it is evident that the author of such a work must have an impressive philological background. Professor Jaeger has given us "fully 12,000 elements from which scientific biological names and terms are made. With them are given their Greek, Latin, or other origins and their concise meanings, together with numerous examples of their use in scientific nomenclature." In other words, this is not a lexicon of biological words, but a list of the "elements" from which such words have been made. The definition of each is illustrated by names and terms derived from it, and sometimes by a small drawing.

Considering what a stupendous task this is, the author has done a remarkable job. In these 256 pages one may ferret out the etymology of such historical accidents as *parenchyma* and such tongue-twisters as *Mesembryanthemum* and *Dolicho-opselephus.* The author writes, "That some errors and omissions may have inadvertently crept in is beyond doubt." Whether or not an omission is likely to "creep in," there are certainly some errors patent even to one so innocent of philology as the present reviewer. For instance, κάλυξ (kalux), from which we derive *calyx*, does not mean a *cup* but a *covering;* it has been confused with the Latin *calix*, from which we get *chalice*, and which is related to κύλιξ (kulix, cup). *Strictus* is assigned its classical meaning of *drawn tight;* but the current botanical meaning of *strict* is *erect. Adiantum* and *aphyllous* are not Latin words, except by adoption. The Latin prefix *dis-* is given only one of its meanings, and that the least common; *dissepiment* is separately treated, the prefix not explained; *-ant* is called an English suffix; so it is, but the derivation is old French. *Stramineus* did mean *made of straw* to Ovid, but in botanical usage it refers only to a color. Diploid is not derived from Greek *dipl-* and New Latin *-oid,* but from *diplo-* + *-id.* The classification of roots into "prefixes" and "suffixes" has got the author into trouble with *arch,* which he calls a prefix; he has forgotten such words as monarch, mesarch, where the *arch* might conceivably be called a suffix, but is really the principal root of the word. The treatment of this important root under two headings (as if there were two such words) is misleading; its various senses are all derived from one primary meaning.

It is sometimes hard to find one's way in this jungle of roots and stems; it would perhaps have been better if roots were definitely treated as such and distinctively printed. For instance, the common root ακ (ak), meaning a point, is correctly given as the source of such words as *acute, acicular;* but *acer* is not included, being separately treated; and though under *acut-* we are referred back to *ac-*, under *acumin-* no mention is made of the derivation. Incidentally, that old fallacy of "connecting vowels" bobs up here, in quotations from the *International Rules of Botanical Nomenclature.* Like the authors of that work, Jaeger perhaps does not realize that the *o* in such combinations as *atropurpureus* and *rubigino-tomentosus* is not an added vowel but part of the stem of the first word; in *moniliform*, on the other hand, the *i* is correctly designated as a connecting vowel.

Such a catalogue of errors is offered largely in response to the author's expressed wish, and not as a detraction from the work. The number of doubtless correct derivations is enormous and gratifying. But in another respect the book merits severe criticism. Anyone who handles derivations from Greek and Sanskrit has a certain amount of trouble with transliteration. It is well known that when a word passed from Greek into Latin, υ became Y, and κ became C. You can make this a guide for transliteration into English, if you wish, but if you do so it is best to be consistent. Why "kalyx" (rather than "calyx" or "kalux") should be written for κάλυξ it is difficult to understand. And "elayno" for ἐλαύνω (elaunō) is just nonsense. In my opinion, anyone capable of using such a book is also capable of learning the Greek letters. Then one could perhaps make it clear that ἴον (ion) is the same word as *Viola*, the digamma (vau) having been lost, and that *Vaccinium* is similarly related to ὑάκινθος (*Hyacinthus*).

H. W. RICKETT.

Fungi in Human Disease

MILITARY MEDICAL MANUALS—Manual of Clinical Mycology. Prepared under the Auspices of the Division of Medical Sciences of the National Research Council. 348 pages with 148 illustrations. W. B. Saunders Company, Philadelphia and London, 1944. $3.50.

Conant, Martin, Smith, Baker, and Callaway, in the book "Manual of Clinical Mycology" put out by the National Research Council, have filled a long felt need for a work of this sort. It is complete in that a chapter is given to each disease, and both the clinical and mycological aspects are covered. The importance of the laboratory in making a diagnosis is stressed, and many helpful hints as to technique are given.

The material is presented in a clear and concise manner, with numerous illustrations. It will be a decided help to the worker in this field.

RHODA W. BENHAM,
Department of Dermatology,
Columbia-Presbyterian Medical Center.

Writings on Nature

THE BOOK OF NATURALISTS. Edited by William Beebe. 499 pages. Alfred A. Knopf, New York, 1944. $3.50.

Dr. Beebe is well qualified to prepare and edit an anthology of natural history. He has succeeded in his purpose of providing for the readers of this book a cross section of the growth and development of natural history writing since the time of Aristotle. The selections are, almost without exception, well written, informative, and interesting. A brief biographical note precedes each one. Although Beebe's idea of "natural history" apparently does not include much plant life, the book will please those who appreciate almost all other phases of natural history. For readers who are particular in their interests, this book may serve as an introduction to authors who have been unfamiliar to them.

LEON HERVEY,
Evander Childs High School.

Michigan Plants

FLORA OF OAKLAND COUNTY, MICHIGAN. Marjorie T. Bingham, 155 pages, illustrated. Bulletin 22, Cranbrook Institute of Science. Bloomfield Hills, Mich., 1945.

A detailed discussion of the physiographic features, geologic history, environmental factors, and plant communities of the area is followed by an annotated check-list of species and varieties of vascular plants, giving the types of habitat, so far as known, in which each plant occurs. About 1,600 species are listed. A summary, glossary, and bibliography are given. The nomenclature, except for the orchids, is chiefly that of Gray's Manual, 7th edition; orchid names are according to Oakes Ames. Two large-scale maps of surface-formations and land-types are included.

ARTHUR CRONQUIST.

On Photosynthesis

PHOTOSYNTHESIS AND RELATED PROCESSES. Vol. 1. Eugene I. Rabinowitch. 599 pages, indexed. Interscience Publishing Co., 1945. $8.50.

This is the first volume of a two-volume monograph on the chemistry, physics and biology of photosynthesis. The volume is divided into two parts: I, The Chemistry of Photosynthesis and Related Processes; II, The Structure and Chemistry of the Photosynthetic Apparatus. Particular emphasis is placed on the theories of the photosynthetic process. This book should be in the library of all who work with any of the many aspects of photosynthesis.

F. W. KAVANAGH.

Science Simplified for Gardener

PLANT GROWTH. L. Edwin Yocum. 203 pages, illustrations, glossary, index Jaques Cattell Press, Lancaster, Pa., 1945. $3.

This book lives up to its title -it is filled with information on *plant growth* and written especially for those interested in growing their own vegetables and flowers. It consists of 25 chapters which are short, easy to read, and directly to the point.

The subjects discussed range from the fundamental principles of plant structure and organization to advice on such matters as fertilizers, soil improvement, hormones, insects and diseases. Practical hints are given on whether to mulch or hoe, how to prepare a compost pile, what to do about weeds, and many other items of interest to the gardener. The book is fairly well illustrated with a few of the "old timers" from standard texts, and some original photographs. A helpful glossary is also included. If one is actually in the gardening business, has progressed beyond the seed catalogue stage, and wishes more knowledge on the requirements for plant growth, he will find this book both interesting and helpful.

E. E. NAYLOR.

Your Forests

YOUR FORESTS. Martha Bensley Bruère. Foreword by Gifford Pinchot. 159 pages, maps, illustrations, index. J. B. Lippincott Co., Philadelphia and New York, 1945. $2.50.

With increased emphasis in recent years on wood and wood products, our forests have taken on a new importance. This is pointed out in this volume, which aims to present the cardinal features about forests. How our woodlands came to be what they are, kinds of forests, tree dissemination, care of wooded areas, harvesting trees, forest fires and their control—these are some of the topics which the author might be expected to discuss, and does. But there are also chapters on forest products such as paper, plastics including rayon and nylon, forest careers and opportunities—"Men Who Work in the Woods"—and the outlook for the future.

One of the most interesting discussions—"Nets to Catch Wind"—is on shelterbelt plantings and the role which they may ultimately play, along with planting of grasses and reservoir systems, in preventing wind erosion.

In brief, this little book tells authoritatively what our forests are, and discusses the part which they play in our welfare. It has the prefatory blessing of Gifford Pinchot, and is written in simple, straightforward, lucid style, in language that Jack and Mary can understand.

EDWIN B. MATZKE,
Columbia University.

Hardy Woody Plants

TREES, SHRUBS, AND VINES FOR THE NORTHEASTERN UNITED STATES. George Graves. 267 pages, 68 illustrations. Oxford University Press, New York, 1945. $3.

This neat little book is recommended as a ready reference guide to several hundred species and varieties of woody plants. It is a carefully selected group presented in alphabetical arrangement, with brief notes on their garden value and hints on culture and methods of propagation.

Berberis dictyophylla is deserving of better mention than that given. With this reviewer it is one of the most beautiful of shrubs with its white stems and lovely fall coloring. It might be added that, for those who would like to carpet the bare ground beneath a beech, *Euonymus Fortunei colorata*, which is mentioned as a ground-cover, will do it to perfection with a little help in getting started.

The author follows Rehder's "Manual of Cultivated Trees and Shrubs," second edition, in the matter of botanical names. In the case of some that have recently had their names changed, it was a good idea to include designations by which they are better known. Appropriate common names are also given for most plants, which should please those who are scared of botanical names. Following listings in different categories, the book concludes with brief chapters on "How to Shop for Trees, Shrubs, and Vines" and "The Problem of Pruning."

Besides being a handy reference, this book should stimulate interest in a wider variety of woody plants than is usually seen in our communities.

HENRY E. DOWNER,
Vassar College.

Camellia History in Color

CAMELLIAS. G. G. Gerbing. 42 pages, 8 by 12 inches, 37 of which are life-size camellia pictures in natural color. Published by G. G. Gerbing, Fernandina, Florida. 1945. $10.

This pictorial history of camellias is in loose-leaf form, with a substantial binder, so planned that additional sets of pages may be added from time to time as published. The author is one of the largest growers of camellias in the South, and it is his worthy ambition to make a complete history of camellias which will be valuable for growers and also to non-growers. The book is good to look at. If the colors and a few typographical errors give evidence of wartime difficulties in publishing, it is still a unique and beautiful link in the chain. This is the second of the series. (The first "Camellias," a bound volume with 108 illustrations, is in the second printing and is still available at $15.) Mr. Gerbing expects to publish another set of pages for the loose-leaf volume, in time for the autumn opening of the camellia season.

EVA NOBLE,
Jacksonville, Fla.

Unwanted Plants

WEEDS OF LAWN AND GARDEN. J. M. Fogg, Jr. 215 pages, illustrated, indexed. University of Pennsylvania Press, Philadelphia, 1945. $2.50.

This new book describing the weeds of the eastern temperate region of North America has interesting criteria for identifying undesirable plants. The author emphasizes those characteristics of plants which place them in the category of weeds: their geographic region; their underground systems; their flowers, stems, and leaves; fruits and seeds; and the all-important means of dispersal which primarily determines their eventual establishment in any flora.

The author gives some emphasis to weeds as soil indicators, an item not to be overlooked in our economic consideration of this type of plant. He indicates some chemical control measures for common weeds. Several of these are new, but others have been recognized for years.

The list of plants classified as weeds is inclusive, and the illustrations, while not graphic, indicate the parts such as seeds, roots, stolons, etc., which are effective in distribution. The inclusion of "tree weeds" is one I have not observed before and is an addition of real value to a comprehensive treatise of undesirable plants.

JESSIE G. FISKE,
State Seed Analyst,
New Jersey Agricultural Experiment Station.

Orchard Crops

THE ENCYCLOPEDIA OF FRUITS, BERRIES AND NUTS AND HOW TO GROW THEM. Albert E. Wilkinson, 271 pages, illustrated by Tabea Hofmann. Blakiston, Philadelphia, 1945. 69c.

This book is divided into two parts, the first containing a list of fruits and nuts with descriptions.

The more common fruits are described at some length, varieties are discussed, cultural instructions given, and the control of insects, pests and diseases affecting them are treated.

Of the lesser known fruits and nuts, many items listed in this encyclopedia are of doubtful value and the reason for their inclusion in a book of this character is difficult to understand.

Part two of this work, which is called the "Gardener's Guide," dispenses information of a cultural character. Lists of fruits and varieties suited to the various sections of the country are given, the laying out of orchards is described and illustrated, together with other matter pertaining to the raising of fruit, including a spraying calendar. But with all this, it is not a very convincing book.

EDWIN BECKETT,
Middletown Farm,
Red Bank, N. J.

*Current Literature**
At a Glance

By Harriet K. Morse

Light as an Ecological Factor. Experiments in the control and measurement of light and shade as they apply to plant growth are under discussion in the *Botanical Review* for November 1945. The article is a continuation from one published ten years ago in September. Man's successful management of natural vegetation by attention to light has enormous possibilities in the future. Hardy L. Shirley of the New York State College of Forestry, who has writen these articles, appends a bibliography of 168 items, showing the vast extent of the literature pertaining to this subject.

Growing Holly. Dr. Charles H. Connors has writen in the simplest possible terms an 8-page illustrated bulletin on how to raise Christmas holly (*Ilex opaca*) from seed or from nursery grown stock, in New Jersey Agricultural Experiment Station Bulletin 493. Cultural directions are given in full detail. Causes for non-fruiting are carefully explained and corrective measures suggested.

Latest Research on Roses. Of interest to the rosarian is Professor Alex Laurie's composite report on recent work undertaken at various experiment stations. His address as delivered at the "Roses, Inc.," meeting at Milwaukee, November 4, is published in the *Florists Exchange,* November 10. Professor Laurie discusses here the latest findings on such topics as soil aeration, gravel culture, automatic subirrigation, effects of light on roses, etc. Tests at Cornell have shown that roses have greater keeping quality when afternoon cutting is practised.

Hunting for Primulas. Those many admirers of Captain F. Kingdon Ward will be interested in Caroline Morse Lord's two articles of appreciation of the great explorer who has contributed so richly to our literature and horticultural advancement, in the Quarterly of the American Primrose Society, July and October 1945. She discusses the Captain's expeditions into the Far East (there were eleven) and his primula discoveries and introductions. She quotes liberally from his writings in which he delightfully describes the primroses as he first saw them growing in the wilderness.

Effect of Mulches on Soil Properties. *Soil Science* (March 1945) reports an interesting project conducted by the Oregon Experiment Station (Technical Paper 441) to determine the effect of straw, trash and other mulches on moisture conservation, nutrient supply, and soil structure. Six plots were under different treatment over a period of three years during which time the results were carefully recorded.

Thomas Jefferson. In two illuminating articles entitled "Thomas Jefferson: His Interest in Plant Life as Revealed in his Writings," Edmund H. Fulling evaluates Jefferson as among the first in the New World to attempt to raise farming to a science and to realize the potentialities of crop rotation. He further discusses the two great projects sponsored by Jefferson, namely the Louis & Clark Expedition, and its plant collection, and the school of botany which was instituted at the University of Virginia, founded by Jefferson. These articles have appeared in the Bulletin of the Torrey Botanical Club, Novmber 1944 and May-June 1945. A third article in the series is yet to be published.

Plants Neglected in Landscape Use. In a stimulating article, N. R. Elliott, Professor of Landscape Architecture of the University of Kentucky, makes a plea for the greater use of comparatively little known plants which deserve greater popularity. Among his recommendations, given in the *American Nurseryman,* November 1, are the Japanese pagoda-tree, American yellowwood, sourgum, wintergreen barberry (*Berberis Julianae*), and oakleaf and climbing hydrangeas, along with numerous other worthies.

Early History. "America's Indian Background" is the title of an informative leaflet from the Southwest Museum (No. 18, 1945. 35c). It tells briefly the story of the Indians in America from times previous to the advent of the white man. From a folding map showing the location of the native Indian tribes, we learn that half of our states and thousands of lakes, rivers and other places are known by Indian names, often corrupted. Included in this interesting 20-page leaflet is a list of some 60 books of value to the student.

* All publications mentioned here—and many others—may be consulted in the Library of the Botanical Garden, in the Museum Building.

LETTERS FROM READERS

On Cocobolo Flutes

To the Editor:

I WAS interested in your account in the Journal of the investigations in connection with wood allergy, for I have had a good deal of experience in the last two years with cocobolo flutes. Some people do not seem to be bothered at all, while those who are, may be either greatly sensitive or only slightly so. My own experience is that sensitiveness seems more acute in the spring of the year.

The flute maker who is using cocobolo does not appear to be bothered by handling and working it, but a second maker could not handle it and used rosewood and mahogany instead. I understand the maker's hands become sensitized; in the player it is usually the lips and the chin. One girl I know complained when using a mahogany flute, so there may be allergies to other woods. The first symptom seems to be dryness of the lips, then an itching of lip or chin at some spot. It is the raw wood of the cocobolo flute that is bothersome. One make in which raw cocobolo and red cedar come in contact with the lower lip causes itching and then eruption on two separated spots where the unfinished cocobolo rests. The finished upper surface, that comes in contact with the upper lip, does not seem to cause trouble. The finish is some kind of varnish. The worst offenders are flutes made of cocobolo containing a great deal of the yellowish resin in the wood pores. A white cloth used in swabbing the bore of such a flute will come out discolored yellow.

Only once in a long while have I run across one of the really bothersome ones. I found that the ferric chloride "poison-ivy preventive" used after playing was effective if any slight itchiness were felt. Half-inch lengths cut from the fingers of rubber surgical gloves can be used to cover the mouthpiece and prevent direct contact of the lips with the wood. This has proved almost entirely effective as a preventive. These rubber mouthpieces should be washed frequently with soap and water and dusted with talcum powder. They should be put on the flute with the same side out each time. The sad feature of it all is that the maker using cocobolo produces the best domestic instrument, both in workmanship and tone, in my opinion.

JOSEPH F. BURKE.

Rebuttal on Cinchona Review

To the Editor:

EVER since Jussieu (1704-1779) collected cinchona in South America, it has been determined that the alkaloidal content of bark increases towards the southward, culminating in Bolivia where they may reach 5-6% of quinine sulfate. Dr. Fosberg in his review of my "Cinchona in Java" (September Journal) chides me for repeating this truism although he knows, or should, that even the best Bolivian barks are far below those grown in Java and hence, in normal times, commercially negligible.

In Dr. Fosberg's "Colombian Cinchona Manual" (2nd edition, Bogotá, 1944) he rightly uses *quinine sulfate* as a criterion of bark value, following a fifty-year old trade custom established at Amsterdam where the bark auctions are conducted upon the content of quinine sulfate, not upon quinine alkaloid. But his review says that my book is "marred" by following exactly Amsterdam's and his own procedure!

His final charge that my "job is to carry on propaganda for the Dutch cinchona growers" creates an impression that the review merely reflects the naiveté or disingenuousness of much recent writing on cinchona. Actually, the Cinchona Products Institute is a non-profit educational and research institution run on behalf of growers and quinine manufacturers both here, in Europe and Java. Grants-in-aid or fellowships have been given to universities, medical schools, private investigators and state departments of health.

NORMAN TAYLOR.

JANUARY EVENTS AT THE GARDEN

Members' Day

Jan. 9 3:30 p.m. ***The Working Technique of a Taxonomist***

Arthur Cronquist

The aim of this opening program of the new year is to demonstrate to members and their guests the methods used by a botanist in identifying plants, particularly when a large and complex group, such as the composites, or daisies and their relatives, is being studied. Dr. Cronquist is engaged in special studies of the Compositae. Work such as he and other members of the staff are doing comprise that branch of botany known as *taxonomy*, which is the identification and classification of plants. This work, also classed as "systematic botany," is the foundation upon which the New York Botanical Garden is built. Scientists the world around look to the Garden for authentic identifications of plants, particularly of North America and the northern part of South America, and adjacent regions, to serve as a basis for their own botanical research.

Saturday Afternoon Programs

3 p.m. each Saturday

Jan. 5 ***Travelog of French North Africa*** — *Lawrence C. Curtis*
Connecticut Agricultural Experiment Station

Jan. 12 ***Explorer in the Galápagos Islands*** — *Victor W. von Hagen*
Author of "South America Called Them"

Jan. 19 ***In All the World***
A motion picture showing vacation scenes in Glacier National Park

Jan. 26 ***The Pineapple Industry*** — *Ralph H. Cheney*
Long Island University and Brooklyn Botanic Garden

* * *

Radio Programs

3:30 p.m. on alternate Fridays over WNYC

Jan. 11 ***The Story of Quinine, from Tree to Pharmacy*** — *W. H. Camp*
Assistant Curator

Jan. 25 ***Vegetable Oils That Make Fine Soaps*** — *Georgia Leffingwell*
Author of "Soap, Its Industrial and Commercial Uses"

* * *

Courses

Two-Year Science Course for Gardeners

General Botany II, E. E. Naylor, Instructor, commencing Jan. 7, 8 p.m., and meeting weekly.

Systematic Botany Laboratory, Arthur Cronquist and Frances E. Wynne, Instructors, commencing Jan. 7, 9 p.m., and meeting weekly.

Two-Year Course in Practical Gardening

Outdoor Flower Gardening, Arthur King, Instructor, commencing Jan. 10, 8 p.m. and meeting on alternate Thursdays.

* * *

Forthcoming Events

Members' Day, Feb. 6, "My Garden of Myomycetes" by Mrs. Ruth N. Nauss. *Saturday programs*: Feb. 2, Succulent Plants, E. J. Alexander; Feb. 9, Vitamins, Ilda McVeigh; Feb. 16, Trees in Winter, Arthur Cronquist. *Radio Programs*: Feb. 8, Maple-Sugaring, Harold C. Kimball; Feb. 22, Sugar, Foundation of Life, E. E. Naylor. *Course*: Nature Study, commencing Feb. 20.

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

York Central to the Botanical Garden stat

Membership in

THE NEW YORK BOTANICAL GARDEN

and what it means

TO THE INSTITUTION, membership means support of a program that reaches several hundreds of thousands of persons annually.

Briefly, this program comprises (1) horticultural display, (2) education, (3) scientific research, and (4) botanical exploration. To further this work and to disseminate useful information about plant life to the public, the Garden issues books and periodicals, both scientific and popular, and presents lectures, programs, radio broadcasts, and courses of study in gardening and botany. The laboratories and large herbarium and library serve the staff in its research and educational work, while the extensive plantings at the Garden give the public vistas of beauty to enjoy the year around. The public is also free to use the Botanical Garden's library, and, under direction, to consult the herbarium.

TO THE INDIVIDUAL, membership means, beyond the personal gratification of aiding such a program, these privileges:

Free enrollment in courses up to the amount of the annual membership fee paid.

A subscription to the Journal and to Addisonia.

Admission to Members' Day programs and use of the Members' Room also at other times.

A share of plants when made available for distribution. (These plants may include the Garden's new introductions into horticulture.)

Personal conferences with staff members, upon request, on problems related to botany and horticulture.

Free announcements of special displays, lectures, broadcasts, programs, and other events.

Use of lantern slides from the Garden's large collection, under established regulations for such loans.

A membership card which serves as identification at special functions at the Botanical Garden and also when visiting similar institutions in other cities.

* * * *

Garden clubs may become Affiliate Members of the New York Botanical Garden, and thus receive certain privileges for the club as a unit and others for individual members. Information on Garden Club Affiliation will be sent upon request.

Business firms may become Industrial Members of the New York Botanical Garden. Information on the classes of Industrial Membership and the privileges of membership will be sent upon request.

* * * *

Classes of membership in the New York Botanical Garden in addition to Industrial Memberships are:

	Annual Fee		*Single Contribution*
Annual Member	$ 10	Member for Life	$ 250
Sustaining Member	25	Fellow for Life	1,000
Garden Club Affiliation	25	Patron	5,000
Fellowship Member	100	Benefactor	25,000

Contributions to the Garden may be deducted from taxable incomes.

Contributions to the Garden are deductible in computing Federal and New York estate taxes.

A legally approved form of bequest is as follows:

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

Gifts may be made subject to a reservation of income from the gift property for the benefit of the donor or any designated beneficiary during his or her lifetime.

All requests for further information should be addressed to The New York Botanical Garden, Bronx Park, New York 58, *N. Y.*

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

FEBRUARY EVENTS AT THE GARDEN

Members' Day

Feb. 6 3:30 p.m. *My "Garden" of Myxomycetes* — *Mrs. Ruth N. Nauss*

Saturday Afternoon Programs

3 p.m. each Saturday

Feb. 2 *Succulent Plants for Indoor Gardens* — *E. J. Alexander*, Assistant Curator

Feb. 9 *Vitamins from Vegetables* — *Ilda McVeigh*, Technical Assistant

Feb. 16 *Trees in Winter* — *Arthur Cronquist*, Assistant Curator

Feb. 23 *Floral Emblems of the Nations, and State Flowers of the U. S. A.*
Two motion pictures in color by *Russell T. Pansie*

Radio Programs

3 30 p.m. on alternate Fridays over WNYC

Feb. 8 *Maple-Sugaring in New England* — *Harold C. Kimball*, President, Southern New York Fish & Game Association

Feb. 22 *Sugar is the Foundation of All Life* — *E. E. Naylor*, Assistant Curator

Courses

Nature Study

E. E Naylor, Instructor, commencing Feb. 20, 4-6 p.m. and ending June 12. Alertness credit arranged for New York City teachers.

Forthcoming Events

Members' Day, March 6, "A Commuter's Greenhouse" by John H. Myers. *Saturday programs*: March 2, Diatoms, Jewels of the Sea, J. F. Burke; March 9, Paper-making, Floyd E. Carlson; March 16, Romance of the Hybrid Orchid, a motion picture in color by A. M. Zinner. *Radio Programs*: March 8, Lesson in Landscaping, Mary Deputy Lamson; March 22, Plant-Hunting in Mexico's Mountains, E. J. Alexander. *Courses*: Outdoor Gardening Practice, April 18.

TABLE OF CONTENTS

FEBRUARY 1946

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The Surucucho

By W. H. Camp

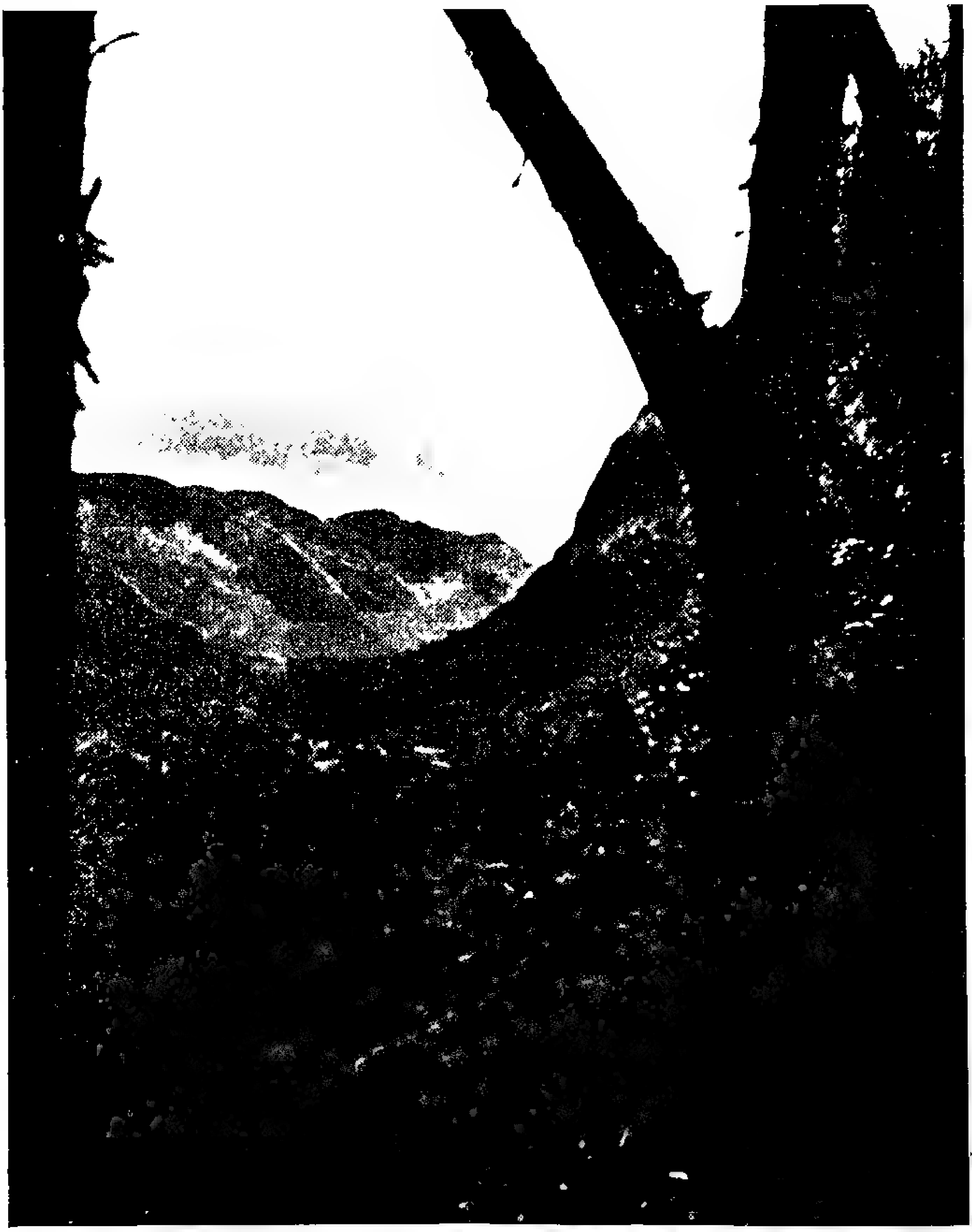
COLD, bleak and forbidding, lashed by incessant storms, and with much of it over twelve thousand feet in elevation, the Páramo des Soldados lies athwart the treeless crest of the western cordillera of the Andes exactly 3 degrees south of the equator in the province of Azuay, in Ecuador. Rain falling on this páramo, or the water from its melting snows, first gathers in a series of moraine-bound lakes, remnants of an earlier glaciation, which are draped like a ragged necklace around its margin.

The waters from the westernmost of these lakes come together and form such streams as the Ríos Balao, Mihuir and Patul. Tumbling over the edge of the great escarpment, these soon come to rest in the deep bosom of the Pacific. The streams rising in the eastern string of lakes? That is another story—and quite a different journey. Let us follow one of them.

Some of the waters of the eastern side of the Páramo des Soldados form the Río Surucucho; this joins the Mazán—both of them roistering mountain streams—and together they make up the Matadero (the Killer). The Matadero is an irresponsible mad-cap in its calmer moments, a veritable "killer" when angry and in flood.

Anxious to be on its way, the Matadero scurries past the small farms of the patient Cholos in the valley, pausing occasionally with an obscene chuckle to tickle the bare legs of the brown-skinned women who stand in it as they beat their laundry on its spray-wet rocks. Then, lightly mocking and sometimes a little blasphemous it hurries past the ecclesiastically pious city of Cuenca with its nearly thirty cathedrals and churches. Soon it is

Surucucho is a Quechua compound name, SURU standing for *Chusquea*, the giant bamboo-grass which so often forms impenetrable thickets at the higher elevations throughout the Andean regions, and CUCHO meaning a corner, cleft, or narrow canyon. Hence: SURUCUCHO—"the canyon where the bamboo-grass grows."



ENTRANCE TO THE VALLEY OF THE SURUCUCHO

". . . it was evident that the valley was U-shaped and typically glacier-formed."
The large transverse moraine which dams the valley may be seen in the middle distance. The waters of the Río Mazán enter the valley from the right over a series of cascades and waterfalls; joining with those of the Surucucho in the valley floor, they form the Río Matadero.

joined by the pagan Yanuncay and once-bloody Tarqui. Together these become the Paute. At first this is a rapidly descending chute of white water while it gathers momentum; then, twisting and turning, beating itself to a frothy rage on the jagged rocks, roaring aloud in the agony of its seeming frustration, trying first to the north, then to the south, then doubling back on its course again and again—but ever a little more eastward—the Paute finally writhes its tortured way down through the black and somber gorges of the eastern cordillera . . . only to find its way once more blocked.

Exhausted by its efforts, the Paute is picked up and carried along by the eager and less weary waters of the Upano and Zamora (the Zamora rises far to the south in the mountains back of the town of Loja; the Upano northward among the melting snows near the crest of the now-flaming and explosive volcano called Sangay). Together—as the Namangoza—they make short work of the last barrier, ploughing straight through between the ends of the detached ranges called the Condor and the Cutucú. And there, stretching ahead in its vast flatness, seemingly for interminable steamy miles, lies a green forested plain.

What is the catalog of rivers from there? The Namangoza becomes the Santiago; the Santiago swings far to the south to join the Marañon; and, after a journey when it seems not quite certain which way to turn, the Marañon finally finds the Río Solimões which, dallying through the lowland jungles—but ever trending eastward toward the Atlantic—is lastly called the Amazon.

Eastward from the crest of the Páramo des Soldados, it is two thousand miles in an air-line route to the Atlantic (and well along toward three thousand miles if one were to follow the meandering of the rivers). Westward from the same place on that páramo, it is a mere thirty-five miles to salt water. Of the innumerable headwater areas of the Amazon River this one is not the farthest from its mouth; its distinction lies, I think, in being the one closest to the Pacific.

* * * *

Being below the equator, the Andean highlands of southern Ecuador were blanketed with winter last July. Even so, having collected on its margins previously, I had wanted to get up onto the Páramo des Soldados to investigate the cold-weather flora. It probably would not be particularly rich, but possibly might contain some few items of interest. Negotiating the transportation necessary for a dash onto this páramo—to be made by relays spread along the line—took some time (especially finding a man willing to rent mules for the last part), but was finally accomplished and our trip was scheduled for the 16th of July.

Saturday the 14th was a beast of a day; Sunday the 15th was worse—and I wished more than once that I could call the thing off. But there was no way of finding the man who was bringing the animals for the last part so that it might be cancelled. Nor did it seem the least bit auspicious when we set out in the pre-dawn darkness on the morning of the 16th. I had on full-length woolen underwear, a heavy lumberman's shirt, a fleece-lined jacket, and a fine-meshed wind-breaker. Even so, the cold seeped in around the edges (or I might more properly say that at those elevations the air is so attenuated and forms so poor a "blanket" in the interstices of clothes that the heat loss from the body is often greater than normal bodily oxidations can replace it; men and animals often die on those páramos, not from freezing, but from excessive heat loss and the lowering of bodily temperature below that of normal function).

Traveling westward from Cuenca we arrived at the little village of Sayusi, picked up our string of animals before 7 a.m. and started the real climb toward the crest. It was not long until we came to the last of the valley cabins. At one of them was a man who said that he had crossed one part of the páramo a few days before and that he had encountered snow most of the way—not so much snow on the ground, but that he had been in snowstorms much of the time. And there ahead of us we could see the clouds—black and threatening—hanging on the crest. A little farther along the trail it began raining and sleeting and through occasional breaks we could see that it was snowing on the heights above.

If it had been only a problem of sticking to the trail and driving ahead over the páramo it is likely we would have pushed on, but I had wanted to have our party spread out and thus be more likely to pick up the material which might be present. Frankly, the storm gave us more than mere "cold feet." Although the boys were bundled up in several layers of poncho they did not have the clothes I did and already I was beginning to feel the insidious symptoms of high altitude heat loss (it is different from being just ordinarily cold; apparently it affects mental co-ordination quite as much as the physical system). At best, the rolling, treeless and usually featureless páramo is a place where it is easy to get lost. And a plant collector, occupied with his job and watching close by, seeing first one plant and then another—and over there a little way yet another—can soon get himself twisted in his directions if he is not exceptionally cautious. Riding along with occasional glimpses of what was ahead, I certainly was not relishing the prospect of the responsibility of trying to keep the party together; also a compact group doesn't collect enough plants; and, besides, who wants to collect plants in a snowstorm?

At an elevation of about 10,000 feet we noted a side valley and our guide said he thought there ought to be a trail going up it. Also, it looked as if it would be somewhat protected from the storm which occasionally swooped angrily down off the heights and lashed at us. The guide's guess as to the trail proved correct and so, with some relief on my part and (if I could judge by their faces) considerable on the parts of my boys, we left the main trail, crossed the Río Mazán, and ducked up the valley of the Surucucho, penetrating it for several miles. After twisting a bit, the aspect of the valley changed and assumed the appearance of a box-canyon (only I couldn't see the head to be certain). Then through the mists and rain it was evident that the valley was U-shaped and typically glacier-formed. Farther along we came to a high wall of unassorted rock and earth—nothing but a giant moraine—and back of the moraine was a gem of a glacial lake in as wild and picturesque a setting as I saw anywhere in Ecuador.

We booted the horses over the moraine and slid down the other side through the tangled thickets and forest which covered it, entering a veritable garden and collector's paradise. Soon the fire was going and some coffee was inside us. The group then scattered, coming together occasionally to compare notes or to dash back to the welcome aroma of the coffee pot (the guide kept it going, saw that the animals didn't stray, and also that they didn't begin to browse on the piles of specimens beginning to accumulate around the fire).

It was, I assure you, a rather queer feeling working around that lake, in the nearby forest, on the neighboring cliffs, or out on the meadow, for up above us that snow-storm still churned around the surrounding peaks. I say that it gave one a queer feeling, one which seemed other-worldly, to see the snow whirling up there and then to reach out—knowing that you were at a little better than 10,000 feet elevation—and gather in another

"... *back of the moraine was a gem of a glacial lake* . "

" . . . *for a few brief moments the cliffs were tipped with golden light.*"

armload of variegated white and pinkish-mauve and brownish-purple orchids, or to climb one of the gnarled trees and dislodge a colony of epiphytic lycopods, its filmy-threaded and intricately branched stems hanging down as much as a meter long, or to trudge across that squashy meadow, yellow with no less than three species of buttercups.

The whole setting—the peaks, the snow swirling above, the beetling crags, the glacially-scoured canyon walls, the lake and its flower-strewn meadow—yes, even the array of buttercups—was so similar to the glacial cirques and valleys whose plants I had studied in our own Rockies, Sierras, Cascades and Alaskan coastal mountains that a feeling almost of nostalgia assailed me. It was made doubly so when, from far up on the cliffs, I heard a shrill cry reminding me for all the world of the eagles in our own mountains. It was one of the spectacularly beautiful black and white birds found at high elevations in Ecuador, more like a falcon than a hawk —and possibly even more closely related to the eagles. An ordinary cotton-tail rabbit scurried out from under my feet, and later, adding to the feeling I had, I looked across the lake and saw a deer bounding over the meadow.

But this feeling of being back in the scenes of other and earlier collecting days was quickly dispelled by the massed epiphytic ferns and lycopods; the shimmering orchids; the thick-stemmed and almost arborescent pipers; the clumps of roseate and purplish peperomias; the gnarled and patriarchial lauraceous trees with their aromatic leaves; the massed Compositae, found not only as herbs and shrubs but also as trees and even as great ropy lianas climbing over trees; the various oddments of the blueberry group so common in the region, one extreme type so small as to be hidden in the grass, the other a coarse and knotty-stemmed vine climbing all of sixty feet; the tangled thickets of melastomes, some with flowers so deeply magenta that they appeared to be black, or other members of this same multitudinously confusing family with sprays of foamy white flowers, some of these on veritable trees; dainty purplish bog-violets (pinguiculas) tiptoeing their way around the dank margins of oozy springs; great heaping mounds of real violets, their stems sometimes long and almost vine-like, the flowers not blue or violet as one would expect but a deep and brilliant crimson; the frizzly-leafed hypericums, their flowers a brilliant cadmium-yellow; the highly variable and almost unreal forms of the arborescent PUMAMAKI (Araliaceae); the clumped and frothy masses of pungent valerianas; the cascading trusses of golden-flowered barberries; and, scattered here and there, seemingly aloof from the rest of this wild tangle of high-mountained jungle in their stately grace, the enormous trunks of the tree-fern, which, forsaking the gentle heat of the warmer regions thousands of feet below have, through the centuries, somehow acquired an immunity to the cold and ventured up to the very edge of the bleak and bitter páramo. Any slight disappointment at having failed to reach our original objective was easily forgotten in the work of collecting the more than 550 specimens we roped onto the backs of the pack-animals at the end of that day.

It had cleared late in the afternoon and for a few brief moments the cliffs were tipped with golden light. As we turned to leave, the equatorial night slid out from behind the peaks with its ever-surprising swiftness and tumbled into our valley, filling it with darkness. The horses picked their way slowly and cautiously among the treacherous rocks. Pausing for a moment I looked back. Far above, a thin moon glistened wanly over the páramo. Behind us—only a black cleft in the mountains—lay the valley of the Surucucho, dark and mysterious amid the mists and shadows of the Andes.

On the Cover. The valley of the Río Mazán in the Province of Azuay, Ecuador, like that of its neighbor, the Surucucho, was scoured out of the very ancient volcanic deposits by one of the many glaciers which originated in the ice cap that once covered the Páramo des Soldados. Here at 10,500 feet elevation the arborescent vegetation is limited to the sheltered valley floor, the grassy páramo vegetation beginning at the edges of the valley and extending onto the heights above where the terrain is more rolling. Later, the Ríos Mazán and Surucucho unite to form the Matadero.

Seaweed Products And Their Uses in America

By C. K. Tseng
Scripps Institution of Oceanography

PARTS I and II of this article, which were published in the Journal for January, first gave a brief survey of the American industries based on kelp and other seaweeds, then dealt with specific uses of the three main products of the algae: AGAR, derived from several species of *Gelidium*, ALGIN, from *Laminaria digitata*, *L. saccharina*, and *Macrocystis pyrifera;* and CARRAGEENIN, from the Irish moss, *Chondrus crispus*. Their use in dairy and bakery products, confectioneries and other sweets, and in items bought at the drug-store— pills, capsules, ointments, and such— were described, as well as their uses by themselves as food, roughage, and medicine.

In this concluding part the products from alage, as they are used in scientific research, in agriculture, dentistry, and photography, and in making cosmetics, varnishes and paints, as well as their important place in many other industries, are described. A list of references appears at the end.

PART III

IN SCIENTIFIC RESEARCH AND IN INDUSTRY

In Microbiological Culture Media

THE use of agar for bacteriological culture media is well known, for these are employed in biological laboratories everywhere. They are used regularly, for example, by public health workers in the standard analyses of milk and water supplies, and are required by every research worker who deals with micro-organisms. In the culture of yeasts and of pathogenic and non-pathogenic bacteria, as well as fungi such as *Penicillium notatum*, and other molds, the solid medium used is invariably agar gel, to which are added various chemicals to encourage the growth of these organisms.

Agar is valued for these solid culture media, because of several unique characteristics. A one percent agar gel is solid at 37°C, the temperature at

The agar used in American biological laboratories comes mainly from these two delicate seaweeds, *Gracilaria confervoides* (left), used in the East (though also found in West Coast waters), and *Gelidium cartilagineum* variety *robustum*, the agarweed of California (right). Agar is also widely used today in food and other industries. (*Gelidium* photograph by courtesy of U. S. Fish & Wildlife Service.)

which most pathogenic bacteria must be cultivated. At the same temperature, gelatin, which was formerly used, is a fluid. Again, agar is a relatively inert substance, not digestible by most bacteria, whereas gelatin is readily digested and liquefied by numerous micro-organisms. While agar does "sweat," as do all hydrophilic colloids, the degree of syneresis is not great enough to interfere with the enumeration of colonies on the culture plate and with the isolation of pure cultures. Other gelling substances, such as carrageenin, would be useful in preparing culture media if it were not for the excessive separating out of the liquid. Agar is a reversible colloid, and can be warmed to a sol and cooked to a gel alternately. The firm and rubbery surface of the agar gel is not easily ruptured by the inoculating loop or needle. Moreover, agar is nearly transparent and is neutral in reaction. At present algae, and even young stages of orchids, as well as micro-organisms, are grown on agar media.

In Scientific Research

In biological technique, agar is used as an embedding agent for small or slender objects. It is especially recommended for plant materials which are to be sectioned with the freezing microtome.

Plant physiologists use agar as a vehicle to carry test solutions in the standard *Avena* method for the quantitative determination of plant growth hormone. In the analytical laboratory, agar is useful as a coagulant for barium sulfate, since the addition of mere traces of the colloid causes flocculation of an ordinary analytical precipitate of barium sulfate in a very short time.

In colloid research, agar is one of the classical materials. Much of our present knowledge concerning the behavior of hydrophilic colloids has been based on studies of agar.

Sodium alginate is employed by scientists working with sex hormones.

In Agriculture

When cultures of nitrogen bacteria are prepared by inoculating humus or peat, agar serves to coat and protect the granules. These are mixed with chemical fertilizers to be introduced into the soil for providing a good supply of these beneficial soil micro-organisms. There are on the market several commercial agar cultures of certain superior strains of soil bacteria such as *Rhizobium* species for promoting crop production.

Agar and algin have been used in agricultural sprays, in which they activate the insecticide to a noteworthy degree and greatly reduce the necessary amount of the effective chemical.

As Impression Materials

Until the outbreak of the war, when agar was frozen by the War Production Board and its use restricted to preparing microbiological culture media, about 75,000 pounds a year were used to make impressions for dental plates. A substitute was soon found in another seaweed product, algin, and this, with the proper chemicals and fillers added to give the necessary toughness and resistance, is probably now used as a base as much as agar.

Algin-based dental materials do not produce as accurate molds as do the agar-based ones. They are, however, more convenient to use, since the dentist has only to add warm water to the commercial mixture, stir and pour the resulting paste into the oral cavity, and in about two minutes the necessary mold is obtained. For general purposes the algin mixtures are therefore used. Agar materials are preferred for critical inlay and fixed bridge works, where great accuracy is necessary.

In Cosmetic Preparations

Phycocolloids are variously employed in the cosmetic industry as binders, emulsifiers, gel-formers and bodying agents. Irish moss is a regular ingredient in many tooth pastes. A thick mucilage of carrageenin is used in deodorant pastes. It serves as the base of sulfonated oil curling jellies. It is also an ingredient of compact powders and rouges.

Algin is probably the most useful seaweed product in the cosmetic industry. Its value lies in its ability to produce standard preparations of controllable consistency, which are transparent, water-white, and almost odorless. Ordinary preparations made with karaya gums have a grayish-brown color, and those made with tragacanth are quite opaque. Another advantage of algin preparations is the wide range of controllable viscosity, effected by the addition of calcium ions to sodium alginate solutions. The preparations may either be thickened to creams or converted into jellies, depending on the amount of the calcium salt added.

Because of its unique properties, algin is used in a great variety of cosmetic preparations, such as glycerine hand jellies, beauty milks, creams, mouth washes, hair pomades, hair fixatives, and lotions for transparent hair-setting.

In Varnishes and Paints

Both carrageenin and algin are employed in making water paints. Casein paints stabilized with carrageenin are easily applied and adhere to the surface while drying. Recently sodium alginate has been extensively used in the preparation of vehicles for resin emulsion paints, the algin serving as an emulsifier. Sodium alginate dissolves shellac to form a lacquer which dries to a tough, tenacious film. Treatment with dilute acids or calcium chloride solution renders this film insoluble, hence useful as a waterproof

THREE SOURCES OF ALGIN, A SEAWEED DERIVATIVE

The broadleaf kelp (*Laminaria saccharina*) and the horsetail kelp (*L. digitata*), at the left and center, both of which are found along the East Coast, and the seaweed at the right, a very young plant of *Macrocystis pyrifera* from California, are the three important algae from which the phycocolloid ALGIN can be extracted. It is used in such products as frozen desserts, commercial cake icings, cosmetics, paints, and dental impression materials, as well as in many industries. (*Laminaria* photographs by courtesy of William Randolph Taylor; the left and right pictures by courtesy also of the *Scientific Monthly*.)

varnish. Coated over asphalt paints for steel plates and insulated wires, sodium alginate helps to prevent the painted surfaces from adhering to each other. Algin is used as a stabilizer for camouflage paints. Copper alginate serves as a dressing for canvas and burlaps to prevent mildew.

At the United States Forest Products Laboratory, a new type of fire-retarding compound has been developed, consisting of finely ground fire-retarding chemicals dissolved and suspended in an aqueous sodium or ammonium alginate solution. Best results are obtained with mono-ammonium phosphate as the fire-retardant, although satisfactory preparations are also made from a mixture of borax and boric acid.

As Coating Materials

Recently ammonium alginate has been adopted for coating dentures made of acrylic resin to take the place of tinfoil, which has not been available for this purpose because of the war. Two coatings of the alginate solution are applied with a brush to the gypsum molds when these are still warm from the wax removal. When dry, these are immersed in calcium chloride solution, and thus converted *in situ* into insoluble calcium alginate coatings. It is believed that the use of alginate in coating dentures will be continued because of the greater ease and uniformity with which it is applied.

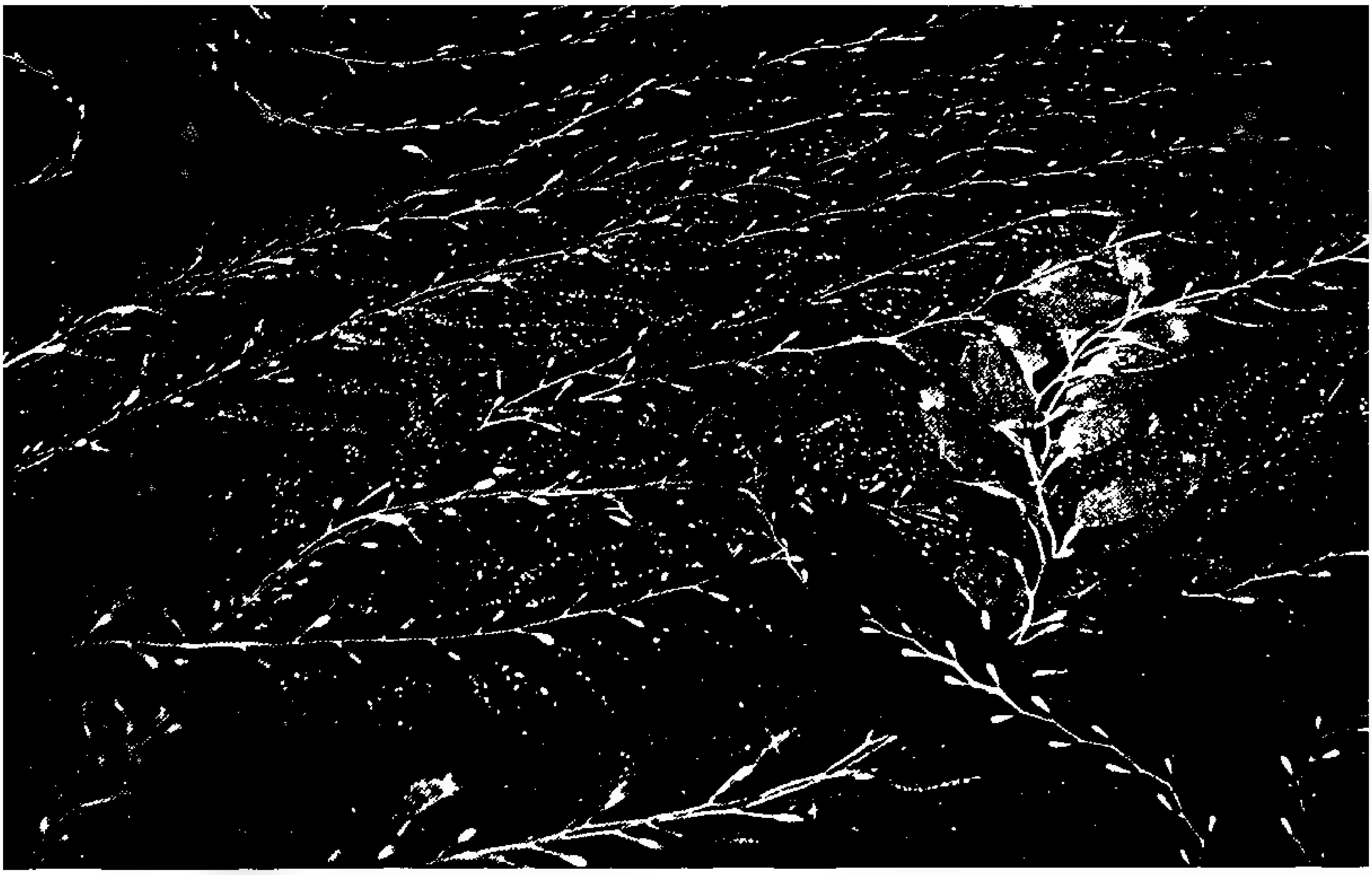
Another useful coating material made from algae is called triethanolamine alginate, which is prepared by adding triethanolamine to alginic acid. This results in a rather stiff and heavy paste, which produces a smooth, soft, flexible and strong film readily soluble in water but insoluble in oils and greases. It is strongly adhesive and may be used to coat solid surfaces such as cheese, meat, and even metals, plastics and various other articles. Unlike some of the other alginates, it is not readily attacked by molds and other micro-organisms.

In Creaming of Latex

An important use of algin is in the rubber industry, where it acts as a creaming agent to separate the rubber from the serum—the rubber-free lower layer. Formerly Irish moss and other hydrophilic colloids were used for this purpose. In recent years ammonium alginate and, to a lesser extent, locust-bean gum, have been the principal creaming agents. A very small amount (about 0.04%) of the phycocolloid is sufficient to bring about the separation of rubber.

In Photographic Films

Though agar alone is unsuitable for use in certain photographic materials because of its tendency to stick to gelatin and its insolubility in organic solvents or in alkaline solutions, the esters of agar are soluble in a number of organic solvents and can therefore be employed as coatings



Out in the ocean near Laguna Beach, California, this kelp, *Macrocystis pyrifera*, patterns the surface of the water with a mosaic of bright brown. Besides being one of the sources of algin, this abundant seaweed is used in making kelp meal for stock feed and kelp pills, containing certain minerals and vitamins (Photograph by courtesy of U. S. Fish & Wildlife Service.)

or backings for photographic films, from which they may be later removed by means of alkaline solutions. Backings are required to keep the films flat and, to some extent, to carry colored materials for minimizing halation.

In Liquor Clarification

Before liquor prohibition in the United States, one of the most important uses of carrageenin was in the fining of beers and ales. In early stages of beer brewing, the cloudy solution of malt extract contains insoluble materials and undesirable proteins. These can be removed by natural slow setting or rapid fining with the help of a clarifying agent. Carrageenin has the ability to combine with the tannin of hops to form a gelatinous mass, which absorbs the suspended impurities. The resulting flocculent mass is easily removed as a scum. At present, while carrageenin is still being used in the liquor industry, it has been partially replaced by other chemical finings.

Algin finds use for the purification of beet juices in sugar manufacture. Sodium alginate is added to the liquors, and, upon subsequent acidification, forms the insoluble alginic acid. The suspended impurities adhere to the colloidal micellae, which settle in a precipitated gelatinous mass, and the liquors are thus clarified.

As Wire-Drawing Lubricant

In the hot-drawing of tungsten wires for electric lamps a lubricant is necessary. At present the lubricant is an agar gel in which powdered graphite is mechanically held in suspension. Formerly the industry used an expensive material known in the trade as "aqua-dag," procurable only from limited sources. The agar-based lubricant is not only relatively inexpensive and easily procurable but also more efficaceous. The agar gel is able to hold in suspension larger particles which, within certain ranges of size, provide more complete and uniform protective covering on the exterior of the wire.

In Boiler Water Treatment

In modern steam plants, the elimination of scale-forming salts in boiler feed water is of utmost importance. Crude algin is now extensively used in the water treatment. Its value lies in its reaction with the calcium and other scale-forming metallic ions in hard water. The precipitated calcium alginate forms globular flocculent masses and envelops other sediments to give a soft pasty sludge, most of which can be blown out of the boiler at regular intervals. Being flocculent and hydrated, the calcium alginate precipitates are not likely to adhere to the heated surfaces of the boilers, and thus scale formation may be avoided. Alginate also appears to interfere with crystal growth, which in itself is a long step toward scale prevention.

In Leather Finishing

Carrageenin imparts to certain types of leather a desirable gloss and stiffness. It is principally used in the finishing of straight grains and grain upper leathers. Carrageenin solution is brushed on the leather, which is then glazed by rubbing with glass cylinders. This mucilaginous substance smooths and holds down the tiny rough projections on the surface of unfinished leather.

In inner soles, carrageen is used as a filler to import stiffness and body to them. Its use also helps in the waterproofing of very heavy leather. When used in shoe polish and leather dressing, carrageenin serves to restore the finish to worn scuffed leather. According to Chase (1942) one shoe manufacturer in New England alone used to import annually about 12,000 pounds of *Chondrus crispus* from Ireland solely for leather finishing.

Miscellaneous Uses

There are still more industries which use the products of algae. A mere enumeration of some of them is all that can be presented here. For example:

Shredded agar may be incorporated in small amounts in tobacco to retard excessive evaporation of moisture.

In hectograph duplicators, agar is used to make the gelatinous rolls.

Agar is reported to be used in the manufacture of submarine storage batteries.

A mixture of alginic compounds with an inert siliceous substance and concentrated sulfuric acid, after heating and washing free from the acid, makes an efficient color-absorbing material in decolorizing liquors.

Algin is reported to be used as a binder in cartridge primers. It is also employed in oil-well drilling muds to seal off porous formations, in can-sealing compounds, as a medium for separating plates in manufacture of storage batteries, and as a binder for printer's ink.

Algin and carrageenin both are used in making calico printing pastes.

Recently great interest has been shown in certain alginic fibers as possible textile materials. Chromium and beryllium alginate fibers are of special interest because of their strength and their fire-retarding properties, and some United States patents for their manufacture have already been granted.

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The California Big Tree at Aurora, New York

By W. C. Muenscher, Cornell University

IN May, 1923, while on a field trip, accompanied by Dr. A. S. Foster, my attention was called to a California Big Tree (*Sequoiadendron giganteum*) growing in a field north of the village of Aurora on the eastern shore of Cayuga Lake in central New York. A report of its occurrence and a description and a photograph of the tree were published in *American Forests and Forest Life.*[1] As was pointed out at that time, this individual tree was of special interest because of its unexpected location, its size, apparent healthy condition, and its supposed age. Since the appearance of the article in 1924 many botanists, horticulturists and others have become interested in this Big Tree; even within the last year several inquiries have been received about it.

The tree was killed in the severe winter of 1935, but it was not until 1945 that I obtained permission from the present owner to fell the tree.[2] This note, explaining its ultimate fate, will shed some light upon the age of the specimen. At the time of its death in 1935 this tree was approximately 65 feet in height and 50 inches in diameter at its base. It was 48 inches in diameter one foot above the ground level and 33 inches in diameter 4½ feet above the ground. Several attempts on my part to germinate seeds from this tree and to propagate it by cuttings failed. So far as I have been able to determine, attempts by several others to root cuttings likewise did not succeed.

Along the highway near the tree, sometime between 1925 and 1935, a New York historical marker was erected bearing the following inscription:

"SEQUOIA, CALIFORNIA REDWOOD, PLANTED IN 1826, BY PETER SMITH."

This marker proved of much interest to passing tourists and others and helped to perpetuate the local tradition that the tree had been planted on this site between 1820 and 1830 after it had been brought by boat from California.

The botanist interested in this tree finds two faults with the above inscription. (1) The tree was a California Big Tree and not a California Redwood (*Sequoia sempervirens*). (2) If this particular individual tree had been planted in 1826 it would mean that New York State had a California Big Tree growing in it more than 20 years before the botanical discovery of the Big Tree in 1852. Of course this is not an impossibility

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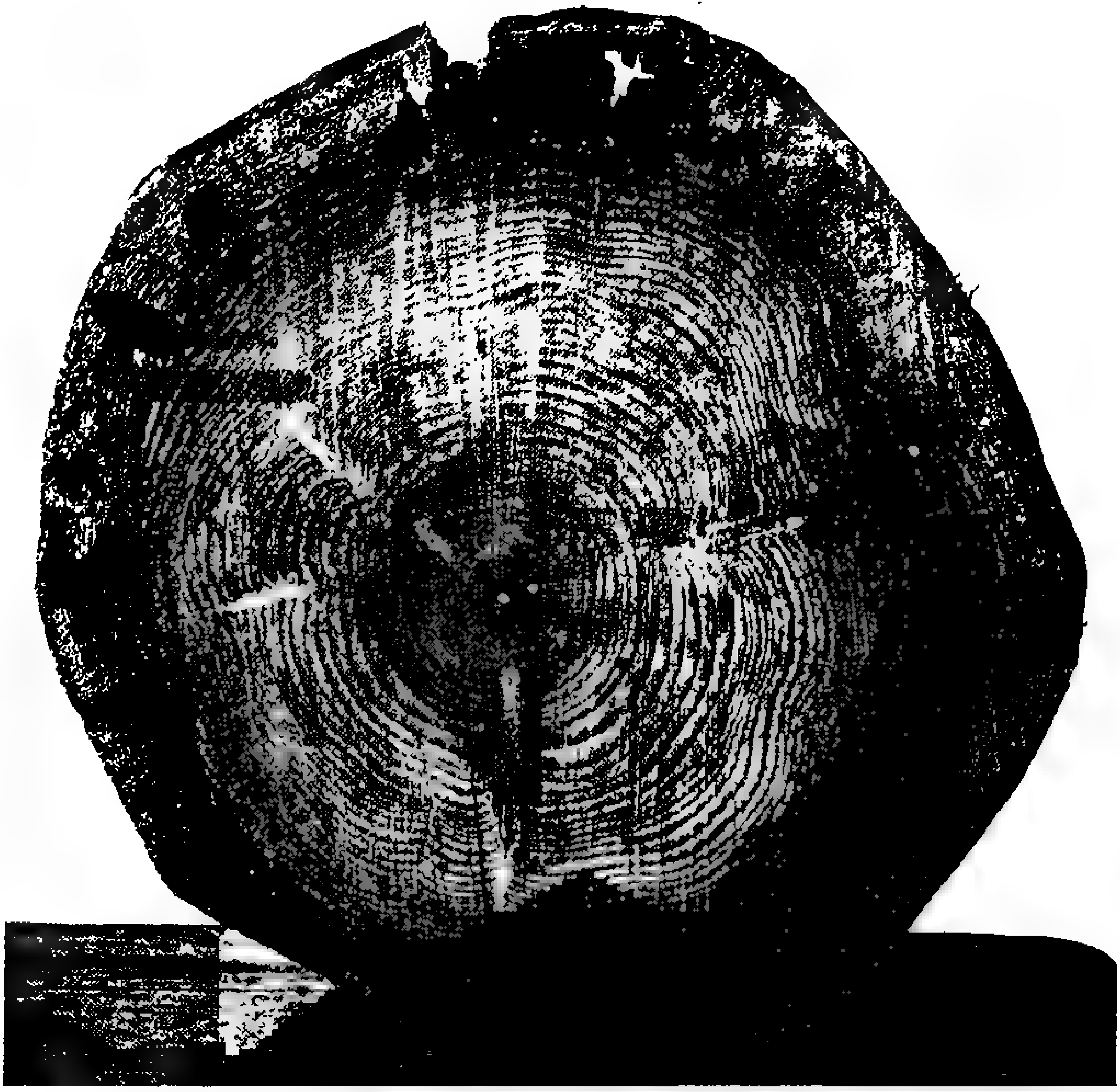
[1] Muenscher, W. C., A Sequoia tree far from its home. Vol. 30: p. 617, 1924.

[2] I am indebted to my assistant, Miss Babette I. Brown, for help in felling the tree, preparing the cross-sections and counting the growth rings. I wish to acknowledge the co-operation of Mr. O. H. Kenyon of Aurora, New York, for granting permission to fell the tree and to remove such parts as were necessary to determine its age.



CROSS-SECTION OF TRUNK OF CALIFORNIA BIG TREE AT AURORA

Taken 4½ feet above ground, the diameter is 33 inches and shows 62 growth rings. The bark has been removed. The outer 18 rings represent sapwood which is badly decayed. The last ring was laid down in 1935. From the outside toward the center, each of the first six white dots delimits ten rings. The space between the two dots near the center contains two rings. (Photo by W. R. Fisher.)

but it appears highly improbable. The species was not botanically described and named until 1853. A few white men—mostly immigrants, trappers and prospectors -undoubtedly saw Big Trees growing in the Sierra Mountains prior to 1852. It seems highly improbable, however, that any of these trees were transported to tidewater where they could have been loaded on ships for transportation as early as 1830.

The Aurora tree was felled on April 7, 1945, ten years after its death. By this time the upper 30 feet of the crown had been broken off by the wind. Much of the sapwood of the remaining 35 feet of trunk left standing had decayed badly, but sufficient was sound enough to permit the determination of the growth rings. The heartwood was still sound but heavily water-logged near the base. The bark, about four inches thick at the bottom of the trunk, was intact.

From independent determinations along several radii on cross-sections of the base of the tree (less than one foot above the roots) the number of growth rings was established as 67. In this latitude and climate there is only one growing season each year; therefore, each growth ring represents the growth of one year, or an "annual ring." The annual rings may be used to determine the age of the tree. Since the tree died in 1935 after growing 67 years, it appears to have been planted after 1868 unless we assume that it was less than one foot in height at the time it was transplanted to the Aurora site. Since the height and age of the tree at the time of transplanting are not known, it may not have been transplanted until several years after 1868. The study of the growth rings leads to the conclusion that this individual tree lived not less than 70 years and at the most not more than 75 years, assuming that it lived 5 years before it attained a height not to exceed one foot.

Since the tree died in 1935 after having lived less than 75 years, it is obvious that it could not have been transplanted in 1826. If it had been transplanted on that early date it would have been at least 109 years old at the time of its death.

A critical examination of this tree's own record does not support the legendary explanation of its early adventurous sea voyage from California to New York in 1826. A more plausible explanation is that it may have been one of many seedlings that were grown in the decade of 1860 in a nursery in Rochester, New York. A number of these seedlings were planted in various places in the northeastern United States and Europe. In 1924 I could find trace of only two large California Big Trees in the northeastern United States, the Aurora tree, and another in the Painter Arboretum, near Philadelphia. In 1931 I saw a number of them about the same size in botanical gardens in Europe—in Edinburgh and Prague and in several places in between. Those planted in Europe, for some reason, seem to have fared better than those in the eastern United States.

In view of the fact that the dead tree has now been felled and the historical marker removed, this note may serve to correct any false impressions gained from the misleading statements inscribed thereon. For future record and reference, herbarium specimens of leafy shoots and mature cones of this tree and also a cross-section of its trunk taken 4½ feet above the ground have been deposited in the herbarium of the Department of Botany at Cornell University.

Torrey Botanical Club Observes Garden's Semi-Centennial

CELEBRATION of the fiftieth anniversary of the New York Botanical Garden was officially brought to a conclusion January 8 with a program in the Members' Room arranged by the Torrey Botanical Club. Preceded by a luncheon served to more than 60 members of the club and of the Garden staff, the program consisted of addresses by Dr. L. C. Petry of Cornell University, Dr. Jacob R. Schramm of the University of Pennsylvania, and Dr. Edmund W. Sinnott, Director of the Sheffield Scientific School at Yale and a member of the Garden's Corporation.*

Dr. F. J. Seaver, retiring President of the Torrey Botanical Club, opened the occasion with a brief address in which he spoke of the appropriateness of the very room being used for the program, because it was the room in which for many years both Dr. and Mrs. N. L. Britton had worked and where Dr. John K. Small and Percy Wilson also had their offices. He reiterated the story of the original plea made by Dr. and Mrs. Britton to the club in 1888—the plea which resulted in the Torrey Club's promoting the founding of the New York Botanical Garden.

After a few words from Dr. William J. Robbins, Dr. Petry spoke on "The Place of Botany in General Education." He was followed by Dr. Schramm on "Objectives of a Course in Botany for College Students." Dr. Sinnott closed the program with an address on "Botany in the Next Half Century."

"Science is progressing, in contrast to esthetics and philosophy," Dr. Sinnott said. "Fifty years ago, the ultimate aim of botany was to establish a natural system of plant classification." From there he described the multitudinous fields into which botany has extended, and into which it may extend in the next fifty years. "Biology, of which botany is a part," he said, "should become the synthesis of all scientific thought."

Dr. Sinnott discussed the relation between the study of physics and bio-chemistry and of botany, particularly as they concern understanding of the structure and composition of protoplasm, of respiration, photosynthesis, morphogenesis, enzymes, light, radio-activity, and "tracer" elements in mineral nutrition of plants. He also referred to antibiotics, experimental evolution, viruses, phylogeny, to ecology and plant distribution in their relation to geology, and to the subjects of growth, the action of genes, and electrical systems in living matter.

"The older aspects of botany should be pushed vigorously in the direction of the newer fields of the science," he said, remarking also that students should be trained to think philosophically, not taking their botany as something abstruse, but as something vitally affecting life. Among his examples he mentioned the recently increased respect of medical men for the science of botany, largely because of penicillin and other antibiotics, and development of better crop plants through botanical research.

The Torrey Club's day of celebration was continued in the evening with the annual dinner at the Men's Faculty Club at Columbia University, when Dr. Joseph Brandt, President of Henry Holt & Co., spoke on "Science Writing and Politics."

At the club's annual meeting which followed the dinner, Dr. P. W. Zimmerman of the Boyce Thompson Institute was elected President to succeed Dr. Seaver.

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* Dr. Sinnott has since been elected to the Garden's Board of Managers.

Notices and Reviews of Recent Books

(All publications mentioned here may be consulted in the Library of The New York Botanical Garden or may be purchased on order through the Library.)

Vegetation of the Far East Described For Men In Service

PLANT LIFE OF THE PACIFIC WORLD. Elmer D. Merrill. 295 pages, illustrations, glossary, index. Macmillan, New York, 1945. $3 50

Most of the good things resulting from the war are so bound up with the bad, or so complicated, that we do not know yet whether they are really good or not. "Plant Life of the Pacific World" is, however, a result of the war that is pure gain. As a logical consequence of the presence in the Pacific Islands of hundreds of thousands of men, the dean of the botanists interested in the Pacific flora was stimulated to take time out and summarize his vast knowledge of this fascinating flora and vegetation. This is especially significant since he is the world's acknowledged authority on the plants of much of this area. Too often those who know a great deal never get around to writing down a general picture of what they know—they are too busy with the details and it is left to the less competent to perform this essential task of generalization.

After a chapter summarily disposing of the imaginary perils and horrors of the tropical jungle, and an elementary one for the beginners on plant classification, Merrill takes up the main vegetational formations to be seen in the islands. The strand formation, the one likely to be seen first and by most people, is discussed first. Then follow the mangrove, the secondary forest, and finally the primary forest, the wonderful climax vegetation of the tropics with its unbelievably complex flora. The common and obvious genera and species in the first three formations are discussed and well illustrated by over 250 simple but good line-drawings. There are so many species in the primary forest that it is practically impossible to pick out those that are dominant or even characteristic of any large area. Certain genera are *considered*, but only a small scattering. The dipterocarps and *Eucalyptus* are especially mentioned, and the phenomena of the dwarting of vegetation at high altitudes and the presence of temperate zone genera on the high mountains are brought out.

Special characteristics of tropical plants, interesting and curious species of tropical weeds, cultivated plants and food plants are all given attention. It is made obvious that there is little need to starve in the jungles of the Old World Tropics for anyone with a little knowledge of the plants.

Naturally, among the most fascinating chapters in any book on island floras are those on the distribution of the plants. How did they get to the islands? Where are their relatives? What bearing have they on prehistoric geography? These chapters in Merrill's book live up fully to expectations. Good maps are provided to clarify these discussions. The one place that leaves the critical reader wishing for a further exposition of the author's opinions is the matter of those much discussed "old" or "archaic" elements of the floras, plants that have no obvious close relatives anywhere. These are an important feature of insular floras (and faunas) that must weigh heavily in any final consideration of the subject.

An excellent discussion of local names follows, based mainly on those of the Philippine and Malayan languages. A consideration of certain particular island groups, the history of botanical exploration, mention of work yet to be done, a short bibliography of publications essential to the study of these floras, directions for preserving and sending in specimens, and a short glossary of botanical terms complete the book.

Of course, the book shows signs of having been rushed to completion to meet an immediate need, even at the expense of the smoothness and polished English that might have been expected. It is written much as though an extended extemporaneous discourse had been recorded and sent, without further ado, to the printer. Certain botanical flaws have inevitably crept in, such as the assigning of the genus *Saurauia* on one page to the family Dilleniaceae and on the second page following (100) to the Actinidiaceae. One misconcept deserves note. In the discussion of endemism the terms *endemic* and *indigenous* are contrasted as opposites, when actually, any endemic species is automatically also indigenous. The alternative should have been *widespread* or *wide ranging*.

An unusual feature of the book is its extreme interest and readability. A belief has become current, perhaps fostered by those popular science writers whose stock of facts is a bit low, that factual material must be colored, doctored up, and diluted with emotional pap and fancy language to be made palatable. This notion is very effectively disposed of by Merrill's book. I detected not a single sentence of such writing; there are no wasted words. Here is a book whose major fault is that there is not space enough for more information of a factual nature. All that is required to be able to read this book is a rudimentary intellectual curiosity.

In his introduction Merrill says, "This work has not been prepared for the professional botanist. . . ." The reviewer, however, though perhaps one of the small number who are reasonably familiar with some of the floras under consideration, is one professional botanist who found the book stimulating, informative, and well worth reading. If the other books of the Pacific World Series even approach this one in quality of information and presentation, an eminent contribution to synthetic as well as popular science will have been made.

F. R. FOSBERG.

Flax and Civilization

THE STORY OF LINEN. William F. Leggett. 102 pages. Chemical Publishing Co., Brooklyn, 1945. $2.75.

This book makes mighty good reading for everybody, even though you may start out with only the faintest interest in linen as such. Mr. Leggett's charming personality and reputation as raconteur are a delight to his friends, and will become so to you—for the man shines through every page. The student of fibers will recognize that a lifetime of discerning research lies back of the historical data included. The layman will be led enjoyably to a realization of how closely the story of linen parallels civilized advancement in other fields.

BERNICE S. BRONNER,
Textile Technologist.

Greener Grass

BETTER LAWNS. Howard B. Sprague. 205 pages, illustrated, indexed. American Garden Guild and Doubleday, Doran, New York. New edition, 1945. $2.

This is a well thought out treatise on the making, maintaining, and general upkeep of a lawn. However, on page 190 the author says that for the control of chinch bug one can use a liquid spray of nicotine sulfate, along with a gallon of 40% liquid soap to each 100 gallons of spray. If this mixture is used on a lawn that had previously been treated with arsenate of lead for Japanese beetle grubs (as lawns should be), burning may result.

Generally speaking, however, I would give the book a worthy O.K.

JAMES B. JACK,
Superintendent, Glencliff Estate,
Mt. Kisco, N. Y.

Desert Woodies

A MANUAL OF SOUTHWESTERN DESERT TREES AND SHRUBS. Lyman Benson and Robert Darrow. Biol. Sci. Bull. No. 6 in Vol. 15, No. 2 of University of Arizona Bulletin. 411 pages, illustrated, indexed. University of Arizona, Tucson, 1945.

Although intended primarily as a "semipopular" guide to the woody plants of our southwestern deserts—and really accomplishing this in an excellent manner—there is nothing of the looseness in the text which long experience has taught us to expect from "semitechnical" works. The line drawings, for the most part, are quite clear, the half-tones illustrate the general habits of the various species, the two-color distribution maps are easily visible, and the numerous natural-color reproductions enliven the text. Serving as it does the desert areas of California, Nevada, Utah, Arizona, New Mexico and Texas (and by inference the adjacent desert areas in northern Mexico), this text fills what has been a conspicuous need among our regional Floras. It is perhaps unfortunate that a book of this size and quality is available only in paper binding.

W. H. CAMP.

Wine from One's Own Grapes

GRAPES AND WINES FROM HOME VINEYARDS. U. P. Hedrick, 326 pages, illustrated, indexed. Oxford University Press, New York, 1945. $3.50.

The subject matter of this volume is indicated by the chapters as follows: Part I, The Home Vineyard with chapters on Cultivated Grapes; The Grape Plant; Propagation; Climates, Sites, and Soils; Planning for a Vineyard; Planting a Vineyard; Care of a Vineyard; Insects and Fungi; Pruning; Old World Grapes in Eastern America; The Vintage; Vineyard Miscellanies; Grape-breeding; and Varieties of Grapes. Part II, Wines from a Home Vineyard with chapters on American Wines; The Home Winery; On Making Wine; On Making Red Wines; On Making White Wines; On Making Sparkling Wines; The Care of New Wine; On Serving Wines; Wine Drinks; Wine in Cookery.

These various topics are presented clearly, concisely, authoritatively and in an interesting manner. Part I presents everything that one needs to know on the culture of grapes in the northeastern states. Part II is devoted to the making of wines in the home.

A. B. STOUT.

Plant Collecting in Brazil

BRAZIL: ORCHID OF THE TROPICS. Mulford and Racine Foster. 314 pages, illustrated. Jaques Cattell Press, Lancaster, Penn.

This is primarily an account of several expeditions of two enterprising plant collectors into various parts of the central and western Brazilian jungle and savannah wilderness. The Fosters specialized in bromeliads, and it is evident that in this field their collecting was both extremely extensive and extraordinarily complete. To a lesser degree, they were also engaged in the collection of orchids and other epiphytic flora. Their travels, as covered by the book, ranged from Rio de Janeiro and São Paulo to the hinterland of Matto Grosso, and included work in Bahia, Espirito Santo, and Minas Geraes, among other states. It did not include Pará or the Amazon region.

The account is soberly and realistically told, with none of the spurious coloring and emphasis sometimes found in books of this kind. It is primarily a travelogue, and bromeliads and orchids, though extensively treated, enter in specific relation to the story of their collection.

One of the most charming features of the book is its illustrations. There are four truly beautiful color photographs of bromeliads, and a wealth of black-and-white photographs. Most of the latter are excellent also. In a few of them, line retouching, obviously done in order to bring certain features of the original into sharp relief, is a little too evident. In one, facing page 36, the title is puzzling since the "Dr. Hoehne" mentioned seems nowhere in evidence. In addition to the photographs, there are numerous, and frequently unusually effective, line drawings by Mulford Foster.

The text is adequate, but the style would stand a good deal of improvement. There are one or two minor inaccuracies noted by the reviewer, though these do not occur in any areas in which the authors are specialists. The reference to the ocelot as a "huge, gorgeously striped 'cat' of Brazil," for example, on page 275, could be a bit misleading, since it is doubtful whether these very modest-sized spotted cats prey upon cattle, except possibly on extremely young stock, and the behavior of a cornered animal as described sounds somewhat bolder than ocelots usually are. In many parts of South America TIGRE refers to the much larger, heavier, and more dangerous jaguar, and perhaps this is what is intended.

Altogether, the book is worth reading by those who would gain a glimpse of jungle and savannah conditions in middle Brazil, and particularly by those interested in bromeliads, which are treated unusually well. It is an interesting and clearly unexaggerated account of a full and strenuous collecting expedition.

CARYL P. HASKINS,
Union College,
Schenectady, N. Y.

Current Literature*
At a Glance

By Harriet K. Morse

DDT. By last October, it is reported, one news clipping service had piled up 20,762 items on DDT. To get at the truth behind these, the January 1946 issue of *Fortune* magazine contains an up-to-date, illustrated report on the findings regarding this first-rate insecticide—its effectiveness, failures, toxicity, and methods of application.

Gardens by Thomas Church. Modern design in landscape architecture is skillfully interpreted by one of the leading California landscape architects in *The Architectural Forum* (August 1945). The qualities which distinguish Thomas Church's gardens are structural simplicity, informality, usefulness, and economy of upkeep. His design is deftly created through the use of brick, stone, stucco, and wood, to the accompaniment of well selected plant materials. Excellent ideas may be gleaned from the 21 illustrations which accompany the text.

For Lily Enthusiasts. The Lily Committee of the American Horticultural Society has published an informative bulletin of news reports from member groups in various sections of the United States, Canada, and overseas. The articles discuss new varieties, latest cultural theories, disease control, hybridizing, and other topics. This bulletin, also reprints of lily articles from the *National Horticultural Magazine*, are made available to non-members of the society for a small fee collected for the Lily Committee.

Recommended Vegetables. Of great interest to the vegetable gardener is a series of five articles on disease-resistant and hardy vegetables written by Victor R. Boswell of the U. S. Department of Agriculture for the *National Horticultural Magazine*. The first article (April 1944) discusses beans; the second (July) evaluates cabbages, celery, and sweet corn varieties; the third (October), cucumbers, melons, squashes, and pumpkins; the fourth (October 1945), the solanaceous vegetable "fruit" crops such as eggplant, peppers and tomatoes. The concluding article is scheduled for April 1946.

Care of Fruit Trees. The following bulletins are of special interest to those who grow fruit trees: "Pruning Fruit Trees," dealing with "the one operation that is most generally misunderstood and misused in its practical applications" (W. Va. Agric. Exp. Sta. Extension Circular No. 341); and "Nitrogen Fertilizers for Fruit Trees," explaining why "no other fertilizer is likely to be as effective for the maintenance of desirable growth and yield of fruit trees as one containing nitrogen, particularly in readily available form." (Missouri Agric. Exp. Sta. Bulletin 489).

Shall I Buy a Farm? The 31-page pamphlet by this title evaluates the various phases of farm selection, budgeting, and possible returns. It suggests also how to study such types as vegetable, fruit, livestock, and dairy farming (N. J. Agric. Exp. Sta. Bulletin 719).

Wax Begonias. "Your chances for success with ever-flowering or wax begonias (*B. semperflorens*) are perhaps better than with any other flowering houseplant," writes W. D. Holley in the *Flower Grower* for December. He discusses soil, exposures, watering, temperature, feeding, troubles, propagation, and summer care. Sixteen of the most popular single-flowered varieties are listed and a few double varieties suggested.

Dahlias. Three experts have selected the best dahlia varieties for 1946 and provided a rating table for the East, Mid-west, and Pacific Coast in the *Flower Grower* for December.

Making a Herbarium. The Herb Society of America has published a 10-page pamphlet of suggestions for the collecting, preparation, and mounting of dried plant materials. It is intended primarily for the amateur, or as a possible garden club project. The Journal of the New York Botanical Garden in May 1930 published instructions for preserving herbarium specimens.

* All publications mentioned here—and many others—may be consulted in the Library of the Botanical Garden, in the Museum Building.

Notes, News, and Comment

Members' Days. In place of the report on the Garden's Mexican expedition of 1944-45 by E. J. Alexander scheduled for the Members' Day program of Dec. 5, Dr. W. H. Camp related some of his experiences of the three years he spent away from the Garden, especially of the last six months before his return late last October, when he was exploring in Ecuador for plants for the New York Botanical Garden. He displayed cotton textiles in which the design was introduced by tieing and dyeing the yarn before weaving.

The horticultural exhibit of the day featured plants that he had sent back from the expedition. Among them were species of *Tropaeolum, Oxalis, Begonia, Passiflora, Cobaea, Solanum, Tradescantia, Bomarea, Costus, Cyphomandra, Amaryllis,* and *Epidendrum.* Two of the species of *Solanum* are plants widely used for their fruits in South America—*S. quitoense,* the NARANJILLA and *S. muricatum,* the PEPINO. It is likely that three different species of *Tropaeolum* are represented in the specimens that were displayed, all of which were in full flower. Several new species of other genera shown are expected to be found when the task of identification begins. Most of the plants on display had been grown from seeds or other living parts shipped from Ecuador and flowered in the Garden's greenhouses.

At the January Members' Day program, at which Dr. Arthur Cronquist spoke on "The Working Technique of a Taxonomist," Dr. F. J. Seaver exhibited a specimen of *Polyporus sulphureus,* an edible fungus which had sprouted in the greenhouse. Numerous orchids and other plants of interest were displayed, and a brief description of some of the more unusual ones was given by T. H. Everett.

Mrs. A. Sherman Hoyt. The donor of the miniature desert which for five years was a feature of the cactus house in Range I at the New York Botanical Garden, Mrs. A. Sherman Hoyt, died Dec. 15 at her home in Pasadena, Calif. Mrs. Hoyt had been a Life Member of the New York Botanical Garden since 1930. The authentic southwestern desert scene which she provided for the Garden in 1928 contained about 50 characteristic species of plants, in a naturalistic setting with sand, stones, and examples of animal life. The scene was originally on view at the International Flower Show in New York, where it was displayed primarily in the interest of the Conservation Committee of the Garden Club of America.

A second miniature desert scene provided by Mrs. Hoyt and originally displayed in Boston was later set up in a specially built glass house at the Royal Botanic Gardens at Kew, England.

Mrs. Hoyt's major interest was preservation of native desert plants, and she was President of the International Desert Conservation League, which she founded around 1930. It was largely through her persistent and enthusiastic work that Joshua Tree National Monument, a million-acre tract near Twenty-Nine Palms, Calif., was set aside by the Federal Government in 1935.

Mrs. Hoyt was also active in musical circles, and was founder of the Music and Arts Association of Pasadena, as well as president of the old Los Angeles Symphony Orchestra.

Visitors. Dr. Ugo Cenóz, Argentinian plant pathologist from Buenos Aires, spent the day at the New York Botanical Garden Dec. 28. Theodor Just of Notre Dame University, Editor of *The American Midland Naturalist* and of *Lloydia,* and Clarence E. Kobuski of the Arnold Arboretum were visitors Dec. 27. Llewelyn Williams, botanist at the Chicago Museum of Natural History, with Mrs. Williams, was at the Garden for several days the last week in December.

Among other recent visitors have been Miriam Bomhard of the U. S. Forest Service in Washington, who worked on palms in the herbarium Jan. 17 and 18; Ralph W. Chaney, Berkeley, Cal.; Clarence J. Hylander, who has been appointed editor of scientific books for Macmillan; John D. Dwyer of Albany, N. Y.; G. T. Nightingale of the Hawaiian Pineapple Co.; A. N. Langford, Lennoxville, Quebec; Dr W. R. Arde, amateur mycologist of Philadelphia; Mr. and Mrs. Albert Linton, Philadelphia; and W. E. Roever, Oved Shifriss, and Miss E. H. Lintleman of the Burpee Company, Doylestown, Pa.

Lectures. Dr. H. W. Rickett addressed the Garden Club of Greenwich Jan. 15 on "The World of Plants." Dr. W. H. Camp talked on "Plant Hunting in Southern Ecuador" before the Torrey Botanical Club at the Garden Jan. 16.

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

An Illustrated Flora of the Northern United States and Canada, by Nathaniel Lord Britton and Addison Brown. Three volumes, giving descriptions and illustrations of 4,666 species. Second edition, reprinted. $13.50.

Flora of the Prairies and Plains of Central North America, by P. A. Rydberg. 969 pages and 601 figures. 1932. Price, $5.50 postpaid.

The Bahama Flora, by Nathaniel Lord Britton and Charles Frederick Millspaugh. 695 pages. Descriptions of the spermatophytes, pteridophytes, bryophytes, and thallophytes of the Bahamas, with keys, notes on explorations and collections, bibliography, and index. 1920. $6.25.

North American Cariceae, by Kenneth K. Mackenzie, containing 539 plates of *Carex* and related plants by Harry C. Creutzburg, with a description of each species. Indexed. 1940. Two volumes, 10¾ x 13½ inches; bound $17.50; unbound $15.50.

Keys to the North American Species of Carex by K. K. Mackenzie. From Vol. 19, Part 1, of *North American Flora.* $1.25.

Food and Drug Plants of the North American Indian. Two illustrated articles by Marion A. & G. L. Wittrock in the Journal for March 1942. 15 cents.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal, 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 15 cents.

The Flora of the Unicorn Tapestries by E. J. Alexander and Carol H. Woodward. 28 pages, illustrated with photographs and drawings; bound with paper. 1941. 25 cents.

Catalog of Hardy Trees and Shrubs. A list of the woody plants being grown outdoors at the New York Botanical Garden in 1942, in 127 pages with notes, a map, and 20 illustrations. 75 cents.

Succulent Plants of New and Old World Deserts by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. Second edition 1944. 50 cents.

Periodicals

Addisonia, annually, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Now in its twenty-second volume. Subscription price, $10 a volume (four years). Not offered in exchange. Free to members of the Garden.

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1.50 a year; single copies 15 cents. Free to members of the Garden. Now in its 47th volume.

Mycologia, bimonthly, illustrated in color and otherwise; devoted to fungi, including lichens, containing technical articles and news and notes of general interest. $7 a year; single copies $1.50 each. Now in its thirty-eighth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers published in co-operation with the American Society of Plant Taxonomists. Subscription price, $5 a volume ($4 to members of the Society). Now in its fifth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 94 parts now issued. Not offered in exchange. Prices of the separate parts on request.

Contributions from The New York Botanical Garden. A series of technical papers reprinted from journals other than the above. 25 cents each, $5 a volume.

Memoirs of The New York Botanical Garden. A collection of scientific papers. Contents and prices on request.

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

MARCH EVENTS AT THE GARDEN

American Orchid Society

March 19 1 p.m. *Trustees' Annual Meeting in the Members' Room*

Members' Day

March 6 3:30 p.m. *A Commuter's Greenhouse* — *John H. Myers*

Saturday Afternoon Programs

3 p.m each Saturday

March 2 *Diatoms, Jewels of the Sea* — *J. F. Burke*, Honorary Curator

March 9 *Paper-Making—* A short motion picture accompanying a talk by *Floyd E. Carlson*, New York State College of Forestry

March 16 *Romance of the Hybrid Orchid* A motion picture in color by *A. M. Zinner*

March 23 *Gardening in the City* — *Harriet K. Morse*, Author of "Gardening in the Shade"

March 30 *Medicinal Plants—Their History and Folklore* — *A. H. Graves*, Brooklyn Botanic Garden

Radio Programs

3:30 p.m. on alternate Fridays over WNYC

March 8 *Lesson in Landscaping* — *Mary Deputy Lamson*, Landscape Architect

March 22 *Plant-Hunting in Mexico's Mountains* — *E. J. Alexander*, Assistant Curator

Forthcoming Events

Members' Day, April 3, "Report on Mexico" by E. J. Alexander *Saturday Programs*: April 6, Lilies for Garden Beauty, by A. B Stout: April 13, Wild Flowers Seen on Springtime Walks, Walter Shannon: April 20, Plants of the Bible, Harold N. Moldenke, April 27, Realm of the Wild, a motion picture in sound from the U. S Department of Agriculture: *Radio Programs*: April 5, Little Gardens of New York City, Mrs Garret Smith: April 19, Bugs, Beware!, Louis Pyenson. *Courses*: Outdoor Gardening Practice, April 18; Field Botany, April 20; Garden Construction, April 30.

TABLE OF CONTENTS

MARCH 1946

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The Shamrock of Ireland—What Is It?

An Investigation of the Probable Plants Involved

By Harold N. and Alma L. Moldenke

"Sing a song of Ireland,
Blue lakes and sparkling rills,
Gray rocks and misty moorlands,—
Of shamrocks and green hills."

SPEAKING of Ireland, a popular ballad says: "The angels . . . sprinkled it with star-dust, just to make the shamrock grow—it's the only place you'll find it, no matter where you go."

The composer of this song expresses what is probably the firm belief of sons and daughters of Erin and people of Irish descent all over the world. To them shamrock is a wonderful plant of magic virtues, which grows nowhere else in the world except on the Emerald Isle.

Actually there is no basis for this belief. There scarcely could be, when no one knows what the shamrock really is. While there has been considerable argument as to the identity of the "true" shamrock, the only point upon which all botanical investigators agree is that it is one or more of a small group of trifoliate-leaved herbs widespread in the British Isles and common throughout most of Europe. Several of the leading contenders for the title, indeed, are common as weeds in almost every section of the United States as well! This statement will be forthwith condemned as a base and vile canard by all true Wearers of the Green, but it is true nonetheless. Let us consider the botanical and historical facts of the case.

According to leading linguistic authorities[1,2] the name "shamrock" is derived from Gaelic SEAMRAG and Irish SEAMROG (a bar or accent over the o), a diminutive form of SEAMAR, the generic term for "trefoil, clover, honeysuckle" or for just "clover." Some writers[3] state that the Gaelic word SEAMRAG etymologically signifies "three-leaved" and was applied originally to any plant with compound leaves of three leaflets. From this original form the word had evolved already in the 16th century to the present-day "shamrock." Other forms of the word in the 16th century were SHAMROTE, SHAMROCKE, SHAM-ROKE, and SHUM-ROKE. In the 17th

THE ST. PATRICK OF ANCIENT AGES

A portrait of the Patron Saint of Ireland holding a shamrock leaf, from a woodcut in "The Most Ancient Lives of St. Patrick" by Rev. James O'Leary D.D., sixth edition, 1882, lent by courtesy of the library of Notre Dame University.

century it had evolved to SHAMROOT, SCHAMROCK, SHAMROOK, SHAMOCKE, SHAMROGH, SHAMROGTH, SHAMERAG, SHAMRUG, SHAMROGUE, and CHAMROCH; and in the 18th century to SHAMMOCK, SHAMROQUE, SHAMROGGE, SHAMBROGUE, and SHAMBROGH. In both the 17th and 18th centuries we find the forms SHAMROG and SHAMROGE in use.

Irish folklore tells us that Saint Patrick (389?-461), patron saint of Ireland—who, by the way, was not an Irishman by birth, but either French, Scottish, Welsh or English [4]—soon after landing in Ireland in 432, established a mission in County Meath. During the course of a sermon delivered in the open air on the Hill of Tara [5] to the curious Druid natives, he stooped and plucked a leaf of three leaflets from some small plant growing in the green sod at his feet on the open hillside. With this trifoliate leaf he attempted to illustrate the doctrine of the Holy Trinity, and so ably did he preach and so apt and easily understandable was his illustration that the members of his presumably considerable audience were converted to Christianity on the spot. This incident is generally credited with being the reason that the shamrock was adopted as the national emblem of Ireland.[2,6] There is no valid reason for supposing that the sermon on the Hill of Tara was preached on the 17th of March, now celebrated as St. Patrick's Day. Rather, that date was the date of St. Patrick's death. On the 17th of March true sons and daughters of Erin the world over are expected to wear a shamrock, or, lacking this, a leaf resembling a shamrock, or lacking even that, something green.

That the shamrock was generally regarded as the floral symbol of Ireland, as the thistle (*Onopordum acanthium*) is the symbol for Scotland and the rose for England, is well illustrated by the toast proposed by Oliver Wendell Holmes in 1856:[7] "We drink a triple health—the Rose, the Shamrock, and the Thistle," and, even earlier, by Steele in 1712 [8] when he speaks of "the Scotch Thistle, the Irish Shambrogue."

An old English belief maintains that the name "shamrock" was applied to trefoils, worn to commemorate St. Patrick, to denominate him as a *sham* rock in contradistinction to St. Peter, who is the *true* rock upon which the Church is founded.[9] This, of course, is a totally fallacious and, one suspects, malicious interpretation of the origin of the word. Queen Victoria (1819-1901) placed the trefoil in her royal diadem in lieu of the French fleur-de-lis. The shamrock is now side by side with the rose and the thistle in the national badge of the United Kingdom.

Up to about the 17th century Irish peasants were accustomed to using SEAMROG for food, and this plant has been quite certainly identified as the purple or "red" clover (*Trifolium pratense*). This species is still frequently called "honeysuckle," "honeysuckle-clover," or "suckles" by farmers in England and the United States,[10] and is probably the plant referred to by authors who claim that SEAMROG originally applied to "trefoil, clover, honeysuckle."[1]

Among the earliest references bearing on this form of shamrock is one in 1571, when Campion in his history of Ireland [11] says "Shamrotes, Water-cresses, Roots, and other Hearbes they feede upon." Other 17th century references to this use of shamrock as food include these: "They feed willingly upon mushrooms, shamroots and rootes."[12] "Feeding upon water-cresses, rootes, mushromes, shamrogh, butter tempered with oatemeale."[13] "In no more cloathing than a mantle goe; And feed on Shamrootes as the Irish doe."[14] "They willingly eat the hearb Shamrock."[15] "Whilst all the Hibernian Kernes in Multitudes Did feast with Shamerags stew'd in Vsque-bagh."[16] "Their fare being many times shamrookes, oaten-bread, beanes and butter-milke,"[17] and "Butter, new cheese, and curds and shamrocks, are the food of the meaner sort all this season."[18] Gerarde in his famous herbal [19] of 1597 definitely identifies this early shamrock as *Trifolium pratense* when he says "Medow Trefoile is called . . . in Irish shamrockes." In this identification Lhwyd concurs in 1699 by saying categorically,[20] "Their shamrug is the common Clover."

In addition to the application of the name to the red clover, there is evidence [21] that it was applied also to the water-cress (*Nasturtium officinale*), a species of crucifer which does *not* possess trifoliate leaves. In 1577, for instance, Stanyhurst makes this comment:[22] "Water-cresses, which they terme shamrocks, rootes and other herbes they feed upon," and Spenser in 1596 [23] tells that "Yf they founde a plotte of water-cresses or sham-rokes, there they flocked as to a feast for the time." Holland in 1632 seems definitely to identify it with the water-cress when he says [24] "Cresses . . . of which the Irish Shamrogth are a kinde." Yet it is altogther possible that these identifications may be erroneous since the 1571 and 1611 references [11,13] quoted in the preceding paragraph seem definitely to keep the shamrock separate from the water-cress in listing articles of food of the natives. That this shamrock was eaten with relish seems to be indicated by a passage from Taylor in 1643:[25] "Some Bookes also of Irish Rebellion were devoured as they had been shamroys [shamrogs]."

The wearing of the shamrock as an emblem or badge on St. Patrick's Day was first mentioned in literature [3] in the year 1681 when Dineley wrote:[26] "The 17th day of March yeerly is St. Patricks, an unmovable feast, when . . . the vulger superstitiously wear shamroges, 3 leav'd grass." From that time on the mention of shamrock as a food speedily declined, and we hear more about the potato (*Solanum tuberosum*), a far more nutritious staple food. A native of the temperate Andes of Peru this was introduced into Ireland from what is now North Carolina in 1585 or 1586,[27] and was adopted to such an extent that the species is even today called the "Irish potato" and many there are who erroneously believe that the white potato is an importation from Ireland.

From the 18th century on, the references to shamrock incline toward its

White clover (Trifolium repens), one of the numerous plants whose trefoil leaves make it a candidate for the title of the true shamrock of Ireland (Photograph by L. W. Brownell).

emblematic use. For instance, a poetically disposed writer in 1741[28] unburdened himself of this sentiment: "Go little shamrogge, and adorn My pretty Flavia's breast this morn." In 1775 Sheridan[29] tells us: "I put a great shammock in his hat this morning," and in 1781 Johnston[30] recounts that "he marked our young hero on the left breast with a shamroque." That it was employed by Hibernians as a badge of honor, even as the laurel (*Laurus nobilis*) was employed by Greeks and Romans to crown their heroes, is further indicated by the lines from the Irish poet, Thomas Moore, in 1813:[31] "Chosen leaf Of Bard and Chief, Old Erin's native Shamrock!"

Concerning the identity of this shamrock used as a badge or emblem there has been much discussion and no little argument. Webster[1] says: "The original shamrock is variously considered to have been a hop clover (*Trifolium dubium*), regarded by many as the true shamrock, the wood sorrel (*Oxalis acetosella*), the white clover [*Trifolium repens*], or the black medic (*Medicago lupulina*)." To these possibilities the other authorities[2,6] add the red clover (*Trifolium pratense*), the water-cress (*Nasturtium officinale*), the lesser yellow hop clover (*Trifolium minus*), and the bird's-foot trefoil (*Lotus corniculatus*). All these species, now common in Ireland, probably have valid claims for being thus associated with the national emblem. The water-cress, however, has the least claim, for the application of the name "shamrock" to this non-trifoliate plant was doubtless very local, applied, if at all, only to the edible form. Because of its affinity for cool running water, it could not have been the plant used by St. Patrick, and the designation certainly has not survived. The wood-sorrel, black medic, red clover, white clover, and yellow hop clover are widely sold [21] all over Ireland today as the "true" shamrock and are exported in large quantities to the United States and other countries where loyal Hibernians will pay fancy prices for a spray to wear on St. Patrick's Day as a reminder of home associations dear to their hearts.

According to the Oxford English Dictionary, Century Dictionary, and other recognized source-books,[2, 32, 33] the name "shamrock" is now most generally applied in England to *Trifolium minus* [often regarded as only a variety of *T procumbens*], and this is the plant most frequently worn there on St. Patrick's Day. The new International Encyclopedia agrees [6] that this species "is the generally accepted modern shamrock."

If we agree that the identification of the "true" shamrock must be associated with the story of St. Patrick on the Hill of Tara, then, in spite of the conclusions of Brande and Bentham,[34] the wood-sorrel can be eliminated from the running at once. The wood-sorrel grows only in the dense shade of cold damp woods. Even in such a wet country as Ireland it would never be found naturally on an open hillside such as the one on which St. Patrick is generally considered to have preached his famous sermon. The clovers and black medic, on the other hand, are commonly found along roadsides, in fields, pastures, and waste places. Most of them—with the possible exception of the red clover, which generally requires a less rugged and exposed position—might well have been present at his feet. Nicholson, who has devoted quite some time to this subject,[3] concludes that the white or Dutch clover (*Trifolium repens*) and the small yellow hop clover (*T. dubium*) are the two most likely candidates for the honor of having furnished a leaf to St. Patrick, and, of the two the latter is the more probable since it is most abundant in poor stony ground such as found on the Hill of Tara. Also, some botanists maintain that *T. repens* is not truly native in Ireland and was not introduced there until long after the time of the Saint.[33]

In 1891 Nathaniel Colgan, a member of the Royal Irish Academy, issued an appeal to all parts of Ireland for plants of the "true" shamrock. He received, in return, 49 specimens from the Irish-speaking districts, representing 21 of the 32 counties. Of these *Trifolium repens* was represented by 24 specimens, *T. dubium* by 21, *T. pratense* by 2, and *Medicago lupulina* by 2.

It is interesting to note in this connection the divergence of opinion among well-known botanical authorities as shown by the species to which they apply the name "shamrock" in their floral lists. It is applied to *Oxalis acetosella* by Britten & Holland,[32] Britton & Brown,[10] Blanchan,[35] Henkel,[36] Lyons,[37] Sudell,[38] Webel,[39] and Griffith.[40] The last-mentioned, in fact, makes a special comment to the effect that this is the "Irish shamrock." It is listed for *Trifolium minus* by Britten & Holland[32] and in "Standardized Plant Names."[41] The latter work reduces *T. minus* to the category of "a hort. var. of *T. repens.*" Britten & Holland[32] apply it also to *T. pratense;* Britton & Brown[10] and Webel[39] to *T. repens;* and Britton & Brown,[10] Lyons,[37] Brenchley,[42] and Stuhr[43] to *Medicago lupulina.* The closely similar *Trifolium dubium* [*Chrysaspis dubia*] is called "shamrock" by Jepson[44] and Robbins,[45] "true shamrock" by Britton & Brown,[10] and "true shamrock of Ireland" by Lyons.[37] Lyons calls *T. repens* "white shamrock" and Webel[39] designates *T. repens* var. *purpureum* "Scotch shamrock." Of the eight species of *Trifolium* and *Oxalis* listed by Stewart & Corry[46] from northeastern Ireland, only *Trifolium repens* is designated as "shamrock," while Mackay[47] says of this species: "It is

Species of Oxalis and its close relatives often appear in representations of the Irish shamrock, and often they are grown in small flower-pots to be sold on St. Patrick's day. The species above, with characteristic trifoliate leaves, each leaflet slightly indented at the tip, making it somewhat cordate in outline, is Oxalis (or Caudoxalis) Bowieana, photographed in the Thompson Memorial Rock Garden.

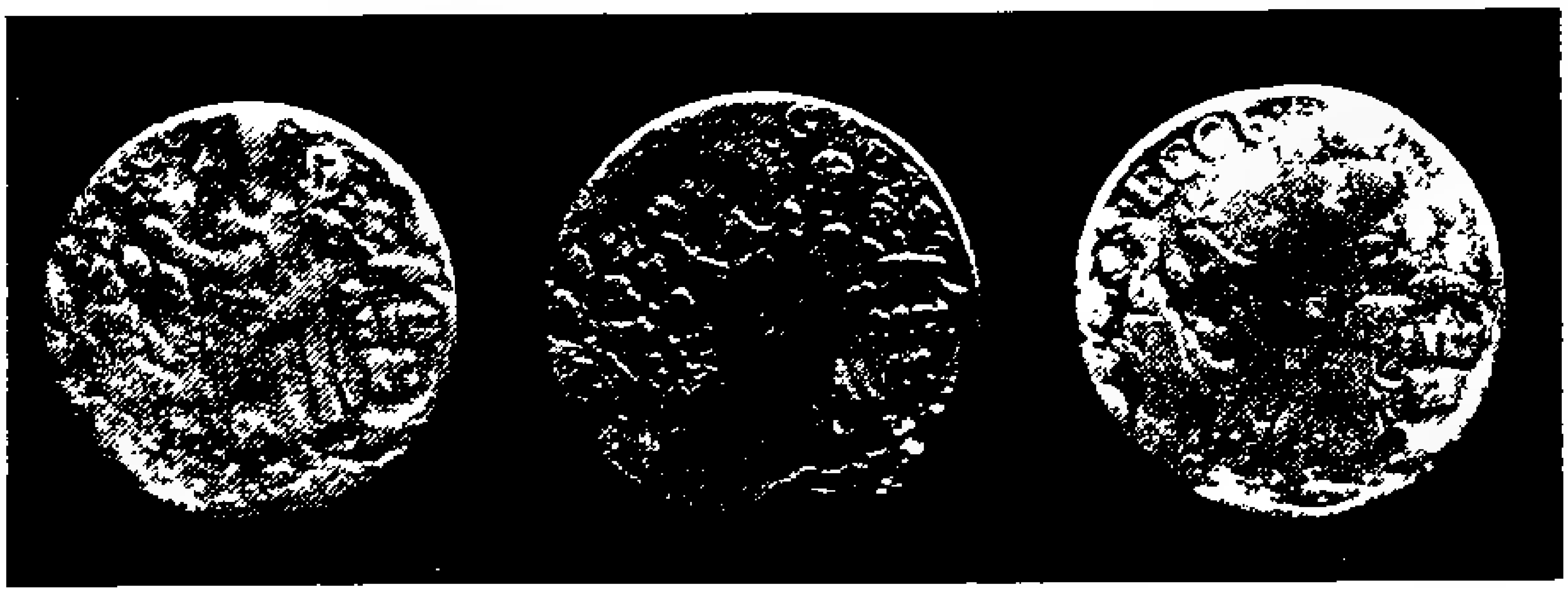
the plant which I have observed, for the last 30 yrs., to be worn as the shamrock on Patrick's Day." He lists the name "shamrock" only for *T. repens,* but under *Oxalis acetosella* he makes this comment: "Mr. Bicheno in a paper published a few years ago . . . states it to be his opinion that the wood sorrel . . was the ancient shamrock as old authors say it was a sour indigenous plant showing itself on St. Patrick's day, and was eaten; and, therefore concludes, that the *Trifolium repens* or common white clover now used, could not have been the plant in former use."

Symbolically, in the so-called "language of flowers," shamrock—there usually identified with *Trifolium repens*—is supposed to indicate light-heartedness and loyalty.[34,48] As a heraldic badge it marks the Kingdom of Ireland, and also St. Patrick, who is represented in the habit of a bishop holding a generalized trefoil, most often a stylized oxalis leaf.[9]

Probably we should not fail to take note here, also, of the expression "to drown the shamrock." This phrase is often heard among lovers of the Emerald Isle and signifies the old custom of men drinking in honor of the shamrock on St. Patrick's Day. In 1726 Threlkeld[49] had something to say of this custom, to wit: "Trifolium. This Plant is worn by the People . . . upon . . . St. Patrick's Day. It being a current Tradition that by this Three Leafed Grass, he emblematically set forth to them the Mystery of the Holy Trinity. However that be, when they wet their Seamar-oge, they often commit Excess in Liquor, which is not a right keeping of a Day of the Lord." Succinct and to the point are these two items from the London "Daily Telegraph" for March 22, 1888, and March 18, 1901, respectively: "An Irishman . . . on Saturday last resolved to drown the shamrock in the orthodox fashion."—"The opportunities for drowning the shamrock were commendably abbreviated by the law."

The word "shamrock" is also frequently used as an adjective and as a prefix or combining-form. For instance, in the British Empire "Shamrockshire" is a jocular name for Ireland. This was so even as far back as 1689 when an author[50] comments on the factors "which . . . Make Wit so scarce in Shamrogeshire" and in 1724 when Moffet[51] informs us that "Priests in Shambroghshire they say, Can women kiss, as well as pray." Coming to our own country, we leave it to our kind readers to guess the origin of the first settlers of the towns of Shamrock in Florida, Missouri, Oklahoma, Pennsylvania, and Texas!

As an adjective we find it used as far back as 1581 when Derricke[52] says "My soule dooeth detest their milde shamrocke manners." It is frequently found as a modifying or defining word in the common names of other plants which originally certainly had no connection with the true shamrock. Thus, the "native shamrock" of Morris[53] in Australia is *Lotus australis;* the "Australian shamrock" is *Trigonella suavissima;*[54] "water shamrock" is *Menyanthes trifoliata;*[36, 37, 40, 43, 55] "blue-flowered shamrock" or "shamrock-pea" is *Parochetus communis;*[56, 57] "Cape shamrock"



Coins issued in Ireland presumably about 1643 *show St. Patrick with mitre and crosier holding a shamrock in one hand. Known as the "Mark Newby coins," these pieces of money were brought to America and used in New Jersey in the middle* 17*th century. (Reproduced by courtesy of the American Numismatic Society).*

is *Caudoxalis bowiei*;[38] and "Indian shamrock" is *Trillium cernuum* and *T. erectum.*[37, 43, 55, 58] In the horticultural trade almost any trifoliate-leaved plant is offered to the gullible public as "shamrock" on St. Patrick's Day, most especially any species of *Oxalis, Ionoxalis, Bolboxalis, Caudoxalis,* or *Xanthoxalis.* And yet,

There's a plant the Irish hold dear,
No other like it we're knowing;
'Tis a native, same as the hills,
The Shamrock, in Erin long growing.

On the Cover

St. Kelvin's Church at Glendalough, Ireland, shown in the cover photograph by Mrs. Branson De Cou, is in eastern Ireland, near Tara Hill, where St. Patrick is believed to have preached his famous sermon, using the shamrock to represent the Trinity. (Photo from Black Star).

FOOTNOTES

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3 C. Nicholson, Gardeners' Chronicle, London, vol. 89, pp. 205, 206. 1931.
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5 Dr. Healy in his "The Life and Writings of Saint Patrick" (1905) claims that the site of this sermon could as well be the Rock of Cashel in County Tipperary as Tara Hill in County Meath. He states, further, that there is no trace of this story in the early works on the life of the Saint, "still it has caught the popular imagination and made St. Patrick's shamrock the immortal symbol of Ireland's faith and nationality."
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[19] John Gerarde, The herball, or general historie of plants, book 2, chapt. 477, p. 1018. 1597.
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[23] Spenser, A view of the present state of Ireland. 1596 [Works, ed. Globe, p. 654. a. 1599].
[24] Philemon Holland, Xenophon's Cyropaedia, part 1, chapt. 1, p. 4 margin. 1632.
[25] John Taylor, Preter-pluperfect, p. 4. 1643.
[27] The "potato" carried from Santa Fé to England by John Hawkins in 1563 is thought to have been the sweet-potato (*Ipomoea batatas*).
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Some Irish tokens of the last century, impressed with various forms of the shamrock. (Courtesy of the American Numismatic Society)

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Science Writing and Politics

By *Joseph A. Brandt*

Excerpts from an address delivered by the president of Henry Holt & Company, publishers, at the annual meeting of the Torrey Botanical Club, January 8, 1946.

OF all the pure sciences, botany has always seemed to me to be the most humane, the warmest, the most necessitous. Plant life is as indissolubly interwoven in man's life as the white and red corpuscles of his blood stream, and as necessary as air and water.

Of course, I am speaking of botany in the broadest possible way. Historically, botany was always a science conceived of as directly in the service of man, an earthy and a humane science. The earliest literature of botany concerned itself with those plants medicinally useful to man. And while many modern botanists think of their science along the narrowest lines, I believe the average layman, thinking of botany, remembers such direct benefits as soil conservation, plant hybridization, and other aspects of applied botany.

I suspect, if you will permit such a broad and catholic conception of your science, you will find that you have less for which to apologize than any other science in the Pandora box which the physical sciences opened by conquering energy and matter.

Science is now the capital word of politics and diplomacy. Yet, the modern scientist has grown up unaware of the world about him. He has conducted his experiments alone in a laboratory far removed from the hungry and the destitute. Society has been a remote term. Now, it may become an angry term of reproach.

After further references to the atomic bomb, Dr. Brandt continued:

We had unlocked the secret of nature without comprehending the penalty which nature exacts from those who cannot live in harmony with her. Historical record is replete with accounts of what we would call "civilizations" which have disappeared because of disharmony. The Mayans carved from the jungle a brilliant civilization long before Plymouth Rock and Harvard University. The jungle reclaimed most of the Mayan civilization, because the Mayans had not lived in harmony with nature! Perhaps only a botanist, or his more modern derivative, the ecologist, could comprehend what either the decay of Mayan civilization or the possible decay of scientific or atomic civilization of today, could mean in terms of steps untaken by man to counteract that decay. However immune we may think science has made us to nature's laws, nature still is an immutable, all-pervasive force. Politics is the science of man living with fellow men; and pure science in the service of society should be, therefore, the application of science and nature to man's living together so that the residue of nature may be passed on from one generation to another unimpaired.

* * *

The capitulation of Germany and the surrender of Japan brought little real joy to the world; they brought instead an even greater unease, a fear of peace, a fear of one another, a distrust among nations, among families, among individuals.

This all happened at the time science reached its greatest climax, the conquest of atomic energy. When science and education had succeeded in almost unbelievable triumphs, such as world-wide instantaneous communication, wide-spread literacy, the greatest spread of mass education, the world greeted peace with fear and many grasped at the straw of another war.

Does this mean anything to the scientist, in other words, the educator? It does. It means, it seems to me, that the life of academic quietism is over. The man of learning, however ill-equipped he may be, must become a man of action, a politician, a man of the people, speaking for the people, leading the people.

* * *

I agree with Professor Harold C. Urey's statement to *The New Yorker*: "I've dropped everything to try to carry the message of the bomb's power to the people, because, if we can't control this thing, there won't be any science worthy of the name in the future. I know the bomb can destroy everything we hold valuable and get a sense of fear that disturbs me in my work. I feel better if I try to do something about it."

The actions of men like Professor Urey, like Paul B. Sears of your own ranks, make me feel better about the future of science and education, about the future itself. I entered the learned world via the back door—that is, from a newspaper city editor's desk. I was firmly imbued with the idea that it was dangerous to set up the world of learning as an aristocracy, set apart from the lesser people whom the learned thought could never possibly comprehend what they were doing.

I must confess that while I did not surrender, I found it increasingly more difficult, the longer I stayed in academia, to talk with the scientists about translating the translatable things they were doing. In far too many instances, the scientist-scholar would reply: "Oh, I couldn't think of doing anything popular. Why, it would ruin me in the profession." . . .

* * *

Sometimes the youngsters were ready to go ahead but were held back. I well remember one very brilliant young historian who had written a beautiful dissertation which, with some modifications, would have reached a considerable audience. The modifications that I suggested had nothing to do with scholarship or erudition. They were simply concerned with pruning a too lush dissertation which had been assembled to satisfy the vanity of a Ph.D. jury. With these modifications, the university could publish the book and pay him a rather nice royalty. But if he insisted upon the dissertation, which was designed for no audience, he would have to pay a fair sum for publication.

The young scholar agreed heartily with my memorandum of suggestions. "There's one thing I want to do, however," he said. "I think I should talk this over with my professor who directed my doctoral work."

"Well," I replied, "I know what the answer is. Either you were trained to be an independent thinker or you weren't. I'm afraid you are going to miss an opportunity to serve the people to satisfy the vanity of a single professor."

Nevertheless, the young man did consult the professor. My memorandum might be all right, the professor said. He didn't quarrel with it as a commercial proposition—and mind you, I was in a non-commercial institution when I wrote the memorandum—but the young historian had better publish just as he had written the dissertation. And the reason?

"You may want to get a job in some other university some day," the professor told the young man. "You'll have to show some department head that you know how to do research. You may not get the job if you don't publish your dissertation as you wrote it."

On that narrow plane, on that viciously anti-social plane, have we conducted the business of higher education. The modern American university has become merely a super-employment service in the interest of scholars but not in the interest of society.

On the other hand, I will remember the day, during the height of the dust storms in Oklahoma, when Paul Sears came to my office and without preliminaries, said, "Joe, how would you like to publish a book called 'Deserts on the March'?"

Paul Sears had seen what man was doing to nature. He had pursued his research to the point that now he knew he had to do something for society. We were groping in fear of the awful calamity of witnessing daily millions of tons of precious earth being swept into the atmosphere. All that the chambers of commerce could hold out was the hope of rain. Professor Sears knew that the answer lay not alone with nature but with man, who had to live in harmony with nature or perish.

His book, as most of you know, was scientifically correct. But anyone with a high school education could read it and understand it. And furthermore, after reading it, he knew what he ought to do. At first, because the book had an extraordinarily popular success, some of Mr. Sears' colleagues dismissed it with the remark, "It isn't science, it's literature."

Finally, in irritation, I asked on of these scientific critics the question, "Well, what is literature if it isn't the record of life as we live it?"

Men like Sears, however, remained far too few until the atomic bomb suddenly awakened even the most unsocial of the scientists to the knowledge that he was a part of politics as well as of a learned aristocracy.

* * *

So the scientists like Professor Urey, like Professor Sears before him, have turned to politics. They have at last assumed the responsibility of citizens which they have shirked in the past. And I think they can no longer turn back exclusively to the laboratories or content themselves with writing learned abstracts for their society journals. Time is too short. The world is too amoral. We know we can't trust ourselves or anyone else. We now know that we've got to begin the real education of man to assume the responsibilities in the new world which science created.

That education has to be two-fold. It must be carried to the people as rapidly as possible and by every conceivable means, through speech, through writing, through action. And no longer can the scientist or the American scholar content himself to train young citizens to be mere job-seekers. Scholarship and the people must be reunited, so we can build a world in which we can live; otherwise, our time on this planet is limited. Otherwise, civilization is walking its last mile.

Teaching the Blind the Art of Gardening

BLIND men and women can become successful gardeners. Using special tools they can learn to dig and rake and hoe, to sow seeds, weed and cultivate their gardens, and to harvest their crops of vegetables or flowers.

Dr. Hugh Findlay, who for a score of years directed work in landscape architecture at Columbia University, has been devoting himself since shortly before his retirement to the teaching of gardening to the blind. Tools which he has designed now are used in forty places in the United States and in Canada and Cuba. Every week he goes from his home in Englewood, N. J., to the Naval Hospital in Philadelphia, where, under his patient instruction, some of the wounded, blinded veterans are learning to "see" by using fingers, hands and arms, feet and ankles, in handling gardening tools and the soil and seed with which they work. They are gaining health and new interest in life, too; and Dr. Findlay tells many stories of their pride and excitement in the gardens they are making.

For many years he has had this hope of working with the blind. "While on the battlefields of France during the first world war," he says, "I dreamed of these blind boys being able to come close to the soil and to know its healing happiness. As Frank Eyre, blind English gardener, once said, 'I should like to insist on the value of gardening as an occupation for the blind. I consider it one of the best and happiest ways of finding abundant life.'

"When our boys started to come back from the battlefields of the second war with the light of day shut out of their eyes, I found a way to have special gardening tools made for them."

Dr. Findlay expresses his gratitude to a number of teachers of the blind, and quotes one of them, who has said: "Gardening is an especially desirable activity because it takes them out into the sunlight and overcomes a natural tendency to stay indoors and miss out on proper exercise. . . . It is peculiarly adapted to their specialized senses and needs. It provides the feel of the soil and of plant textures, the smell of the earth and various flower fragrances, the sound of windblown foliage. And, because gardening is never easy, it offers a challenge; successful accomplishment becomes a triumph over odds and helps build confidence, assurance, and independence."

Dr. Findlay's first work with the blind was at the Institution for the Blind in the Bronx several years ago. Last summer he demonstrated his specially built tools at the Detroit Harvest Festival. "Each blind person took about fifteen minutes to memorize the tools through his fingers," he reported. "With no further instructions they used the tools successfully."

Dr. Findlay finds that his blind gardeners can make a furrow straight, sow seeds in it with skill, thin their plants accurately by measuring between

SOIL AND SEED IN THE SENSITIVE HANDS OF BLIND GARDENERS

1. A slight movement of the fingers across the palm of the other hand, in which a sample of soil has been placed, will indicate the nature of any kind of soil without recourse to sight. Sand is being identified by the pair of hands at the upper corner. 2. To the right, a gardener is "seeing" clay for the first time. 3. Below at the left, the gardener is showing how seeds can be sown by using the thumb to work them out from a partly closed hand. In the garden the seed sower lets the tips of his fingers follow a wire which has been set directly over the furrow.

The five pictures of soil types, as they have been studied under Dr. Findlay at the Naval Hospital in Philadelphia, are (4) sand, (5) leafmold, (6) clay, (7) muck soil, and (8) garden loam, ready to receive seeds.

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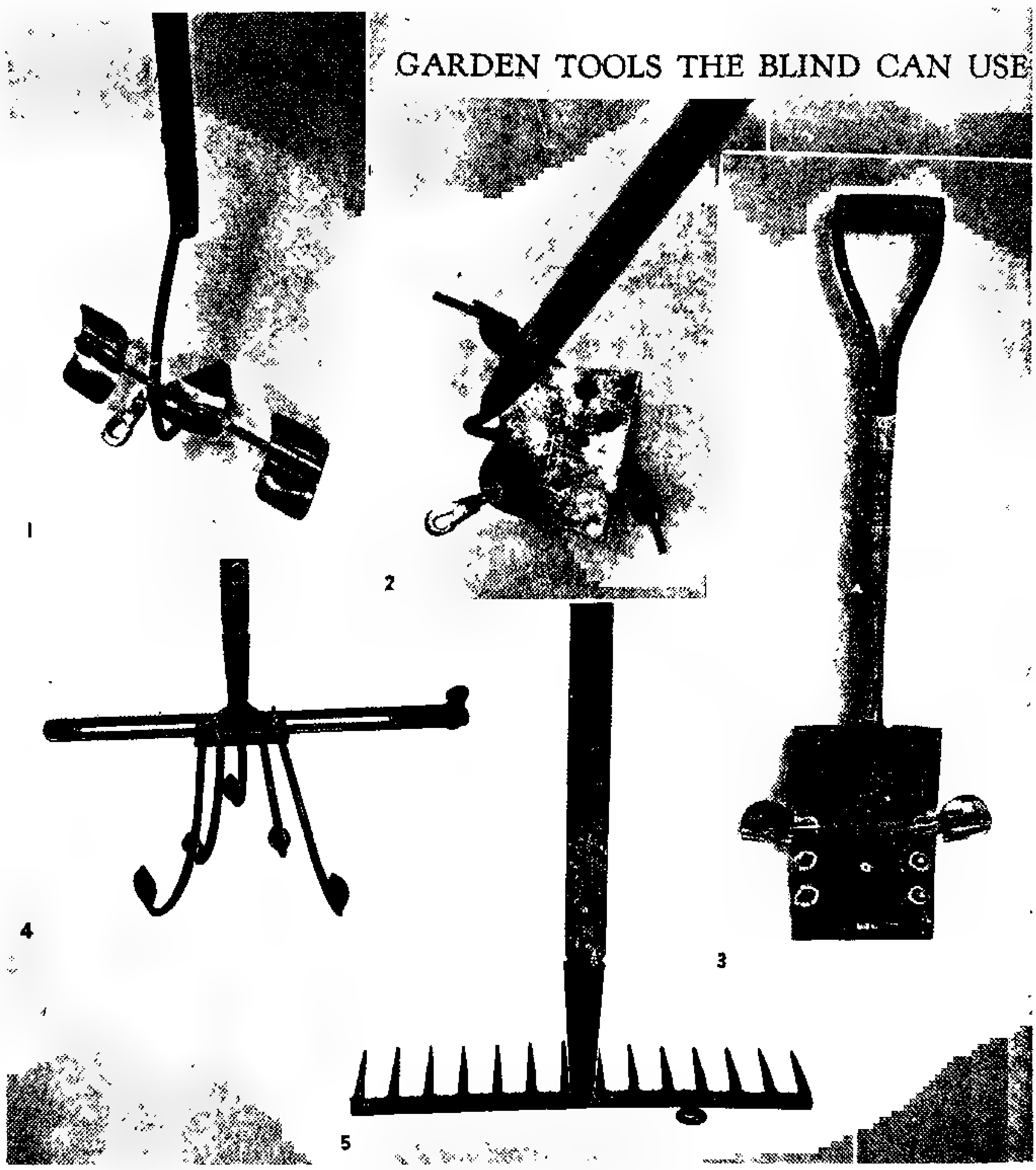
them with their fingers, and, through their sense of touch, quickly determine top and bottom of a bulb that they are planting.



1. *A furrow hoe, made by attaching a discarded blade of a mowing machine to an iron rod which in turn is attached to the handle. The wire clip is attached to this rod. Across the mowing machine blade is welded a rod with two shoes attached, one at each end. These shoes prevent the hoe from making too deep a furrow.*

2. *A hoe with shoes attached to a bent rod for guidance in working. Two sets of holes for the wing screws by which the rod is held to the blade provide for two different depths of hoeing.*

3. *The spade has a gauging rod with shoes that may be adjusted to dig a hole from two to eight inches deep.*

4. *The Norcross weeder, which is valuable in destroying weeds and in cultivating plants so that air may reach the roots. The clip is attached to a wire strung close to the plants and the bar is adjusted for distance.*

5. *The rake is provided with a clip attached to a wire which runs the length of the area to be raked. The height of the wire gauges the depth of the raking.*

1. Tightening the guide wire with a tee-rod.
2. Measuring distance at which to set the weeding implement.
3. Raking along the line of the wire.
4. Making a furrow for seeds with a special hoe.

1. A wire to guide the implements is a necessity. Here a blind gardener is being shown how to force a tee-rod into the soil before turning it to tighten the wire. Sometimes a tool is attached to the wire by a clip. At other times the gardener uses the wire as a guide by holding one ankle against it as he works.

2. When using a Norcross weeder, the distance from the plants to the first blade is measured with the hand. The weeder is clipped to the wire and the movable rod is set in such a way that the roots of the plants will not be touched by the prongs of this implement.

3. This shows how the rake is guided through the soil by means of the wire to which it is clipped. Blind gardeners quickly learn to handle a rake properly and find that preparing the soil in this manner is one of the pleasantest aspects of gardening.

4. Ankle and hoe alike are guided by the wire. Although the finely raked soil covers the shoes attached to this hoe, the shoes determine the depth of furrow.

Notices and Reviews of Recent Books

(All publications mentioned here may be consulted in the Library of The New York Botanical Garden or may be purchased on order through the Library.)

Dutch Science In the Malaysian Islands

SCIENCE AND SCIENTISTS IN THE NETHERLANDS INDIES. Edited by Pieter Honig and Frans Verdoorn. xxiii.+ 491 pages, 134 illustrations. Board for the Netherlands Indies, Surinam and Curaçao, New York City, 1945. [Chronica Botanica Co., Waltham 54, Mass.] $4.

This large octavo of 500 pages is of such varied content that a satisfactory review of it is difficult to compress into a few brief paragraphs.

One might expect from its title an orderly, systematic history of science in the Dutch Indies. Instead, it comprises some 80 essays, by 75 authors, most of them on decidedly unrelated topics. None are printed in the Dutch language; three are in French, one in German, all of the rest in English.

Some are reprinted from serials, some from books, some are here presented in English for the first time, some were never before published. The subjects are as varied as the natural sciences themselves: chemistry, meteorology, climatology, topography, geology, mineralogy, paleontology, anthropology, zoology, botany, forestry, agriculture, medicine. There is no index to the volume, and the individual contributions would be effectively buried were it not for the detailed table of contents filling five of the preliminary pages.

Presumably our readers will be particularly interested in the portions of the book relating to plants. The essays on agriculture include discussions of botanical and plant-pathological investigations of tea, of rubber, and of cinchona. Some of the most interesting botanical papers are extracted from books of travel by A. R. Wallace, H. O. Forbes, and D. G. Fairchild. There are essays on phytochemical research by D. R. Koolhaas and on paleobotanical research by O. Posthumus. Other botanical contributions include: an account of the botanic garden of Buitenzorg by J. Bernard; a history of the visitor's laboratory of that garden for its first 50 years, 1884-1934, by K. W. Dammerman, with an enumeration of the scientists who worked in the laboratory each year (more than 250 in all), and a summary of their researches; Rumphius, the blind seer of Amboina, by M. J. Sirks; a botanical trip in Sumatra, by C. G. G. J. van Steenis; a short history of botany in the Netherlands Indies, by F. A. F. C. Went; and an account of the flora of Tjibodas, by W. M. Docters van Leeuwen.

To the editors of this volume, its preparation was doubtless a labor of love and a tribute to their Fatherland, and in its execution they deserve nothing but praise. To its publishers it was probably something else. The Board for the Dutch colonies specifically disclaims responsibility for any of the statements made or opinions expressed, yet the critical moment of its appearance leaves little room for doubt that, to the Board, this book is important as political propaganda. It presents throughout, clear and convincing evidence that Dutch control of their East Indian colony has conferred upon the entire world of science benefits that would have been utterly impossible under native rule.

JOHN HENDLEY BARNHART

Southern Viewpoint On Conservation

LIVING BY THE LAND. John C. Gifford, 139 pages, illustrated, indexed. Glade House. Coral Gables, Florida, 1945. $2.50.

Dr. Gifford is very much in earnest about the urgency of a belated conservation of the things which make the earth good and beautiful, particularly forestry.

He also believes that the one-family homestead provides a happy solution of economic ills. The five-acre or the 160-acre farmstead division of the land, rather than vast acreage owned by absentee landlords, is one way of making proper use of the land without waste, according to the author. Being professor of Tropical Forestry and Conservation at the University of Miami, he has acquired a southern viewpoint, and rather liberally designates Florida, the southern United States, and the Caribbean region as "the Tropics."

The chapters of this book are really articles on diversified subjects. The purpose of the book is to give a broad foundation for a more specialized study of conservation and restoration, for the good of all. The bibliography is a guide to further reading on the subject. The illustrations are typical scenes in Florida.

EVA NOBLE,
Jacksonville, Fla.

Handling the Shears In South and West

HOW TO PRUNE WESTERN SHRUBS. R. Sanford Martin. 90 pages, illustrated by the author. Murray & Gee, Inc., Hollywood, Calif., 1944. $1, paper bound.

Drawings accompanied by arrows and printed directions illustrate instructions in the text for the pruning of about 75 different kinds of shrubs that are cultivated in the West. The oft-repeated admonition, "Have your nursery man identify your plants," might well be whispered to the author, who seems to have had some difficulty with what he calls *"Cretaegus,"* making it appear as the botanical name for *Cotoneaster* and also as a synonym of *Pyracantha*. A number of other botanical names do not look quite familiar in the text. However, a man can probably handle pruning shears efficiently whether or not he can spell or distinguish two related plants,

(*Continued on page* 69)

On this, the first occasion when this Journal has been open to advertisers, the New York Botanical Garden is glad to welcome the distinguished names which appear on the following pages.

and the drawings seem to give the reader a clear picture of what to do and why and when.

HOW TO PRUNE FRUIT TREES. R. Sanford Martin. 90 pages, illustrated by the author. Murray & Gee, Inc., Hollywood, Calif., 1944. $1, paper bound.

A practical guide for fruit growers, especially in the South, where citrus fruits, avocados, and guavas, as well as grapes, apples, and blackberries can be grown. Sketches by the author illustrate the methods and reasons for the manner of pruning forty different kinds of fruit-bearing trees and shrubs.

Autobiography

THE LIFE HISTORY OF AN AMERICAN NATURALIST. Francis B. Sumner. 298 pages. The Jaques Cattell Press, Lancaster, Pa., 1945. $3.

A professor of biology, who was given the rank of Emeritus several years ago by the University of California, looks back upon a long life in which details of daily occurrences assumed importance in his education and adjustment.

Storied Background

GREEN CARGOES. Anne Dorrance. 187 pages, Doubleday, Doran & Co., Garden City, New York, 1945. $2.

To the person uninitiated in botanical history and the tales of explorations which, in recent centuries, have brought to the western hemisphere a large proportion of our foods, spices, drugs, flowers, and other important plants, this small book provides an entertaining background.

While the professional botanist, to whom these stories have long ago become commonplace facts in his storehouse of knowledge, may object that it is incomplete or even misleading in its sentimentalizing, to the layman these accusations matter little, for here is an inviting introduction to a subject which might with pleasure be further pursued. The bibliography offers welcome suggestions for additional reading.

HELEN M. WOODWARD.

Library Gifts

AMONG recent gifts to the Garden's library, some presented by the authors, some by other friends of the Garden, have been a number of books of significance. Some brief notes on these are given below.

The Lost Woods by Edwin Way Teale, 326 pages, illustrated with 200 of the author's own photographs, indexed, published by Dodd-Mead & Co., New York, 1945. $4. A book of adventures in the life of a naturalist—adventures in reading as well as in experience with the out-of-doors. Though he is known especially for his books on insect life ("Grass-Root Jungles," "The Golden Horde," "The Boys' Book of Insects," and others), Mr. Teale has not neglected plant life in this entertaining volume. One chapter is devoted mainly to the life-work of Robert Hagelstein who, until his death last Oct. 20, was Honorary Curator of Myxomycetes at the New York Botanical Garden.

Lista Preliminar de Plantas de El Salvador by Salvador Calderón and Paul C. Standley. 450 pages. Second edition, 1941. Twenty collaborators from institutions in the United States have contributed to this work, the first edition of which appeared in 1925. Of the twenty, four at the time were members of the staff of the New York Botanical Garden. Plants are listed by families, common names given where they exist, and from a word to a paragraph of information added about each plant. Commonly cultivated plants are included. Two supplementary lists follow the original one, and the book concludes with a section of posthumous writings of Dr. Calderón.

The Wonderland Ecuador by Raphael V. Lasso. 286 pages with maps and many photographs. Alpha-Ecuador Publications, New York, 1944. $3.50. This is a factual reference book prepared by the Founder and President of the

Ecuadorean-American Chamber of Commerce in New York. Dr. Lasso is also editor of the magazine *Ecuador.* He opens his book with a chapter on the geography of the country; then come several historical chapters, followed by such topics as Government, Language, Art, Communications, Climatology, Products, Industries, and others. In one long chapter, essential facts are given about each province.

Mitobotánica Zapoteca by Blas Pablo Reko. 154 pages, with 7 illustrations and frontispiece showing the Zapotecan god of flowers, love, music, and dance. Nearly 40 pages of interesting text precede the long, descriptive, alphabetical list of Zapotecan plant names, beginning with APA, the sapote, and ending with ZOO PATAO, *Paneolus campanulatus.* Just above the end it is interesting to note that ZIICHA, the Zapotecan name for species of *Sedum* and *Bryophyllum*, means "siempreviva" or live-forever. An alphabetical list of botanical names follows, with cross-references to the native names.

Les Pipérales by Henri Stehlé, 144 pages, illustrated. Published as part of the *Flore Descriptive des Antilles Françaises,* 1940. Mr. Stehlé, who is a Collaborator of the New York Botanical Garden, has also recently sent other numbers to augment the Garden's files of publications from Martinique, among them two papers on orchids and on the genus *Piper,* from the Agricultural Bulletin of the Islands, a Catalogue of Phanerogams and Ferns prepared with L. Quentin, and a biography of Père A. Duss, of his own authorship.

Hayfever Plants by Roger P. Wodehouse, 245 pages, illustrated, indexed, published by Chronica Botanica Co., Waltham, Mass., 1945. $4.75. An authoritative work by a man whose career has been devoted to the study of pollen, with emphasis on the species that affect the human respiratory system. Dr. Wodehouse, who did some of his graduate work at the New York Botanical Garden, is now

Associate Director of Research in Allergy at the Lederle Laboratories. The chapters present the botany of hayfever; descriptive, classified lists of all the known hayfever plants; and regional surveys which tell the hayfever sufferer, by means of chronological tables and lists of plants, which parts of the country to avoid in the months when the troublesome species are shedding their pollen. A glossary and extensive bibliography precede the index. The book will be reviewed in an early number of the Journal.

Current Literature At a Glance*

By Harriet K. Morse

Patents. The U. S. Patent Office lists among its recent grants the following: a scarlet-red carnation; a hardy clingstone peach; a large, long-stemmed, purple viola; a hardy, day-blooming, long-lasting, pale pink waterlily; an avocado of nutty flavor and high oil content; and a fragrant hybrid tea rose in white overcast with La France pink. The Garden's Library has a complete bound set of United States plant patents dating from 1931, with full descriptions and colored plates. To date the collection contains 670 items.

Three Cereals. The story of rice and methods of rice farming in the Old World are presented, with illustrations, in *Natural History* for January. The wild rice of America, though of a different genus, is also discussed. Two previous articles have stressed the importance of wheat and corn in the development of different civilizations.

From England. "Answers to Growers" is the title of a new bulletin being issued by the John Innes Horticultural Institute in London. Articles of special interest in No. 1 are based on the questions: "What is the use of hoeing?" "How does seedling treatment affect the crop?" and "What is the best leaf-mould?"

* All publications mentioned here—and many others—may be consulted in the Library of the Botanical Garden, in the Museum Building.

Food from Wood. A good protein feed for cattle can be prepared from sawdust and other wood waste, according to experiments reported in *Country Gentleman* for January under the title, "Wood is an Amazing Crop." Other wood products discussed include ethyl alcohol, plastics, soil conditioners, and artificial flavorings.

A Botanist's Escape. A lively account of the scene in Honolulu on Dec. 7, 1941, and during the subsequent half year accompanies the story of Otto Degener's dramatic experiences in evacuating his botanical assets and coming by clipper to the United States to remain for the duration of the war and longer. The narrative appears in *Torreya* for last September, following a lecture that Mr. Degener gave before the Torrey Botanical Club. While in this country he has been continuing his work as Collaborator in Hawaiian Botany for the Garden.

Life of William Curtis. The bicentennial of the birth of this great "naturalist and humanist" was celebrated in England in January of this year, and the Jan. 5 issue of the British magazine, *Nature,* devotes two articles to him. William Curtis was the founder, in 1787, of the *Botanical Magazine* (still extant), and was the author of the monumental "Flora Londinensis" containing 435 magnificent color plates.

Aphid Resistance. How to tell at an early stage whether or not a plant will be resistant to aphid infestation is described in *The Journal of Heredity* for December, in a report of experiments at the Texas Agricultural Experiment Station. "This method," it says, "is based on the fact that if aphids are placed on the emerging first true leaf of a susceptible plant, in a very short time the leaf petiole bends downward and the young leaf begins to curl. Such effects are not produced in resistant plants."

Excised Root Studies. In a bulletin of more than 200 pages, dedicated to Léon Delarge, a young plant physiologist who lost his life in the recent war, his father, Georges Delarge of the University of Liége, reports extensively on roots that have been subjected to experiments *in vitro.* Repeated reference is made to the studies of Dr. William J. Robbins and his co-workers.

Notes, News, and Comment

Annual Meeting. E. J. Alexander and W. H. Camp addressed the annual meeting of the Corporation and Board of Managers of the New York Botanical Garden Jan. 22 in the office of Joseph R. Swan, President. Together they described the technique of exploration, Mr. Alexander explaining what must be done from the time an expedition is planned until the plants collected are shipped back home, and Dr. Camp continuing the story from there to the final identification of the specimens. Their talks will be published in the Annual Report to be issued in the spring.

Dr. Edmund W. Sinnott, Sterling Professor of Botany at Yale University and Director of the Sheffield Scientific School at Yale, was elected to the Board of Managers to fill one of several existing vacancies. By virtue of appointment by Columbia University, he had been a member of the Board from April 29, 1933, to Oct. 3, 1940, when he went to Yale. Previous to that time—from January 1930 to December 1932—he had been a Scientific Director of the Garden.

New members of the Corporation who were elected at the meeting were Arthur S. Vernay, Sidney J. Weinberg (who had been elected to the Board in September), Mrs. Albert D. Lasker (elected to the Board last April), Mrs. Hugh Peters and Mrs. Charles Doscher (new members of the Advisory Council).

All officers were re-elected for the year, and the seven board members whose terms were expiring were re-elected for another three-year term. They are Henry de Forest Baldwin, William Felton Barrett, Edwin De T. Bechtel, Henry F. du Pont, Rev. Robert I. Gannon, S.J., Mrs. Harold I. Pratt, and Joseph R. Swan.

Mrs. J. Henry Harper, who is Assistant to the President in the Manhattan office of the New York Botanical Garden, reported on progress in the campaign for funds, and Mrs. Robert H. Fife gave her annual report as Chairman of the Advisory Council. Dr. William J. Robbins presented the introduction to his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annual report as Director. The complete report will be published as a section of the Journal.

To Chicago. Dr. Frances E. Wynne, who had been Assistant Curator on the taxonomic staff since September 1942, left the Garden February 4 to be married to William Hillier, a lawyer recently returned from overseas service with the U. S. Army. Dr. Wynne will live in Chicago, where she plans to continue her studies of certain mosses for *North American Flora,* using the facilities of the Chicago Museum of Natural History. Much of her time at the Garden was devoted to supervising the illustrations being made for the revision of Britton & Brown's Illustrated Flora. She edited the *Taxonomic Index* during most of the time that Dr. W. H. Camp was away from the Garden, and for a time was Acting Editor of *The Bryologist,* to which she also contributed several papers. Other botanical studies of hers have been published in the Bulletin of the Torrey Botanical Club and elsewhere. "A Life Story of the Mosses" appeared under her signature in this Journal for April 1944. She had previously lectured on mosses at the Garden and last year took part in the series of Saturday programs in the spring on "The Great Groups of Plants." Dr. Wynne assisted in several of the botany classes given in the Garden's Science Course for Gardeners and also taught a class at Hunter College.

John R. Brinley. A man whose name was often associated with the New York Botanical Garden in its early days died in Morristown, N. J., Jan. 31. He was John R. Brinley, civil engineer and landscape architect, who had done extensive work on the laying out and developing of the grounds when the Garden was first being landscaped. He was retained by the Garden as Landscape Engineer from January 1901 until December 1931. He was 84 years old at the time of his death.

Garden Lectures. A series of four invitation lectures on gardening subjects has been sponsored this winter by the Women's Division of the Garden operating through the Manhattan office. Held at the home of Mrs. John Sloane, the opening lecture took place Jan. 17 with T. H. Everett speaking on "Gardening Efficiently." He was preceded by Dr. William J. Robbins, who described the Garden's functions and activities to the group of 100 invited guests. A question period followed Mr. Everett's talk, with James G. Esson, James B. Jack, and Arthur King participating in the answering. The lectures were planned by a committee headed by Mrs. Melvin E. Sawin and Mrs. John Beals, and including Mrs. James Cox Brady, Mrs. Robert H. Fife, Mrs. Harold I. Pratt, and Mrs. Ogden White. Patronesses sponsoring the series are Mmes. William C. Breed, W. Douglas Burden, Charles Burlingham, Robert De Vecchi, Sherman Haight, Lytle Hull, James R. Hunt, Jr., O'Donnell Iselin, Jan Juta, James A. K. Marshall, Edwin G. Merrill, Harold R. Mixsell, Frederick Moseley, Harry T. Peters, Reeve Schley, John Sloane, and Myron C. Taylor.

Subsequent lectures were: "Planning and Planting To Save Garden Upkeep" by H. E. Downer with Edwin Beckett and Frederick Sparks assisting in answering questions; "What's New in the Garden" by J. H. Beale with George H. Gillies and F. F. Rockwell assisting; and "That Construction Problem" by A. C. Pfander with Henry B. Aul and Carl F. Wedell assisting.

Lectures. In Providence the evening of Jan. 26, the Rhode Island Horticultural Society saw the Garden's 20-minute motion picture film, "Plants and the Life of Man," and heard a lecture by Dr. William J. Robbins on "The Importance of Plants to Man." Dr. Harold N. Moldenke addressed a group of garden clubs in New Jersey on "Marvels of Adaptation Among our Local Plants" Jan. 23, and on Feb. 8 spoke before the Garden Club of Englewood on "A Naturalist in Florida." Elizabeth C. Hall talked to the Scarsdale Women's Club garden section on horticultural literature Jan. 23. On Jan. 6 she addressed alumnae of Ambler School of Horticulture for Women on "The Library of the New York Botanical Garden and its Readers." E. J. Alexander described his Mexican expedition at the annual meeting of the Garden's Advisory Council Dec. 10.

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

Third Avenue Elevated to the Botanical Gar
York Central to the Botanical Garden statio

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

The New York Botanical Garden was incorporated by a special act of the Legislature of the State of New York in 1891. The Act of Incorporation provides, among other things, for a self-perpetuating body of incorporators, who meet annually to elect members of the Board of Managers. They also elect new members of their own body, the present roster of which is given below.

The Advisory Council consists of 12 or more women who are elected by the Board. By custom, they are also elected to the Corporation. Officers are: Mrs. Robert H. Fife, Chairman; Mrs. Elon Huntington Hooker, First Vice-Chairman; Mrs. William A. Lockwood, Second Vice-Chairman; Mrs. Nelson B. Williams, Recording Secretary; Mrs. Townsend Scudder, Corresponding Secretary; and Mrs. F. Leonard Kellogg, Treasurer.

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

APRIL EVENTS AT THE GARDEN

Members' Day

April 3 3:30 p.m. *Report on Mexico* — *E. J. Alexander*

Saturday Afternoon Programs

3 p.m. each Saturday

April 6 *Lilies for Garden Beauty* — *A. B. Stout*

April 13 *Wild Flowers Seen on Springtime Walks*
With Kodachrome Illustrations — *Walter Shannon*

April 20 *Plants of the Bible* — *Harold N. Moldenke*

April 27 *Realm of the Wild—*
A motion picture in sound from the U. S Department of Agriculture

Radio Programs

3:30 p.m. on alternate Fridays over WNYC

April 5 *Little Gardens of New York City*
Honorary President, Little Gardens Club — *Mrs. Garret Smith*

April 19 *Bugs, Beware!*
State Institute of Agriculture on Long Island — *Louis Pyenson*

Courses of Study

Outdoor Gardening Practice, Arthur King and George H Gillies, Instructors, starting April 18, 7 p.m. Part of the Two-Year Course in Practical Gardening.

Field Botany, G. L. Wittrock, Instructor, starting April 20, 1:30 p.m. Identification of wild flowers, trees, shrubs, and ferns.

Garden Construction, A. C Pfander, Instructor, starting April 30, 7 p.m. Actual, supervised work in the building of garden fixtures.

Forthcoming Events

Members' Day, May 1, Comments on the Living Plants Displayed, by T H. Everett. *Saturday Programs*: May 4, Plants of Tropical Regions, with Scenes from Nassau, by Otto Degener; May 11, Journey to Ecuador, with a motion picture, "Down Where the North Begins," by W. H. Camp; May 18, Mushrooms and Other Useful Fungi, by F. J. Seaver.

TABLE OF CONTENTS

APRIL 1946

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58. N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.50. Single copies 15 cents. Free to members of the Garden.

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of

THE NEW YORK BOTANICAL GARDEN

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Introductions of Daylilies in 1946

By A. B. Stout

WITH the ten new daylilies here named and described, the number of horticultural clones of *Hemerocallis* named by the writer reaches fifty-nine. The total number of pedigreed seedlings that have been grown and studied in this breeding project is about 100,000; so the proportion of named selections is about one in 2,000. The remarks made in the Journal of the New York Botanical Garden in January 1941 in connection with descriptions of introductions of daylilies apply equally well to the selections that are now given horticultural names.*

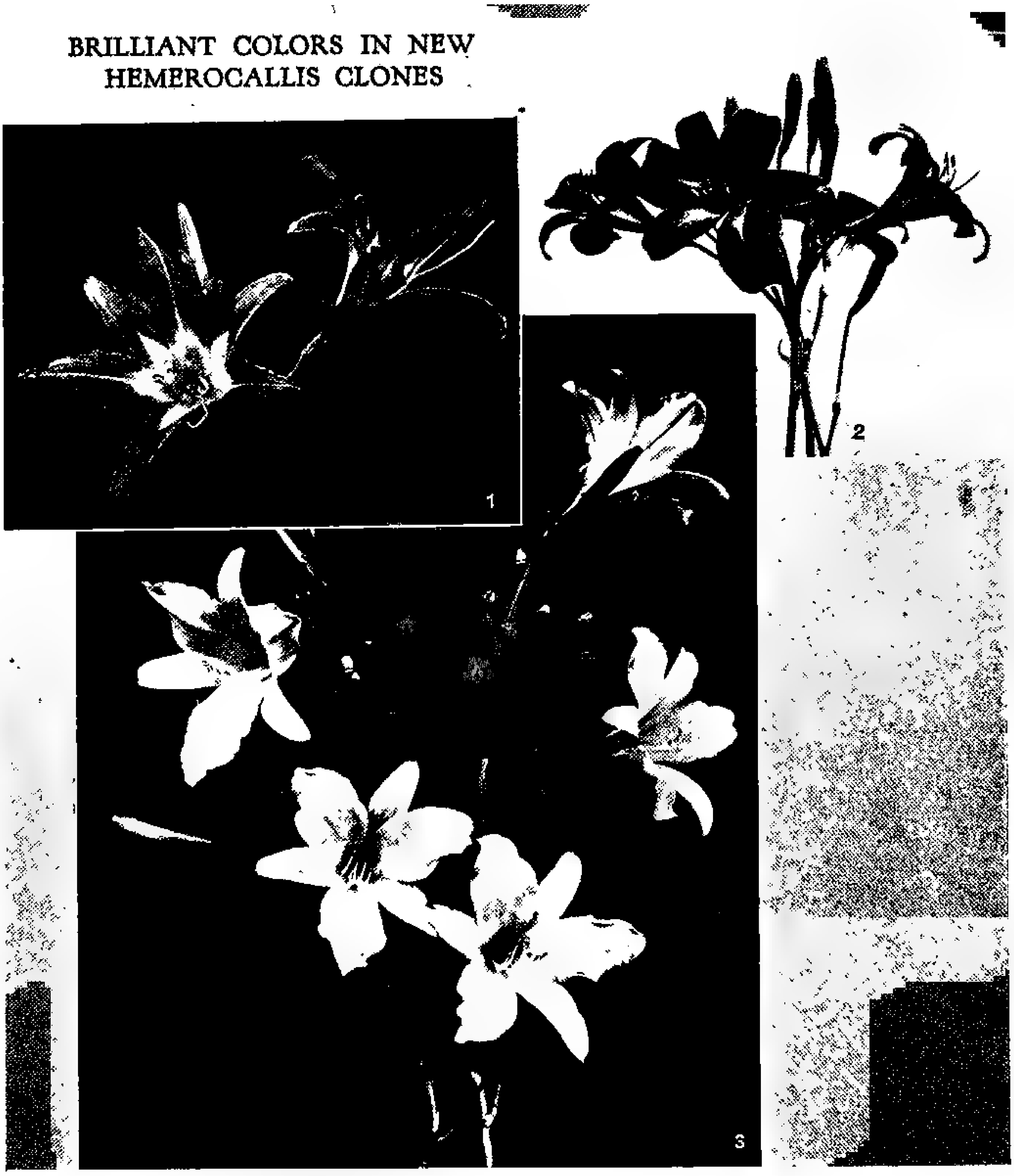
As a rule a selection seedling is observed over a period of at least five years. Several years after the first flowering are indeed necessary before a plant reaches its full stature and habit of growth. Only then can adequate evaluations be made, based on critical comparisons with other seedlings and with named clones of the same type or class.

The past five years have been difficult ones for nursery propagation and hence there is only limited stock of these new daylilies for distribution by the Farr Nursery Company, which propagates these plants for distribution to the trade.

* "All of these are seedlings of hybrid origin and many have a complex ancestry that includes several species and also several generations of selective breeding after the hybridization. In the descriptions of the coloring, references are made to "Color Standards and Color Nomenclature" by Ridgway, to the first volume of the "Horticultural Color Chart" recently published by the Royal Horticultural Society, and to the plate of colors in the "Garden Dictionary" edited by Norman Taylor and published by Houghton Mifflin and Co. . . .

"It has already been reported to the readers of this Journal (February 1931, page 32) that the New York Botanical Garden does not propagate the daylilies either for sale or general distribution. This is done by the Farr Nursery Co. All of the clones here described have been under observation and critical evaluation during several years of propagation in the nursery of this company, whose records on evaluations, on vigor and hardiness, and on other important characteristics of these selections have been considered in deciding on introductions and in formulating the descriptions here presented."

BRILLIANT COLORS IN NEW HEMEROCALLIS CLONES



1. *Firebrand, rich crimson-red with orange throat.*
2. *Blanche Hooker, brick red with a throat of light cadmium.*
3. *August Orange, rich coloring with numerous flowers on branching scapes.*

Numerous gardeners visit the experimental plots of daylilies at the New York Botanical Garden once during a season of flowering. Some come two or more times in one season. As a rule the choice of seedlings by these persons is based on personal preferences in regard to color of flowers. There has, however, been a growing appreciation of the various horticultural classes of daylilies and of their comparative values in gardens. The great diversity now existing in daylilies makes such evaluations necessary. The writer has records of many selections which visiting gardeners have made. One such evaluation is noted in the description of the ***Firebrand Daylily.***

Several somewhat distinctive daylilies are included in the ten here described. None closely duplicates any clone already named. Some of the readers who have visited the experimental plots in recent years will note that several of the somewhat distinctly new classes (Early Dwarf, Pink, Mignon, and Candelabrum) are not represented in these selections. A considerable number of selections in these classes was made in 1945 and these will be critically evaluated as well as propagated during the next five years. These selections include several of the pink-flowered type, the best of which will be named ***Martha Turner,*** and also several seedlings with crimson-red flowers, one of which will be named ***Martha Strong.*** For years both Mrs. Theron G. Strong and Mrs. Harold McL. Turner have been active in the selection of seedling daylilies and have shown special interest in the progress of the breeding. Mrs. Strong has been a member of the Advisory Council since June 1918 and a member of the Corporation since January 1931. Mrs. Turner, her daughter, was a member of the Advisory Council from April 1925 and of the Corporation from January 1931 until her death on September 27, 1945.

The new clones of daylilies here named and described for the first time are as follows:

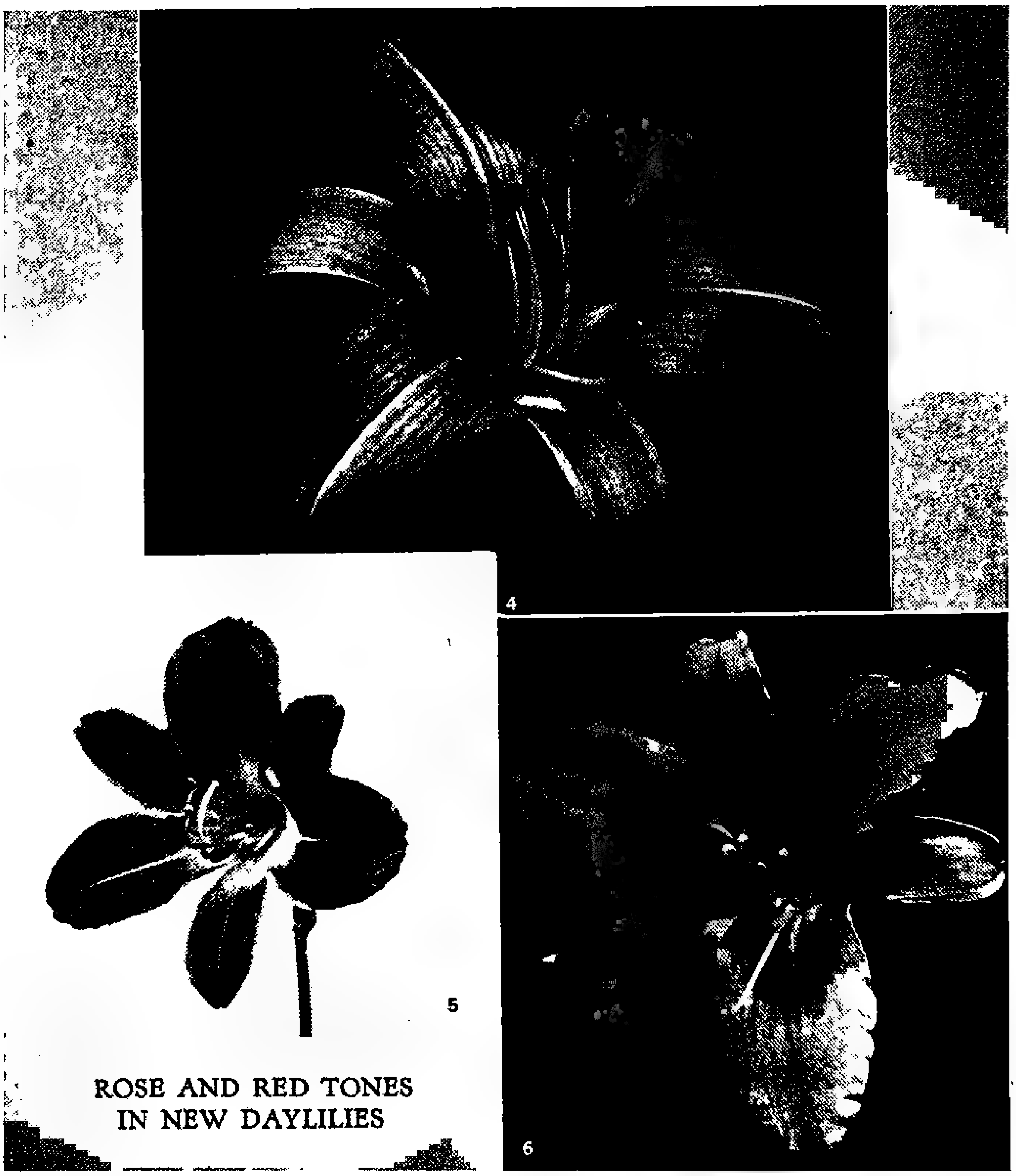
August Orange Daylily: This daylily blooms in August. The flowers are rich orange and are larger and more conspicuous than those of *H. multiflora*, which is one of the parents. The scapes are about 3 feet tall and much branched. The plant is dormant in winter and will probably be hardy throughout northern United States.

Blanche Hooker Daylily: Visitors have frequently classed this plant as the "best red" of all the numerous seedlings in bloom at the New York Botanical Garden during the last ten days of May. There is also a second rather profuse period of flowering in September and October. The flowers have a spread of about 4½ inches; the color of the throat is near deep chrome or light cadmium (a shade of orange), and the blades are near brick red (Ridgway) and slightly more intense in the midzone. The scapes reach a height of about 3 feet. The foliage is evergreen and there is some winter injury at New York.

Mrs. Elon Huntington Hooker (Blanche Ferry Hooker), in whose honor this daylily is named, has been a member of the Corporation of the New York Botanical Garden since 1933, a member of the Advisory Council since 1931, its chairman from 1934 to 1941, and a member of the Board of Managers since January 8, 1934.

Caprice Daylily: For its season of flowering in late May and early June the ***Caprice Daylily*** is a distinctive and somewhat new type. The flowers are relatively small (about 2½ inches in spread), full, cup-shaped and rich brownish red. The sepals have a border or margin of cadmium which is the color of the throat. The buds are dark brownish red. The scapes are usually about 2 feet long and the flowers are mingled with or somewhat surmounted by the tips of the foliage. The habit of the plant strongly resembles that of *Hemerocallis minor*, which is the seed parent. The pollen parent was a complex hybrid which had in its parentage *H. flava, H. fulva* clone ***Europa*** and *H. Middendorffii.*

Fantasia Daylily: The widely spreading petals and sepals, usually much twisted, with pale and rather faint dull red tints over greenish yellow, give the flowers of this plant distinctive charm. The red pigmentation gradually increases toward the tip of the petals where it approaches burnt sienna. Thus there is a two-toned distal color pattern. The sepals are less red than the petals. In well grown



4. *Rose Gem, with old rose coloring.*
5. *Caprice, a smaller flower of brownish-red with cadmium throat and sepal margins.*
6. *Fiftieth Anniversary, a handsome large flower of orange-red, the petals marked with oxblood red, the throat tinged with green.*

RECENT DAYLILY DEVELOPMENTS WITH EVERGREEN LEAVES

7. *Viking, a tall plant with good foliage; the flowers orange-red.*
8. *Fantasia, the twisted petals showing faint red tints over greenish yellow.*
9. *Georgia, an unusual pastel combination of pale rose and buff.*

plants the scapes stand above the foliage and reach a height of nearly 4 feet. The foliage is evergreen and there has been some, but no fatal, injury at New York during severe open winters when plants were given no protection.

Fiftieth Anniversary Daylily: The rich orange-red coloring (orange-rufous) of the blades, the broad midzone of oxblood red in the petals, and the greenish orange throat of the flowers combine to give outstanding character to this clone. The flowers are full and about 5 inches in spread and the period of flowering begins in late June. The scapes stand about 3 feet tall. A good showing of flowers has been made during the past 8 years. The plant has an evergreen habit. The year 1945 marked the fiftieth anniversary of the New York Botanical Garden. Various members of the Garden's staff, including the Director, collaborated in the selection and naming of this plant.

Firebrand Daylily: This daylily has a rich crimson-red coloring (near Morocco red of Ridgway), with conspicuous orange throat, and a Wau-Bun type of flower shape but somewhat less full. It is a seedling obtained from ***Wau-Bun*** x ***Red Bird*** that first flowered well in 1936, when it was admired and its selection requested by Mrs. Gifford Pinchot. The scapes stand erect to a height of 3½ feet. Flowering period begins in late June. The foliage is evergreen.

Georgia Daylily: This daylily is somewhat like the ***B. H. Farr Daylily*** but is a taller plant that is later in blooming. The flowers are large, full, and widely spreading. The general color is a pastel or pale buff with delicate rose tints, the veins of the petals are darker, there is almost no eye-zone, and the throat is greenish yellow. The foliage is evergreen but the plants have suffered little or no winter injury at New York. A well grown plant stands from 3 to 4 feet tall. At New York the period of flowering is in July. The delicate coloring of the flowers is somewhat remindful of peach colors—a feature which suggested the name ***Georgia.***

Manchu Daylily: In comparison to the ***Georgia Daylily***, this has a narrow, arching but prominent eye-zone in the petals. The throat is greenish yellow and the general color of the blades is near apricot-orange. The flowers are medium large. The scapes are 3 to 3½ feet tall and they stand only slightly above the mound of leaves. The period of flowering is in late June and early July.

Rose Gem Daylily: This plant has a vigorous habit of growth with a fine mound of evergreen foliage and scapes to 4 feet. The flowers are medium large and full with a spread of nearly 6 inches. The general color of the flower is near old rose (Ridgway XIII), there is some eye-zone of a darker shade in the petals but this is not in very sharp contrast. The throat of greenish yellow is conspicuous, especially when the flowers are viewed from a distance. In some winters at New York the plant suffers some winter injury but the recovery in summer is very complete and the plant makes a fine showing of flowers during July and early August.

Viking Daylily: The scapes of this richly colored daylily are about 3½ feet tall, stiffly erect and well branched. The foliage is evergreen but hardy and upstanding, and it holds its form and dark green color throughout the summer; hence it is cleaner and of better appearance than many daylilies. The flowers are medium large; the segments spread widely and smoothly, holding their form well. The general color is a rich orange-red without much of an eye-zone and the throat is greenish chrome. The plant has an excellent habit and a commanding appearance. At the New York Botanical Garden the period of bloom has been from mid-July to mid-August.

Growth

By William J. Robbins

A talk delivered during the Philharmonic-Symphony United States Rubber Company broadcast over CBS Network, Sunday, February 10, 1946.

GROWTH is a subject of interest to all of us. It is a personal subject. We have all grown. We may wonder at times why we have grown no more than we have, or why we grew the way we did; but not many persons do more than wonder. Few attempt to learn what growth is, how it occurs, and why—or to answer any of the other fundamental questions we might ask about this process which we all experience.

What is growth? Most people would probably answer by saying that when anything grows it gets bigger. But this is evidently not all that we mean by the term growth. A dog is not merely an enlarged puppy; a man is more than a magnified infant, and an oak tree is much more than an expanded acorn. As an individual grows, the body structure and its proportions and functions change. This phase of growth is commonly called *differentiation,* or is referred to by the term *development,* and in all but the simplest living creatures it is intimately associated with increase in size.

Most living things originate as a single cell, microscopic in size and derived from the parents. This minute bit of protoplasm, or living material, grows—that is, it divides and multiplies, until the mature individual - if it be one of the larger plants or animals—contains millions on millions of cells, all descended from the original one. An average-sized potato, such as you may have eaten for dinner, has between five and six billion cells. As these cells are formed, they enlarge; and they also change in character, become organized into tissues and organs—that is, they undergo *differentiation.* This phase of growth is the process that makes our bodies develop with separate organs and parts, instead of becoming merely a shapeless mass of 160 pounds or so of quivering jelly.

Differentiation follows a definite rule with each kind of living thing. A frog's egg always grows into a frog, and never into a chicken or a peony. Our nose always grows on the front of our face and not, fortunately, between our shoulder blades. What causes differentiation, and what causes it to follow a definite rule? Why do we grow hair on the top of our head instead of on the soles of our feet, and why does an orchid not produce tomatoes? Why do we stop growing? Why don't we continue to enlarge throughout our lives and reach a height of 10, 15 or 20 feet instead of 5 or 6?

A usual answer is *heredity*, which means in plain language that our fathers grew that way before us and we grow like them. The cell from which each individual, plant or animal, starts contains a special kind of living stuff derived from its parents. Therefore, like theirs, it carries on a predetermined series of chemical reactions and physical processes which result in the characteristic structure and life span of the individual.

To make this point of view clearer, we might use an analogy from a familiar type of fireworks. Perhaps you have seen the kind called Pharaoh's serpent, in which the tip of a small cone of mercury sulfocyanate, when lighted, burns and forms a serpent-like ash a hundred times or more the size of the original cone. The growth of Pharaoh's serpent depends on the kind of material of which the cone is made. To use charcoal, sulfur, or gunpowder will not do. It *must* be mercury sulfocyanate. The behavior of the ash depends also upon the chemical reactions which this stuff undergoes. Only oxidation, that is, burning, forms the snake. Also, the cone must burn from the tip. If it burns over all its surface, the ash will form a shapeless monster rather than a serpent. This shows that certain physical conditions also are necessary to get the desired result.

Thus we conceive the growth of a plant or animal to depend upon the particular kind of living stuff in the original cell. We picture this highly individualized living stuff as carrying on its own series of chemical reactions and physical processes which culminate in the characteristic mature individual. The chemical constitution of living protoplasm is, of course, exceedingly complex, and the chemical reactions and physical processes in growth are infinitely numerous and complicated.

When we say growth takes place by a process in which each cell divides into two, followed by enlargement of the resulting cells and their differentiation into permanent form, we are actually giving but the barest outline of growth. This concept is important, because it suggests that anything which changes the nature of the original protoplasm, the living matter in the cells, or which modifies the interrelated chemical reactions of the substance of the cells, will influence growth. And that idea is fundamental. Such substances as the sulfa drugs and penicillin are effective because they interfere with some of the chemical reactions essential for the growth of bacteria. Thus, growth is not only a problem for the biologist, it is one which concerns the physicist and chemist as well. We need to know not only the details of the way in which cells divide and how they are arranged in tissues and organs; we need knowledge also of the chemistry and physics of growth, the role played by enzyme systems and their inhibitors, information on surface tension and radiations, and many other highly technical matters.

One of the things we should like to know is how to control growth. Many of the diseases which plants and animals endure are results of the growth and multiplication of other organisms in or on their bodies. For example, athlete's foot is caused by the growth of a specific fungus in the skin of the foot; pear blight is caused by the growth of particular bacteria in the twigs of the pear tree; pneumonia is a consequence of the growth of certain bacteria in the lungs. To prevent or cure these diseases we must prevent or stop the growth of the parasite in the host. The rotting of fruits and vegetables, the decay of lumber, and the mildewing of cloth are caused by the growth of bacteria or molds in or on the material affected.

As human beings we grow—and we grow old. What causes old age and senility? Do all living things age? Is there a fountain of youth? These are questions intimately associated with the process of growth. Even cancer is a growth problem. In cancer certain cells of the body which have matured and ceased to grow suddenly change their character and begin to grow rapidly. As a consequence they do not keep their ordered place in the community of cells but become unruly members which insist on pushing their way through and over their more orderly associates, and thus destroy the body of which they are a part. Why should some cells—and not others—change from their mature non-growing condition to a rapidly growing form, and how can they be induced to return to their normal and harmless condition? If we knew enough about growth we could answer these questions and many others.

One of the interesting and hopeful things we have learned is that growth is fundamentally the same process in humble and simple living things, both plants and animals, as it is in man. We can experiment more easily and freely with these less complicated forms of life, though the final test, of course, is the particular organism concerned, and that may be the human body. It is important, therefore, to study growth in plants, including the bacteria, yeasts, and molds. It is important not only because such study enables us to control these living things and use them but also because it tells what may occur in our own bodies. Perhaps it seems odd to think of looking for an answer to old age or cancer in the growth of yeasts, fungi, or squashes, yet the key to these problems so profoundly important to us may be discerned more readily through the study of plants or some other lowly things than in man himself.

BROADCAST

By CHARLES A. BERGER, S.J.

IN CLASSROOM *and laboratory, onions from a nearby grocery-store are helping to enlighten both students and scientists in their studies of cells and chromosomes. Dr. Charles A. Berger, S. J., head of the biology department at Fordham University, described his investigations of cells in the root tips of onions in the New York Botanical Garden's broadcast over station* WNYC *October 5. Father Berger's answers to some of the questions he was asked over the air are given here.*

NEARLY all biologists have at some time used the onion for study, because in working on cell structure and behavior, they generally find the largest cells in the tips of the onion roots.

To provide a bit of background first:

All living things, plants and animals both, are made up of living cells, which are microscopic in size. Growth consists of the constant dividing of these cells. Each cell becomes two; each of these becomes two, making four; these divide again and thus, with geometric progression, we soon have a complicated structure such as a moss—or an onion,—yes, or even an animal. Every human being began life as a single cell, which, just like the first cell of a growing onion, divided and divided and became differentiated until an embryo was formed with recognizable parts. The fact that all living structure and growth depend upon microscopic cells and their behavior makes the study of the cell important.

70 *Years of Cell Study*

The earliest studies of cell structure were made in the 1870's — the period known as the Golden Age of cytology. Onions have been used in this work for about the past 50 years. It took at least a generation of workers to discover the plant that was best suited to their research. Hyacinths and a few other plants actually contain larger cells, but one can not obtain them so readily, and in the last few years they have been out of the market entirely. But onions are always easy to buy at any neighborhood store. The older they are, the better for the purpose.

In recent years, in our own laboratory at Fordham University — and in many other institutions too—biologists have been treating the growing onion root tips with various chemicals and drugs and observing the effects of these substances on the dividing cells. Through the microscope we can see remarkable changes in the cells under the influence of certain chemicals. Of course, we are looking at only the minutest fraction of the entire plant, but in this way we get a preview of what might happen to any mass of living matter if it were all exposed to these chemicals. By studying these artificially produced abnormalities, new information is obtained about the normal process of cell division.

From Research to Application

Pure science research is primarily concerned with increasing man's knowledge and not with applying the newly found information to particular uses. The application of biological discoveries is usually made by medicine, agriculture, or industry. For example, some of the chemicals applied to onions have the effect of doubling the size of the cells. Agricultural stations and horticultural institutions now use these chemicals to produce new types of plants with larger flowers or leaves or fruits.

The onion is also employed in medical research. At Montefiore Hospital in the Bronx Dr. Michael Levine is using the onion in his study of the causes of cancer. By application of chemical agents he produces cancer-like swellings on the onion root tips, then he studies the cells of these abnormal growths under the microscope.

Chromosome Investigations

My own special field of research with the onion is the chromosomes that are in the cells.

When a cell is ready to divide and make two cells, each exactly like the original one, the chromosomes divide lengthwise and are then distributed equally into the two halves of the cell. When they are in place, a wall develops down the middle of the cell, and thus two new cells are formed. Each of them soon is as large as the parent cell, and ready in turn to divide in the process of growth.

It was not until around 1880 that the behavior of the chromosomes in a cell was first noted and verified by scientists. A cell itself is microscopic in size, and the chromosomes are so much smaller that they are difficult to distinguish, even with the finest of microscopes. Now that we know what to look for, the problem is probably not so great as it was in the earlier years, when chromosomes were first being discovered, and yet those pioneer scientists made as fine observations as are being made today. With little more than half a century of work behind us, however, there is still much to be discovered about cells and chromosomes and their effect on life. I always tell my students that chromosomes are the most important material particles in the universe, because chromosomes are known to contain the material that is responsible for heredity.

A Hidden Botanical Garden

Planted Only by Nature, Sycamore Canyon in Southern Arizona Yields Species of Plants from Distant Regions As Well as Numerous Rarities

By Leslie N. Goodding

IF you care to wander down to the southern border of Arizona, following the unsurfaced road indicated on the sketch map here, you will find, in a neglected nook called Sycamore Canyon, a remarkable botanical garden in which the agencies of nature have been the only planters. In this narrow, precipitous ravine, extending scarcely five miles from north to south, plants from the tropics and species from the north combine with other rarities, as in a man-made garden, to present a pattern of vegetation that is unique. The terrain is so rugged that cows and man alike have been discouraged from violating the sanctum, and even botanists generally have recognized the place as having nothing more than passing interest.

Though the canyon itself must be explored on foot (horses can traverse only a few spots), an automobile can carry you to the very gate of the hidden garden. The best approach is from the north, taking the Nogales highway to the Amado junction (which is just a service station and store along the road), then turning almost due west on the main road (unpaved but well traveled) to Arivaca, a little "Mexican" village. From that point the road leads almost due south a short distance and then, worried by the topography, winds aimlessly toward the hills to the south. The old adobe walls and ruined buildings of the once somewhat famous mining camp of Oro Blanco are passed and finally the more recent mining town of Ruby—until lately a heavy producer of silver. Ruby is left behind on the traveler's right, and the road grows poorer. To one used to mountain roads of the West, however, it is still a good road. Five miles over hills and ridges and down draws from Ruby bring you to the entrance to the garden. From the highway, if it may be called such, in the very bottom of the draw, a dim road leads to the right. This ends abruptly a short distance beyond a stock-watering trough.

Two sights will assure you that you have arrived at the desired site. First of these is several trees of *Salix taxifolia.*[1] You must travel many miles from here to see another of these trees. A specimen or two is hidden away northeast of Tucson, a few occur on the Santa Cruz east of Nogales, a few in the San Rafael Valley west of the Huachuca Mountains. For

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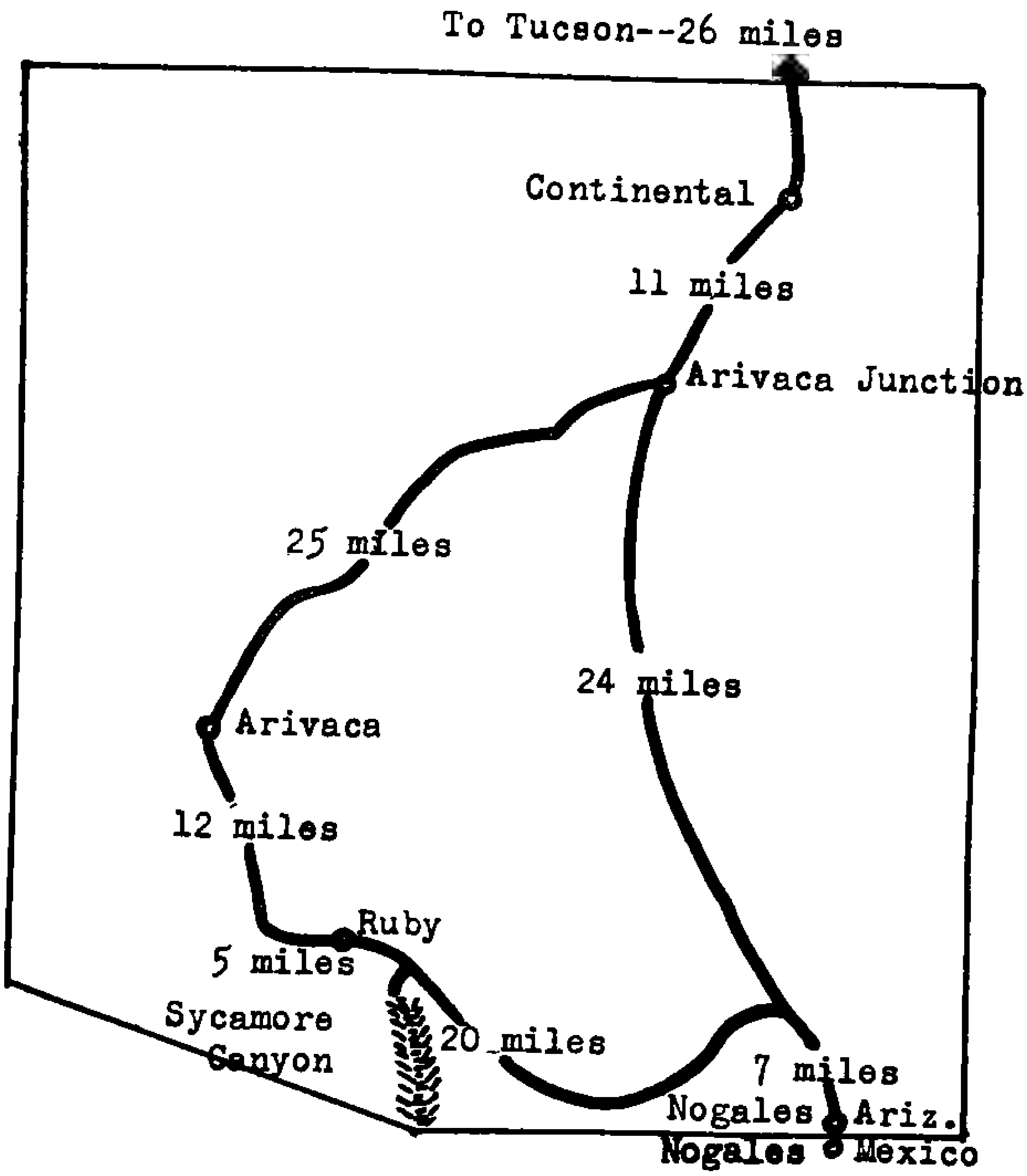
[1] This writer has depended entirely on "Flowering Plants and Ferns of Arizona" by T. H. Kearney and R. H. Peebles for the taxonomy of the plants of this region. The Pinchot juniper is the only plant mentioned here which is not recorded in that book.

more, you must jump into the southwestern tip of New Mexico. *Salix taxifolia* is unique among willows, at least in the United States. The leaves are small, narrow and silvery, the twigs small in the extreme, and the tips form perfect canopies. Incidentally, the branches are pruned just cow high, since the leaves and twigs are relished by cattle.

Another landmark has some historic significance. It is the remains of the old Bartlett ranch. Only an old adobe corral and a few broken-down adobe walls of buildings remain of this once prosperous cattle ranch. Here on April 28, 1886, Apaches attacked the ranch and two men were wounded. Most of the story revolves about two ten-year-old boys who ran the Indian



A small corner of southeastern Arizona, showing the location of Sycamore Canyon.

gauntlet to warn the women and children at a nearby ranch and also the men in Oro Blanco. Many weird stories are told. Some must be woven about hidden treasure, for holes have been excavated in the corners of the old adobe building in an evident search for gold, jewels, or trophies.

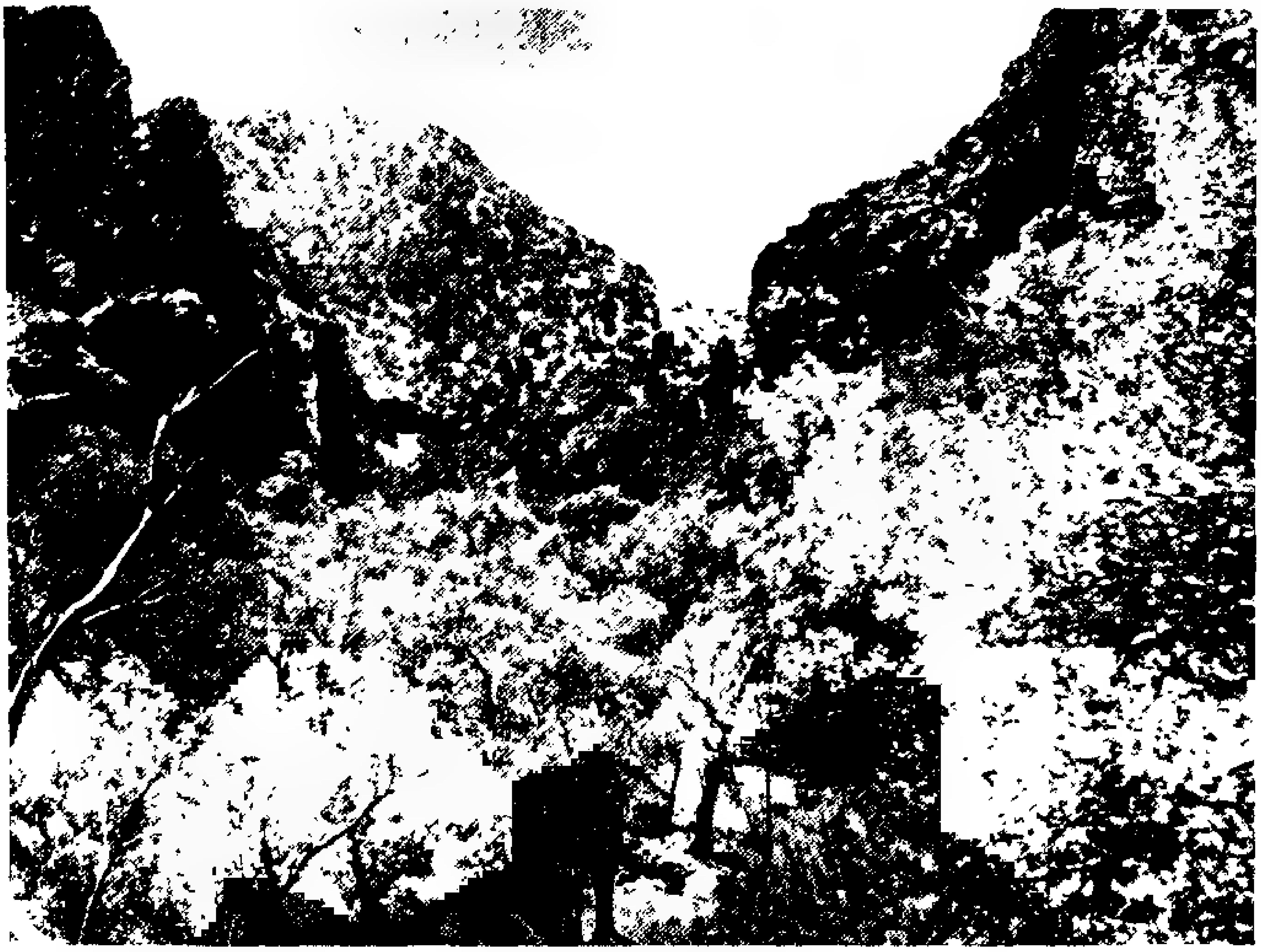
If you wish to explore the garden you will probably park your car in the shade of a widely spreading Emory oak (*Quercus emoryi*). To those who are unfamiliar with this oak its virtues should be extolled, for its acorns, unlike those of most of our oaks, are tasty. The tree is not peculiar to this region, but covers vast areas in New Mexico, Arizona and Mexico, where, at the bases of the southwestern ranges, its forests resemble vast orchards. During the acorn season hundreds of Indians and Mexicans move to the forest to gather BELLOTAS, or acorns, which are common in season in the markets of most southwestern and Mexican towns.

The gateway to the garden is little more than a wash, though a stream emerges from the sands during the rainy season and even in the driest years small seeps of water are to be found occasionally. In spite of the shifting gravel and the total disappearance of the water for long distances during drought, the seeps are always teeming with fish, the largest of which are seldom more than three inches in length.

Almost immediately below where you park, the wash begins to narrow, and as you follow it around a sharp bend, you get the first glimpse of what may properly be called the gate to the garden—slender pinnacles of rock, perhaps one hundred feet high. At the approach to this gate there are abundant trees—notably cottonwood (*Populus arizonica*), ash (*Fraxinus velutina*), and willow (*Salix bonplandiana* var. *angustifolia*) which in size and beauty are beyond the commonplace.

At this point an insignificant side wash yields at least four relatively rare plants: The cassava plant (*Manihot angustiloba*) forces its roots between crumbling layers of rock; two trailing beans, *Phaseolus ritensis* and *P metcalfei,* both of which somewhat resemble kudzu vines, occur on the steep slopes partially shaded by one of the white oaks (*Quercus oblongifolia*); and often associated with *P metcalfei* is the butterfly pea, *Clitoria mariana.* Pause a moment to recall that the butterfly pea grows in the woods of Virginia, and no one in his right mind would accuse it of being a weed or of having been brought to this spot by man. Just as sidelights: The beans of the Metcalf bean are as large as large peas and are delicious to eat—though it is true you might well starve while gathering a mess; rodent competition is too keen. The manihot that grows here is a species unknown to commerce, and the writer has been unable to find any reference to its use as a food plant. It responds beautifully to cultivation and produces large quantities of starchy roots. Like some other manihots, it carries probably lethal amounts of hydrocyanic acid, but also like the others, it can probably be made safely edible with proper treatment.

In the main wash, slightly below your last detour, on the steep west bank



General view of the entrance to Sycamore Canyon.

a rare passion vine (*Passiflora bryonioides*) carpets the sloping rocks. The flowers are typical passion flowers about one inch in diameter with white petals and purple crowns. The center of the small fruit is edible—in case you are quite hungry.

A few rods downstream (from this point on you may designate the wash as a stream) you view a rugged canyon to your right. This is well worth a detour, but the climbing grows tough. Massive boulders and brush obstruct the way. Junipers and oaks are most abundant. Perhaps this can be classed as site A1 for the low, much branched Toumey oak (*Quercus toumeyi*). While this oak, with its small, shiny, dark-green leaves, is not rare in southern Arizona, it is probably unknown to most of our readers. On the north-facing slope of this canyon is a riot of vegetation. Echeverias (*Echeveria rusbyi*) cling to the crevices in the rocks. *Mimosa grahami* var. *lemmoni* happens in just the right place to draw a bit of your blood as you attempt to climb the slope. Tight against the foot of the cliffs are banks of *Choisya mollis* with their waxy white and exceedingly fragrant flowers. It would be a prize in any man-made garden, but it seems to pine away in captivity. In spots are encountered thick brambles of blackberry (*Rubus oligospermus*) in thickets of mulberry (*Morus microphylla*) and hoptree (*Ptelea angustifolia*). In case you are interested, the blackberries, while delicious, are so small that it takes a few to fill a cavity in your teeth. The mulberry is an excellent wild-life and soil-conversation plant, easy to propagate and hardy. The "fly in the ointment" is that the birds beat you to the berries and make seed collection extremely expensive. In southwestern folk-lore, thickets of hoptrees were favorite places for the whites to hide the graves of the victims in Indian wars. Why? Perhaps even the "fact" is fiction.

Below the bramble and the mulberry are three shrubs, one of which in some regions is a vine. Even here the tips of its branches twist crazily in the air. This shrub (*Lonicera albiflora* var. *dumosa*) should have stayed in the higher mountains. The two others are hydrangeaceous shrubs with waxy white and fragrant flowers. The name "mock-orange" is applied to one, *Philadelphus microphyllus,* and perhaps also to the other, *Fendlera rupicola.* These plants are beautiful, but both are hosts of the most hideous disease affecting junipers. In many places along Sycamore Canyon can be observed the huge swellings on the boles and branches of the alligator-bark Juniper (*Juniperus pachyphloea*), the one-seeded juniper (*Juniperus monosperma*), and the Pinchot juniper (*Juniperus pinchotti*). To the pathologist these are beautiful specimens—perverted taste.

The climb up this canyon is an awful scramble. Ladies, wear your slacks, and Scotch Highlanders, better don a pair of overalls. Perhaps the prize of your trip, if perchance you are lucky, will be a beautiful little fern, *Asplenium exiguum.*[2] Consult Kearney and Peebles' "Flowering Plants and Ferns of Arizona" to get an appreciation of it — a native of the Himalaya Mountains and thus far, judging by written records, found in the United States in only two places, and in each of these places probably by but one man.[3]

An interesting detour from the main canyon can be made by crossing over to the next watershed to the south of the side canyon you have been exploring, and working east back to Sycamore Canyon. Perhaps this should be designated as dangerous, as the country becomes cut up into numerous deep, small canyons extremely difficult to traverse. The writer owes his life to a good hat and a thick skull on one of his trips through this bit of country. Women should stay out, and men should go in pairs, for buzzards would have several days to pick your bones should you fall, before your friends could find you. The reward of such a side trip might well be kidneywood (*Eysenhardtia polystachya*); Gregg ash (*Fraxinus*

[2] If the reader is disappointed at the omission of some of his favorite genera, the writer begs forgiveness, for, although they may occur in the canyon, this paper is intended only to stimulate interest in this little known region, and not to give a complete catalog of its plants.

[3] J. G. Lemmon made the first collection, in the Huachuca Mountains. So far as he knows, the writer is the only one to have collected this fern from Sycamore Canyon.

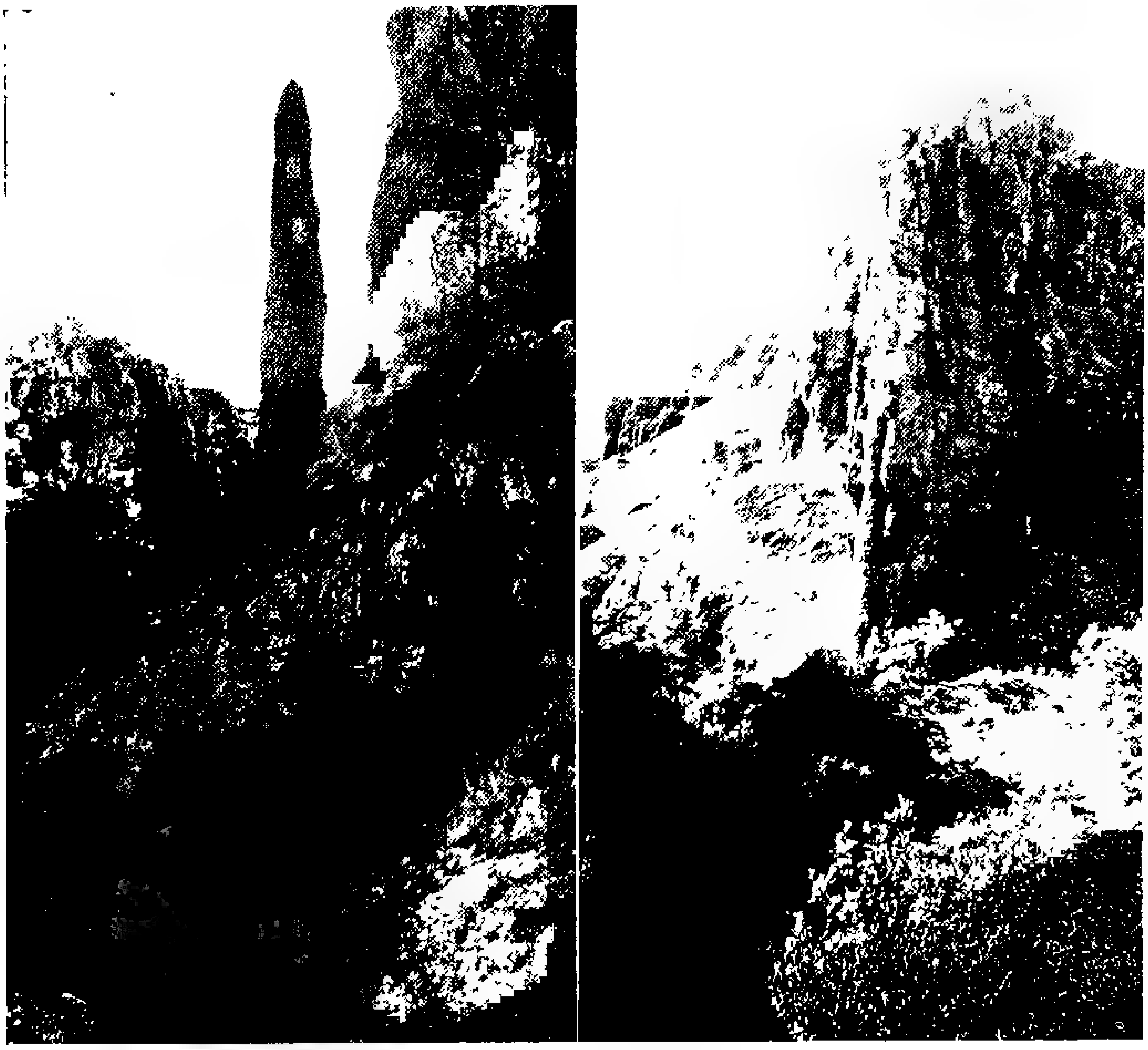
greggii), a truly beautiful and rare tree or shrub; the Texas muhly (*Muhlenbergia texana*); a tiny milkwort (*Polygala glochidiata*), a wanderer from the southland in Mexico; *Setaria geniculata*, a grass found in Arizona only in this spot; and *Aeschynomene americana*, a *Desmodium* relative which is reported in the Southwest from this region only, but which is widely distributed in the American tropics.

But rather than attempt this dangerous detour, you may return to our side canyon with all its diverse vegetation. The south facing slope is strangely different from the north facing. Here much of the slope below the cliffs is covered by a carpet of amolle (*Agave Schottii*). With care and good heavy shoes you can work your way through the dagger-like vegetation. By the way, the roots of this plant are used the same as yucca roots as a substitute for soap in shampoos. They are potent. On this slope two Acanthaceous plants occur in some abundance. One common over wide areas of southern Arizona, but frequently overlooked, is *Tetramerium hispidum*, and the other—much rarer but more widely distributed—is *Elytraria imbricata*. The latter is truly remarkable. The closely imbricated leaves give it the appearance of a club-moss. The flowers are somewhat showy but so evanescent that they are seldom seen.

Before you leave this rocky side canyon, two other rare plants should be found. One is an indigo (*Indigofera sphaerocarpa*) confined to southern Arizona and northern Mexico—or, perhaps it is better to say "known only from this region," for it is quite abundant within a mile of the New Mexico line in Cochise County, Arizona, and doubtless does not recognize the state boundary. The other plant is a rare species of dalea (*Dalea lagopus*); at least it is rare in the United States, having been found in but this one locality. Elsewhere it is reported from southern Mexico and Central America. Perhaps our ecological friends will explain this little hop.

It may be of interest to note in what has gone before and what will follow, the number of plants from the tropics which have found a rendezvous in Sycamore Canyon. It will be equally interesting to note plants from more northern regions. In no sense of the word does this region resemble a tropical jungle. The general aspect of the region is that of central or northern Arizona.

There are no well-defined trails down the canyon. From the moment you pass the sharp finger-like pinnacles on either side of the entrance to the upper end of the garden, you are in a real canyon for miles. The sides are precipitous in many places, but shrubbery and small trees cling to the steep slopes. It is possible to get through the canyon with a horse, but going in several places is tough, and grazing animals do not pass through without extreme persuasion. A mile or so below the entrance, however, a canyon opens in from the east through which cattle and horses pass from the Bear Valley ranch. The stock, however, cannot climb the precipitous slopes



GATEWAY TO THE "HIDDEN BOTANICAL GARDEN" IN ARIZONA

At the left, an imposing spire of rock seen around the bend in the wash by which one enters the canyon on foot. At the right, a view looking west from the entrance.

except in a few places and the overgrazed condition so prevalent in many places in the Southwest is strangely absent.

On the floor of the canyon, as well as on the slopes and on the benches above, the manzanita (*Arctostaphylos pungens*) is frequent and in spots abundant. Judging from the size of many of the shrubs, one would be inclined to call this an optimum site. Perhaps no more nearly perfect specimens can be found any place. At least one specimen the writer encountered is no less than 15 feet high with an even spread of 25 feet in all directions from the center; a perfect cone, the outer limbs tight to the ground and well rooted. The dense, almost impenetrable stands of manzanita so common in many parts of central Arizona are, however, absent in this region.

Lest you begin to wonder about the reason for the name Sycamore

Canyon, sycamores (*Platanus wrightii*) are common along the stream, but no more so than in hundreds of canyons and draws in the Southwest.

In parts of California there is a species of *Dichondra* with bright green leaves that is cultivated quite extensively as a ground-cover in shaded spots. In Sycamore Canyon there is a related plant with small silvery leaves which forms a dense natural ground-cover in at least one spot. While widely distributed in tropical America, this plant (*Dichondra repens* var. *sericea*) has apparently been reported within the United States only in this region.

In many places in the canyon a lotus of exceptional habit (*Lotus alamosanus*) occurs along the stream banks, where it forms close stands like burclovers. Its leaves are glabrous and shiny, and the flowers rather showy. Here again is a plant known in the United States only from Sycamore Canyon. Possibly it is common in Sonora and Durango in Mexico.

In early summer a dark red lobelia (*Lobelia cardinalis*) is abundant along the stream banks. This is a common plant in many parts of the country, but a second one (*Lobelia laxiflora* var. *angustifolia*), which is a later bloomer in the canyon and an almost perpetual bloomer in cultivation, is found in the United States only in this canyon. This plant is now well established as an ornamental at the Thompson Arboretum near Superior, Arizona, at the Soil Conservation Service Nursery at Tucson, Arizona, and at a few residences in Tucson.

* * *

Botany does not claim all the rare species in the canyon, so, to digress for a moment, an experience with an unusual snake[4] will be described. With his daughter, Mrs. Charlotte Reeder, the writer one time encountered an extremely curious snake basking in a low willow tree. It was at least six feet long and so slender that it could not have exceeded three-quarters of an inch in the thickest portion. The tail for a length of two feet was not thicker than a lead pencil. The head must have been six inches long, tapering from the thickest portion into a slender snout. It was not in the least disturbed by our presence. In fact, it permitted us to handle it, pulling it from one position to another. At one time we had it protruding at least three feet straight out in the air. There it stayed sticking out like a poker, perfectly straight. The chief evidence of life was the constant protruding and threatening movements of the tongue.

* * *

The ball-moss (*Tillandsia recurvata*) is abundant from Florida to Texas and in tropical America. In Arizona it appears to be confined to Santa Cruz County; in our garden it is abundant on oaks and junipers.

The yellow-flowering currant (*Ribes aureum*) is comparatively rare in southwestern ranges and commonly occurs at relatively high altitudes. In

[4] For a further discussion of this exceedingly rare snake (*Oxybelis microphthalmus*) refer to "Field Book of Snakes" by Schmidt and Davis.

FOR AGRICULTURAL EXPERIMENTERS

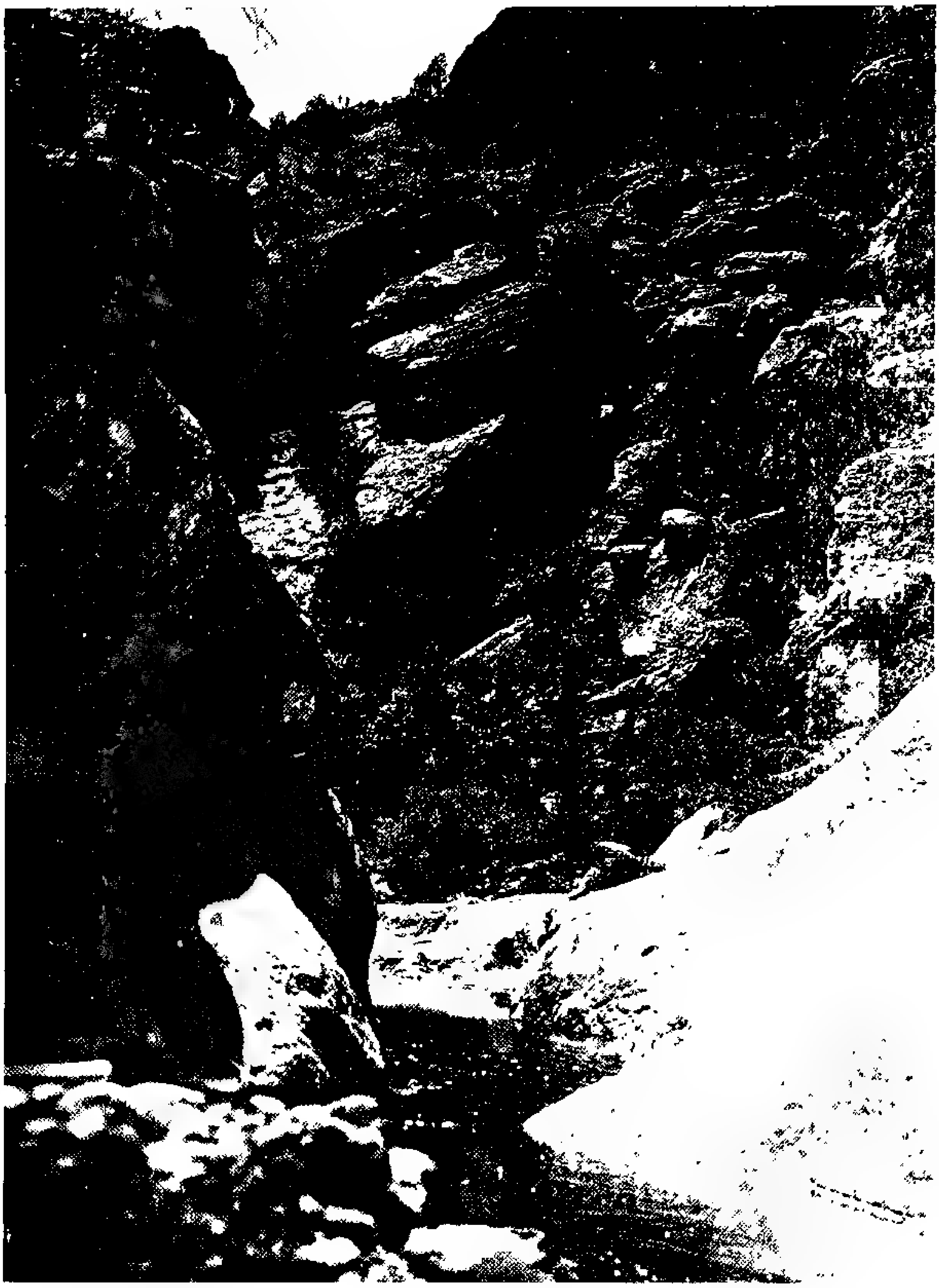
Above are shown cassava roots, approximately five pounds on a single plant, grown at Bard, Calif., from seed of Manihot angustiloba, an unexploited species, collected in Sycamore Canyon.

FOR MYCOLOGISTS

At the right is shown one of the distorted junipers which makes the region of interest to mycologists. The picture gives evidence of the effect of Gymnosporangium speciosum infecting Juniperus monosperma. Numerous rusts, including other species of Gymnosporangium, also of Ravenalia, are to be found there.

Sycamore Canyon it seems peculiarly out of place, hugging the base of the cliffs. It is not abundant and is confined to one small area. In the crannies of the rocks above it are tufts of the relatively rare fern, *Phanerophlebia auriculata.*

In a small canyon leading into the main canyon from the east, the flora appears a bit unusual. Here one of the liverworts, *Anthoceros laevis,* is abundant. Probably this occurs in every mountain range in Arizona, but most people, including the writer, ignore the liverworts and mosses. This, however, is so striking in its fruiting condition that it is hard to over-



A view in Sycamore Canyon.

look. Much stranger is the appearance of a tall serviceberry (*Amelanchier mormonica*). Here the altitude must not be more than 3,500 feet, whereas the usual habitat of this species is in the mountains from northern Arizona to Wyoming at altitudes over 6,000 feet. Another peculiarity in this site is the apparent absence of *Gymnosporangium* on the leaves or fruits of this serviceberry, despite the association of abundant junipers.

It would be a mistake to say nothing about the grasses of this region. Many are common; others are rare. A small clump of gama grass (*Tripsacum lanceolatum*) resulted in a laborious trek by two Soil Conservation Service men a few years ago. They gathered a box of the roots and carried them about two and a half miles through the rocky canyon. These were transplanted in the Soil Conservation Service Nursery at Tucson. This grass is interesting, not alone because it is rare in the United States, occurring only in Cochise and Santa Cruz Counties in Arizona, but because of its close relationship to maize and because of its high palatability. Though it is a perennial it cannot withstand grazing, as stock browse it too closely. In the Mule Mountains in Cochise County, on the west slopes of the Huachuca Mountains, and in Sycamore Canyon it grows only in places so rough that cattle cannot reach it. Two other grasses which are common on the ranges of northern Mexico get into Santa Cruz County and incidentally into Sycamore Canyon. They have only recently been mentioned in palatability tables put out by the U. S. Forest Service and the Grazing Service. These are the crinkle-awn (*Trachypogon montufari*) and *Elyonurus barbiculmis*. Three muhlies are abundant in the canyon. These are *Muhlenbergia emersleyi*, *M. rigens*, and *M. pauciflora*. Less common is *M. dumosa*, a handsome cane grass with slender solid stems. Rare species are the curious little annual, *M. pectinata*, and the somewhat wiry perennial, *M. xerophila*.

Space will hardly permit a discussion of the grama grasses (*Bouteloua*), of which there are seven or eight species in the canyon and on its slopes.

There are four or five species of *Panicum*. *Poa, Festuca, Bromus, Agropyron, Sitanion, Koeleria, Sphenopholis, Lycurus, Stipa, Aristida, Hilaria, Cynodon* (introduced), *Chloris, Trichachne, Paspalum, Setaria, Andropogon*, and *Heteropogon* also are all represented here.

Not all the interesting plants in this canyon can be mentioned, but two more seem to be of special interest. Huisache or sweet acacia (*Acacia farnesiana*) is common in the tropics, doubtless widely distributed by man because of its fragrance and supposed medicinal value. It is reputedly rare in southern Arizona. It is, however, quite abundant on the slopes of lower Sycamore Canyon near the Mexican border. It may be mentioned here also that it is abundant on the upper slopes at perhaps 5,000 feet on the east slopes of the Baboquivari Mountains in Arizona. The other plant is *Lippia ligustrina*. This is abundant in western Texas, where it fringes many dry arroyo banks. It is missing in New Mexico and southeastern Arizona, but is abundant in Sycamore Canyon near the Mexican border. The delicate racemes of white flowers of this species are beautiful and delightfully fragrant.

No one owns this botanical garden. Any time you visit it you can expect to find an unreported plant—if, of course, you are willing to pay the price in sweat. This garden is guaranteed to please—any botanist.

Notes, News, and Comment

Arizona Author. As a botanical collector in western and southwestern states and in Mexico, Leslie N. Goodding, author of "A Hidden Botanical Garden" appearing in this issue, has contributed specimens to the herbarium of the New York Botanical Garden. Now retired, he has been a teacher in Arizona and for 27 years was in Government Service as forest pathologist and botanist in the western United States and in British Columbia.

Bequest. The will of Mary Thurston Cockroft of New York City and Saugatuck, Conn., who died last Dec. 11, provides for a portion of the estate to be given to the New York Botanical Garden. The amount has not yet been made known. Few people living today have had as long association with the Garden as Miss Cockroft had. She had been an Annual Member since 1896.

Invitation Lectures. A second series of invitation lectures planned by the Women's Division of the Garden's Manhattan office has been given during the past month at the home of Mrs. Arthur Lehman. "A Botanical Garden and What It Does" was the subject of Dr. William J. Robbins Mar. 7. Dr. W. H. Camp spoke on "Plant Explorations in Ecuador" Mar. 14; Elizabeth C. Hall on "The Library and its Services" Mar. 28, and Dr. H. W. Rickett on "The World of Plants" April 4. With Mrs. Melvin E. Sawin and Mrs. John D. Beals as co-chairmen, the committee consisted of Mmes. Charles Burlingham, James Lloyd Derby, Robert H. Fife, Reginald Fincke, O'Donnell Iselin, Grafton H. Pyne, and Philip B. Weld. Patronesses were Mmes. Vincent Astor, Louis G. Bissell, Neville Jay Booker, Donald Brown, Ludlow Bull, Henry Fenimore Cooper, De Coursey Fales, Henry G. Gray, Ellery S. James, Henry James, Arthur Lehman, John J. McCloy, George Eustis Paine, Rufus L. Patterson, Harold I. Pratt, Harry Pelham Robbins, Nelson A. Rockefeller, Morton L. Schwartz, Donald B. Straus, John A. Warner, Medley G. B. Whelpley, Sidney Weinberg, and Knight Woolley and Miss Mabel Choate.

Graduate Students. Two candidates for advanced degrees are registered at the New York Botanical Garden. Hassan Mohamed Yousef has come from Alexandria, Egypt, where he was lecturer in botany at Farouk I University, to study for a Ph.D. degree in the physiology of the fungi. He is enrolled for work under Drs. Robbins and Dodge. For six years previous to his appointment in Alexandria, he was on the faculty of science at Cairo.

Grail O. Fernwood, recently discharged from the U. S. Army and formerly a student at the University of California, where he obtained his B.S. degree in 1940, is studying taxonomy and genetics under Drs. Camp and Stout.

Microscopist. Joseph F. Burke, the Garden's Honorary Curator of Diatomaceae, has been elected President of the Staten Island Microscopical Society.

Caribbean Conference. Two Antillean authors who have contributed articles to the Journal of the New York Botanical Garden were delegates at a ten-day conference in the interest of Caribbean agriculture and forestry, held in Trinidad in January. Henri Stehlé, Director of the School of Agriculture at Tivoli, Martinique, represented French interests there and John S. Beard, Assistant Conservator of Forests at Port of Spain, Trinidad, the British West Indies.

Visitors. Mustafa Bey Barbary, who is in America to attend the University of California at Berkeley, spent the day at the Garden Feb. 13.

L. R. Holdridge, forester, who has just returned from Haiti and other Caribbean regions, stopped at the Garden Feb. 20 on his way to Michigan, where he plans to undertake graduate work in botany.

Elisa Hirschhorn of the University of La Plata, spent two days at the Garden in early March, just before returning to Argentina. Dr. Hirschhorn, who is a mycologist, has been in this country two years studying at Minnesota, Washington and Harvard Universities.

Dr. Harry K. Phinney of Yale University has been studying algae at the Garden for several weeks under a Theresa Seessel fellowship.

A group from Moscow, including N. Zacharevich and A. Alpatiev, here in this country to obtain seeds of tropical plants, came to the New York Botanical Garden Mar. 7.

Other visitors of recent weeks have included Reid V. Moran of Cornell, F. R. Fosberg of the U.S.D.A., Alma Stokey of Mt. Holyoke, Dr. & Mrs. Vincent W. Cochrane (Jean Conn) of New Haven, William T. Innes of Philadelphia, Commander Edward Steichen of Ridgefield, Conn., who had charge of naval photography during the war, and Mr. and Mrs. Alan Macneil, lily growers of North Springfield, Vt., who are the authors of a forthcoming book, "Garden Lilies," announced by the Oxford University Press.

Lectures. E. J. Alexander talked before the Garden Club of America Feb. 14 on his 1945 expedition to Mexico. Control of plant diseases and pests was the subject of Dr. B. O. Dodge at a meeting of the Garden Club of Mt. Vernon, an affiliate of the New York Botanical Garden, Feb. 18. Dr. Dodge talked particularly on troubles of roses, boxwood, pachysandra, African violets, and pines.

Dr. Harold N. Moldenke lectured Mar. 5 to the Men's Garden Club of Westfield, N. J., on "Treasures of our Hills" and Mar. 14 to the Evening Garden Center of Elizabeth on the Watchungs.

On Feb. 15 Dr. A. B. Stout spoke on daylilies at Essex Falls, N. J., where the garden club is planning a war memorial garden near the railroad station.

Dr. William J. Robbins addressed Colloquium in the Botany Department at Columbia, Mar. 12 on "Some Physiological Problems of the Fungi."

Elizabeth C. Hall appeared on the program of the annual meeting of the Pennsylvania Nurserymen's Association in Philadelphia Feb. 19, talking about books that nurserymen have written and are writing today.

Rutherford Platt, a member of the Garden's Corporation, spoke on "Art Forms in Nature" before the Torrey Botanical Club at Hunter College March 5, illustrating his subject with his own kodachromes.

Tyler Arboretum. The 70-acre tract of land at Lima, Pa., which has long been known as the Painter Arboretum, after the Painter brothers who, a century and more ago, planted on it many fine rare trees, has been enlarged by 600 acres adjoining and is now established as the John J. Tyler Arboretum. Several years ago the land once owned by the Painter brothers was transferred to the Tyler Arboretum. The additional territory has been made possible by the death of the last of the owners of the adjacent property. Dr. John C. Wister, Director of the Arthur Hoyt Scott Horticultural Foundation of Swarthmore, Pa., and a member of the Corporation of the New York Botanical Garden, has been appointed Director of the newly enlarged arboretum.

Affiliate. The John Burroughs Garden Club of Yonkers has become an Affiliate Member of the New York Botanical Garden.

Tafelberg's Discoverer

THE first white man ever to see the great tableland of Tafelberg in Surinam, which was explored for the first time by Dr. Bassett Maguire in 1944, was Dr. A. A. Pulle, now Director of the Botanical Museum and Herbarium of the State University of Utrecht, Netherlands. He tells the story of his adventure briefly in a letter received last month by Dr. Maguire. Commenting on Dr. Maguire's article on Tafelberg in *The Geographical Review* of last October, Dr. Pulle writes:

"I have been the first white man who saw the Tafelberg. I climbed the De Kock Berg (to the southeast) in March 1903 and reached the summit about half an hour before my colleagues. There happened to be a clear-up between two showers and so I saw a remarkable plateau with an escarpment just as in your Fig. 4.* The moment my colleagues reached the summit all was covered by clouds. Van Stockum and De Kock would not believe my story until they saw the plateau with their own eyes the following morning.

"It has always been my desire to set my foot on that plateau some day, and only the war has prevented me from doing so."

Earlier in the letter he remarked: "We have resumed our work immediately after the war but are still working under extremely trying circumstances."

*This is the same photograph as the one appearing on page 284 of the Journal for December 1945.

Notices and Reviews of Recent Books

(All publications mentioned here may be consulted in the Library of The New York Botanical Garden or may be purchased on order through the Library.)

Sources and Uses of Glycerin, First Discovered in Plants

GLYCERIN: Its Industrial and Commercial Applications. Georgia Leffingwell and Milton A. Lesser. 259 pages, indexed. Chemical Publishing Co., Brooklyn, 1945. $5.

In this comprehensive survey of the sources of glycerin and the large number of industrial products which utilize it in larger or smaller percentages, the authors have brought out a fact which not everyone, familiar as technicians are with glycerin's diversity of industrial applications, realizes—namely, that glycerin itself was in its original discovery a plant product.

Glycerin was discovered in 1779 by Karl Wilhelm Scheele, a young Swedish chemist, who first extracted his "sweet principle of fats," as glycerin was then called, from olive oil. At that time Dr. Scheele obtained glycerin by mixing olive oil with litharge and heating. Washing the mixture with water produced a sweet-tasting substance which remained, after the evaporation of the water, as a viscous heavy liquid. Continuing his experiments, Scheele in 1784 obtained this same, then unfamiliar, sweetish substance from almond oil. Subsequently he found it could also be obtained from lard and from butter, thus confirming its presence in both vegetable and animal fats and oils.

Sugar too, the book notes, is an important source of glycerin through fermentation. In 1858 Pasteur found that approximately one-thirtieth of the sugar, transformed under ordinary circumstances in the fermentation of grape juice and similar liquors into alcohol and other substances, becomes converted into glycerin.

The bulk of the world's supply of glycerin, however, is derived from the saponification of oils and fats known as glycerides. Glycerin, in fact, is described as "one of the natural resources of the countryside," since it may be derived from all growing things, both vegetable and animal.

In addition to the reviews of glycerin usage in specific fields of American industry, the book also includes a chapter on the place of glycerin in agriculture, where it finds helpful application not only in such new phases of agriculture as seed germination treatments but also in a variety of sprays and other preparations.

One of the newest applications of glycerin in solving farm problems is its use in the treatment of seeds and seedlings. In Europe where self-sufficiency has become a major issue, studies have shown that the germination of oats is stimulated by the use of dilute solutions of glycerin, the phases being accelerated by two to nine days, and sometimes increasing the amount of dry substance. Other winter cereals and some spring cereals were also found to be stimulated by similar treatment. It was found that oil-bearing seeds of such plants as flax, hemp, and mustard germinate in more concentrated glycerin solutions just as well and as rapidly as in water. This is an important factor because recent preliminary American experimental studies have shown that the stimulation of plants by small amounts of glycerin may have important uses during transplantation periods.

WILLIAM F. LEGGETT.

Reference Work for Cactophiles

THE MAMMILLARIA HANDBOOK. Robert T. Craig. 390 pages, illustrated, indexed. Abbey Garden Press, Pasadena. 1945. $7.50.

That our knowledge of the Cactaceae is growing apace is evidenced by the appearance of a book devoted in its entirety to a single genus of this interesting family of plants. It is also evident that we must look to California for monographic work of this nature, as climatic conditions there are favorable for outdoor growth which is necessary tor a full understanding of plants of this type. Herbarium material is of little value except as a record in the Cactus family, where growth-form and general structure are of prime importance in studying the plants both taxonomically and horticulturally.

Dr. Craig has produced a monumental work on this second largest genus of the Cactaceae, as is evidenced by the carefully worked out synonymy, completely drawn descriptions, and the usable keys. Many muddled points of nomenclature have been cleared, and the way is pointed out for still more clarification when field workers take sufficient notes and obtain living material from little known areas for further study.

The cactus and succulent world must again acknowledge a debt of gratitude to the Abbey Garden Press for its beautifully made-up and well illustrated books upon difficult succulent groups. No cactophile would dream of not having this handbook for his reference library, and no taxonomist of this group can afford to be without it.

E. J. ALEXANDER.

Where Research Can Be Done

BIOLOGICAL FIELD STATIONS OF THE WORLD. Homer A. Jack. 73 pages, illustrated, issued as No. I of Vol. 9 of Chronica Botanica, edited by Frans Verdoorn. Waltham, Mass., the Chronica Botanica Co. New York City, G. E. Stechert & Co., 1945. $2.50.

A useful guide to centers of botanical and zoological study in the United States and throughout the rest of the world, listed alphabetically from Alaska to Yugoslavia. In addition to the list of stations, there are chapters on the purpose, history, location, administration, equipment, living facilities, instruction, and research at biological stations. In the list, the location, equipment, and opportunities of each station are given.

Lone Star History

HORTICULTURE AND HORTICULTURISTS IN EARLY TEXAS. Samuel Wood Geiser. 100 pages, bibliography and index. Southern Methodist University Press, Dallas, Texas, 1945. $1.50.

In Part I, historical notes from the Lone Star State cover more than a century of horticulture, chiefly as it concerns the growing of fruits. "The earliest settlers (1821-27) . . . brought with them . . . a tradition of fruit growing," the author says. He tells of the first oranges grown there in 1836 and quotes from early diaries which describe such wild fruits as "grapes . . . of the most exquisite flavor" and plums of the largest size, "which were *delicious* when ripe." History is given of the state's horticultural journals, which started in 1868, and of the horticultural societies, beginning in 1870. Part II is devoted to biographical notes on a long list of Texas horticulturists.

New Edition

THE GARDENER'S ALMANAC. Edward I. Farrington. 146 pages, illustrated. Oxford University Press, New York, 1945. $1.50.

A revised edition of a book first issued in 1939 by the Massachusetts Horticultural Society. Suggestions are given month by month for different types of plants, with occasional separate directions for the South. Some extremely ugly dwarfs are used to illustrate the seasonal gardening practices recommended.

For the Very Young

TRAVELERS ALL. The Story of How Plants Go Places. Irma E. Webber, with illustrations in color by the author. William R. Scott, Inc., New York, 1944. $1.25.

The story of seeds and how they are carried from place to place by wind, water, on fur and clothing, and by other means.

USEFUL PLANTS AND ANIMALS. Glenn O. Bough. 36 pages, illustrated in color. Row, Peterson & Co., Evanston, Ill., 1945. 32c.

An entertaining introduction to applied biology for children who are reading their first books.

Ocean-Dwellers

A LIST OF MARINE BACTERIA Including Descriptions of Sixty New Species. Claude E. Zobell & Harvey C. Upham. 53 pages, citations, index to genera and species. University of California Press, Berkeley, Calif., 1944. 50c.

Nearly 50 species are described here, with facts derived from laboratory culture presented about each one. While some species, the authors point out, are known to be of economic importance, none are known to be pathogenic for man.

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

Third Avenue Elevated to the Botanical G

Membership in
THE NEW YORK BOTANICAL GARDEN
and what it means

TO THE INSTITUTION, membership means support of a program that reaches several hundreds of thousands of persons annually.

Briefly, this program comprises (1) horticultural display, (2) education, (3) scientific research, and (4) botanical exploration. To further this work and to disseminate useful information about plant life to the public, the Garden issues books and periodicals, both scientific and popular, and presents lectures, programs, radio broadcasts, and courses of study in gardening and botany. The laboratories and large herbarium and library serve the staff in its research and educational work, while the extensive plantings at the Garden give the public vistas of beauty to enjoy the year around. The public is also free to use the Botanical Garden's library, and, under direction, to consult the herbarium.

TO THE INDIVIDUAL, membership means, beyond the personal gratification of aiding such a program, these privileges:

Free enrollment in courses up to the amount of the annual membership fee paid.

A subscription to the Journal and to Addisonia.

Admission to Members' Day programs and use of the Members' Room also at other times.

A share of plants when made available for distribution. (These plants may include the Garden's new introductions into horticulture.)

Personal conferences with staff members, upon request, on problems related to botany and horticulture.

Free announcements of special displays, lectures, broadcasts, programs, and other events.

Use of lantern slides from the Garden's large collection, under established regulations for such loans.

A membership card which serves as identification at special functions at the Botanical Garden and also when visiting similar institutions in other cities.

* * * *

Garden clubs may become Affiliate Members of the New York Botanical Garden, and thus receive certain privileges for the club as a unit and others for individual members. Information on Garden Club Affiliation will be sent upon request.

Business firms may become Industrial Members of the New York Botanical Garden. Information on the classes of Industrial Membership and the privileges of membership will be sent upon request.

* * * *

Classes of membership in the New York Botanical Garden in addition to Industrial Memberships are:

	Annual Fee		*Single Contribution*
Annual Member	$ 10	Member for Life	$ 250
Sustaining Member	25	Fellow for Life	1,000
Garden Club Affiliation	25	Patron	5,000
Fellowship Member	100	Benefactor	25,000

Contributions to the Garden may be deducted from taxable incomes.

Contributions to the Garden are deductible in computing Federal and New York estate taxes.

A legally approved form of bequest is as follows:

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

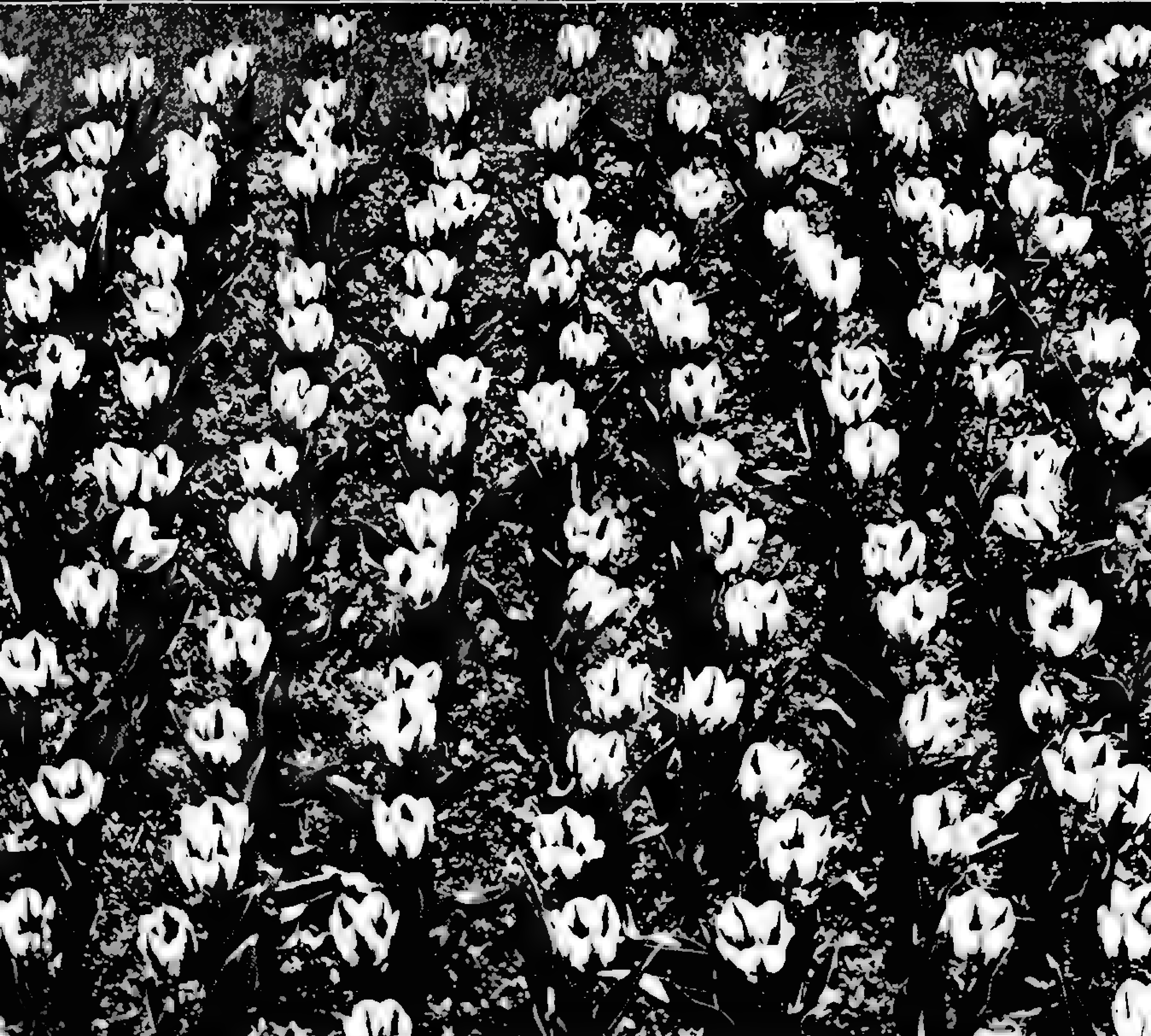
Gifts may be made subject to a reservation of income from the gift property for the benefit of the donor or any designated beneficiary during his or her lifetime.

All requests for further information should be addressed to The New York Botanical Garden, Bronx Park, New York 58, *N. Y.*

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN



VOL. 47 | MAY | PAGES

No. 557 | 1946 | 105—132

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

MAY AND JUNE EVENTS AT THE GARDEN

Rose-Growers' Day

June 12

All-day meeting, with F. F. Rockwell as speaker in the morning, followed in the afternoon by a clinic and demonstration on rose diseases and culture. Registration free.

Members' Days

May	1	*Comments on the Living Plants Displayed*	*T. H. Everett*
June	5	*Painting Wild Flowers in Westchester County*	*Eloise P. Luquer*

Saturday Afternoon Programs

3 p m. each Saturday

May	4	*Plants of Tropical Regions with scenes from Nassau*	*Otto Degener* Collaborator in Hawaiian Botany
May	11	*Journey to Ecuador With a motion picture, "Down where the North Begins"*	*W. H. Camp* Assistant Curator
May	18	*Mushrooms and other Useful Fungi*	*F. J. Seaver* Head Curator

Radio Programs

3:30 p.m. on alternate Fridays over WNYC

May	3	*Vegetables for Late Spring Planting*	*George H. Gillies* Head Gardener, Marshall Field Estate
May	17	*The World's First Agricultural Crops*	*Major LaVerne V. Johnson*
May	31	*Sixteen Centuries of Tea-Drinking*	*William H. Ukers* Editor, Tea and Coffee Journal
June	14	*Your 230-Acre Garden*	*Mrs. Melvin Sawin* Member of Advisory Council, New York Botanical Garden
June	28	*Sugar is the Foundation of All Life*	*E. E. Naylor* Assistant Curator, New York Botanical Garden

TABLE OF CONTENTS

MAY 1946

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JOURNAL
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THE NEW YORK BOTANICAL GARDEN

VOL. 47 MAY 1946 NO. 557

A Commuter's Greenhouse

By John H. Myers

"WHAT is a greenhouse?"

This was the opening question in the informal talk on "A Commuter's Greenhouse" given by Mr. John H. Myers of White Plains, a member of the Garden for many years, at the Members' Day program March 6. He answered his own question as follows:

"It is primarily a glass-enclosed building; in the case of the amateur it may perhaps be better defined as a glass-enclosed room. The glass allows the light and heat of the sun to enter and at the same time retards the radiation of heat from within the greenhouse to the great outdoors.

"The equipment of a greenhouse consists of some tools, a supply of water, a source of heat, containers for the medium in which the plants grow, and the medium itself."

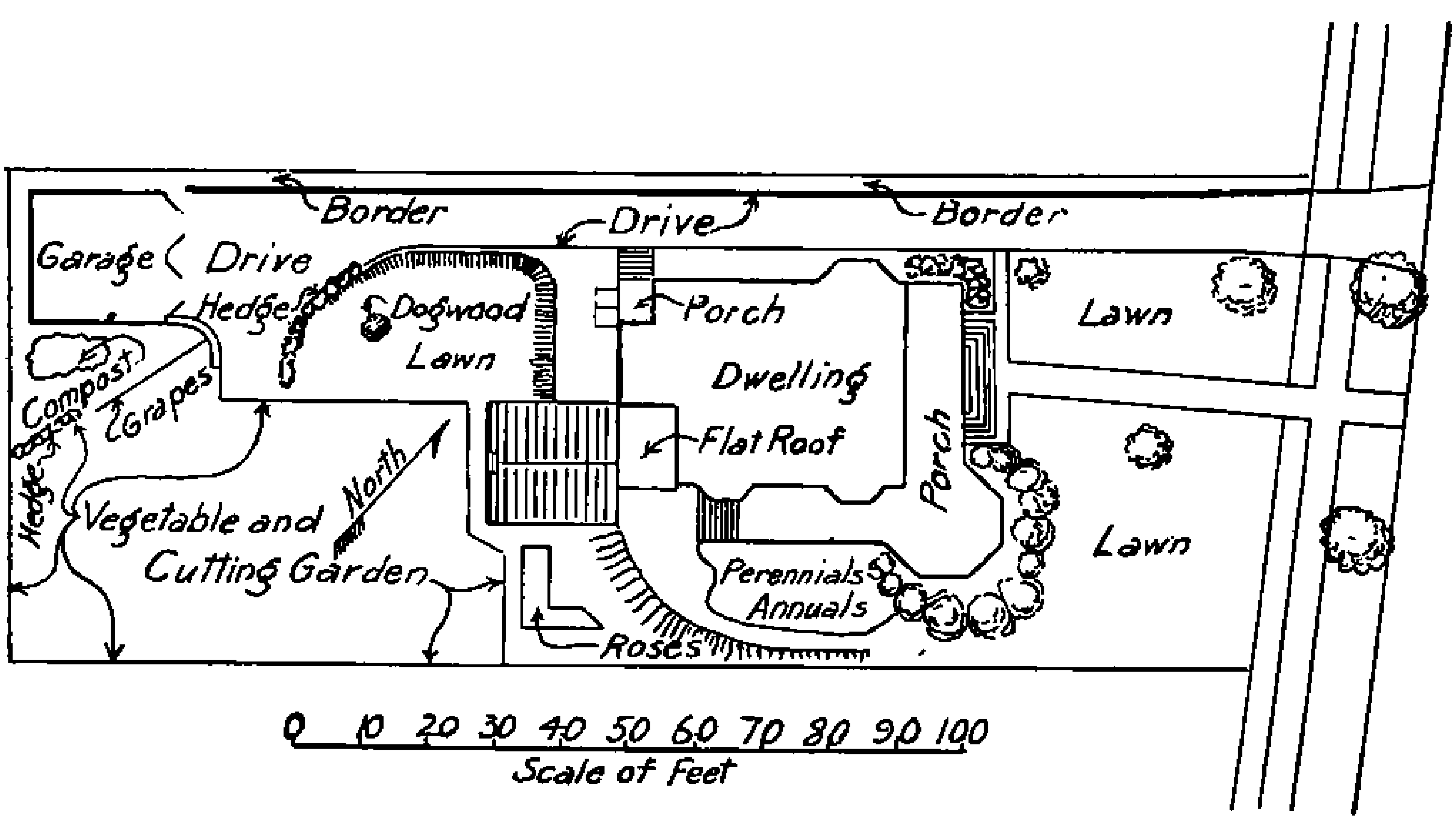
The article below has been adapted from his talk. Illustrations show the plans and equipment of his own house.

AS a student and a young engineer, I was always more interested in seeing the wheels go round than I was in a garden. However, when I eventually acquired a home in White Plains and became interested in improving its grounds, I began, probably unconsciously, to acquire an avocation—an interest in gardening.

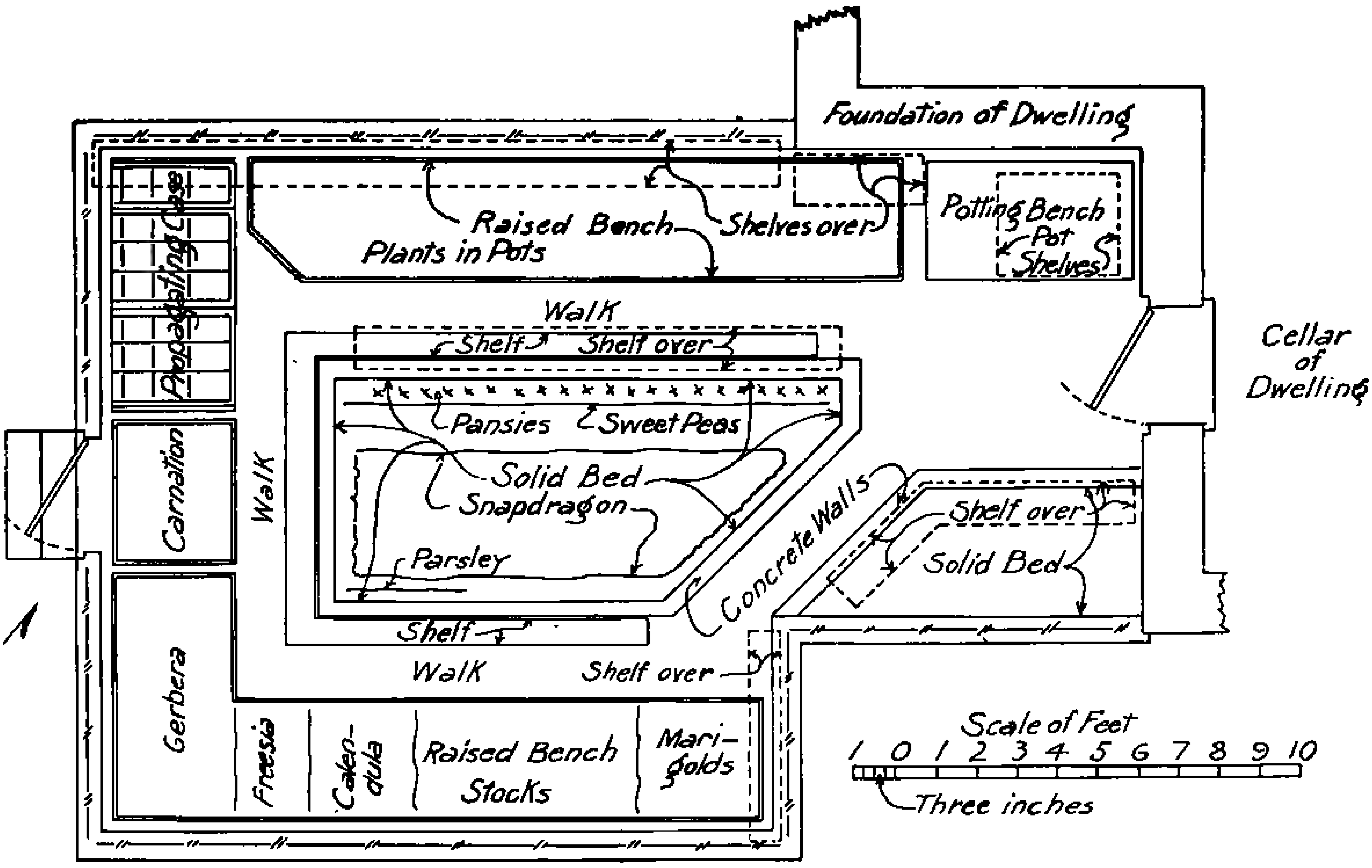
As some walks, a patch of grass and a driveway, then a vegetable and cutting garden slowly came into being, my avocation took a stronger hold on me and I began to realize, regretfully, that I could garden only about seven-twelfths of the year. Where the idea came from I do not know, but I began to think about forcing vegetables in a greenhouse. I read, I rubbered, I asked questions, and, after much scheming and planning, and waiting for the high prices following World War I to subside, I plunged. As a result, in the fall of 1921 a greenhouse came into being.

To use a feminine term, the greenhouse was "appliquéd" on the southeast corner of the dwelling, opening out of its cellar. It was heated by hot water circulating through pipes running under the side benches and coming at first from a coal-burning boiler in a pit below the cellar floor. The dwelling at that time was heated by a similar but independent plant. Since then an oil burner has been installed which furnishes hot water heat for dwelling and greenhouse with thermostats governing each independently.

At the start I experienced much difficulty in acquiring knowledge about the small greenhouse. Seed catalogues of that date, 1921, did not feature greenhouse plants and did not, as most of them do now, offer lists of "Greenhouse Flower Seed Specialties" or "House Plants From Seed"—to quote two of them. What information there was was tucked away in obscure places. Fritz Bahr's Commercial Floriculture—a worthy book—became my guide and mentor, but the scale of it had to be reduced to fit the needs of an amateur. Outdoor gardeners at that time—that is, the amateurs—knew next to nothing about gardening under glass. The men who did know were those who operated large greenhouses on private estates, and with them I had few contacts. An entrée to this botanical garden such as I now enjoy would have been a grand help. And many florists had little general knowledge, as they were one-crop men, but I



Plan of the property, showing the position of the greenhouse in relation to dwelling, garden, and lawn.



Plan of the greenhouse, showing the raised benches down either side, the solid bed in the center where sweet peas and snapdragons are grown for cutting, with smaller plants along the edge and a hanging shelf from each side for an extra row of potted plants. The carnation bench at the end is removable so that in summer the outside door is usable.

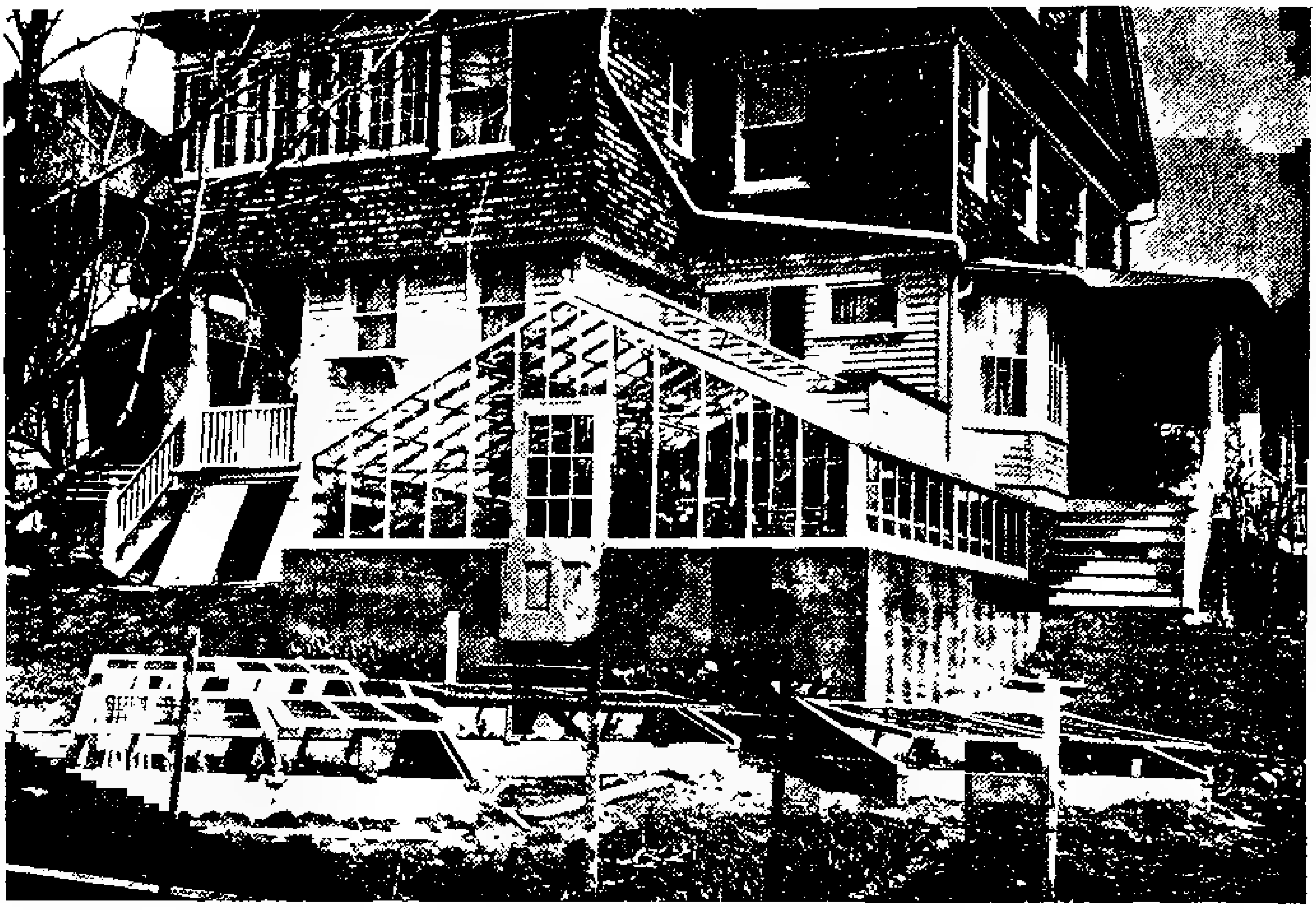
cross-examined them and everyone else who seemed to possess any of the information I was after. So slowly but surely I learned something.

For a few seasons vegetables were forced, lettuce and cauliflower in the fall, tomatoes and English cucumbers in the spring. Perhaps I should be careful about using the plural number because there were none too many of them. And I realized as season succeeded season that while any number of people could get an eyeful of beauty from an artistically arranged bouquet of well grown flowers, by no means could the same, or even a less number, get a stomach full of fresh vegetables from the house which produced the bouquet. So the little greenhouse is now used to grow flowers, although in spring a few tomatoes or cucumbers are sometimes ripened in it and plants of tomato, pepper and eggplant are grown, to fruit later in the outdoor garden.

Tools, Pots, Flats, and Benches

What sort of equipment is used in operating a greenhouse?

Greenhouse tools are diminutives of garden tools. The trowel substitutes for the spade or shovel, the hand fork for the spading fork, and a scratcher does the same work as a three- or five-prong cultivator in the garden. They are used in the right hand whereas the use of the garden tools requires both hands and sometimes, in addition, the right foot. A hose-bib in the greenhouse generally furnishes the water. The source of heat is very often a hot water boiler, and if the amateur's greenhouse



Rear of the house showing how the one-room greenhouse has been attached, opening out of the cellar and connected with it through a flat-roofed passageway which serves as a potting shed. In the foreground are the author's coldframes, which supplement the greenhouse in starting plants for the outdoor garden.

which I have defined as a glassed-in room is attached to garage or dwelling, their heating plants may also serve the greenhouse. Pipes through which the hot water circulates are generally placed along walls or under raised benches.

Containers for the growing medium (which for the amateur is generally good suitable soil) are clay pots, flats and benches. Flower pots need no description. "Flat" is the name used by gardeners for a plant box. *Use it always, or you lose caste.* Say, "Two flats of petunias," "A flat of chrysanthemum cuttings," etc. Flats are best made of cypress as it stands up well under damp conditions.

Benches need somewhat more description. They may be divided into two kinds, solid and raised. The solid bench consists of soil laid on the dirt floor of the greenhouse and often confined by a low curb. Or the curbs may take the form of walls about 2 feet 6 inches high and the space between them, except for the top 12 or 14 inches, may be filled with broken brick, pieces of concrete, stone and dirt not suitable for a garden. The top is filled with suitable soil. The raised bench is in effect a table generally of wood, preferably cypress, like the flats. The boards of its top are separated by 1/8 or 1/4 inch to afford drainage and around its edges are boards about

6 inches high to retain soil or to keep pots from being pushed off and broken.

Selecting the Plants to be Grown

The question is often asked, What may be grown in the small greenhouse? The answer is, almost any plant that can get along with a night temperature of 50-55 and a day temperature of 60-70. Plants of fine foliage or fruit and plants with attractive flowers may be grown in pots. This, by the way, is what our grandmothers did before the introduction of steam heat robbed the air of our homes of most of its moisture content, and many a sitting-room window looking to the south was, during winter, a little greenhouse in itself. Often displayed there were beautiful specimens of foliage and flowering plants. Grandmother tenderly cared for her plants and on severe nights drew the curtains or even moved the plants away from the glass.

Another use to which the small greenhouse lends itself is the production of cut flowers. Many people are fond of bouquets in their living-rooms and on occasion derive pleasure from sharing their flowers with friends who from age or illness may be shut-ins. The flowers grown by florists present no great difficulty.

A small greenhouse may, in the early part of the year, also furnish seedlings of vegetables or annuals for setting in the garden where their fruits and flowers will mature. Plants grown from seed sown in the greenhouse, followed by those whose seed is sown later outdoors, will afford a succession of vegetables and flowers. Bulbs may be made to bloom in a greenhouse before they open outdoors in the spring. In fact, greenhouse and garden are complementary and, used together, they broaden and round out the pleasure of gardening.

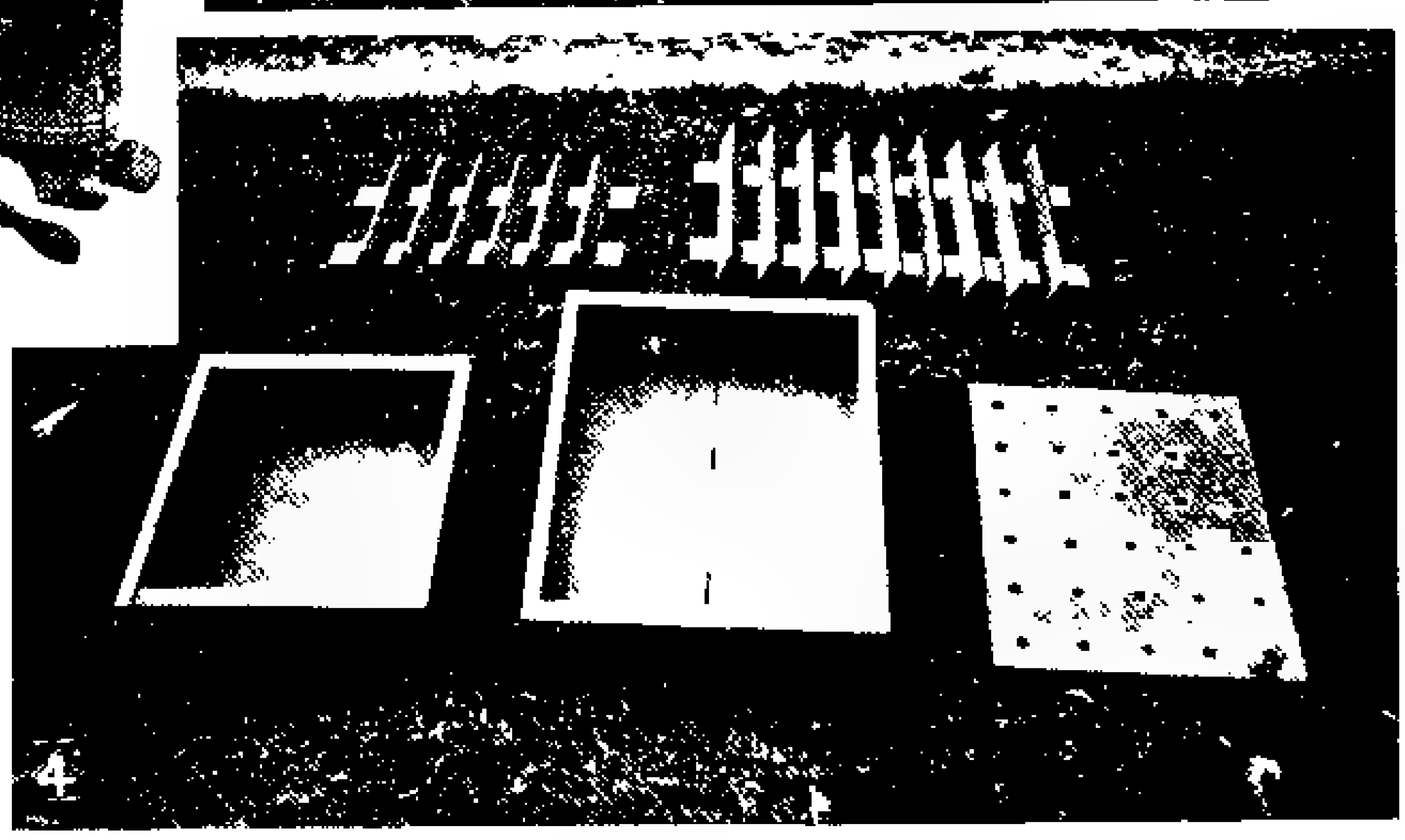
Warning Word for the Beginner

Without meaning to pose as an expert, a few words of advice to the amateur, culled from my own experience as one of them, may not be out of place. We amateurs are prone to be enthusiastic, optimistic and ambitious. If we were not we would not be successful in gardening or in any other avocation or hobby. Therefore it is well to solemnly warn the beginner who has the ambition to possess a greenhouse that, in indoor gardening as in any other work, one must creep before he or she can walk. Furthermore, while many people understand and make a success of their outdoor gardening, by far the greater number of them are tyros when it comes to the operation of the amateur's greenhouse. Out of doors, nature supplies the light, heat and moisture, while indoors she furnishes only the light and during the short dull days of winter often not too much of it. Gardening under glass is an entirely different operation, as I discovered when I began some twenty years ago. And while I now grow

THE COMMUTER'S GREENHOUSE AND SOME OF ITS EQUIPMENT

1. *Looking down the right aisle to the propagating cases at the farther end.*
2. *A closer view of the propagating cases.*

3. *Tools that are essential in the greenhouse.*
4. *Two flats for raising seedlings and cuttings, with home-made devices for making straight furrows in them and for getting plants or seeds placed evenly.*



some plants from all of the groups which I have referred to above, I by no means did this when I began, but I have expanded my operations little by little over a period of years.

If my experience counts for anything, the beginner is likely to have rather vague notions as to what use he wishes to make of his greenhouse. So my advice to him is not to bite off more than he can chew, and to make an easy start in the fall of the year by procuring from friend or florist a few potted plants which will flower in the greenhouse. Then let him pot a few King Alfred narcissus bulbs and bury them in his garden and, after the proper interval, bring into the greenhouse a pot or two of them at a time. And, when spring is at hand, let him sow seeds of a few annual flowers and a few vegetables, say lettuce and tomato. The chances are that when the following fall arrives he will be eager to start another cycle of growing, to avoid errors made the previous season and to widen somewhat the scope of his operations. Thus in time will he find himself and realize to what use he wishes to put his greenhouse and, as season succeeds season, and he perfects his technique, he will derive more and more satisfaction and pleasure from gardening under glass.

Begonia Literature and Notes Bequeathed to Library

FORTY-FIVE notebooks containing a wealth of material on begonias have become the property of the Library of the New York Botanical Garden through the will of Mrs. Albert H. Gere of Merion, Pa. The collection, which assembles much widely scattered material on the subject, is looked upon as one of immeasurable value for reference work on begonias.

Of the notebooks, 42 quarto-size volumes contain photographic and photostatic copies of literature and illustrations of *Begonia* species and varieties, including hand-painted reproductions of 83 plates from Curtis's *Botanical Magazine* and of six from *Addisonia;* also descriptions of begonias as contained in the Transactions of the Linnean Society, the Proceedings of the American Academy of Science, the Philippine Journal of Science, *Botanical Cabinet*, Paxton's *Magazine of Botany*, and other publications; photographic reproductions of begonias listed in trade catalogs; typed descriptions of begonias from *The Gardeners' Chronicle* and other periodicals; photographic reproductions of "Les Begonias" by Charles Chevalier, of "Die Begonien" by Karl Albert Fotsch, and of "Begoniaceen-Gattungen und Arten" by H. Klotzch.

In addition, one leather-covered notebook provides an index to all the material contained in the 42 quarto-size books, giving the contents of each book and an alphabetical index to the literature on begonias that is reproduced. The two other notebooks contain citations to the literature on begonias, arranged alphabetically according to species or variety.

Orchid Society Meets at Garden

Members of the American Orchid Society from a dozen states assembled at the New York Botanical Garden March 19 for the annual trustees' meeting. Luncheon provided by Mr. and Mrs. Rodney Wilcox Jones was served to 65 in the Members' Room, where others joined the group for the meeting which took place in the afternoon.

Immediately following lunch, the group inspected orchid literature and publications of the Garden in the library, and after the meeting they were taken on tours of the building and of the main conservatories.

From the Garden's propagating house about 75 orchid species were selected to be displayed in the Members' Room. Fifteen water-color paintings of Florida orchids by Olivia Embrey Lay were also shown.

Among the guests of the day were R. H. Gore, Fort Lauderdale, Florida; Mr. & Mrs. Clint McDade, Chattanooga, Tennessee; Dr. Norman C. Yarian, Cleveland, Ohio; Dr. O. Wesley Davidson, Rutgers University; Mr. and Mrs. George H. Pring, Missouri Botanical Garden; Mr. and Mrs. George Butterworth, Framingham, Mass.; E. J. Hammington, Chestnut Hill, Mass.; Robert J. Titherington, Philadelphia, Pa.; Mr. and Mrs. Halle Cohen, Jacksonville, Florida; Dr. H. O. Eversole, La Canada, Calif.; Louis V. Dorp, Morristown, Pa.; Oliver Lines, Elkins Park, Pa.; Alfred S. Knowlton, Essex Fells, N. J.

Mr. Jones, who is President of the American Orchid Society, has been a member of the New York Botanical Garden since 1919.

The Huanita

Rare Fragrant Tree of Mexico Found Blooming In the Courtyard of a Ruined Chapel

By Margaret Douglas

EVEN before we entered the gate to the courtyard of the old monastery in the little Mexican town of Santa Cruz de las Flores, which we had come to the State of Jalisco especially to see, the fragrance of flowers from within the high stone wall reached us as an overpowering scent. Inside there grew a gnarled old tree, which, although the trunk was hollow, still had sufficient vitality to produce a crown of foliage and flowers. The shiny leaves of a clear green resembled those of a young citrus tree. It was in full bloom when we were there in January. The clusters of flowers were snow white and grew the way apple blossoms do. The buds were white and waxy-looking, like those of orange blossoms, but the texture of the open flower was not as heavy, and the five petals had a slightly crinkled edge, reminiscent of a crepe-myrtle. The custodian gathered flowers for us, and later as we left the gateway a passing Mexican, seeing them in my hand, stopped and remarked, "That tree is very rare."

An old priest, seeing us there, came to invite us into his house beside the present church. That was just at the moment when the Mexican spoke to us, and the priest listened with astonished interest, as he had never heard the legend, while the villager told us the story of the tree.

The Legend of the Flowering Tree

Hundreds of years ago, he said, a pilgrim was passing through this town, carrying a crate with two little pots in it. He was very weary and as he had to continue his journey, he asked the woman who had given him shelter if he might leave the crate with her, and get it on his return from his pilgrimage. The only thing he asked was that she would pour some water into the crate occasionally, but not open it. This she did, and watered the plants faithfully for years. The pilgrim never returned, and one day when a heavy perfume issued from the box, she decided to open it. There were two beautiful plants, covered with white bloom. She took them to the church and planted them one on each side of the entrance. They grew for years, then finally one died. The villagers, who had become superstitious about losing the last tree, attempted to take cuttings, also to grow plants from seeds, but none ever succeeded. A few years ago, when repairs had to be made to the wall around the church, a long root was evidently cut through by the workmen, and to everyone's surprise, a shoot started up about ten feet from the tree!"

The shoot has grown well and the villagers hope that it will live. I took some slips and I dipped them in hormodin, and they did sprout four small leaves, but unfortunately the pot was tipped over and the roots dried before I discovered the accident.

I wrote to the friend who drove us to see the hospice, for any particulars she could glean about the unusual flowering tree. Below I am quoting her reply:

Report from Mexico

"Señor Cornejo, Director of the Library at the University of Guadalajara, and a most serious student on Hispanic and pre-Hispanic periods in Mexico, discouraged me by admitting that practically nothing of authenticity is known here on the subject. In his extensive perusal of old books and manuscripts, he has found no reference to this tree other than the legend we heard of when we visited Santa Cruz.

"The ruins we visited are what remains of the chapel of an old Franciscan hospital, meaning hospital in the sense of the Latin HOSPITAL, or guest house. This guest house was originally intended for the accommodation of officials and priests traveling from the main Franciscan establishment at Tlalcomulco to the outlying convents throughout Nuevo Galicia.

"The legend of the tree as fostered by the Spanish priests is this*: An image of the Virgin Mary was shipped from some unspecified port in Spain, cradled against breakage with thin branches of an unfamiliar tree. Upon the arrival of the figure at the hospital, a botanically curious priest placed them in the ground, where one took root to become the tree we saw. Subsequent attempts to propagate the tree in this manner having failed, the rooting of this branch is considered a miracle due to its position over the heart of the image of the Virgin.

"Señor Cornejo called to my attention a significant and most interesting fact. The village is now known as Santa Cruz de las Flores, supposedly from the fact that the tree is still in full blossom on the third day of May, which is the festival of the Holy Cross. But this village was known in Hispanic times as Santa Cruz Xuchitlan, Xuchitlan being the Spanish corruption of the ancient Indian name of the village, Xochitlan. We know that in the Nahuatl tongue XOCHI meant 'flower' and TLAN 'place of.' Señor Cornejo mentioned the known exactness of the Indian nomenclature in identifying place names to some outstanding characteristic of the locality. He cites Mazatlan, place of the deer; Zapotlan, place of the zapote; Aguacatlan, place of the aguacate, et cetera. Therefore, he believes that when the Indians gave this village the name of 'Place of the Flowers,' it was because of some unusual botanical phenomenon occurring there which was not common to the surrounding country. Therefore, Señor Cornejo, along with others interested in the subject, concludes that this tree, with the smaller one we saw, is the sole remaining example in this village of a tree surely indigenous to this part of the world and certainly pre-Hispanic. He believed that the subsequent stories came into being not earlier than the 18th century, when the tree had already become rare enough to have its origin questioned, and pondered upon. He has heard reports of others of its kind in different parts of Mexico, but although he has tried to find the exact location of these specimens, has been unable to discover their whereabouts. There is no record of the tree in Guadalajara."

Identification of the Tree

From a small branch which I sent to Dr. Robbins, Dr. H. A. Gleason identified the tree as the HUANITA, known in most botanical writings as

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*The legend here is slightly different from that related by the Mexican villager.

The huanita, rare flowering tree of Mexico and southward, as depicted in W. B. Hemsley's "Biologia Centrali-Americana" published in London in 1888.

Bourreria formosa, but more properly called, he said, by the older specific name of *huanita.* It belongs to the Borage family and is native to southern Mexico, Guatemala and El Salvador, but is apparently always excessively rare. Most herbarium specimens have been taken from cultivated trees.‡ Paul C. Standley, in "Trees and Shrubs of Mexico" (Vol. 23, part 4, page 1224), gives the following brief description of the genus:

"Shrubs or trees; leaves alternate, petiolate, entire; flowers rather large, white, in terminal corymb-like cymes; calyx campanulate, 2 to 5-lobate, the lobes valvate; corolla salverform, the limb usually 5-lobate; styles 2-cleft, the stigmas flattened; fruit a drupe, containing 4 bony nutlets."

At the end of Standley's list of ten accepted species of *Bourreria, B. huanita* is given as a "doubtful species." This is because no specimen was known to the author from Michoacán, the type locality. Yet he gives a number of vernacular names for the plant, such as HUANITA (Michoacán), IZQUIXOCHITL and JAZMÍN DE TEHUANTEPEC (Oaxaca), and YAGA GUIEXOBA (Oaxaca, Zapotec).† If *B. huanita* is identical with *B. formosa,* as seems likely from the description, then, according to my informants at the New York Botanical Garden, the tree should be known by its earlier name of *B. huanita;* or, perhaps, if international rules are to be strictly followed, the spelling should be in the original form of *Beurreria,* or

‡ A specimen in the herbarium at the New York Botanical Garden, collected in August 1938 by George B. Hinton at Acahuato in the district of Apátzingan, Michoacán, came from a spreading tree 15 meters (about 45 feet) high. It was found in the plaza of the town, and a notation on the herbarium sheet states that "no other exists in the region."

A letter in the folder for the species in the herbarium gives some additional information about another specimen of the tree. Addressed to Dr. N. L. Britton, May 23, 1923, it is written by Sylvester Baxter of Malden, Mass., a business man and writer who did some botanical collecting while in Mexico. Mr. Sylvester writes:

"It was in April, 1899, that I went to Uruápam. I had picked up in a curio-shop in Querétaro a history of the Bishopric of Michoacán, in Spanish. . . . It was printed about 1840. In its account of Uruápam it told about a remarkable tree growing near the old mill and quoted La Llave as naming it *Huanita uruapensis,* and pronouncing it as unique in family, genus and species, and the only individual known to exist. At Uruápam, a little city of rare beauty, I was told that the original tree was dead, but that trees from three cuttings were in existence, one in the garden of the Governor of Michoacán, and one in the garden of a lady in town. . . The [latter] tree was in full bloom and about 20 feet high. Flowers white and crape-like, and of exquisite perfume. The leaves seemed something like an orange. . . I sent cuttings to Prof. Sargent, but they spoiled in the mail; also some seeds, but Dawson could not make them germinate. I think the flowers I sent for the herbarium were referred to Dr. Goodale at Harvard. Probably the common name at Uruápam was JUANITA.

"It should be worth while for some botanical explorer in Mexico to go to Uruápam and get cuttings, if possible. April is probably the best time, for it would then be in full bloom. It would be a misfortune for such a rare and beautiful thing to be lost to the world."

The tree described by Mr. Baxter, if alive today, stands within range of the dust falling from the newly active volcano Parícutin.

E. J. ALEXANDER.

† In a later work (Tropical Woods, 1931), Standley accepts the name of *Beureria huanita,* as made by Hemsley.

even *Beureria.** The change to an *o* was authorized by de Candolle in the Prodromus, Vol. 9, page 504.

In an extensive article on the huanita in the *Anales del Instituto de Biologia,* 1931 (Universidad Nacional de Mexico), A. R. Laguna describes the genus, which he calls *Beurreria,* as containing only trees and shrubs belonging to the extra-tropical regions of America. The huanita itself, he says, was famous medicinally for many years in Michoacán as a cough medicine, digestive, flavoring, astringent, and a perfume. In delving into the history of the tree, Laguna cites the monumental work of Francisco Hernández, physician to Philip II of Spain, "Rerum Medicarum Novae Hispaniae Thesaurus," published in Rome in 1649, where there is a description with a magnificent wood engraving of a tree cultivated in Cuernavaca and Huaxtepec and known by the indigenous name of YZQUIXOCHITL. This agrees, in large part, with the plant in question. The same description of the plant appears with slight variations in an edition of the work entitled "De Historia Plantarum Novae Hispaniae," published in 1790. Laguna writes further:

"Worthy of special mention is the first description in Spanish of the 'yzquixochitl,' published in Mexico in 1615, in the work entitled, "Cuatro Libros de la Naturaleza y virtudes medicinales de las plantas y animales de Nueva España,' by Brother Francisco Jiménez, Dominican friar, who made the translation of the original work of Dr. Francisco Hernández, enriching it with numerous personal observations, before it was published in Rome.

"In 1824, a work written by don Pablo de la Llave and don Juan Lexarza entitled, 'Novorum vegetabilium descriptiones,' first saw public light, and in this was found the first botanical description of the 'huanita.' This description, done in Latin by such illustrious botanists, is found in the first chapter of the work, and in it the scientific name of *Morelosia huanita* Llav. and Lex. is given to the 'huanita.'

"Doctor don Nicolás León published in the Gaceta Oficial del Gobierno del Estado Libre y Soberano de Michoacán, in 1866 two articles about this important plant, the 'huanita.'

"In the first article, Dr. León says that he tried to find the plant that Llave and Lexarza were studying, but he was only able to find out that it was found near the old capital of San Pedro, in the district of the same name, in the city of Uruápan, and grafted to a cherimoya, and that it had died many years ago 'for lack of life because of old age.' Farther on he says that he had seen two individuals of this plant: 'one in the house of the estimable señora doña Lugarda Izazaga de Cano,' and the other on the place called 'la cineraria'; he adds that both examples are notable for

*Johann Ambrosius Beurer (2 Mr 1716—27 Je 1754), for whom this genus was named, was a pupil of Trew and well known to contemporary botanists. Browne, in 1756, was the first to use his name for the genus, speaking of him as "Mr. Bourer, an apothecary of Nuremberg." He spelled the genus-name *Bourreria;* in the index, however, it appears as *Beureria,* which suggests that someone may have called his attention to his wrong spelling.

Jacquin took up the name in 1763; his is the first legitimate publication. He spelled it, unfortunately, *Beurreria,* correcting the first vowel but retaining the double *r.* It would be possible to regard this as an unintentional orthographic error and change it to *Beureria.*

De Candolle had no business changing it to *Bourreria* in any case. The name is certainly not *Bourreria;* it may be *Beurreria* or *Beureria* as one interprets the international rules. I should favor the later, since the original intent is clear.

H. W. RICKETT.

their development and that they exceed the designation of 'shrub'* that was given them by de la Llave and Lexarza; that he had news that another example of great size existed in the village of Tacáscuaro, and that in the beautiful village of 'Los Reyes' there were also several. Finally, he points out that the Tarascan name of the village of Jiquilpan, which is 'Vanimba,' signifies 'place of huanitas,' which might indicate that in this place there existed at one time, some examples of the plant in question, and that notwithstanding its Tarascan name, considering its rarity in Michoacán, it is believed that this plant is not indigenous there, but imported."

I wonder if any of the one hundred fifty members of the Garden Club of America who visited Uruapan with me in 1936 saw any huanitas in the Botanic Garden there. It was the season of bloom. Some years ago we visited President Cardenas at Jiquilpan. He is a great lover of flowers and plants, and had I only known about the huanita at that time, might have hunted for it there, with much helpful assistance from him.

In Mixteca the huanita is called YTAYUCUINE, which means "Flower of the Tiger Mountain," according to Dr. Martinez Gracida, who says that YUCUINE of TEHUANTEPEC means "Mountain of the Tiger," and that this place is the plant's native habitat. In ancient times the historian monks called the huanita FLOR DE YUCUAMA, surely a corruption of the name YUCUINE—a type of change which often occurs when a name is difficult to pronounce.

Genesis of a War

Historians consider this plant as the cause of a bloody war between two of the oldest and most powerful villages. It took place in Tehuantepec in approximately 1496, when an army of Mexicans, sent by the King of Mexico, Ahiutzotl, were vanquished at Guiengola by the Zapotecas and Mixtecas, allies, under the command of the King of Zaachila, Cozijoeza. The Mixtecas, subdued by the King of Achiutla, on the return from the campaign in the country of Tehuantepec carried a tree covered with beautiful and fragrant white flowers, known to the Mexicans as YZQUIXOCHITL. The Mixteca Cacique diligently cultivated it in his gardens and refreshed himself with the beauty and aroma of the flowers. He felt proud to possess this tree belonging to the hot country, and reminding him of the lovely country of Tehuantepec, for which reason he named it, in the Mixtecan, idiom, YTAYUCUINE.

When the new king of Mexico, Moctezuma II, heard of it he craved to possess it, and in the second year of his reign, therefore, sent a commission to the Mixtecas to secure by peaceful means the object of his desires. But the Mexican ambassadors were haughtily received by Mallinalli, the Cacique of Tlaxiaco, who refused to give or sell his YTAYUCUINE. Thus started the war—the troops of Moctezuma with their greater units invaded the territory, and were victorious. Mallinalli and the Cacique of Achiutla

*The tree at Santa Cruz, growing at an altitude of about five thousand feet, is more than thirty feet high and about eighteen inches in diameter, although described as a shrub of about three feet high, in some other states!

were taken prisoners, their towns burned after practically all the inhabitants were sacrificed. Then in the end, the Mexicans transported the precious tree with great care to the gardens of Moctezuma II, at Huaxtepec, near Cuernavaca in Morelos, where plants of all climates seem to flourish.

Some Indian monarch said of this tree that the flowers are not to be found anywhere, the solitary specimen having dried out on the road to the garden. Other authors affirm that seeds of this notable tree were carefully sown and cultivated by Moctezuma, and were studied there in the beginning of the 16th century by Hernández and Fray F. Jiménez.

Half-century of Work at Garden Observed by Joseph W. Smith

IN tribute to Joseph W. Smith, gardener, on the 50th anniversary of his employment at the New York Botanical Garden, a purse of more than $200 was given to him on March 21. Presented during the noon hour in the palm house of Conservatory Range No. 1, it represented contributions from the entire roster of the Garden's employees, who, with a number of friends from outside the staff, all attended the brief, informal ceremony.

Mr. Smith, who is now 71, was brought up on a farm in the Bronx, and when the new Botanical Garden was opened in Bronx Park, he sought a job there and began working March 21, 1896. It was about five years before the conservatory, where he has spent most of his half-century at the Garden, replaced the wild cherry trees and mountain laurel that had overrun the old pasture north of Fordham University. He can remember when all the apartment-covered blocks of today's populous borough of the Bronx were rolling farm lands occupied by a mere handful of families. And he can remember when a visit to the new Botanical Garden meant, for most people, a long trip with horse and carriage, with a picnic lunch packed under the back seat.

Joe Smith has personally watched the growth of a large number of the plants that have been cultivated in the Garden's conservatory since the building was erected in 1900. A sugar palm that he planted grew in time to the top of the 90-foot dome; eventually flowered, died, and was cut down in 1934. A seedling from this tree has already shot up some 30 feet.

In addition to brief talks given by Dr. William J. Robbins and T. H. Everett, the anniversary ceremony included presentation of a water-color painting, showing Mr. Smith in the palm house, made by one of the younger gardeners. The margins bore the signatures of the Garden's staff and employees.

At the Members' Day program May 1, Mr. Smith was presented with a resolution of congratulation from the Board of Managers.

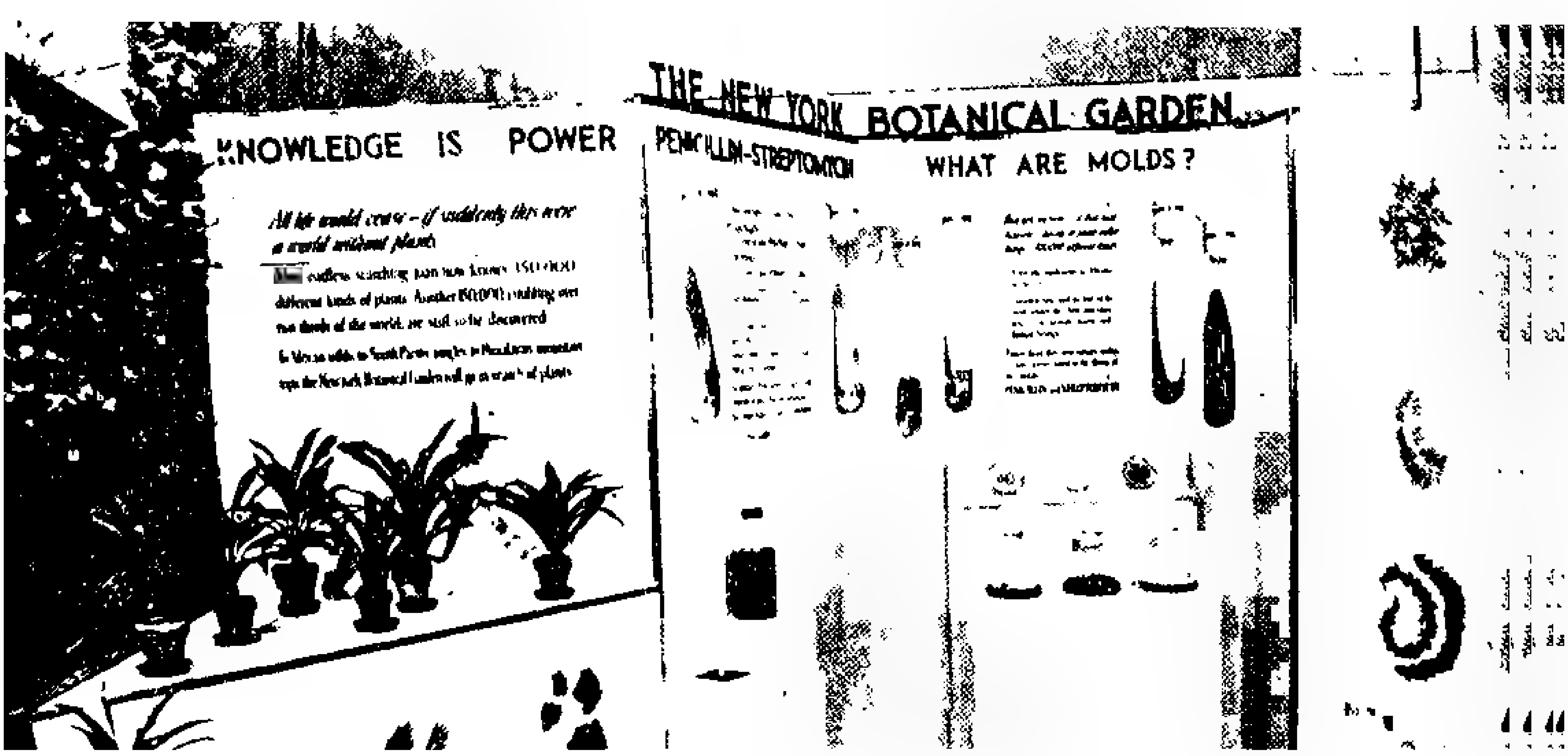

Exhibit of Plants Without Flowers Wins Award for Botanical Garden

A GOLD MEDAL was awarded to the New York Botanical Garden for its exhibit of "Plants Without Flowers" presented at the International Flower Show at Grand Central Palace March 16 to 23. This was the first International Flower Show to take place since the war.

The Garden's exhibit featured seaweeds, yeasts, molds, and bacteria. An aquarium containing seaweeds from the West Coast occupied the center of the exhibit and a decorative border was made of some of the most ornamental specimens of algae from the Garden's Herbarium.

Cultures of various molds, yeasts, and bacteria were shown in four-foot test tubes. Descriptive labels told briefly of the usefulness of these forms of plant life. Enlarged photographs of diatoms were shown at the side as the public approached the exhibit. Flowering plants from the Garden's conservatories occupied tables at either end.

A staff of volunteers recruited by the Garden's Manhattan office served at the Flower Show each day, and a member of the staff was also present to answer technical questions. Along with announcements of the Garden's publications and activities, folders prepared by the Manhattan office—"Through the Garden Gate," "See How It Grows" and other pieces of literature—were distributed to all who stopped to view the plants without flowers.

The exhibit is now temporarily placed on the main floor of the Museum Building.

The New York Botanical Garden's Gold Medal Exhibit of Plants Without Flowers at the International Flower Show. March 1946.

BROADCAST

By Louis Pyenson

Bugs, Beware!

CONTROL MEASURES *for a dozen common garden pests were given by Dr. Louis Pyenson of the State Institute of Agriculture, Farmingdale, Long Island, on the New York Botanical Garden's radio program over* WNYC *April* 19. *The information on which his talk was based is given here.*

Grubs

About the first pests that the gardener will run across while digging up his plot are the white, fat, half curled grubs that represent the immature stage of such beetles as the Japanese beetle, the Asiatic garden beetle, and the June beetle. Regardless of what beetle they will develop into, they all may cause considerable damage by feeding on the roots of vegetables and lawn grasses. Some lawns can be rolled up like a carpet because the grubs have chewed off the roots about an inch below the ground.

If you find numerous grubs in the garden area that you are spading up, mix up 2½ tablespoonsful of ethylene dichloride emulsion to each gallon of water and apply it with a sprinkling can to the prepared soil at the rate of 1 gallon per square yard. Water the garden well afterwards. The same method may be used on turf, but an easier method to kill grubs in turf is to apply a 10% DDT dust at the rate of 5 pounds per 1,000 square feet, watering it in well afterwards. The kill is spectacular, as the grubs come to the surface of the ground before dying.

Canker Worms

More commonly known as inch worms, these pests are beginning their annual destruction of tree and shrub foliage now. They can be easily disposed of, however, if you are fortunate enough to have a good sprayer. Either lead arsenate or DDT can be used, but DDT appears to be the more effective material. Next year you can do away with spraying foliage for canker worm by using DDT on the trunks of the trees in much the same way as tanglefoot. Apply DDT to the tree trunks with sprayer or brush in a 3- to 6-foot band in the proportion of 4 tablespoonsful of a 50 percent wettable DDT powder to a gallon of water, which is twice the normal strength used on foliage. One application should be made about the middle of October to get the fall canker worms and one about the middle of February to get the spring canker worms as they crawl up the trunks to lay their eggs on the twigs.

Cutworms

Another early bird in the garden is the cutworm, which seems to wait for the unwary gardener to put out his cabbage, tomato, or pepper plants to begin snipping-off operations. The easiest way for the average small gardener to protect his plants is to put stiff paper collars loosely around the stem of each plant and push them about an inch into the soil. These can be easily made from milk containers. For gardeners with a more extensive acreage, poison baits, made up especially for cutworms, should be scattered over the field a few days before planting.

Flea Beetles

Nearly as quick on the trigger as the cutworms are the minute black flea beetles, which appear about the same time as the tomato plants are set out and proceed to pepper the leaves with tiny holes. They can destroy small plants with little foliage in a few days unless something is done to protect them. Pyrethrum, rotenone, or DDT dust can be used effectively but a continuous film on the foliage is necessary during the period of beetle abundance.

Aphids

Nearly every vegetable, fruit, and ornamental appears to have a species of aphid that is particularly fond of its juices. In no time at all aphids can breed up in tremendous numbers. They are biological wonders, as they go through one generation after another in the summer time with a complete absence of males. On trees and shrubs you must get them early or you don't get them at all, since they are quite well protected from sprays in the curled up foliage. The fairly new DINITRO sprays sold under a number of trade names are excellent for killing aphid eggs on trees and shrubs before the leaf-buds open. Of course, it is too late for that now. Nicotine sulfate is still about the best material for aphids beyond the egg stage on shrubs, trees, and vegetables.

Cucumber Beetles

An uncanny judgment as to when to come out of hibernation seems to be possessed by the cucumber beetles. They generally pick a warm, sunny weekend when no one is around to pounce on the recently emerged cucumber, squash, and melon plants, and simply cause them to disappear by Monday. Even if they don't destroy the plants, they may affect them with one of two bad diseases—cucumber wilt and cucumber mosaic. The beetles should be kept entirely away from the plants if you wish to keep the plants healthy. That means dusting from the time the seedlings emerge until harvesting time with a rotenone-copper or cryolite-copper combination dust.

Boxwood Leaf-miner

One of the worst pests that the boxwood grower has had to contend with is finally on the verge of being conquered, even wiped out. I am referring to the boxwood leaf-miner, which has been very difficult to keep down without considerable labor. Recent experiments that I have conducted on the grounds of the State Institute of Agriculture show that one DDT spray applied thoroughly to all sides of the foliage just prior to any adult emergence (generally early in May) will destroy every single fly coming out of the foliage for the entire emergence period of 2 to 3 weeks. Rains do not impair its effectiveness providing suitable stickers are used in the spray.

Mexican Bean Beetle

We can always be sure of one pest that will be with us in the garden—the Mexican bean beetle. The beetles come out of hibernation about the time the earliest planted beans are getting their second or third set of leaves. Both they and their spiny yellow larvae do considerable damage to bean foliage. We still have to rely on pyrethrum or rotenone dust to keep these pests under control. Two or three dustings at weekly intervals are essential—and remember, the underside of the foliage must be hit.

Chinch Bugs

In June some of our once beautiful lawns will begin to show brown patches—those chinch bugs again. But this year you will be equipped to deal with them more effectively than ever before. Two new dust materials are available, both of which are much better than the rotenone or nicotine formerly recommended. They are a 10% SABIDILLA dust and a 10% DDT dust. Either of these materials applied in early June and early August at the rate of 2½ pounds per 1,000 square feet and raked in well should nearly eliminate chinch bug trouble.

Corn-Borer

We also have two new chemicals to help conquer the European corn-borer which attacks nearly all succulent stemmed plants, especially sweet corn, dahlias, and gladiolus. One of these materials is known as RYANEX and is obtained from a tropical shrub; the other chemical is the well known DDT, used as a 3% or 5% dust. Either of these materials applied in dust form at five-day intervals during the hatching periods of the corn-borer eggs (June and August) gives better control than rotenone.

Slugs

Many gardens in damp seasons or in damp locations are troubled by slimy, gray, spotted creatures that come out only after dark and feed on vegetables and flower foliage and in addition leave slimy trails wherever they go. If you suspect slugs, go out after dark with a flashlight and inspect your plants. You will see them all over the foliage, if they are present. Small heaps of a prepared poison bait containing methaldehyde placed at intervals in the garden will effectively curb these night prowlers.

Japanese Beetles

We must not forget the Japanese beetle, which is sure to be with us again in July and August, chewing on everything that appears edible. So far the best protection for foliage has been obtained with the use of DDT, which will not only kill them but seems also to keep them away from foliage coated with it. DDT tends to stay effective for about three weeks, so that one application in early July and another some three weeks later should give ample protection to foliage for the season. Remember, DDT is a poison and should not be used on fruits or vegetable parts that are to be eaten. Fruit trees can be sprayed with DDT safely only if the fruit is not to be harvested until two months later.

Notices and Reviews of Recent Books

(All publications mentioned here may be consulted in the Library of The New York Botanical Garden or may be purchased on order through the Library.)

Nine Experts Solve Dilemmas For the Home Gardener

GROUNDS FOR LIVING. Edited by Van Wie Ingham and Richard B. Farnham. 323 pages, indexed, illustrated by George J. Baetzhold. Rutgers University Press, New Brunswick. 1946. $2 50.

The gay paper cover of this book was its first attraction, depicting the enclosed outdoor living-room which is essential to my happiness; I have never understood the American propensity for goldfish-bowl existence, and have always loved the European way of placing houses directly on the street front, with gardens for outdoor living behind, completely screened from public view, and high walls even shutting out the adjacent neighbor's roving gaze. So it was pleasant to find my own desire for privacy, even slightly emphasized by Charles H. Connors, the first of the nine experts who have undertaken this comprehensive and valuable contribution to the solution of the many problems besetting the small home owner who is eager to use his limited grounds to the best advantage.

The volume is full of charts, references and helpful suggestions, some new and most welcome even to those of us who have done much reading and given much thought to this engrossing subject. It is particularly good to be reminded of the many excellent government and college bulletins available today; we are apt to overlook the sources of information so easily available to us. Landscaping in miniature—lawns, shade trees, flowers, vegetables, fruits, soil and outdoor construction are all ably covered. The chapter on flowers is particularly good, encouraging the amateur, reassuring and giving confidence to the beginner with common-sense observations and practical instructions; with wise cautions against undertaking too much—advice which the over-ambitious would do well to heed, or the pleasure which should be derived from the outdoor living room will turn to gall and wormwood!

I was surprised, in the section on fruit trees, that their beauty when in flower is not more stressed—that all too brief moment of sheer, exquisite joy for which one waits all winter; and that the espaliered tree is not mentioned for its highly decorative and space-saving qualities. In the chapter on construction, the type of wall preferred is not to my taste, and I looked in vain for practical suggestions for a watering system which would save the poor householder hours of tiresome toil which could better be devoted to relaxation or other pursuits. Was it not the Romans who used overflow bath water for irrigation of their grounds? To be able, with a turn of the wrist, to attend to this most irritating of summer chores, is a dream I wish our nine experts had put their minds on causing to come true! A permanent, efficient installation of some sort should not be too difficult of realization these days of amazing modern improvements.

But in spite of this lack, more than made up for in other respects, here is a book which should be on every gardener's bookshelf—the acid test being, that having just read and enjoyed it, I have ordered it to add to mine, and expect to turn often to its pages for solutions to my own dilemmas.

KATHERINE G. FENIMORE COOPER.

Nutrition from a New Food

THE USEFUL SOYBEAN — A plus factor in modern living. Mildred Lager. 295 pages, indexed. McGraw-Hill Book Co., New York. 1945. $2.75.

Miss Lager is a pioneer in nutritional education and in introducing new foods to the public. In this book she has given a brief history of soybeans and their uses. Especially striking is the description of their increase in importance as a food product during World War II. Miss Lager's statements concerning the value of the soybean in nutrition are backed by scientific facts coming from some of the leading laboratories and nutrition experts. She gives facts concerning the protein, vitamin and mineral content of soybeans. One chapter is devoted to the use of soybeans in industry. She includes 350 recipes for preparing soybean foods.

ILDA MCVEIGH.

Manifold View Of American Forestry

BEHOLD OUR GREEN MANSIONS. Richard H. D. Boerker. 313 pages, illustrated, indexed. The University of North Carolina Press, Chapel Hill, N. C. 1945. $4.

A compendium of useful facts about forestry in the United States, "Behold Our Green Mansions," is written in a manner to make a strong appeal both to the professional forester and the lay reader. One is impressed particularly by the thoroughness with which every phase of forestry is treated and the reliability of the statistics presented.

A wealth of excellent photographs illustrate the points brought out in the text. In them certain minor errors were noted, as follows: In the last page of photographs following page 30, the bottom one should be labeled "The Flowed Lands," instead of "Blue Mountain Lake." The titles of the two photographs on the fourth page immediately following page 78 should be transposed.

The preface enumerates the many ways in which the forests of this country and their products contribute to the national economy. Next, forest fires and their destructiveness and provision for forest recreation are covered well. The discussion of progress in wild life management is comprehensive.

The book is particularly thorough in treating the relationship of forests to stream flow, soil conservation and flood control. Particular mention is made of the value of forestry on the upper watersheds of streams to control floods. This is followed by a summary of Federal legislation for flood control which, as the author is very careful to point out, is not a cure-all.

A thorough discussion of all forest products, with considerable statistical information regarding production, is contained in the chapter on lumber and its by-products.

In the chapter on the forest as a livestock range, a most interesting picture of the livestock history is given of the West in relation to forestry, with especial mention of what government control has accomplished in the West with regard to grazing. The author points out the need of co-ordinating grazing and timber production in the Northeast. He could well have emphasized more strongly how detrimental grazing is to farm woodlands in this region.

The relation of the farmer to forestry and the importance of farmlands in producing forest crops for both local use and for sale are brought out rather well, and the author points out how farmers can and should support forestry.

In the chapter on "Fire, the Destroyer" it is stated on page 149 that one fire in New York State in 1903 burned 450,000 acres. That was the total area burned that year, rather than the area of a single fire.

A brief but excellent summary is given of insect enemies and tree diseases, particularly the chestnut bark disease and the white pine blister rust among the tree diseases, together with a brief discussion of wood rotting fungi and others.

The author devotes a chapter to the leadership of the Federal government in forestry, taking a great deal of his material from the so-called Copeland Report of 1933 and the report of the Joint Congressional Committee on Forestry in 1941. He shows an appreciation of the fact that the burden of responsibility for developing forestry on all but Federal lands lies upon the states.

A complete chapter is devoted to the forestry problems of the South, which the author points out is particularly important as a forest producing region.

Mention is made of successful European community forests and the advantages of this type of forest to American communities.

The last chapter covers economic factors in private forestry. The author feels that privately owned forests cannot meet future demands for timber crops. He recommends the increasing of publicly owned forests from the present 196,000,000 acres to 315,000,000 acres. It appears that he is influenced in this recommendation by the Report of the Joint Committee on Forestry referred to above. He points out that public help is needed for private forests. Then he tackles the extremely controversial question of public regulation, beginning with the statement that "as long as the private owner and the states cannot effectively handle the forest resources problem, public regulation is inevitable." However, Mr. Boerker evidently is not in entire sympathy with the United States Forest Service in demanding Federal regulation, for he states that he favors "local legislation and enforcement with a minimum of Federal supervision"—a position with which most foresters and timberland owners will agree.

WILLIAM G. HOWARD.
Director, Lands and Forests,
N. Y. State Conservation Dept.

Long-Needed Handbook

GUIDE TO SOUTHERN TREES. E. S. Harrar and J. G. Harrar. 712 pages, illustrated, indexed. Whittlesey House, McGraw-Hill Book Co., New York. 1946. $4.50.

This is an excellent handbook of the trees indigenous to the region south of the Mason and Dixon Line, the Ohio River, and an extension of the Missouri-Arkansas boundary to the western limit of southern forests. Somewhat over 350 species are discussed and more than 200 are illustrated by excellent line drawings showing all important characters. There is a handy introductory portion giving the basic concepts of nomenclature and taxonomy, an illustrated glossary of terms employed, and a 19-page key leading sometimes to genera, sometimes to individual species. Genera with more than one species in the area have a key to species included after the generic description. Common names, as well as scientific names and authorities, are given for each species. The specific descriptions are quite complete, including in most cases statements concerning the habit, leaves, flowers, fruit, twigs, bark, habitat, distribution, and economic importance. There has long been a need for such a book as this.

H. N. MOLDENKE.

Beneficial Bacteria

MICROBES OF MERIT. Otto Rahn. 277 pages, illustrated, indexed. Jacques Cattell Press, Lancaster, Pa. 1945. $4.00.

It is indeed high time that someone called our attention to the fact that not all microbes produce disease, and no one is better qualified to do so than Dr. Rahn, who has spent years working and teaching in this field. His book emphasizes the large number of harmless and beneficial bacteria; he tells us that only one out of every 30,000 bacteria produces disease. He discusses briefly the characteristics of micro-organisms and describes the various types of beneficial ones, not forgetting the yeasts and molds, in such a simple manner that anyone can understand him. His illustrations are especially worthy of note; they add greatly to the interest and clarity of the book, and some of them are really fascinating.

In spite of its simplicity, however, this book is remarkably complete and accurate, and should appeal to scientist and non-scientist alike. It should prove especially interesting to science students of high school age.

JEAN E. CONN,
New Haven, Conn.

Rice-Planter's Tale Of a Century Ago

THE SOUTH CAROLINA RICE PLANTATION as revealed in the papers of Robert F. W. Allston. Edited by J. H. Easterby. 478 pages, indexed. University of Chicago Press, Chicago. 1945. $5.

Mr. Easterby has given us a painstaking, intelligent study of rice planting in the low country of South Carolina, more specifically in the Georgetown district, from 1820 to 1868.

The book has three divisions:—first in fifty pages, an interesting account of the life of Robert F. W. Allston, graduate of West Point, engineer, lawyer, governor of South Carolina, but above all rice-planter.

Two hundred pages of the Allston family letters follow, then come another two hundred pages of overseer accounts, slave documents and factors' correspondence.

At one time Robert Allston owned seven rice plantations, all situated in the tidal swamps of the Georgetown district that lies along the neck of land between the Peedee and Waccamaw rivers. Rice planting was big business. One of the Allston plantations one year produced a crop of 20,000 bushels of rice.

The documents show men and women doing honest but difficult work, day by day, year after year—a far cry from the romance of the legendary South, or the pigsties of "Tobacco Road."

We should be grateful to Mr. Easterby for a job well done.

LEE WICKER KINARD,
Winthrop College
Rock Hill, South Carolina.

Conifers for Cultivation

THE FRIENDLY EVERGREENS. L. L. Kumlien. 230 pages, indexed, illustrated. D. Hill Nursery Company, Dundee, Ill. 1946. $6.

Here is a beautifully illustrated volume, worthy of inclusion in the library of everyone interested in the horticultural aspects of coniferous evergreens. The abundant drawings, black-and-white photographs, and colored pictures were well made and are excellently reproduced. And in the chapters are accounts, not only descriptive of most coniferous evergreens in cultivation, but also covering pruning, diseases, insects, landscape uses, soils, fertilizers, transplanting, propagation and other relevant topics.

E. H. FULLING,
Editor, The Botanical Review.

Chromosomal Point of View

GENETICS. Edgar Altenburg. 452 pages, illustrated, indexed. Henry Holt & Co., New York, 1945. $3.20.

This is a general text covering the entire field of genetics. It approaches the subject primarily from the chromosomal point of view and includes more material on chromosome behavior and the chromosomal basis of inheritance than do most elementary texts. A very helpful innovation is the inclusion of a brief summary at the end of each chapter, which should prove of distinct use to the beginning student. There are numerous problems, which will also serve to increase his understanding of the subject.

Many of the figures are new and some, notably the chromosome map of *Drosophila* on pages 194-195, are interesting and ingenious.

No book of this sort can include everything, but it seems to the present reviewer that the author might well have added a brief discussion of the remarkable studies in physiological genetics which have been made on *Neurospora*. Nothing is said about plant chimeras, which have thrown a good deal of light on the genetic basis of developmental problems. In general, the chapter on development seems a little limited. The introduction of the student to the chromosomal and genic mechanisms before he has studied the genetic facts is perhaps not as good pedagogy as taking up Mendelism first and passing from it to the physical basis of inheritance. This, however, is an arguable point. The author has taken over into all his genotypic formulae the use of the wild-type symbol +, as has long been done with *Drosophila*. With plants this sometimes results in rather awkward situations since the wild-type may be unknown and the choice of a particular trait as wild-type must therefore be arbitrary. It might be simpler to give a definite letter symbol for every pair of alleles.

These are minor points, however, and the text in general seems to be excellent. It should prove a valuable addition to the list of books available to the teacher of introductory courses in genetics.

EDMUND W. SINNOTT,
Yale University.

A Pioneer Writes Again On Begonia Culture

BEGONIAS AND HOW TO GROW THEM. Bessie Raymond Buxton. 163 pages, illustrated, indexed. Issued under the auspices of the Massachusetts Horticultural Society. Oxford University Press, New York. 1946. $2.25.

In 1939 the author published a book under this same title and it answered a long-felt need and reawakened lively interest in begonias.

The new book embodies much of the first volume—thus it is not exactly a new book, but an old one with additions. New species and varieties increase the list of begonias and more photographs are both helpful and interesting. There is a chapter devoted to tuberous-rooted begonias, as well as one which discusses begonia shows. An appendix describes the American Begonia Society.

This book makes a subtle appeal to the home grower; herein lies one of its high values. It is so designed as to make a delightful hobby workable for the many who have but few leisure hours.

In spots there are accumulated bits of information that are somewhat confusing, as in the paragraph on hairy-leaved begonias under Pests and Diseases. Also one learns from experience and from observation that the Calla begonia is not alone as a contradictory plant among begonias. The reviewer questions the wisdom of such labels as "a difficult plant to grow" and "the result is a sickly plant."

With a wealth of good material scattered through its pages, its usefulness can scarcely be overestimated in the large particular field in which it serves, and in which the author is an outstanding pioneer.

For those who have come further along the road, one hopes for the more technical book, one which will lay down definite rules for begonia culture, such being the result of purely scientific research.

RALPH P. SISSON,
Hopkinton, R. I.

*Current Literature**
At a Glance

By Harriet K. Morse

Fuchsias in Color. The Fuchsia Book for 1944, published last year by the American Fuchsia Society, contains 22 handsome illustrations in color. A descriptive check list of varieties introduced since 1934 is of great interest, as is the list of nurseries which furnish true-to-name stock.

Seed Germination. The Missouri Botanical Garden Bulletin for March 1946 publishes a list of some 150 garden flowers, vegetables and herbs with the number of days required for their germination. Radishes appear in two days while among the slowest are *Gloxinia* and *Lychnis* (21 days).

Delphiniums from Seed. Arnold Zurawski, writing in the 1945 publication of the American Delphinium Society, presents an article of special appeal to those who would like to grow choice delphiniums from seed. Many other authoritative articles also appear in the book.

Novelty Tomatoes. Here is a story about the growing of 22 kinds of miniature tomatoes as a hobby. Wilma S. Soule (in *Home Gardening for the South*, March 1946) describes her collections and comments on their uses as food and decoration. Among them are red and yellow pear tomatoes, plum, cherry, strawberry, peach, persimmon, green gage and apple tomatoes. They are disease resistant and prolific, she says, and they escape the commercial markets because they do not endure much handling.

Rubber. Under the title, "Rubber, Heritage of the American Tropics," W. Gordon Whaley in *The Scientific Monthly* for January gives a concise history of rubber from the 16th century on, when the early Spanish explorers in America first sent back reports of this curious milky substance found in trees. The history is brought up to date with a description of current production problems, including disease control, in different parts of the world.

Postage Stamps. In *Frontiers* magazine for February, stamps of the world have been singled out for the story they tell of the characteristic flora of the country concerned. Costa Rica shows the fruit of the chocolate tree; Bulgaria a full blown rose beside a perfume flask; New Zealand, the kauri tree; Madagascar, the traveler's tree; Colombia, a banana, and so on. The United Nations stamp carries a laurel branch with berries. For further pursuit of the subject, the following articles might be consulted: "Plants on Stamps," *Gardeners' Chronicle of America,* April 1945; "Trees and Postage Stamps," *American Forests,* October 1940; "Breadfruit Tree Stamps," *Nature Magazine,* November 1939; "Things Apothecary on Postage Stamps," *American Druggist,* Mav 1940; "Agriculture in Stamps of the Pan American Republics," Bulletin of the Pan American Union, March 1939.

* All publications mentioned here—and many others—may be consulted in the Library of the Botanical Garden, in the Museum Building.

For the Blind. In a foreword to his brochure, on "Gardening for Health and Happiness," Dr. Hugh Findlay, the author, says, "This book is prepared primarily for the blind who love nature and gardens, and those who might add more vegetables to the world's great storehouse." This informative little book will, it is hoped, be produced in braille, that the blind may read for themselves how to become vegetable gardeners.

Orchid Magazines. The *Orchid Digest,* spring 1946, issued by the Orchid Society of California, lists six periodicals on the orchid in English, besides one in Portuguese and one in Spanish.

Library Acquisitions

Some of the Library's lately arrived purchases are briefly described here.

Two early works on the camellia have been reprinted by E. A. McIlhenny of Avery Island, Louisiana. One is the ***Monography of the Genus Camellia*** by the Abbé Lorenzo Berlese, as it first appeared in an English translation in 1838; the other, "New Iconography of the Camellias" by Alexandre Verschaffelt (1848-1860), translated from the French by Mr. McIlhenny himself. Only the texts of these two books are given; not the illustrations.

Pioneer Settlement in the Asiatic Tropics by Karl J. Pelzer. Studies in land utilization and agriculture in southeastern Asia. American Geographical Society Serial Publication No. 29. 1945.

Darwin on Humus and the Earthworm, with an introduction by Sir Albert Howard. A 1945 edition by Faber & Faber of London of Charles Darwin's volume of 1881 entitled "The Formation of Vegetable Mould through the Action of Worms with Observations on their Habits."

Five illustrated volumes of ***Flora Agaricina Danica,*** dated 1941, have been received from Copenhagen. Prepared by J. E. Lange, they are published by the Royal Veterinary and Agricultural College, Department of Plant Pathology.

Several volumes of the long-awaited ***Flore Géneral de l'Indo-Chine*** have lately arrived from abroad.

Notes, News, and Comment

A. A. A. S. At the meetings of the American Association for the Advancement of Science in St. Louis the last week in March a paper was given by Dr. H. W. Rickett on "Travels of Sessé and Mociño in New Spain" and by Dr. W. H. Camp on "Biochemical Clines, Polymorphic Populations, and the Problems of Specific Delimitation of the Cinchona Population of Ecuador." Charles L. Gilly, who was formerly botanical artist at the New York Botanical Garden and who is now teaching in Iowa State College after spending several years in Mexico, presented a detailed paper on "Distribution and Variability in Teosinte." These were all given at sessions of the American Society of Plant Taxonomists. Mr. Gilly was co-author with Dr. Camp of an extensive article on "The Structure and Origin of Species" which appeared in *Brittonia* in 1943.

Dr. Ilda McVeigh, Technical Assistant at the Garden, was one of four authors of a paper presented on the "Comparative Studies on the B-Vitamin Content of Trisomic and Disomic Maize," representing work that she did while at Yale University, and also presented a paper prepared in co-operation with William J. Robbins on "The Effect of *L*—Hydroxyproline on *Trichophyton mentagrophytes.*"

Dr. Margaret Fulford of the University of Cincinnati, who has twice been a recipient of the Marshall A. Howe Memorial Fellowship at the Garden, presented "A Discussion of Phytogeography of the Hepatics of North and South America."

Chairman. Dr. W. H. Camp was elected chairman of the systematic section of the Botanical Society of America for the year at the meeting in St. Louis at the end of March. He was also appointed chairman of the committee on nomenclature for the American Society of Plant Taxonomists, and was elected a member of a committee for drafting a constitution for the newly organized Society for the Study of Evolution.

Lectures. Dr. Bassett Maguire went to Hanover, N. H., March 19 to address the Dartmouth Science Club March 20 on his exploration of Table Mountain (Tafelberg) in Surinam. He also talked on his expedition before the Quarantine Club in the New York City Federal Building March 27 and the Science Club at Columbia April 8.

Dr. A. B. Stout went to Boston last month to address the Chestnut Hill Garden Club April 2 on "Lilies for Gardens."

T. H. Everett spoke before the John Burroughs Garden Club of Yonkers, an Affiliate of the New York Botanical Garden, April 17 on "Garden Soils and Composts."

Dr. William J. Robbins addressed the Greenwich Garden Club April 16 and gave demonstrations on "The Botanical Aspects of Penicillin and Similar Substances."

Dr. H. N. Moldenke talked on "Treasures of the Watchung Mountains" before the Garden Club of the Oranges April 2.

The Katonah Women's Club was hostess in its club house to two clubs in Bedford Township April 11 to hear a talk by Elizabeth C. Hall on "The New York Botanical Garden's Library and its Services." Miss Hall illustrated her lecture with books, booklets, lists, prints, and other materials from the library.

On his return from St. Louis, Dr. W. H. Camp on April 1 addressed a group at Ohio State University, where he had taught for ten years before joining the Garden's staff in 1935, speaking on "Wartime Experiences of a Botanist."

Field Work. Marjorie J. French of Amherst, Mass., a graduate of Oberlin and a student in the School of Library Science at Simmons College, spent a week at the New York Botanical Garden last month doing library cataloguing as part of the field work required in her course.

Solidago. Dr. Arthur Cronquist worked in the National Herbarium in Washington, D. C., at the Bureau of Plant Industry in Beltsville, Maryland, and in the Gray Herbarium at Cambridge, Mass., during part of February and March studying specimens of *Solidago*. Before he returned from the St. Louis meetings the first of April he stopped at Notre Dame and Ohio State Universities to inspect additional specimens of Composites.

Conferences. Staff members who attended the meetings of the American Association for the Advancement of Science in St. Louis the last week in March addressed the monthly conference of the scientific staff and registered students of the Garden April 10. They were Drs. W. H. Camp, Arthur Cronquist, F. W. Kavanagh, Ilda McVeigh, and H. W. Rickett.

At the previous conference, March 13, Dr. H. A. Gleason spoke on "Trying to Maintain some Well Known Names" and Dr. H. N. Moldenke on "Some Little Known Genera of Verbenaceae."

Groups. M. Truman Fossum, Assistant Professor in the Department of Floriculture and Ornamental Horticulture at Cornell University, brought a group of 22 students on a special trip to New York March 16 to visit the New York Botanical Garden. They were taken on a tour of the Museum Building and Range I and were shown the Garden's short motion picture film. Among other groups which have recently made guided tours of the Garden are a Boy Scout troop from the Bronx and a sixth grade class from P. S. 114.

Visitors. Dr. Albert Zeller of Basle, who is working on a nutrition project for the Swiss government, visited the New York Botanical Garden in early March. He was particularly interested in Dr. Robbins' work on nutrition in which fungi are used as the experimental material.

Dr. Budd E. Smith of Coker College, Hartsville, S. C., came to the Garden last month to consult with E. J. Alexander on his collection of South Carolina plants.

Jeannette E. Graustein, Professor of Plant Morphology at the University of Delaware, spent part of her spring vacation working in the Garden's library on a research project in the correspondence of John Torrey.

Richard A. Howard, who has recently been released from service with the Armed Forces, came to New York from the Gray Herbarium and worked April 10-13 in the herbarium here on the flora of the West Indies.

Among other visitors of recent weeks have been Henry Teuscher of the Montreal Botanical Garden; Olav Einset of Lofthus, Norway; F. W. Went from the California Institute of Technology; Ruth Patrick, Pennsylvania School of Horticulture at Ambler; Edgar T. Wherry from the University of Pennsylvania; Robert T. Clausen, Cornell; C. V. Morton, Smithsonian Institution; A. J. Grout, on his way from Florida to Vermont; George H. Spaulding, a former student gardener who has been serving with the Marines in the Pacific and who is now returning to his nursery business in California; William M. O'Sullivan, Philadelphia College of Pharmacy, and Stanley Smith, Cornell University.

Conference. Research carried on in the Archivo General de la Nación in Mexico during the summer of 1943 by Dr. H. W. Rickett formed the subject of the monthly conference of the scientific staff and registered students of the Garden February 13, when Dr. Rickett spoke on "The Royal Botanical Expedition to New Spain." This expedition, headed by Martin de Sessé, began its work in 1787 under the authority of Charles III; it did not return until 1803, when the court at Madrid was completely indifferent to the flora of New Spain. Much of the work of this group of botanists was therefore lost, until Sessé and Mociño's works were published in Mexico near the end of the 19th century. The expedition, however, resulted in important botanical collections, now deposited in Madrid; these are of value in our knowledge of Mexican botany. Dr. Rickett deciphered and translated all of the correspondence and records relating to their explorations which he was able to locate in the Mexican archives; for the first time detailed dates and itineraries of their travels are available. The complete story will be published in a special issue of *Chronica Botanica.*

Easter. Pre-war crowds invaded the New York Botanical Garden on Easter Sunday, where flowers were blooming in abundance both outdoors and in. Approximately 30,000 people were clocked entering the grounds in automobiles and on foot, and of these more than 7,000 visited the Easter display in House 6 of the Main Conservatories. Among the flowers arranged there in garden effect were Darwin tulips, marguerites, butterfly-flowers (*Schizanthus* hybrids), cinerarias, azaleas, and showy African daisies of several genera.

Outdoors, the late flowering cherries were at the peak of their bloom. The first of the poet's narcissus came out in time to blend with the earlier yellow daffodils, which had remained in prime condition throughout the long cool weeks since they first opened. There were still magnolias in flower at the edge of the woodlands in the southeast section of the grounds, and the many dogwoods gave promise of flowering in another week. The first of the massed azaleas were showing color, and at the entrance to the rock garden the Chinese redbud (*Cercis chinensis*) was brilliant with its deep magenta flowers just opening. In the rock garden itself, which had been opened to the public for the first time this season on the Sunday previous, many hundreds of visitors enioyed the first of the primulas, epimediums, grape hyacinths and other small bulbs, violas, Virginia bluebells, moss pink (*Phlox subulata*) of several colors, rock-cress, evergreen candytuft, the lilac flowers of *Daphne Genkwa* and the pink of *Daphne Cneorum,* and many other flowers.

In several of the tulip beds adjacent to the conservatories, early varieties had come into bloom.

Third Avenue Elevated to the Botanical Gar

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

An Illustrated Flora of the Northern United States and Canada, by Nathaniel Lord Britton and Addison Brown. Three volumes, giving descriptions and illustrations of 4,666 species. Second edition, reprinted. $13.50.

Flora of the Prairies and Plains of Central North America, by P. A. Rydberg. 969 pages and 601 figures. 1932. Price, $5.50 postpaid.

The Bahama Flora, by Nathaniel Lord Britton and Charles Frederick Millspaugh. 695 pages. Descriptions of the spermatophytes, pteridophytes, bryophytes, and thallophytes of the Bahamas, with keys, notes on explorations and collections, bibliography, and index. 1920. $6.25.

North American Cariceae, by Kenneth K. Mackenzie, containing 539 plates of *Carex* and related plants by Harry C. Creutzburg, with a description of each species. Indexed. 1940. Two volumes, 10¾ x 13½ inches; bound $17.50: unbound $15.50.

Keys to the North American Species of Carex by K. K. Mackenzie. From Vol. 19, Part 1, of *North American Flora.* $1.25.

Food and Drug Plants of the North American Indian. Two illustrated articles by Marion A. & G. L. Wittrock in the Journal for March 1942. 15 cents.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal, 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 15 cents.

The Flora of the Unicorn Tapestries by E. J. Alexander and Carol H. Woodward. 28 pages, illustrated with photographs and drawings; bound with paper. 1941. 25 cents.

Catalog of Hardy Trees and Shrubs. A list of the woody plants being grown outdoors at the New York Botanical Garden in 1942, in 127 pages with notes, a map, and 20 illustrations. 75 cents.

Succulent Plants of New and Old World Deserts by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. Second edition 1944. 50 cents.

Periodicals

Addisonia, annually, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Now in its twenty-second volume. Subscription price, $10 a volume (four years). Not offered in exchange. Free to members of the Garden.

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1.50 a year; single copies 15 cents. Free to members of the Garden. Now in its 47th volume.

Mycologia, bimonthly, illustrated in color and otherwise; devoted to fungi, including lichens, containing technical articles and news and notes of general interest. $7 a year; single copies $1.50 each. Now in its thirty-eighth volume. Twenty-four Year Index volume $3.

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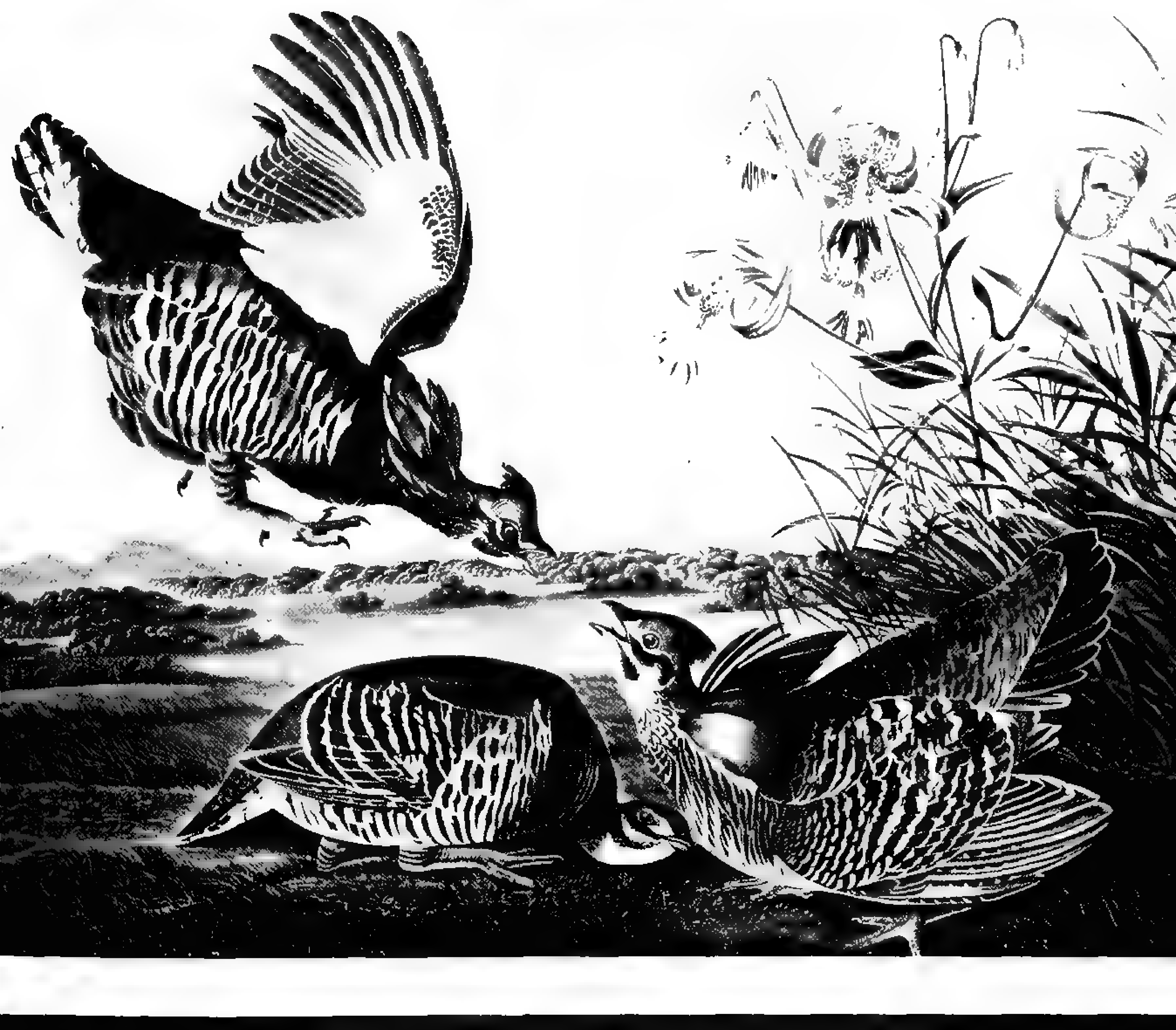
Contributions from The New York Botanical Garden. A series of technical papers reprinted from journals other than the above. 25 cents each, $5 a volume.

Memoirs of The New York Botanical Garden. A collection of scientific papers. Contents and prices on request.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN



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1946

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133—160

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

JUNE BLOOM AT THE GARDEN

Roses

THE great Rose Garden on the east side of the grounds, largely contributed by the firm of Bobbink & Atkins, contains 7,000 or more plants in some 800 varieties and species which will be at their peak the first half of June.

To reach the Rose Garden by automobile, turn into the grounds at the second gate going east off Fordham Road; or, follow the road from the Main Entrance toward the rear of the Museum Building, then east and south to the Rose Garden. By subway, the nearest route is by way of the White Plains Road line on the East Side IRT, walking westward from the Pelham Parkway Station.

Peonies

A collection of 240 varieties, including the Saunders hybrids, at the north end of the Main Conservatory, will be in flower in early June.

Rhododendrons

Starting in late May, the Garden's large collection of rhododendron hybrids will continue to flower during the early part of June.

Daylilies

Late June and July is the peak season for daylilies, to be seen in the Experimental Garden on the east side of the grounds.

Rock Garden

While the peak of the season comes in May, many attractive flowering plants will give pleasing color and pattern during June.

JUNE EVENTS AT THE GARDEN

Members' Day

June 5 ***Painting Wild Flowers in Westchester County*** *Eloise P. Luquer*

Rose-Growers' Day

June 12

An all-day program starting at 10.30 a.m. with an inspection of the Rose Garden. *F F Rockwell*, Editor-in-Chief of *The Home Garden*, will speak at 11:30 on "Roses for the Beginner." A picnic lunch will follow, and at 2 p.m. there will be a clinic and demonstration on roses diseases and culture.

Radio Programs

3:30 p m. on alternate Fridays over WNYC

June 14 ***Your 230-Acre Garden*** *Mrs. Melvin Sawin*
Member of Advisory Council, New York Botanical Garden

June 28 ***Sugar is the Foundation of All Life*** *E. E. Naylor*
Assistant Curator, New York Botanical Garden

TABLE OF CONTENTS

JUNE 1946

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.50. Single copies 15 cents.

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Cushion Plants of the Peruvian Puna

By W. H. Hodge

Illustrated with photographs by the author

FEW COUNTRIES can compare with Peru in the variety of plant formations. There you can find vegetation typical of lowlands, either wet or dry, of warm humid rain-forests or warm dry thorn-forests, of deserts hot and cold, and also of the alpine and the littoral, the arctic and the tropics, plus all the intergrades lying between.

Perhaps most unusual of all are in those areas which the Peruvians call the PUNA—a formation characteristic of the highest Andes and to be encountered from central to southern Peru and in Bolivia. The puna is a part of the treeless ALTIPLANO (high plain), the highest plateau (averaging about 4,000 meters, or 13,000 feet) in the Western Hemisphere, and interesting as the site of the Inca civilization, one of the principal civilization autochthonous to the New World.

The Peruvian puna, which technically is that portion of the altiplano lying above the 14,000-foot limit of cultivation, has its northernmost limits at about 8 degrees south latitude in the beautiful snow-covered range of the Cordillera Blanca, which begins just south of the ancient Incaic city of Cajamarca. From this region, on the flanks of Peru's highest peak—23,000-foot Huascarán—it extends without interruption, but with many an irregular ramification, along the lofty Cordilleras of the western Andes to southern Peru and Bolivia, where it expands to form its principal display on the high rolling country surrounding the Titicaca basin.

The reason the characteristic vegetation of the puna is not found on the snowy volcanoes of Ecuador is apparently due to the rather pronounced reduction in elevation of the Andes in northern Peru, where the cordilleras average considerably less than 4,000 meters, as compared to the 4,000—5,000 meter average of the true puna. This notable break in the Andes—located in the Cordillera de Huancabamba, lying west of the great bend of the Marañon River—has been the key obstacle to the

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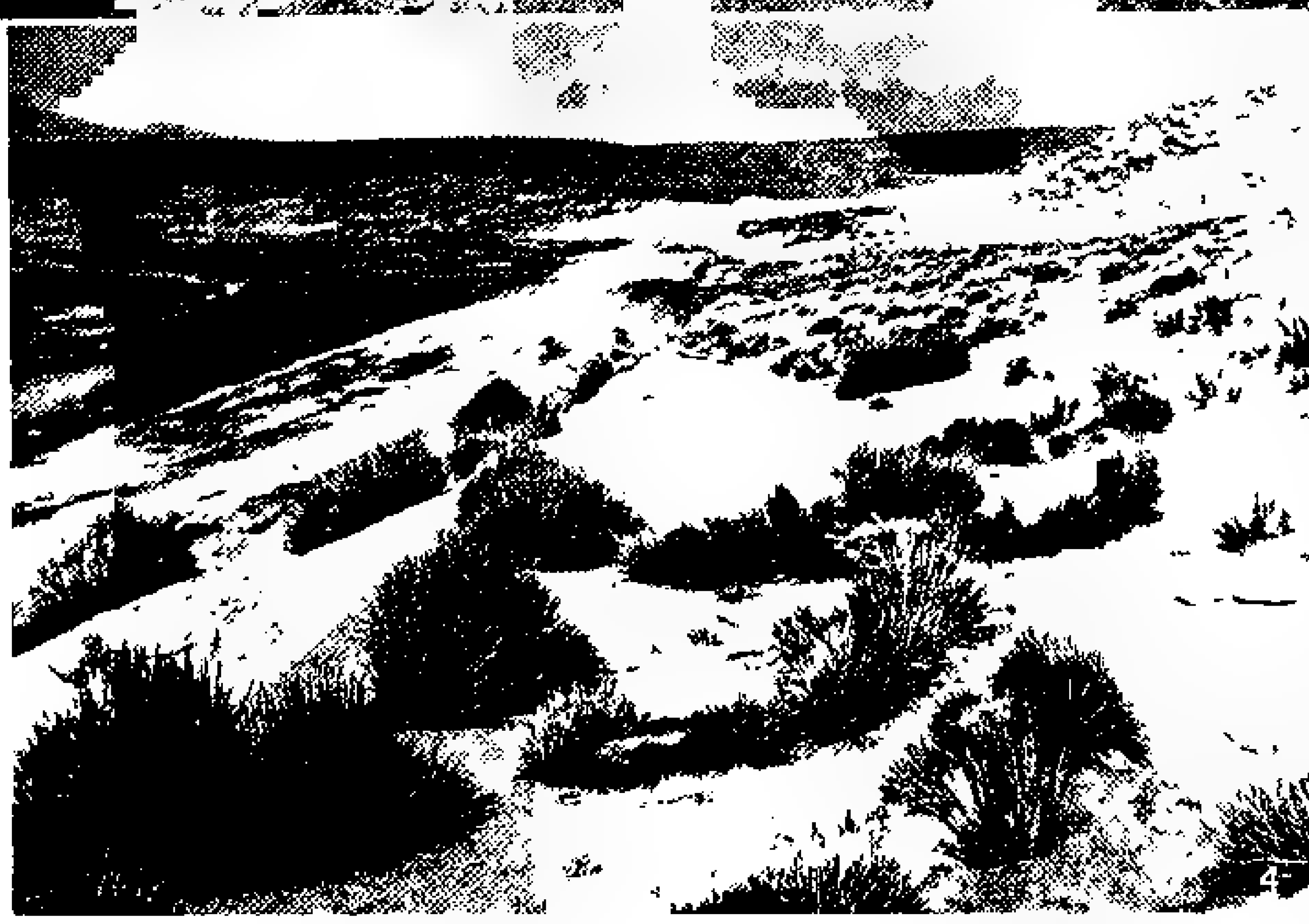
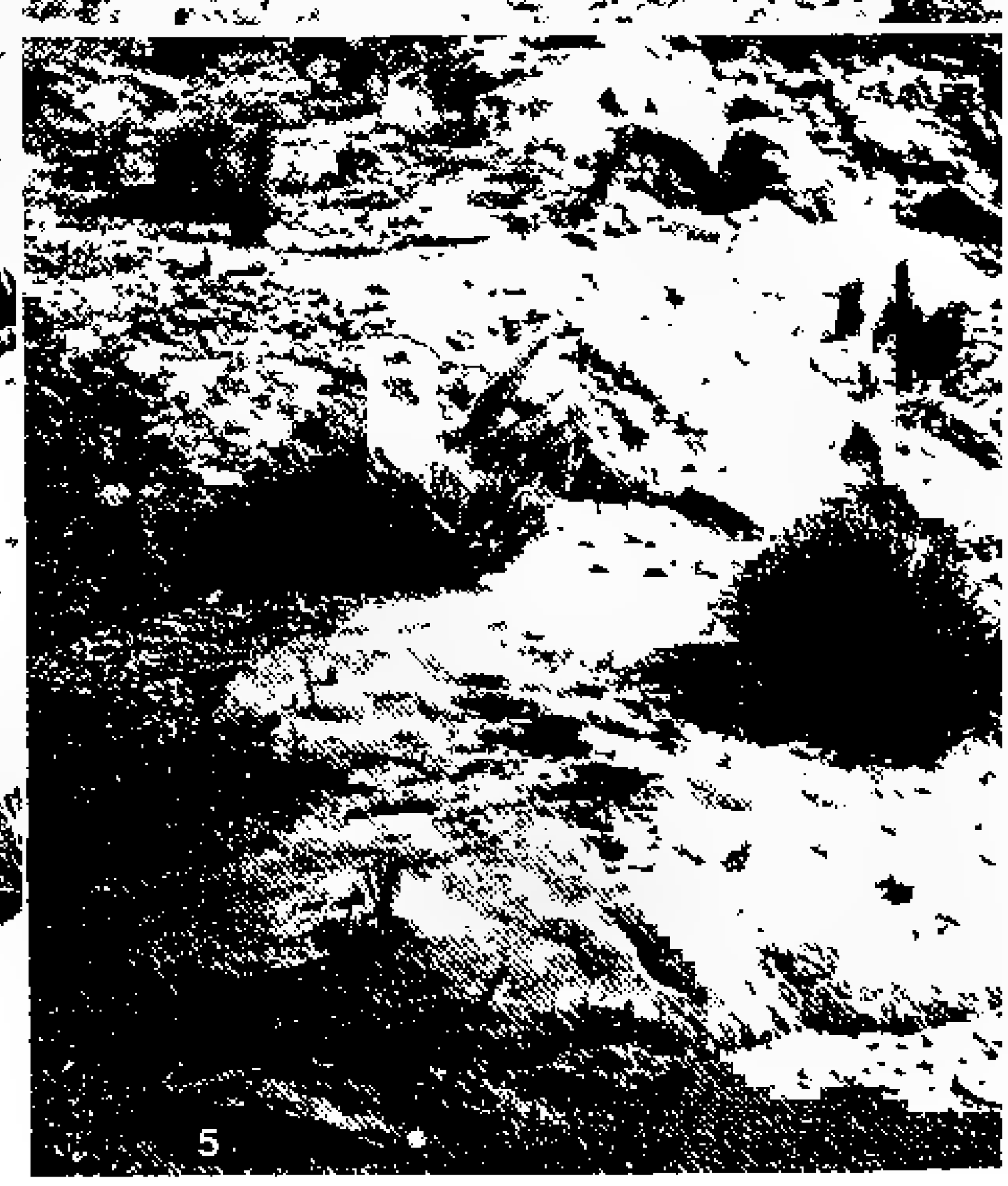
THE PERUVIAN PUNA AND ITS CHARACTERISTIC PLANTS

Photographs by W. H. Hodge





1. *Tola shrub (Lepidophyllum) on the Pampas de Arrieros, dried and stacked to be used as fuel.*
2. *Boundary between the bunch grass and the puna mat formations, in the vicinity of Huito in southern Peru. The cushion plants are often limited to stony or rocky areas such as the slope in the background, where the heat-absorbing power of the rocks raises the soil temperature so that it can better support the plants.*
3. *Scattered cushions of Opuntia lagopus and O. floccosa growing amid bunch-grass on the Pampas de Crucero. This is a favorite grazing ground for llamas and alpacas.*
4. *Ichu grasses on the pampas near Lago de Salinas, east of Arequipa, at an elevation of 15,000 feet.*
5. *Azorella with a variety of plants crowding together to share the moisture which is more abundant under the big compact cushions.*

natural migration not only of high Andean plants but also characteristic puna animals. Thus, puna plants, and especially the cushion formers, are not encountered in Peru north of 8 degrees south latitude; but north of that line occurs a different type of formation called locally the JALCA, or PARAMO,* which is superficially similar to the puna. Except for the absence of the curious FRAILEJON (*Espeletia*) the jalca, or north Peruvian páramo, is apparently more like the páramos of Ecuador and Colombia than the puna of southern Peru.

The puna has an aspect which the Peruvian describes as "triste," perhaps best translated here as "somber." If such a description is just it probably stems from the feeling given by the dull colors characteristic of the vegetation of these high prairies and rock-fields. Except in humid places one seldom sees fresh vivid greens, and instead the perennial wiry grasses have a drab yellow-green or gray-green hue, shared by companion plants and bird life. The year round this color changes little, even during the January to April "winter" when sudden squalls of rain or sleet or snow are in season, offsetting somewhat the overbearing influence of the long dry season.

Except for the wet, poorly drained moorlands, the puna is a region of drought to its plant inhabitants. Dry conditions are brought about by a number of factors common in most regions of high altitude. Low atmospheric pressure permits increased evaporation; sunlight, with its potential dessicating power, is increased tremendously by the thinness of the air; and wind movement, working in conjunction with the preceding agents as a drying power, is particularly effective because of its freedom of movement in a region lacking the windbreaking, moisture-holding and shading properties of trees. Night does little to alleviate these dry conditions, for the temperature often drops to the freezing point, and what little soil water may be available then becomes locked in an icy form which is useless to a thirsty plant.

Thus the puna is largely a desert, a cold desert, and probably the highest desert in the world. In certain places—for instance, in areas high above and to the east of Arequipa—it can be as barren and devoid of plant life as the most arid stretches of any lowland desert, but more often it sports the characteristic semi-desert aspect—a meager sprinkling of plants upon stony, bouldery, or gravelly soil with nowhere, save in the wet moors, a solid turf of vegetation.

The appearance of the puna varies from place to place depending upon such characters as elevation, exposure, soil, drainage, and whether the particular area is in the western or central Andes. On those gravelly prairies bordering upon the tillable portions of the altiplano, tufted bunch grasses called ICHU are most common; brook margins and those ex-

* See Fosberg, F. R., El Páramo de Sumapaz, Colombia. Jour. N. Y. Bot. Gard. **45**: 226-234. October 1944.

pansive and poorly drained basins into which flow the snow-waters from the glaciers and snows of the higher peaks are covered with a rich green moorlike vegetation in which flat mats of *Distichia muscoides* of the Juncaceae are dominant; while at the higher exposed elevations which extend up to snowline at 16,500 to 17,000 feet one encounters most frequently the queerest of the puna lot, the cushion plants.

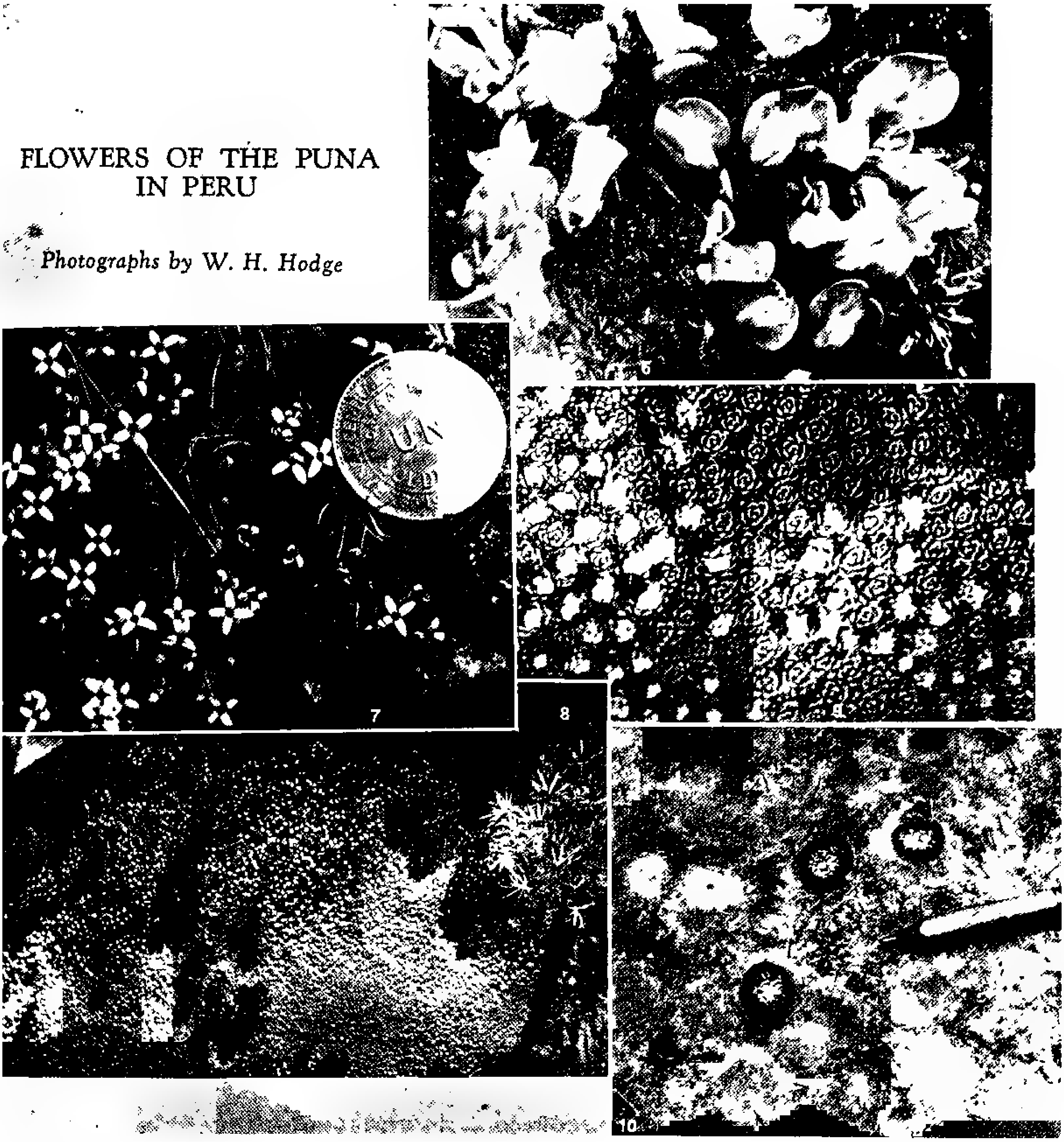
The desert conditions mentioned above have placed their imprint on the flora of the puna in a definite sort of way, for nearly all the plants are herbaceous perennials, much dwarfed and with but slight elevation above the soil. Moreover, stems are generally absent, and roots are disproportionately enlarged, helping to hold the almost insignificant foliage and flowers close to the soil, as though fearful as to what the elements might be able to do if these parts were raised too high above the ground. Actually this form of growth enables puna plants not only to hoard moisture but also to utilize to the full the bountiful heat absorbed by the soil as a result of the intense solar radiation at high altitudes. All plants have certain minimum temperature requirements for soil heat which must be met in order to permit normal growth. If it were not for the increased insolation which makes the soil temperature of the high Andes almost as warm during daytime as the soils at sea level, many of the puna species would be unable to grow at such elevations where air temperatures are always cool. Unfortunately much of the warmth absorbed by the soil in daylight hours is rapidly dissipated at night, but the loss of heat stored by boulders and stony ground is not so rapid. For this reason, at the highest elevations in the Andes, puna plants are often absent on areas of soil, but on boulder-strewn or rocky areas—where the soil temperature averages higher over a 24-hour-day period—associations of plants can still grow and are consequently common.

To a certain degree, most puna plants are cushion plants; that is, they possess the general shape of a cushion, though exhibiting great variety, extending from rosettes and flat plate-like cushions through compacted convex forms to the exploded cushion or tufted plant represented by the bunch grasses.

The tallest plants of the puna are the grasses, but so extreme are the xerophytic conditions of the region that the stiff leaf-blades of even such hardy individuals as the grayish-green ichu grasses (*Festuca orthophylla* and *F. rigescens*, *Calamagrostis* species, and *Stipa ichu*) are generally inrolled to conserve moisture. The ichu grasses, especially the widespread *Stipa ichu*, are the most important economic plants of the puna, for they serve as the principal food for the wandering flocks of sheep, llamas, and alpacas, and also as the universal thatch for the huts of the Peruvian sierra Indians. This use of ichu is a natural hold-over from the days of the Inca empire when regal Cuzco had buildings of massive stonework said to have been thatched with ichu grass.

FLOWERS OF THE PUNA IN PERU

Photographs by W. H. Hodge



6. *Astragalus uniflorus, with attractive lavender blossoms on nearly subterranean stems.*
7. *Hedyotis filiformis, whose fine white flowers are commonly seen along the road between Jauja and Tarma, where the Astragalus also grows.*
8. *Azorella in its characteristic mat interspersed with other species of plants.*
9. *A closer view of the yareta (Azorella) cushion, showing its minute, greenish white flowers.*
10. *Yellow blossoms of the cactus, Opuntia lagopus, nearly hidden by the felted mass of the enormous cushion, photographed on the Pampas de Crucero, in the Department of Puno in southern Peru, at 15,000 feet.*

Bunch grasses have a wider distribution than the other plant associations of the high Andes. The monotonous appearance of these loosely growing ichu grasslands belies the comparative wealth of the cushion flora that often accompanies them. Wandering among the sparsely scattered grass clumps and looking closely at the ground, one may have many a delightful botanical surprise by discovering some of the smaller cushion and rosette plants in such genera as *Calandrinia, Nototriche, Belonanthus, Hedyotis, Capethia, Pycnophyllum, Hypochaeris,* or *Liabum.* Species of *Arenaria* and *Draba* remind one of the Northern Hemisphere, as do also the lavender flowers of a curious rosette-forming legume, *Astragalus uniflorus,* but the cushiony forms of such familiar genera as *Gentiana* (found in *G. sedifolia*) and *Verbena* (in *V polystachya*), are characteristic of the puna.

In the western Andes of southern Peru, and at higher elevations (or wherever soil moisture decreases and desert conditions become more intense), the bunch grasses peter out to give way to the fraternity of the low cushion-forming plants. This is the realm of the so-called puna mat, a plant association whose variegate appearance is caused by the yellow and green colors of its constituents. Spectacular in aspect, it is richer in species than any of the several other puna associations, for besides the tiny rosette plants and insignificant cushion-formers, are to be found several of the wonders of the cushion-plant world—notably the small grayish *Merope aretioides* growing with the bright green *Azorella yareta.* Theirs is a close and curious community life, for despite the many bare spaces of unoccupied soil that are always available, giant cushions, tufts of grass and pigmy rosettes crowd together, often growing one on top of the other as though to shelter, shade, and share alike all available soil moisture.

Azorella, which the Peruvians call YARETA, or LLARETA,* is the most important element of the flora of the puna mat, and is a dominant species over extensive areas, especially in southern Peru, where it is abundant in the high cold desert regions of the Departments of Tacna, Moquequa, Arequipa, and western Puno. Its average altitudinal distribution in this general region runs between 4,000 and 4,800 meters, but yareta will grow as low as 3,800 meters and up to 5,200, an elevation where the temperature as often as not is below freezing. It has been claimed to grow only on slopes facing east, but I have also seen it abundant on north-facing, west-facing, and south-facing slopes. Size is the unusual feature about *Azorella,* for the irregularly shaped cushions of this species are often highly convex, at times as much as a meter high, and single specimens have been measured with a diameter approaching four meters.

Like the adult rosette plants, a juvenile yareta is practically acaulescent, but as it matures the original short stem becomes highly branched. The branches are crowded together in such a way as to form a highly-compacted, tumorous, convex mass. This is the cushion which in outward

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* See Rusby, H. H. Llareta, a Strange Fuel. Jour. N. Y. Bot. Gard. 33: 54-57. March 1932. In this article Dr. Rusby refers to *Azorella diapensioides,* a different species used in the same way.

appearance is for all the world like a gigantic, irregular cauliflower head; and the compacted branches beneath appear like a sectioned head of that vegetable. So tightly packed is the yareta plant that a person can walk across its hard surface without damage to the green tips of the multitudes of branches.

Besides offering a minimum of evaporating surface to the dry environment, cushion plants with a form like yareta are vegetable sponges which can absorb for their use the scant water that may come in the form of precipitation. In the period of maximum rainfall, January to April, the cushions are verdant green, but this color changes during the longer dry season to an earthy shade matching the rocks of the habitat and making it somewhat difficult for the casual observer to differentiate between boulder and plant.

Flowers of the yareta, like those of most puna plants, are not showy but are rather tiny, insignificant, greenish-white affairs which speckle each cushiony lump with the typical petal pattern characteristic of umbelliferous genera. I have noted flowering cushions in the Department of Puno during the months from May to July, the pale yellow seeds being scattered on the surface of the plant during the last months of the year. The seeds are apparently blown by the wind until they reach a spot suitable for their germination.

The stems and foliage of the yareta contain a resinous substance which probably aids the plant to conserve stored water. This may be the species' undoing, for in the high treeless areas, where it has long thrived, ordinary firewood is absent, and yareta has been the only substitute available. It is an excellent pinch-hitter, for as the cushion dries, the resinous material oozes from it, making the plant highly combustible. The sierra Indians have long used the resins obtained from burning the green yareta as astringents and absorbents in their home medicine, while the ashes are utilized as fertilizer. Fuel from dried plants has been shown to evolve an enormous amount of heat with the production of little or no smoke. Yareta exploitation has thus proved to be a good thing not only for the puna herdsman—who annually collects his supply of the cushions three months before needing them, stacking them to dry like cordwood outside his hut—but also for big business, especially mines and railroads. Arequipeñan bakeries, appreciative of an intense heat-producing fuel, prefer smokeless yareta to all other combustibles; the railroads also, especially the Chilean line running from Arica to the Bolivian capital, have demanded yareta and have used it wholesale as a locomotive fuel. Stacks of yareta, and to some extent TOLA (*Lepidophyllum*), another puna plant, are familiar sights piled high along the tracks at trans-Andean railroad stations.

YARETALES, areas abounding in *Azorella* plants, are fast disappearing, especially those located within reach of the railroad. A good YARETAL has from 10% to 15% of the ground covered with *Azorella* plants, a rate of

GENERAL VIEW OF TYPICAL PUNA FORMATION EAST OF AREQUIPA IN SOUTHERN PERU

Elevations here, in the vicinity of Pati on the road between Arequipa and Puno, average between 15,000 and 16,000 feet. The scattered plants are of the cushion or rosette-forming type.

about 70 plants per hectare. At the present time the principal and richest area of yaretales is in the western cordillera near the Chilean-Peruvian frontier, where there are an estimated 500,000 hectares of plants. Harvesting takes place during the dry season and the plants are handled like peat. Fortunately, the Peruvian Government, recognizing the fact that without some sort of control this slow-growing plant may reach the point of extinction, has taken steps to guard against the heretofore unbridled exploitation of it. After more is known about the growth habits of *Azorella,* control may eventually lead to the production of yareta on a sustained yield basis.

Like many another American desert, the puna has its cacti which, similar to their picturesque and grotesque cousins of the lowlands, are outstanding oddities among their companion plants. The familiar genus *Opuntia* is most commonly seen, and is probably the most stratosphere-minded of the whole cactus clan. Species of *Opuntia* may be found growing, often close to snowline at 16,500 feet, in widely separated regions in the Peruvian Andes—on the flanks of Huascarán in the Cordillera Blanca; at easily reached Ticlio pass, 85 miles east of Lima in the Western Cordillera of Central Peru; and especially in the Andean Cordillera of Carabaya lying just north of Lake Titicaca.

Certain species of cushion cacti, like *Opuntia ignescens,* fraternize with *Azorella,* but the larger cushion-forming types of cactus—which vie in size with cushions of *Azorella*—seem to prefer the company of bunch grasses on the high prairie pastures. These areas, which are the favorite grazing grounds of the alpacas and vicuñas, are subject to frequent flurries of snow, which often lingers in scattered patches. At such times cushion cacti and snow patches are almost indistinguishable, for the two commonest cactus species, *Opuntia lagopus* and *Opuntia floccosa,* are covered with snowy-white woolly hairs, as the specific names indicate. *Opuntia lagopus* appears to be a cactus only in its tiny yellow typically cactaceous flowers, which peer from the dense camouflaging wool of the cushion. Otherwise this species is an aberrant member of its family, — with branches packed as closely into its high, convex, woolly cushion as are the branches of the *Azorella.* One can likewise stand upon this firmly packed cushion, but if you think that the mat is soft to the touch, beware! *Opuntia* cushions with their hidden spines are more than plant cushions—they are plant pin-cushions! *O. floccosa* and *O. lagopus* are close associates on the puna prairies, but although similar in shape and in color of flowers, *O. floccosa* forms smaller cushions, in which the individual hairy branches are more loosely packed.

Azorella and the companion species of *Opuntia* constitute an unusual trio which represents the acme of the cushion-forming plants high in the Andes where the atmosphere is thin.

Wildflower Sanctuary In A Long Island Garden

By Edith Farrington Johnston

Published with the aid of the Olivia E. and Caroline Phelps Stokes fund for the preservation of wild flowers.

A WILDFLOWER-CONSERVATION project on a small but impressive scale is the hobby of Mr. and Mrs. S. LeRoy King of East Hampton, Long Island. Mr. King is a carpenter by trade but for many years he has devoted all his leisure time to the collecting, raising and propagating of the vanishing wildflowers native to lower Long Island. Mrs. King is an ardent collaborator in the enterprise and does much to keep boys, dogs and rabbits away from their treasures.

On a lot some 50 by 300 feet the Kings have a small rock garden; a lawn with a magnificent old sycamore and several American cedars; two cottages and a garage; a rock-bordered pool with turtle-head, meadow-beauty, purple loosestrife and broad-leaved arrowhead around its borders; fish and frogs—raised by Mrs. King from the spawn—in its waters; a row of rose-red mallow; and bed after bed of native flowers, all behind low wire fencing, because the rabbits, too, are great flower-fanciers, particularly fond of lilies and orchids.

Here is a bed overflowing with red-and-yellow columbine interspersed with Jack-in-the-pulpit, several trilliums and the yellow lady's-slipper. Across the lot from this, under the pines, is a bed of trailing arbutus, with checkerberry, spotted wintergreen, prince's pine and moccasin-flower. Here, where the ground slopes toward the pool, is a great clump of lavender-blue monkey-flower, three to four feet high. Further back, in the borders, are Joe-Pye weed, purple loosestrife (Ophelia's "long purples"), ironweed, and tall Turk's-cap lilies, sometimes bearing more than sixteen blooms to the scape.

Natural Orchid Hybrids

In the center of the grass-plot stands the crowning glory of the place: a large sunny oval bed of wild orchids, mainly those of the *Habenaria* clan. The two chief parents are the yellow fringed orchis and the white fringed orchis. These two species have given rise to a great number of hybrids. There are yellows paler than the yellow fringed orchis—which is truly orange rather than yellow—, and whites less snowy than the white parent. There are yellows with an orange fringe, pale creams with pure-white fringes, and deep creams with white upper petal. All are thriving gloriously and most of them acquire a height and number of blossoms to the scape that is unusual in wild specimens. In one corner Mr. King has tried an experiment in esthetics by planting four snow-white specimens together and the effect is rich and enchanting.

Near this open bed, but in the sort of shadowy glade that it prefers, the purple fringed orchis shimmers from beneath dark pine-branches. Beyond, in a dappling of shade and sun, the little crested orchis grows in a deep sunken box of sandy loam from its native thickets. It, too, hybridizes with the white fringed orchis but it is not easy for the layman to distinguish its offspring from some of the grandchildren of the yellow fringed orchis.

Around the margin of the large central orchid-bed there is an irregular bordering of grass-pinks, Arethusa orchis and rose pogonia, and outside of that again, a mat of seedling cardinal-flowers, now rapidly outgrowing their living-space. These latter are from seed collected and sown by the Kings only winter before last, but several of them last autumn were already sending up lusty flower-spikes.

A Conservation Practice

Mr. King has acquired this unique collection of choice wildlings not by devastating the natural beauty-spots but by pursuing a fixed policy of conservation over a period of years. As everyone knows, the roads and even the by-ways on Long Island are being constantly widened, graded and generally "improved," from the viewpoint of the motorist if not from that of the naturalist. Mr. King, with five tall sons and a daughter who are all familiar with every aspect of Long Island life, is able to learn of all such projected improvements before the scrapers start their deadly work on the roadsides. In his little jeep-like car, Beelzebub, he drives along the road at about thirty miles an hour and wherever he sees one of his favorites within the zone of prospective operations he stops and with a sharp narrow spade he cuts out a large block of the earth containing the plant. The roots are never exposed, nor are they shocked by being thrust suddenly into alien soil. In the cool twilight he sets them out in their appointed holes in his garden, choosing or creating the sort of habitat in which he found them growing. Losses run about three per cent, he says, although at first, before he discovered the rabbits' passion for lilies and orchids, rabbit-damage to the flower-scapes was heart-breaking.

There have been other disappointments and set-backs. The first purple fringed orchises throve for a few years and then died out; the moccasin-flower refuses to set seed; the habenarias are subject to an occasional blight which distorts the budded scape, making it club-shaped.

But the effect of the intelligent care bestowed on the plants in this private wildflower sanctuary is one of loveliness and perfection in a small earthly paradise that has been rescued from scraper and cement.

Here is a list of the wildflowers being grown in the Kings' Long Island sanctuary:

Prince's pine—*Chimaphila umbellata*
Moccasin-flower—*Cypripedium acaule*
Ironweed—*Vernonia noveboracensis*
Monkey-flower—*Mimulus ringens*
Joe-Pye weed—*Eupatorium maculatum*
Turk's-cap lily—*Lilium superbum*
Yellow fringed orchis—*Habenaria ciliaris*
White fringed orchis—*H. blephariglottis*
Purple fringed orchis—*H. psycodes*
Crested orchis—*H. cristata*
Grass-pink—*Calopogon pulchellus*
Rose pogonia—*Pogonia ophioglossoides*
Cardinal-flower—*Lobelia Cardinalis*
Turtle-head—*Chelone glabra*
Meadow-beauty—*Rhexia virginica*
Purple loosestrife—*Lythrum Salicaria*
Broad-leaved arrowhead—*Sagittaria latifolia*
Columbine—*Aquilegia canadensis*
Jack-in-the-pulpit—*Arisaema triphyllum*
Trillium—*T. cernuum, T. sessile, T. grandiflorum, T. erectum*
Yellow lady's-slipper—*Cypripedium parviflorum* var. *pubescens*
Trailing arbutus—*Epigaea repens*
Checkerberry—*Gaultheria procumbens*
Spotted wintergreen —*Chimaphila maculata*

Some Notes on the Flowers and Trees In Audubon's "Birds of America"

By Helen M. Fox

The Audubon plates shown here and on the cover are reproduced by courtesy of the American Museum of Natural History.

WHEN a horticulturist looks at the pictures in "Birds of America" by John James Audubon he is struck with the surpassing charm of the flowers that accompany the birds. Sometimes the plants are more striking than the birds, as in Plate 64, where a swamp sparrow is shown amid big green leaves and half-hidden blossoms of May apple, or on Plate 5, where Bonaparte's fly-catcher is secondary in interest to the conical red fruit and large glossy leaves of a branch of *Magnolia grandiflora.*

In his work between the years 1826 and 1834, Audubon drew birds and plants almost invariably against the bare white paper, though he often showed a fully filled-in foreground of stream or thicket. During the next few years, and when he was delineating principally water birds, he frequently painted in the sky as well as a background of meadow or distant hills, perhaps because he saw his subjects skimming the water or diving from the sky. He also showed beaches and oceans, rivers flowing through grassy meadows, and once in a while on a distant shore there would be a log cabin or farm house with smoke lazily curling from its chimney. On Plate 231 the city of Charleston in South Carolina is shown along a stretch of water behind long-billed curlews and on Plate 269 the fort and town of St. Augustine form the background to a long-legged greenshank. But when throughout the years he depicted birds and plants without background, the birds were always so well placed and the leaves and branches given such an airy character that the observer could imagine sky or forest trees.

In his "American Ornithological Biography, which appeared in Edinburgh from 1831 to 1839, Audubon published his field notes about each plate. First he described the birds, then the other animals and the plants, interspersing the first three volumes with brief narratives and descriptions of the American scene. The material in this article has been taken from these notes and from his diaries.

The note about Plate 186, which shows pinnated "grous," or prairie hens, against meadows with a background of low hills and with a picture of *Lilium superbum* to one side, says:[1] "This beautiful plant, which grows in swamps and moist copses, in the Northern and Eastern States, as far

[1] Spelling, capitalization, and wording are reproduced here exactly as they appear in the Ornithological Biography.

as Virginia,[2] as well as in the western prairies, attains a height for four to five feet, and makes a splendid appearance with its numerous large drooping flowers, which sometimes amount to twenty or even thirty on a single stem. I was forced to reduce the stem, in order to introduce it into my drawing, the back ground of which is an attempt to represent our original western meadows."

Audubon was both an artist and a scientist. As a youth he went up to Paris from his home in Nantes to study painting with J. L. David, but did not stay there long for he preferred to draw from nature, rather than from statues in a studio. His medium was water color worked over with pastel. He selected plants in order to enhance the color values and shapes, as well as to emphasize the habits of the birds. Often he showed defects such as holes in leaves, corollas dangling from their calyces, and sometimes faded leaves or flowers, as in Plate 32, where the blossom of *Magnolia grandiflora* past its prime harmonizes so perfectly with the tobacco-brown of the black-billed cuckoo. His drawings are entirely different in spirit from Chinese paintings of flowers and birds, for he aimed to reproduce every detail with utmost exactitude, yet in his composition and the sparseness of material there is a quality of Chinese genius for suggestion and simplification.

Audubon knew where each plant was native from his own observation and from consultation of the botanies of Pursh, Willdenow, and Michaux, to which he refers in his notes. To achieve artistic effects, he said, "The flowers, plants or portions of trees which are attached to the principal objects have been chosen from amongst those in the vicinity of which the birds were found, and are not, as some persons have thought, the trees or plants upon which they always feed or perch." Such was the case in Plate 107 where two Canada jays are shown disporting themselves amid leaves of the white oak in autumnal colors. "Although this species of oak is not abundant in Maine," says Audubon, "where the Canada Jay chiefly occurs, I have employed it in my drawing on account of the rich colouring of its fine leaves during the autumnal months. It is in Louisiana, where it is plentiful, that one must see it, to judge of the grandeur which it attains under favourable circumstances. I have often seen these oaks spreading their young branches amid the tops of Magnolias fully one hundred feet above the ground. . . ."

One of the keenest observers of nature to travel in America, Audubon recorded what he saw in writing as well as painting. He was eighteen when he left France in 1798, where he had been since he was a child, to return to America, land of his birth. He always spoke with a French accent and revealed a French influence in his writing, in the choice of words and expressions, as also in the constant use of the article "the." In his passionate love of nature he reflects the Romantic spirit of his time

[2] This lily is hardy to New Brunswick and sometimes grows eight feet high.

A rare bird, Bachman's warbler, is depicted with a rare shrub, the "lost" Franklinia, identified on the plate (No. 185) as Gordonia pubescens. The drawing of the plant was made by Maria Martin, sister-in-law and second wife of the Reverend John Bachman of Charleston, friend of Audubon and discoverer of the bird.

typified by his contemporaries, the French writer Chateaubriand, and the American, James Fenimore Cooper, as the following quotation shows: "Every individual possessed of a sound heart, listens with delight to the love notes of woodland warblers. He never casts a glance upon their lovely forms without proposing to himself to question respecting them; nor does he look on the trees which they frequent or the flowers over which they glide, without admiring their grandeur or delighting in their sweet odours or their brilliant tints."

Of one of his travels he wrote: "The aspect of the country entirely distracted my mind from those objects that are the occupation of my life—the rich magnolias covered with odoriferous blossoms, the holly, the beech, the tall yellow poplar, the hilly ground, even the red clay you looked at with amazement." Besides plants and birds he noticed all other wild animals and reported conversation with squatters and "regulators" who preserved order on the frontiers, Indians and voyagers and runaway slaves, also "liveoakers" as lumbermen were called in Florida, besides such diverse characters as Daniel Boone, Sam Houston, Thomas Jefferson, Thomas Scully the painter, and Charles Lucian (or Lucien) Bonaparte, an ardent ornithologist, so that his notes provide source material for folk lore of early nineteenth century America, west to the Mississippi, south to Florida, and north through the eastern states to Labrador.

To quote from some of his notes on flowers, of the great mullein, *Verbascum Thapsus,* where only flowering tips are shown on Plate 113, he writes, "This plant, which is well known in Europe, is equally so in America; but whether it has been accidentally or otherwise introduced into the latter country, I cannot say.[3] At present there is hardly an old field or abandoned piece of ground on the borders of the roads that is not overgrown with it. . . . The flowers are used in infusion for catarrhs, and a decoction of the leaves is employed in chronic rheumatism."

The note on the sassafras on Plate 114 says, "The beauty of its foliage and its medicinal properties render it one of our most interesting trees." Of *Helenium quadridentatum,* on Plate 145, he writes, "It is often gathered and burnt, to prevent the musquitoes from entering houses." Of the Labrador tea plant, *Ledum groenlandicum,* on Plate 191, he writes, "I was informed that fishermen and Indians frequently make use of it instead of tea."

While observing the habits of birds, Audubon noticed what they ate and at the same time saw other animals feeding. Upon writing up *Vaccinium frondōsum,* shown on Plate 25 with song sparrows, one of them about to catch a spider, he says, "Huckle-berries form a portion of the food of many birds, as well as of various quadrupeds. Of the former, I may mention in particular the Wild Turkey, several species of Grouse, the Wild Pigeon, the Turtle Dove, some Loxias and several Thrushes. Among

[3] *Verbascum Thapsus* was introduced into America from Europe.

the latter, the Black Bear stands pre-eminent, also Raccoons, Foxes, Oppossums, and others destroy great quantities. When the season is favourable, these berries are so thickly strewn on the twigs that they may be gathered in large quantities, and as they become ripe, numerous parties resort to the grounds in which they are found, by way of frolicking, and spend the time in a very agreeable manner."

He notes that animals like to eat the fruits of *Vitis aestivalis* (raccoon grape), shown on Plate 111. "The grapes are small, hard, and very acrid, until severely bitten by frost. The autumn and winter, racoons, bears, opossums, and many species of birds, feed upon them."

Of *Trillium pictum,* the painted trillium, shown in fruit on Plate 176 in a scene representing a meadow with spotted "grous," Audubon writes, "This plant, as well as other species represented, grows abundantly in Maine, in all such secluded places as are frequented by the Spotted Grous, which eagerly devours its berries. . . . The berries are ovate and of a scarlet colour."

Sometimes Audubon mentions wild trees which were planted in gardens, for example, *Prunus caroliniana* (wild almond), shown with blossoms and fruit with cardinals on Plate 159. "Many are planted around plantation grounds or the gardens of our southern cities, on account of their beautiful appearance. The fruits are greedily devoured by many species of birds, but are unpalatable to man." Of the black locust, or false acacia, *Robinia pseudacacia,* shown in bloom with chipping sparrows on Plate 104, Audubon says, "Although abundant in the natural state, it is now planted around farms and plantations, on account of the great value of its timber. It is besides a charming ornament of our avenues, either in the country, or in the streets of villages and cities."

The note on the sweet briar, *Rosa rubiginosa,* shown on Plate 137 with yellow-breasted chats, one of the males feeding a worm to the female sitting on her nest which is placed amid branches of delicate pink and white roses, is revealing of Audubon's romantic sentiments. "The Sweet Briar is very generally distributed throughout the United States. I have found it from Louisiana to the extremities of Nova Scotia along the Atlantic coast, and as far in the interior as I have travelled. The delicious odour of its leaves never fails to gratify the person who brushes through patches of it, while the delicate tint of its flowers reminds one of the loveliness of female beauty in its purest and most blooming state. Truly a 'sweet home' must be the nest that is placed in an eglantine bower, and happy must be the bird that in the midst of fragrance is cheered by the warble of her ever loving mate."

In 1826 Audubon went to Europe to raise money for the publication of the first batch of drawings, a feat which he had been unable to accomplish in the United States. With flowing locks framing his handsome face, his

Baltimore orioles in the branches of a tulip tree (Plate 12) brought high praise to Audubon from the Duc d'Orléans, when Redouté took Audubon to visit the future King of France.

figure clad without intentional conspicuousness in leather-fringed frontier clothes, the portfolio of drawings under his arm, he presented letters from scientists and statesmen in America to the wealthy and scientific people of Scotland, England and France. In his diary on September 20, 1828, he notes meeting the great French flower painter Pierre-Joseph Redouté.

"I had the pleasure of seeing old Redouté this morning, the flower painter *par excellence.* After reading Le Sueur's note to him, dated five years ago, he looked at me fixedly, and said, "Well, sir, I am truly glad to become acquainted with you,' and without further ceremony he showed me his best works. His flowers are grouped with peculiar taste, well drawn and precise in the outlines, and colored with a pure brilliancy that depicts nature incomparably better than I ever saw it before. Old Redouté dislikes all that is not nature alone; he cannot bear either the drawings of stuffed birds or of quadrupeds, and evinced a strong desire to see a work wherein nature was delineated in an animated manner."

Redouté was in the habit of visiting the Duc d'Orléans, Philippe Egalité, later King of France, once a week, and took Audubon with him, who spoke of the hour's visit: "The portfolio was at last opened, and when I held up the plate of the Baltimore Orioles, with a nest swinging amongst the tender twigs of the yellow poplar, he said: 'This surpasses all I have seen, and I am not astonished now at the eulogiums of Redouté!' "

The note on the tulip-tree, or yellow poplar (*Liriodendron tulipifera*), in Plate 12 in the Ornithological Biography is as follows: "This tree is one of the most beautiful of those indigenous to the United States, and attains a height of seventy, eighty, or even a hundred feet. The flowers are yellow and bright red, mixed with green, and upwards of three inches in diameter. . . . It is generally distributed, but prefers rich soils. . . . The wood is yellow, hard, but easily wrought, and is employed for numerous purposes, particularly in the construction of houses, and for charcoal. The Indians often form their canoes of it, for which purpose it is well adapted, the trunk being of great length and diameter, and the wood light. In different parts of the United States, it receives the names of Poplar, White Wood, and Cane Wood."

Much has been written about the "lost tree," called either *Gordonia alatamaha, G. pubescens,* or *Franklinia alatamaha.* John Bartram saw it for the first time in 1777 on the banks of the Altamaha River (spelled Alatamaha at that time), when accompanied by his son William, who saw it again in 1790; but it has never since been seen growing wild. The Bartrams brought cuttings home with them and it is thought that all plants of *Franklinia alatamaha* now grown in gardens originated from those cuttings.

It is surprising to find a reproduction of the plant under the name of *Gordonia pubescens* as a background for Bachman's warbler, *Sylvia Bachmanii,* on Audubon's Plate 185, made in 1833. In his notes Audubon says the drawing of the shrub was made by Miss Maria Martin, sister-in-law and the second wife of the Reverend John Bachman, a keen naturalist and friend of Audubon, who lived in Charleston, and for whom the bird was named. Later the two collaborated on the "Quadrupeds of America." The branch of the *Franklinia* came from the botanical garden of a French gardener, Philip Stanislas Noisette, situated at Romney village, then a few miles outside of the city, now part of the city of Charleston. Audubon's notes on Plate 185 follow:

"My friend Bachman has the merit of having discovered this pretty little species of Warbler, and to him I have the pleasure of acknowledging my obligations for the pair which you will find represented in the plate, accompanied with a figure of one of the most beautiful of our southern flowers, originally drawn by my friend's sister, Miss Martin. I myself have never had the good fortune to meet with any individual of this interesting Sylvia, respecting which little is as yet known, its discoverer having only procured a few specimens of both sexes, without being able to find a nest. The first obtained was found by him a few miles from Charleston, in South Carolina, in July 1833, while I was rambling over the crags of Labrador. According to my amiable friend, it was 'a lively active bird, gliding among the branches of thick bushes, occasionally mounting on the wing and seizing insects in the air in the manner of a Fly-catcher. It was an old female that had to all appearance just reared a brood of young.' "

References to the shrub are given from Willdenow and Pursh and it is described as follows: "This beautiful tree, which grows in Georgia, seldom attains a height of more than fifteen feet. Its leaves are obovato-lanceolate, deep green, downy beneath, and its large white flowers, with their numerous yellow anthers, have a very beautiful appearance."

On the branch, open flowers as well as rounded, pearly-like buds are shown, and a few of the leaves are scarlet, typical of this late-flowering tree whose foliage turns a ruby red while some of the flowers are still in bloom.

Another member of the family, *Gordonia Lasianthus*, is drawn on Plate 168 with the forked-tailed fly-catcher, *Muscicapa savana*, perching on the branch. Audubon notes: "The bird has been placed on a plant which grows in Georgia, and which was drawn by my friend BACHMAN'S sister." He gives references from Willdenow and Pursh and continues, "This beautiful small tree is met with in Georgia, South Carolina, and Florida, in moist lands near the coast, and never fails to attract the eye by its beautiful blossoms. The twig from which the drawing was made was procured from the garden of Mr. NOISETTE, who liberally afforded me all the aid in his power for embellishing my plates. The leaves are evergreen, lanceolato-oblong, shining, and leathery; the flowers white, of the size of the common garden-rose, and placed on long peduncles; the capsules conical and acuminate."

Among other plates drawn by Bachman's "sister" for Audubon were *Azalea calendulacea*, shown with Swainson's warbler on Plate 198. "If I am not mistaken," writes Audubon, "none of the objects represented in this plate have ever been figured before. The flowers and the butterflies are from the pencil of Miss MARTIN This lady also drew a large orange-flowered trumpet-creeper. *Bignonia* (*Campsis*) *grandiflora*, on Plate 184 accompanying a mango humming bird, resplendent with throat of "velvet-black and emerald-green." "For the beautiful drawing from which this plant has been engraved, I am indebted to Miss Martin," notes Audubon.

Evidently Audubon himself also sketched plants from the Noisette garden, for he writes of the lovely pink-flowered *Pinckneya pubescens* (*P. pubens*) on Plate 165 with Bachman's finch: "This shrubby tree grows on the banks of rivers, and near swamps in Georgia; but the twig represented in the Plate was from a tree in the beautiful Botanic garden of Mr. Noisette, a few miles from Charleston, in South Carolina."

Among Audubon's finest plant portraits are *Stewartia malachodendron,* various magnolias, and graceful delineations of pines, larches, hemlocks, and cedars, generally with their fruits and always complementing the colors of the birds that are pecking at the cones, fluttering over them, or perching on the branches.

In short, a study of the flowers in Audubon's "Birds of America" is a visit to the loveliest of native American plants throughout the seasons and seen under the best possible auspices.

Notices and Reviews of Recent Books

First Edition of a Manuscript 656 Years Old

THE HERBAL OF RUFINUS. Edited by Lynn Thorndyke, assisted by Francis S. Benjamin, Jr. 476 pages, indexed. University of Chicago Press, 1945. $5.

Herbals are still being published. We have just had, in 1945, the first edition of a work written about 1290; a long wait for any author. Rufinus was a "sanctus doctor," penitentiary of the Archbishop of Genoa. He had earlier studied astronomy in Bologna and Naples, turning thence to medicine and herbs. His herbal, *De virtutibus erbarum,* contains in its 118 folios a vast number of simples, mostly but not all herbs, arranged in more or less alphabetical order. Most names are followed by quotations from Dioscorides, from Macer Floridus, and from contemporary authorities; the work is a compendium of current information. Curiously, no reference appears to the work of Albertus Magnus, written not long before. No other commentary is needed on the difficulty in communication of knowledge occasioned by the lack of printing. Rufinus' own work shared the common fate, and although copied at least once, passed into an unmerited oblivion.

To the modern botanist this publication of old and discarded cures for human ailments is of small moment. To the historian and even to the taxonomist (who must on occasion be a historian) it is an event of importance. Rufinus' descriptions do not, it is true, always fix the identity of the species as we conceive them; but they are largely original descriptions, not lacking in vigor; the identity of the herbs can usually be traced; and the contemporary Italian names and terminology will be of great value in the interpretation of the general body of old herbals, upon which all our nomenclature is ultimately based. For example:

"Nixella. Hot and dry in the third grade. A herb which forms a stout stem like that of fennel and minute leaves like those of fennel. It forms violet flowers at the summit, very beautiful and very odorous, from which issues a fruit, and in the fruit are enclosed black seeds. This herb is called also by the name Nigella."

Even in the 13th century synonymy was a problem (though our horticulturists think it is something invented by modern taxonomy!). "Millefolium is called also ambrosia and eyebrow of Venus, and also centonium minus; it has a long stem with minute leaves like those of fennel or abrotanum; the flowers are white, in a round crown like that of parsnip. . . ."

For some descriptions and many of the medicinal properties he draws on his colleagues, getting the usual mixture of fact and fancy (I had almost written "medieval mixture," but is it very different today?). "A certain herbalist told me that herba lunaria has a root about a span long bearing three branches, . . . all yellow. And when the moon is one day old each branch puts forth an azure leaf, and in the second day of the moon each produces two small azure leaves, . . . and thus the leaves multiply for 15 days. . . . If any one drink a drachma of the juice of its leaves, I found that even if he were 100 years old he would return to the age of 30."

But even in his medicine, and despite his use of authority, he relies very largely on his own experience. He adduces hundreds of names (carefully cross-indexed) unknown to the other herbalists of the time. At times he introduces a note of caution. Quoting from *Circa instans* on Euforbium he writes, ". . . and many other things he says, but because it causes constriction and abrades the intestines, I am silent on it."

This edition appears under the expert care of Dr. Lynn Thorndyke, well known for his studies of the medieval period. He provides a scholarly introduction and a number of useful indexes. It is too bad that because of current conditions the work had to appear on wretched paper, assuredly with a far shorter life than the original manuscript. Perhaps in the future we can hope for an edition worthier (in this respect) of the original; also for a translation into a modern language of Rufinus' corrupt medieval Latin.

H. W. RICKETT.

Ancient Crops and Modern Botany

THE WHEATS OF CLASSICAL ANTIQUITY. Naum Jasny, 176 pages, illustrated with photographs and tables. The Johns Hopkins Press, Baltimore, Maryland. 1944. $1.75.

In "The Wheats of Classical Antiquity," Jasny, a former staff writer for the Division of Statistics and Historical Research, United States Department of Agriculture, has brought together the rather exhaustive researches of ancient scholars and the findings of modern geneticists and systematic botanists, especially A. Schulz, the Cottes, and Vavilov.

This study deals only with the Mediterranean region. The classical period is defined as beginning around 500 B.C. and lasting about a thousand years.

The style of presentation is rather technical. The reader, however, can see by the discussions how the conclusions have been reached. The author reveals inconstancy in Pliny's writings, and concludes that, since most historians have based their studies on Pliny, this work needs to be re-examined for misconceptions.

An item of interest is the supposed derivation of the Latin name of wheat, *Triticum*. Varro, one of the great Roman agricultural writers, interpreted the word to have been derived from TERO (to beat). Thus it was concluded that *Triticum* included barley and other grains of classical antiquity which needed threshing.

This work should be welcomed by all those who have an interest in the subject of wheat.

GRAIL O. FERNWOOD.

Cooking out of the Garden

THE GARDENERS' COOK BOOK. Mildred W. Schlumpf. 346 pages, indexed, illustrated by Edith Coleman. The Anson Jones Press, Houston, Texas. 1945. $3.

This book contains not only an interesting collection of intriguing recipes, but a most useful variety of practical information such as Things Nice to Know, Cuts of Meat to Buy and How to Cook Them, Quantity Cooking, Sugar Substitutes. These sections as well as the explanations of cooking techniques and the way the recipes are clearly set forth recommends this volume to those beginning to cook.

A serious defect in a Gardener's Cook Book is the lack of emphasis on herbs. These seasoning aids, so delightful to grow and to use, are listed as ingredients only in a Cider Gelatine Fruit Ring recipe contributed by Helen Fox which requires rose geranium, pineapple sage and lavendar flowers; in an egg with thyme dish, and as an adjunct to parsley for improving balls of cottage cheese. There is of course some use of mint and good recipes for crystallizing rose petals, violets and mint leaves, but marjoram, anise, oregano and sage, so much used in Mexican cookery and all easy to grow, are conspicuous by their absence, especially as the Mexican dishes for which recipes are given seem to depend almost entirely on a well advertised brand of hot seasoning.

However, the book has value. Perhaps some of the proceeds of its sale will be used to develop a herb garden in the heart of Texas.

MARCIA GARRICK,
Saw Mill Farm,
New City, N. Y.

Seasonings of Many Kinds

THE SPICE HANDBOOK. J. W. Parry. 240 pages, illustrated, indexed. Chemical Publishing Co., Inc. Brooklyn 2, N. Y. 1945. $6.50.

The Spice Handbook is designed as a guide for manufacturers and importers, to whom it should prove very valuable. Amateur herb fanciers may also find it of general interest, especially as dried herbs are classified as spices. The book is profusely illustrated so that every spice, seed and herb can be easily identified. Several spice formulae for mixtures designed for special purposes are informative. Through their use, one may mix his own curry powder, herb seasoning or pickling spice.

Of special interest to the spice trade are the sections which refer to the Federal Pure Food Laws and Standards.

EDITH M. BARBER,
Food Editor,
New York Sun.

Current Literature At a Glance*

By Harriet K. Morse

Mexican Orchids. Thomas MacDougall, who accompanied E. J. Alexander on the Botanical Garden's 1945 expedition to southern Mexico, has written on "Habitat Observations of Some Pacific Slope Orchids" in the American Orchid Society Bulletin issued March 1. The article describes one of his earlier trips in the Chontal of Oaxaca.

Orchid Culture. Detailed instructions for the use of beginners in orchid culture are being given in a series of articles running in the American Orchid Society Bulletin. Starting in June of last year with illustrated directions for growing seedlings, another of the series appeared in February covering the repotting of cattleyas.

New Zealand Alpines. Of interest to rock gardeners in this country is a booklet on "New Zealand Alpines in Field and Garden" by W. B. Brockie. Among the attractive small plants described and illustrated are species of *Ranunculus, Myosotis, Hebe, Gentiana,* and *Helichrysum,* besides *Mazus radicans,* which is established in many American rock gardens.

Button Nuts. The story of the tagua nut, the ivory-like product of the dwarf Ecuadorian palm called *Phytelephas* or *Palandra,* has been brought before the public in a number of recent publications. One of them occurs in *The Grace Log,* published by W. R. Grace and Company, New York, April 1946; another in *Agriculture in the Americas,* published by the U. S. D. A. in Washington, March 1946. The nut is commonly known as vegetable ivory.

Rock Gardening. Helpful suggestions for companion planting in order to prevent the spotty look that rock gardens often assume are given by A. C. Pfander in the January-February Bulletin of the American Rock Garden Society.

* All publications mentioned here—and many others—may be consulted in the Library of the Botanical Garden, in the Museum Building.

Textiles Through History. M. D. C. Crawford, author of "Art of the Ancients," an article on cotton which appeared in the Journal of the New York Botanical Garden in December 1942, has written "5000 Years of Fibers and Fabrics"—a 34-page, illustrated handbook to a recent exhibition at the Brooklyn Museum.

Vanilla Leaves. So sensitive to light are the leaves of the vanilla, that in Dominica, where vanilla is grown commercially, the size, shape and coloring of the leaves are used by growers as indicators of light conditions. How they successfully supplant photometers is told by Leo Narodny in the December Bulletin of the American Orchid Society.

Chestnut Blight. Fear for the chestnut groves of Italy, where the European species (*Castanea sativa*) is widely cultivated as a food and timber crop, is expressed in an article in *Trees* magazine for April. John B. Woodruff, who has been serving with the Army abroad, reports that the chestnut blight which has robbed America of its trees has lately invaded Italy to a serious degree.

Choosing a Farm. Prospective farmers in Connecticut are told what to look for, what to expect, and where to get additional information in Bulletin 372 of the University of Connecticut Extension Service at Storrs.

Mango Culture. With the purpose of furthering home culture of the mango in southern Florida, the Atkins Institution of the Arnold Arboretum in Cuba has co-operated in the publication of a booklet which brings together much widely scattered information on this tropical "King of Fruits." David Sturrock is the author of the volume, which is entitled "Notes on the Mango." The book comes from the press of the Stuart Daily News in Florida and is priced at a dollar.

Southern Gardening. Of special value in Elizabeth Lawrence's booklet, "Gardens of the South," issued by the University of North Carolina Press (50c), are the lists of books and of nursery catalogues of interest to southern gardeners. A dozen brief chapters give useful information on gardening. The author was 1943 recipient of the Herbert Medal presented by the American Amaryllis Society. Her book "A Southern Garden" was published in 1942.

Plants and Fishes. "Your Aquarium" is an illustrated booklet on the care of fish and the planting of the aquarium. Concise and to the point, this primer is of real value to beginners. Its author is William T. Innes, past president of the Aquarium Society, Philadelphia, and author of other works on aquaria. (Innes Publishing Company, Philadelphia 7, Pa. 25c.)

Poisonous Pest Plants. In Farmers' Bulletin 1972 of the U. S. Department of Agriculture, (25c) we learn the identification, precautions, and eradication of poison-ivy, poison-oak, and poison sumac, and the recommended treatments for poisoning. Fully illustrated, this type of pamphlet should be owned by every country dweller. For a fuller description of treatment for poisoning see: U. S. Public Health Service, "Ivy and Sumac Poisoning." For sale (10c.) by Supt. of Documents, Washington 25, D. C.

BROADCAST

By Georgia Leffingwell

"VEGETABLE OILS *That Make Fine Soap" was the topic of the Garden's broadcast over* WNYC *January 25, presented by Dr. Georgia Leffingwell, author of "Soap in Industry" and other works. Dr. Leffingwell told how the soap industry has had to comb the seven seas and all the continents to get the right materials for its product—the "right materials" generally being fine quality vegetable oils. The paragraphs below have been adapted from her script, which also included a brief history of the use of soap.*

THE FIRST appearance of genuine soap upon the stage of history is recorded in the writings of Pliny about 77 A.D. Although the Hebrew word which King James' scholars translated as "soap" is now believed to have referred to a preparation of weak lye, perhaps mixed with fuller's earth, and used mainly for washing clothes, certainly it referred to nothing that could be considered as a true soap today.

Animal Tallow First Used

The earliest known soaps were made not from vegetable oils, but from animal fats; but they were scarcely worthy of the name of soap. The ninth century, after the Dark Ages, marks the emergence of soap as a plant product, with olive oil used instead of the primitive goat tallow. Even though all soaps, up until the end of the 18th century, were still quite crude, all the finer soaps for the past eleven hundred years have been made at least in part from vegetable oils, and olive oil was the first of these. For centuries, olive oil had been the most prized of all unguents for skin and hair; chief ingredient of the perfumed ointments of the patrician ladies of Rome, chosen for the ceremonial chrism of ancient priests and kings.

Today the olive is still cultivated and olive oil expressed in very much the same way as when, in ancient times, Ulysses adventured on the wine-dark sea "in the midst of the lands"—which still lead the world in the production of olives, and the oil from there still is used in making soap.

Coconut and Babassú

But many other oils are also used today, and of these coconut oil is the most important. It is nothing for the oil for a cake of soap to travel 5,000 miles and more from the Philippine Islands to the United States.

It is the blending of coconut oil, or some other light tropical oil, with our domestic fats and oils that gives us our popular modern soaps. The usual proportion is about two pounds of domestic fat or oil for one pound of imported tropical oil. Our North American soapmakers would welcome a domestic fat or oil endowed with the quick-lathering properties of the lighter tropical oils, but nature, by way of climate, has thus far denied us this boon. During the war, when the Philippines could do no shipping, we used what substitutes we could. The country was already employing one of the palm nut oils from South America, and in 1942 the United States made a pact with Brazil by which three-fourths of all the babassú nut kernels from that country would be shipped here for a period of four years. Babassú is a Brazilian palm tree whose oil is almost identical with coconut oil. The trees grow in the deep jungles of the Amazon, where the native inhabitants for centuries have used the nuts for food, as a cooking oil, for illumination, and in a number of other ways, while they have used the shells for fuel and the tree itself and its leaves for countless purposes.

There are no babassú plantations as yet, but some day, if they can be established, babassú oil may be an important article of commerce between the two Americas. At present, the mere trickle of oil that came to the United States before the war was the result of the toil of natives who gathered the nuts from the wild and cracked them by hand with heavy hammers. And that is no easy job, because the babassú has one of the largest and toughest and hardest shells known.

Palm Oils from Afar

Two other important oils which must be brought great distances to reach the American soap kettle are palm oil and palm kernel oil, which are obtained from another variety of palm tree growing in North Africa and the East Indies. The huge cluster of fruit which this palm produces is composed of hundreds of small green fruits about the size and shape of an olive. The palm oil is obtained from the flesh of this fruit by boiling and crushing, and the palm kernel oil is obtained from the kernel within this fruit.

Several oil-producing plants that the soap-makers can use can be grown in the United States, but most of them must be grown in the southern states, and even these must be combined with the lighter tropical oils. Cotton is grown, for example, for the cottonseed oil, which is very useful; also soybeans, peanuts, and corn; likewise rape, which is a relative of cabbage and turnip and mustard, and which has a very oily seed. These domestically grown oils have essentially the same lathering qualities as tallow, but to obtain suds quickly and also to meet today's demand for a soap that will react in cold or in hard water, they must be blended with coconut or some other comparatively light oil, such as can be obtained in the tropics.

African Expedition Under Way

L. J. Brass to Collect for Botanical Garden In Six Months' Trip to Nyasaland

L. J. BRASS left New York by Pan-American Airways May 8, on the first leg of a trip to Nyasaland to collect plants for the New York Botanical Garden on the institution's first expedition in Africa. Traveling by way of Newfoundland, Ireland, Dakar, and Monrovia, in 2½ days, he was to reach Leopoldville near the equator in the Belgian Congo, where he would spend a week collecting while waiting for a plane to take him south to Bulawayo in Southern Rhodesia, thence north to Blantyre, which is to be the expedition's base in Nyasaland, reaching there about May 20.

The exploring party for the Vernay Nyasaland Expedition includes Harold E. Anthony, Chairman of the Mammal Department at the American Museum of Natural History, Guy C. Shortridge, Director of the Kaffrarian Museum in King Williams Town on the Cape, both of whom will observe mammals and collect materials for their work, and Arthur S. Vernay, leader of the expedition. Mr. Vernay is a trustee of the American Museum of Natural History and a member of the Corporation of the New York Botanical Garden. For the Museum he has conducted several expeditions, some of the plants from which are deposited at the New York Botanical Garden. In 1941 the Garden published in *Brittonia* the botanical results of the Vernay-Cutting expedition to Upper Burma.

Mr. Brass, who has been exploring almost continuously since 1925 in New Guinea and the Solomon Islands, is on the staff of Archbold Expeditions of the American Museum, which maintains a biological station at Lake Placid, Florida, where he has been making a botanical survey during the past winter. His first botanical work was as assistant in the Queensland Herbarium in Brisbane. After a period of ranching in Australia, in 1925 he started on his first expedition, which was carried on in New Guinea for the Arnold Arboretum, through arrangements made with Professor Charles S. Sargent, then Director. His next expedition, to the Solomon Islands in 1932-33, was also made for the Arnold Arboretum. Subsequent trips to New Guinea in 1933-34, 1936-37 and 1938-39, were Archbold expeditions under the auspices of the American Museum. His collections made on the 1933-34 New Guinea trip are deposited at the New York Botanical Garden.

Mr. Brass first came to this country in 1939; shortly thereafter he started two years of service with the Canadian Army.

In Africa his collecting will be general, covering as many as possible of the 20 to 30 major plant communities that have been reported to exist there.

The expedition plans to spend five months in the field in Nyasaland. It will visit, and investigate for mammals and plants, the various types of country represented in the Protectorate, and pay special attention to the higher mountains on either side of the Great Rift Valley. These mountains run up to about 10,000 feet and their upper levels are uninhabited. There are large native populations on fertile plateaus and in river valleys at lower levels, and around the shores of Lake Nyasa. The itinerary is planned to take advantage of the dry season, which begins in April and ends in November.

Little collecting has been done in Nyasaland in the past. Botanical exploration began there in 1861-62 with the collections of John Kirk and J. C. Meller on the Livingstone expedition. In the 1890's Alexander Whyte, Fellow of the Linnean Society of London, collected from the high mountain areas, and in 1929 Burtt Davy collected woody plants for a check-list of trees and shrubs issued by the Imperial Forestry Institute of Oxford but so far as is known, no other important collections have been made from this region of mountain, jungle, woodland and plateau—a region which promises a rich and varied flora. Mr. Brass will make notes on plants being used by the natives, and will send back seeds of these and of woody materials whenever possible. He plans to record the scenes of his trip both in black-and-white and color photographs. Motion pictures also will be taken during the expedition.

Notes, News, and Comment

T. A. Weston. The Associate Editor of the *Florists' Exchange and Horticultural Trade World*, T. A. Weston, died in New York May 5 at the age of 68. His home was in Hillsdale, N. J., where his garden and greenhouse provided him with material for writing and opportunity for the development and culture of new plant varieties. He was the originator of *Viola* "Jersey Gem" and he also introduced an attractive blue *Streptocarpus* hybrid, of which he gave a quantity of stock for display in the New York Botanical Garden's Main Conservatories. Specimens of the crested hartstongue fern (*Phyllitis Scolopendrium*) which he cultivated were made part of the New York Botanical Garden's exhibit of hardy ferns at the International Flower Show in 1940. The Garden has since grown these ferns outdoors. At the time, Mr. Weston wrote an article on this fern, which was published in this Journal in March 1940 and reprinted in the booklet "Hardy Ferns and Their Culture" published two months later.

Born in London, Mr. Weston came to this country in 1920. For the past 11 years he has written a weekly column, "One Man's Garden," for the New York Herald Tribune. He is the author of two books—"Practical Carnation Culture" and "Bulbs That Bloom in the Spring."

Horticultural Staff. Stuart Longmuir, who has been foreman gardener and chief assistant to the horticulturist since August 1, 1943, left the Garden April 15, 1946, to become head gardener for Edward R. Steichen at Ridgefield, Conn. His place as outdoor foreman is being filled by Charles Pecora, who has returned to the Garden after 3½ years of service with the U. S. Army Air Corps. When Mr. Pecora left in August 1942, he was a student gardener.

Louis Politi, who also came back from service this spring, has been returned to his former job as Arboretum Foreman. He also becomes chief assistant to the horticulturist.

Charles Mampel, Acting Arboretum Foreman during his absence, left the Garden May 18 to become head gardener at The Cloisters. He is replacing Mrs. Hildegard Schneider, formerly a gardener at the New York Botanical Garden, who is transferring her residence to Pennsylvania.

Members' Day. Among the plants displayed at the Members' Day program of May 1, T. H. Everett, speaker for the day, selected 35, exhibited them individually, and commented on each one. They included plants from the rock garden, shrub collections, and conservatories. Some had been recently collected by the Garden's own explorers and were as yet unidentified. Some were of economic interest, others represented plants obtained from different sources — from botanical gardens and collectors in distant parts of the world, from private growers as gifts, by seed exchange with other institutions, and from the wild in various parts of the United States. The majority of them were plants only slightly known to American gardeners. Each member who attended was presented with two specimens of the pickaback plant, *Tolmeia Menziesii.*

Lectures. The Torrey Botanical Club heard an address by Dr. William J. Robbins May 1 on "Some Notes on the Physiology of the Basidiomycetes."

Otto Degener addressed the Botanical Society of Washington and affiliates, in Washington, D. C., May 7 on Hawaii.

"From Indian Arrow Poison to Modern Medicine" was the title of a talk on the Botanical Garden's exploration in South America, given by Dr. H. A. Gleason before the Greenwich Garden Club May 21.

Four other Affiliates of the Garden have chosen lectures by staff members during the past few weeks, as follows:

Dr. A. B. Stout spoke before the Garden Club of Larchmont May 6 on "The Origin and Improvement of Cultivated Plants." Dr. H. N. Moldenke lectured on "Marvels in Adaptation among our Local Plants" April 29 before the Garden Club of Mamaroneck. The Working Gardeners of Bronxville heard Dr. W. H. Camp April 23 on "American Plants for American Gardens." The functions of the New York Botanical Garden provided the subject for Carol H. Woodward in an address before the Short Hills Garden Club, a new Affiliate, April 24. A similar talk was given to a group of garden club presidents at the home of Mrs. Hugh Peters in February and again before the volunteers who were serving for the Botanical Garden at the Flower Show in March.

Radio. Co-operating with the American Women's Voluntary Services in presenting two series of broadcasts on gardening, the New York Botanical Garden was represented by Arthur King of Mt. Kisco over Station WWRL in Queens May 8 in a program entitled "Fundamentals of Gardening for Food Production" and is being represented by Francis Paterson of Huntington, Long Island, over WNYC June 7 on "Summer Care of the Flower Garden."

Dr. Harold N. Moldenke was guest speaker on Margaret Arlen's program over WABC April 19 on the subject of "Botanical Aspects of Easter Around the World."

The winter series of lectures was introduced over the air in a radio talk by Carol H. Woodward on the program "This is our Town" over WMCA.

Board Member. Chauncey Stillman, architect, of 230 Park Avenue, New York City, and of Wilton, Conn., was elected a member of the Board of Managers at a meeting of the Executive Committee held April 29, 1946, to fill a vacancy in the class of 1947.

Visitors. Dr. Stanley A. Cain of the University of Tennessee, just returned from eight months overseas as Dean of the Science School at the American University Abroad at Biarritz, France, was a visitor at the Garden May 2.

D. B. Fanshawe, of the Forest Service at Mazaruni, British Guiana, with whom Dr. Bassett Maguire explored the plateau above Kaieteur Falls in 1944, was at the Garden during May, on his return to British Guiana from England.

Dr. Rolf Singer of Harvard University worked on fungi in the Garden's Herbarium several days during the middle of April. Kenneth Wagner of De Pauw University, Greencastle, Indiana, studied hepatics while here during April; W. E. Roever of the W. Atlee Burpee Company of Philadelphia stayed here for a week; Samuel Bridge, a former student gardener who has just returned from the Armed Forces, visited May 3; José Paixão of the School of Agronomy in Rio de Janeiro, Brazil, came here May 9.

Among other recent visitors have been Daniel I. Axelrod, paleobotanist, on his way back to California after serving in the Armed Forces; Dr. Alfred Gunderson of the Brooklyn Botanic Garden; Josiah L. Lowe from the New York State College of Forestry at Syracuse; Katharine S. Wilson of Yale University; Juan B. Moczá of Santurce, Puerto Rico; Mrs. Lazella Schwarten, Librarian at the Arnold Arboretum; Dr. Hanns Rossl of the Department of Forestry, Lima, Peru, with his daughter, Elisabeth Rossl, and Paul Kuehn, also of Lima.

Western Collecting Trip

STARTING on the sixteenth summer of plant collecting in the Intermountain Region of the West, Dr. Bassett Maguire left the Garden May 1 to spend nearly four months exploring. At Utah State College at Logan, where the work was initiated in 1931, he picked up Professor Arthur Holmgren, with whom he has worked in the area for several years, and together they plan to make a survey of the Snake and Columbia River basins in southern Idaho, eastern Oregon and Washington. He expects to be back in New York September 1.

This is the last remaining unit to be covered in this area of a third of a million square miles. Occupying approximately one-eighth of the entire United States, the Intermountain Region is expected to yield more than 5,000 species of plants—a region of greater floristic diversity than any other part of the country, with the possible exception of California.

To carry on these studies, the results of which will eventually be published jointly by the New York Botanical Garden and Utah State College, 100,000 specimens have already been collected. It is expected that 20,000 more will be added to the lot this year and next.

To complete the survey in 1947, Dr. Maguire plans to cover the entire Intermountain Region, giving special attention to ecology and plant distribution and making a photographic record of the various sections where collecting has been done.

THE NEW YORK BO

THE NEW YORK BOTANICAL GARDEN

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

York Central to the Botanical Garden station
Bedford Park Boulevard

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

The New York Botanical Garden was incorporated by a special act of the Legislature of the State of New York in 1891. The Act of Incorporation provides, among other things, for a self-perpetuating body of incorporators, who meet annually to elect members of the Board of Managers. They also elect new members of their own body, the present roster of which is given below.

The Advisory Council consists of 12 or more women who are elected by the Board. By custom, they are also elected to the Corporation. Officers are: Mrs. Robert H. Fife, Chairman; Mrs. Elon Huntington Hooker, First Vice-Chairman; Mrs. William A. Lockwood, Second Vice-Chairman; Mrs. Nelson B. Williams, Recording Secretary; Mrs. Townsend Scudder, Corresponding Secretary; and Mrs. F. Leonard Kellogg, Treasurer.

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CAROL H. WOODWARD, Editor

MIDSUMMER EVENTS AND DISPLAYS

Century Plants to Bloom

JULY, it is expected, will see the flowering of one of the Garden's largest century plants, a specimen of *Agave neglecta*, native of tropical Florida. At the time of going to press, the flower stalk was reaching some 8 feet above the glass roof of the conservatory, from which a pane had been removed. Meanwhile, a smaller specimen, believed to be *Agave rupicola* with whitish margins on its leaves, is due to bloom within the confines of the glasshouse about the same time. This plant was started from seed in 1923.

Plants Outdoors

HOLLYHOCKS will be flowering in the Advisory Council border in July, and in the pool of hardy waterlilies, the East Indian lotus (*Nelumbium Nelumbo*) will start its long season of bloom. The "catalog border" of perennials reaches the peak of its season in midsummer. Beneath the trees in the model garden, tuberous begonias are making a showy pattern in pastels.

Late June bloom should continue into early July among the Japanese iris and in the vivid collection of Pacific hybrids of delphinium.

The demonstration vegetable garden and the border of perennial herbs nearby are flourishing, while the seedlings of the annual herbs across the path give promise of later interest in this planting. The first signs of color on the newly set out annual flowers also offer a hint of what is to come in the two 500-foot borders of annuals near the Main Conservatory.

Radio Programs

Alternate Fridays, 3:30 p.m., WNYC (830 on the dial)

July 12 ***Sixteen Centuries of Tea Drinking***

William H. Ukers
Editor of the Tea and Coffee Trade Journal

(This program was postponed on May 31 because of the City's broadcasting of the proceedings of the United Nations assembly at Hunter College.)

July 26 ***City Parks for Summer Pleasure***

Francis Cormier
Senior Landscape Architect, New York City Park Department

Aug. 9 ***Daffodils to Plant This Fall***

David Platt
Vice-President, Max Schling Seedsmen, Inc.

Aug. 23 ***Poisonous Plants of Suburban Byways***

Jessie G. Fiske
State Seed Analyst, New Jersey Agricultural Experiment Station

TABLE OF CONTENTS

JULY 1946

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Garnering Edible Mushrooms For Vitamins and Minerals

By Margaret McKenny

SCIENTISTS say that although mushrooms are not the "vegetable beafsteaks" they once were thought to be, they do contain a moderate measure of protein for the diet, and their mineral content provides appreciable amounts of iron and copper. The iron is of special significance, for American diets generally are low in this essential element.

Moreover, the meadow mushroom (*Agaricus campestris*) has been proved by laboratory tests* to be an excellent source of a number of important vitamins, notably the B vitamins, nicotinic acid (or niacin) and riboflavin (B_2), and of pantothenic acid, which is also in the B group. It is a fair source, as well, of vitamin B_1 (thiamin), vitamin C (ascorbic acid), and of vitamin K. All of the essential amino acids are evidently present, and the 2.67% of protein contained in *Agaricus campestris* "compares favorably with that of many fresh vegetables."†

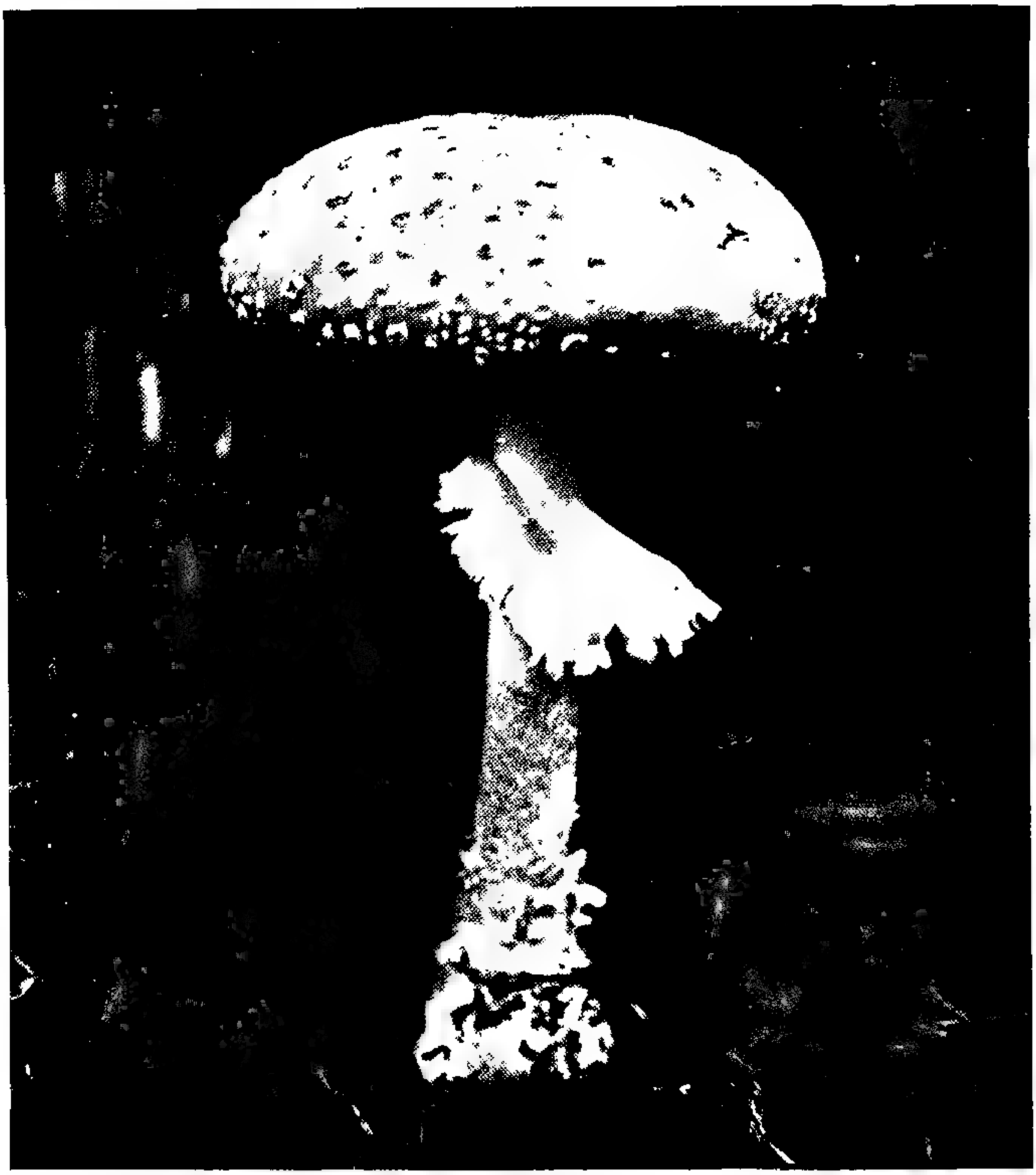
Why, then, do we not avail ourselves more of this pleasant form of nourishment which is so easily obtained? We visit nutrition classes to learn what we should eat, and we plan and budget our marketing accordingly; yet we ignore the vitamin-packed mushrooms growing wild in fields and woods—a food without cost which may be eaten either cooked or raw and also canned or dried for future use.

We can, of course, buy cultivated mushrooms from the market, but during the summer and fall they are expensive, if obtainable, and that is the season when our countryside is bursting with the succulent growth of mushrooms which seem to appear as if by magic after a few soft warm rains.

* Anderson, E. E., and C. R. Fellers. The Food Value of Mushrooms. Published as Contribution No. 441 from the Massachusetts Agricultural Experiment Station *in* the Proceedings of the American Horticultural Society, pages 301-304. 1942.

† Fitzpatrick, William H., William B. Esselen, Jr., and Edith Weir. Composition and Nutritive Value of Mushroom Protein. Published as Contribution No. 521 from the Mass. Agric. Exp. Sta. in Journal of the American Dietetic Association, pages 318-323. April 1946.

Margaret McKenny is the author of "Mushrooms of Field and Wood"; also of "A Book of Wild Flowers," "A Book of Garden Flowers," and "A Book of Wayside Fruits," all illustrated in color by Edith Farrington Johnston (author of "Wild Flower Sanctuary in a Long Island Garden" which appeared in last month's Journal); and of "Trees of the Countryside" and "Your City Garden," the last in collaboration with E. L. D. Seymour.



A TYPICAL AMANITA

Flecks of the veil on top of the cap, white gills, a ring around the stem, and a cup or bulb at the base characterize the members of this deadly poisonous group of mushrooms. (Photograph by Rutherford Platt).

Learning the Poisonous Species

The inevitable question, "How can I tell a mushroom from a toadstool?" always proves a stumbling block to the uninitiated. The first thing to remember is that only in the popular mind is the word toadstool linked with poison and the word mushroom with edibility.

With no more effort than we put into making out our daily menus in the face of shortages, we may learn the characteristics of the poisonous mushrooms which we must avoid. Next we must learn to know the few safe species—those which are so easily distinguished from the harmful ones that they may be gathered with perfect confidence—and we must confine ourselves strictly to these few.

Never experiment. Go out with a scientific expert the first few times and let this person examine every mushroom that you put into your basket or bag. If a poisonous one gets into the container by mistake, the entire lot must be sacrificed. But by all means do not let fear keep you from this fascinating form of hunting which you may pursue on foot—on your lawn, by the roadsides, and in nearby woods.

All the deadly mushrooms—that is, all those at present known to science—belong to one family, the Amanita family. Learn to distinguish the earmarks of this family and, though some of its members are not poisonous, give the whole clan a wide berth.

The true mushroom plant is a mass of white threads called the MYCELIUM, which ramifies through the soil or through rotting wood. With the proper temperature and right amount of moisture to stimulate growth, little bumps or knobs form on these threads. These develop gradually and, in mushrooms of the Amanita family, they become round or egg-shaped and are covered with a white veil called a VOLVA. As the upward urge brings them to the surface of the soil, the cap breaks through the veil, leaving half in the ground in the form of a cup and carrying the other half up on its surface to break into ragged, felt-like particles. The gills, or the radiating plates on the underside of the cap, are protected by still another veil. As the cap spreads wide like a miniature umbrella this veil breaks from the edge and hangs from the stem as a ring. Our deadly amanita is now fully grown. In its various forms the cap may be pure white, yellowish, brownish, or greenish. The gills are always pure white and if the cap is cut from the stem and laid on a piece of colored paper, within a few hours there will be a deposit of pure white spores, the minute reproductive bodies of the plant.

The deadly amanita (*Amanita phalloides*), the pure white form of which is called the destroying angel, is usually found in the woods, but occasionally it may venture forth on the edge of shady lawns or meadows. Learn it well and avoid it, for it contains a poison for which we have no antidote.

Another member of the Amanita family, the fly mushroom (*Amanita muscaria*), is well known in Europe and Asia, where its toxic content has long been used as a poison for flies. It also occurs in America. Its early growth underground is similar to that of the deadly amanita, except that the base of the stem is bulbous and the enveloping veil breaks up into fluffy scales, half of them ringing the bulging base in concentric rows, the other half being carried up on the cap in the shape of fluffy warts. The expanded cap is yellow or orange-red and may have a spread of five or six inches. The fly mushroom grows in the woods, very rarely being found in the open. Often groups of forty or fifty of this regally beautiful plant may be seen in birch or pine woods. It contains a poison for which atropine is a partial antidote.

Seeking Meadow Mushrooms

Knowing these two representative types of poisonous mushrooms, you may now gather up your courage and your basket and venture forth on one of the most delightful hunts in the world—the search for meadow mushrooms. Perhaps it is the end of August, and there have been several gentle rains. The mushroom expert recognizes it as the mushroom season, that subtle interlude between summer and autumn when those attuned to nature can almost hear the rustle and stir of growth beneath the sod.

The meadow mushroom always grows in the open, *never* in the woodland. So out we go to the open pastures, where the lake mist is just rising from the grassy slopes. And there, and there, and there, and far beyond, the close-cropped grass is dotted with the creamy caps! What a feast we'll have for today's dinner! It will be a feast for a gourmet as well as a feast of vitamins and minerals—for in ancient Rome mushrooms were so highly prized that they were prepared only by nobles and served in special golden dishes.

This *Agaricus* is the same species that we buy at the market—but oh, how different in flavor and consistency when we get it fresh from lawns and pastures! The young fruiting bodies of the meadow mushroom, as they grow from the tangled mass of threads beneath the soil, are not surrounded with a protecting veil. They push through the soil in the form of cream-white buttons, soft and silky to the touch as rain-wet skin. There is only a partial veil which extends from the edge of the cap to the stem. As the cap grows this soon breaks loose and hangs as a slight ring on the stem. There is no cup at the base. The stem is short and usually tapers down to a point. The gills below the cap, at first soft rosy-pink, turn gradually to dark purple with the ripening of the spores. This change of color in no way interferes with the mushroom's edibility. If a cap is cut from the stem and laid on a piece of white paper, there will soon be shown a purple-brown spore-print. This is a valuable dis-

TWO UNMISTAKABLE EDIBLE MUSHROOMS

Left: The morel (*Morchella*) whose tawny-colored, spongy cap appears in the woods in spring. *Right*: The meadow mushroom (*Agaricus campestris*), frequently found in grassy places in late summer and fall. The pinkish gills turn purple-brown as the mushroom matures. (Photographs by Rutherford Platt).

tinguishing mark, for the poisonous mushrooms of the Amanita family always have white spores.

Now one after another we drop the pink and white beauties into our baskets. On particularly fortunate days we may each secure a market basket full—enough for a meal for ourselves and our friends, besides a quantity to can or dry. You may be sure of one thing: after one successful mushroom trip you will be forever afterward a devotee of the sport—all through the year spotting favorable hunting grounds and keeping their location a precious secret, only to be disclosed to the chosen few.

Morels in Springtime

In many parts of the country there are people who think no mushroom equals the morel or sponge mushroom (*Morchella*). Unlike the fall-growing meadow mushroom, it appears only in the spring, often growing in open woodlands or old apple orchards. In the South the colored folk call it "hickory chicken" and search for it under the fallen leaves of hickory trees. It often springs up after a forest fire. Long ago in Europe some of the peasants so loved it that they used to set fire to the woodlands in order to secure a bountiful crop, until laws were passed to prevent the holocaust.

The morel may be cream-white, tan or brown in color, and it has an indented, sponge-like surface and form. It has no cup at the base of the stem, both cap and stem are hollow, and the spores are borne in the depressions of the cap. Morels have never been cultivated, but have such a delicious meat-like flavor that in parts of the country where they are abundant, as around the great reservoirs in Ohio, camping parties assemble every year to gather them in quantity to dry for the winter. They are also found in great patches in the far West, and often after a forest fire hundreds of pounds may be gathered by those who are "in the know."

Two Kinds of Coprinus

Other choice morsels for the gourmet are the shaggymanes (*Coprinus comatus*) and the inkycaps (*Coprinus atramentarius*). The shaggymane in shape is like a closed umbrella, with rough and shaggy surface to the grayish cap. The gills at first are pure white, then gradually turn pinkish, at length becoming jet-black and deliquescing into an inky fluid. Pick them in the early stages, while yet firm, and cook them immediately as they are delicious then but soon deteriorate. They generally grow in rich soil in the open or in partial shade, by the sides of roads or near lakes in rich muck soil.

The inkycaps are more rounded or oval in shape, leaden-gray in color, with very short stems. They often spring up in the open on the edge of lawns, in parks, or by the roadside. Sometimes there will be a crowded mass of a hundred or more caps. If picked while they are still young and firm—preferably just past the button stage—they will make one of the most delicately flavored mushroom dishes that can be found.

Puffballs, Large and Miniature

Often growing in the same fields with the meadow mushroom puffballs can be found, and large or small, they are all eminently edible. The giant puffballs (*Calvatia gigantea*) ranging from a few inches to great globes two feet in diameter, often weighing 25 pounds, can be confounded with no poisonous species. Care should be taken, however, in gathering the smaller species (of the genera *Lycoperdon* and *Geaster*) not to mistake the button of a poisonous amanita for a puffball. If a puffball is sliced in two, there is nothing to be seen but solid flesh, while in the amanita may be seen the outline of stem and cap. Puffballs should be gathered while they are pure white and firm, for, as the spores begin to ripen, the flesh gradually turns yellow, then brown, and becomes bitter in flavor.

Yellow Shelves on Rotting Logs

At any time during our strolls in the summer or fall we may come upon the sulphur polypore (*Polyporus sulphureus*), great wavy masses of a shelf-like growth edging a rotting stump or log. The caps are bright orange above and sulphur-yellow beneath. They frequently grow on rotten wood in the forest, but often may be found in the open. In Connecticut a mess weighing more than 20 pounds was once gathered from a telegraph pole, and often this fungus appears at the base of an old tree or in a wound in the bark far above the ground. The sulphur polypore is one of the most beautiful mushrooms, and if you once learn it you can never mistake any other for it. If gathered when young and gently cooked in butter, there is no mushroom which equals it for consistency and flavor. It is like the white meat of chicken, but always moist and tender. As it grows older it acquires an acid flavor, which gives it a tang greatly relished by some people.

Oyster Mushrooms in Quantity

Last but not least of our easily learned mushrooms is the oyster mushroom (*Pleurotus ostreatus*). It is far from being last in bulk, for, although the individual caps are not large, if you once locate a log where oyster mushrooms are growing, by watering it systematically and keeping the caps picked as they mature, you may prolong the fruiting season for a number of weeks and harvest many pounds.

The oyster mushroom always grows on rotting logs, in the open or in the woods. The caps vary in color from white to brownish tan. They are almost stemless and are attached at the side. The gills beneath the caps are pure white. They may be found any time during the summer or fall and occasionally in spring. They are tender, delicate in flavor, and can not be confused with any other species.

Cooking and Serving the Mushroom Feast

All mushrooms should be cooked as simply as possible. They may be cooked in butter, the juice slightly thickened with flour, cream added if desired, and the whole poured over toast. Or they may be made into a delectable soup. Most of the mushroom books offer numerous other recipes. Different species require different lengths of time for cooking. Shaggymanes and inkycaps cook very quickly. Meadow mushrooms, morels, and the sulphur polypore require a longer period of time. Always cook gently and handle with the care that food of such individuality deserves. The meadow mushroom and the sulphur polypore are delicious raw in a salad. Let them stand with a small quantity of French dressing half an hour, then mix them lightly with watercress or celery or both.

Now you are ready to put on sturdy shoes and, basket on arm, search the fields and woods for the delectable, vitamin- and mineral-filled mushrooms which spring up by the thousand in late summer and early fall.

Teasel in the Woolen Industry

By Fred Noechel

MACHINERY and equipment of the twentieth century have not yet been able to equal in combined strength and fineness the delicate barbs on the dried heads of the teasel plant for raising the nap on woolen goods. No wire or brush has yet been found which will give results comparable to those achieved by the teasel in softening the texture of a fabric.

This thistle-like plant which originally grew wild in the hedgerows of the English countryside is used today as it was centuries ago in the gigging process in the woolen and worsted industry. The date when it was first used is a matter of unrecorded history. Possibly some clever woman of the time, intent on creating a better home-made woolen fabric than her neighbor, chanced upon the fact that the dried heads of teasel would soften the texture of a heavy garment by raising a nap on the cloth. This must have happened a very long time ago, for the word occurs in Anglo-Saxon, before the English language as we use it had evolved, and it is directly related to the word *tease* —not in the later sense of annoying, but referring to the act of disentangling fibers.

The wild teasel plant is known as *Dipsacus sylvestris*. With *Scabiosa,* and a few lesser known groups, the genus forms the Dipsaceae or Teasel family, which closely resembles the Thistle family. It has the characteristic tightly packed head of flowers and the prickles on leaves, stem, and bracts which link it at a glance—or a touch —to the more familiar thistles. In the wild form, the minute barb on the tip of each bract in the flower head is straight but flexible. It is the finely hooked awns, or barbs, of the cultivated teasel, after it has matured and dried, that make the plant of value in the napping or gigging process in the finishing of woolen fabrics.

The cultivated form of the plant has assumed the name of *Dipsacus fullonum* and is commonly called fuller's teasel, because the gigging or napping operation in a mill is done under the supervision of the fuller, who supervises the fulling, or felting of the fabric.

The first extensive cultivation of the teasel plant occurred in the southern part of France. In the United States, the first planting of teasel for commercial purposes was at Skaneateles, New York. It was grown from seeds imported in 1840 from England, where small amounts of teasel were then in cultivation. Later, a member of the same family that introduced the teasel plant to Skaneateles went to Oregon, imported seed from France,

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Heads of wild teasel (*Dipsacus sylvestris*) in full bloom.
(Photograph by L. W. Brownell)

and grew a large quantity of a superior type of teasel. These two sections, Skaneateles, N. Y., and Molalla, Oregon, are still supplying the bulk of the teasels used in the United States.

Different sizes of teasel (also spelled teazle) are reaped from each plant. The king teasel (largest on the plant) grows on the main stem. Medium teasels grow on branches off the main stem, and buttons (smallest teasels on the plant) grow off these branches. It takes approximately fifteen months to grow these teasels. They will thrive in almost any type of soil, but for best results need certain climatic conditions, such as a dry soil and climate for strong barbs for blankets, and a moist climate for developing finer barbs for finer quality goods. After harvesting, the teasels are dried and then sorted into their categories such as kings, mediums, and buttons. The king teasel is used chiefly for napping blankets, mackinaws, and other heavy fabrics. Mediums are used for fine fabrics, and are the most valuable teasels grown.

The gigging process, in which the teasel heads function, brings a nap or pile to the cloth by gradually easing, or teasing, the surface fibers out of the yarns, thereby producing a softer feeling material and at the same time softening the outline of the pattern and effecting a more subtle blending of colors. In the general process called moist gigging, the cloth is immersed in water and the fibers are raised while in the moist state.

The teasels for gigging are first treated with hot water or steam for five minutes and allowed to dry. Thus softened, they are then set tightly by hand in two or three rows in iron slats or frames, with the barbed bracts of the teasels all facing in the same direction. These frames are mounted on drums which revolve at approximately 100 revolutions per minute. The cloth to be napped or gigged is then brought lightly into contact with the teasel slats. To produce the finished nap, the contact is gradually increased until the desired softness has been achieved.

The fibers are first disentangled and then lifted out, for it is important that they be raised gradually rather than torn out. Teasels whose points have been dulled and softened are used in the first steps of the process.

FULLER'S TEASEL AS IT IS USED IN THE WOOLEN INDUSTRY

(On the opposite page)

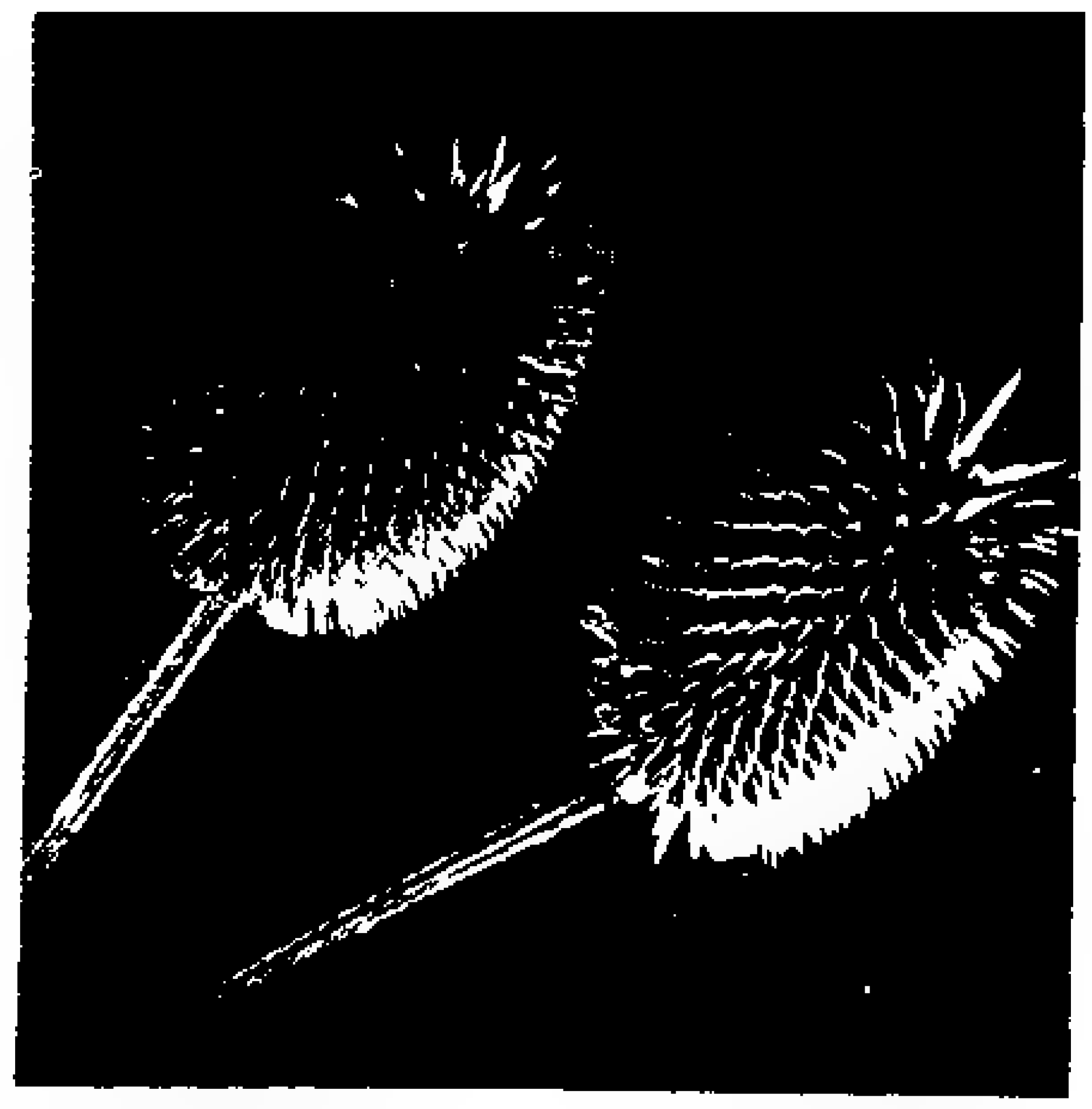
The upper picture shows the dried heads of *Dipsacus fullonum* with their finely barbed bracts. At the left are used heads, dried and brushed clean for further use. To the right of this is a group of badly worn teasels, shown in position as they are removed from the slats (pictured below). Some of these can be reused at the beginning of the gigging or napping in the woolen industry. The dulled points of their barbs prevent the tearing of the cloth in the first stages of raising the nap. Below, the teasel heads are shown fastened into the slats, which are drawn the length of woolen textiles, in order to soften them by teasing out the fibers until a nap is raised. (Photographs by B. I. Bertelsen).

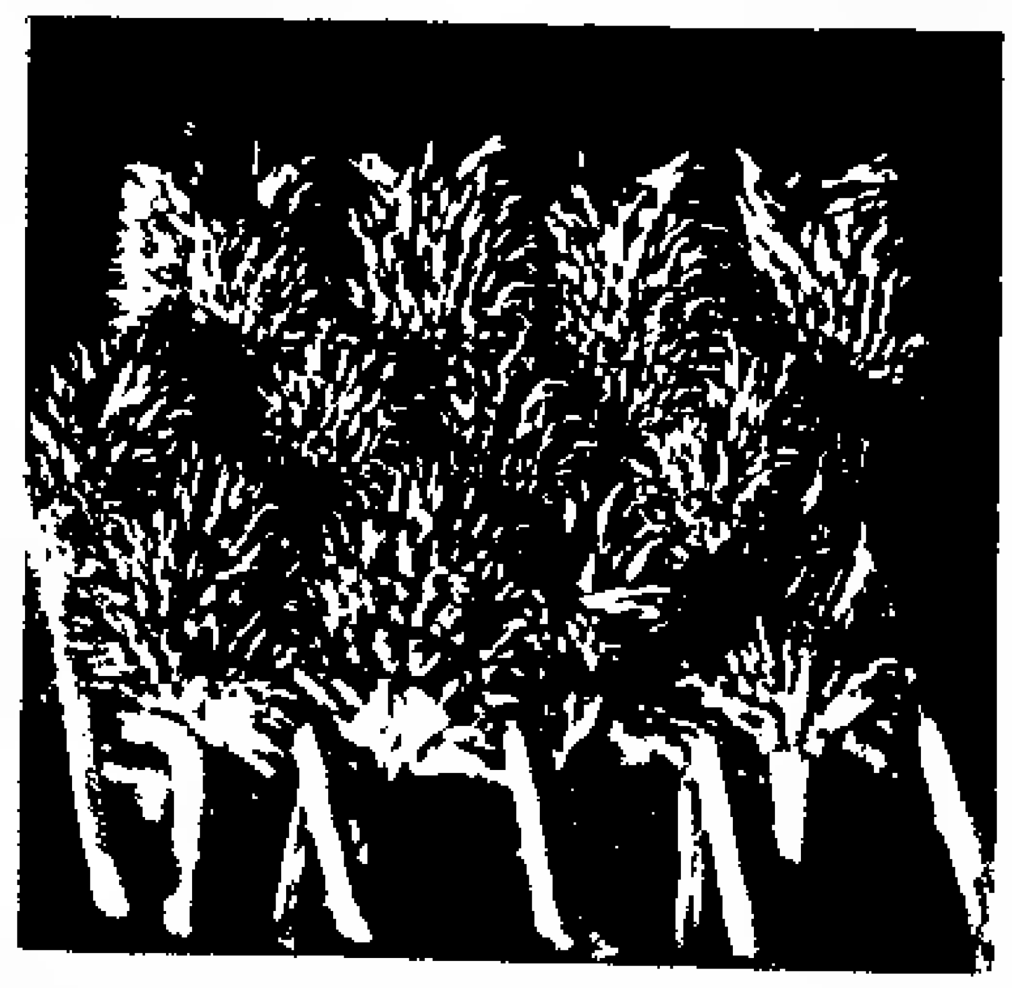
FULLER'S TEASEL

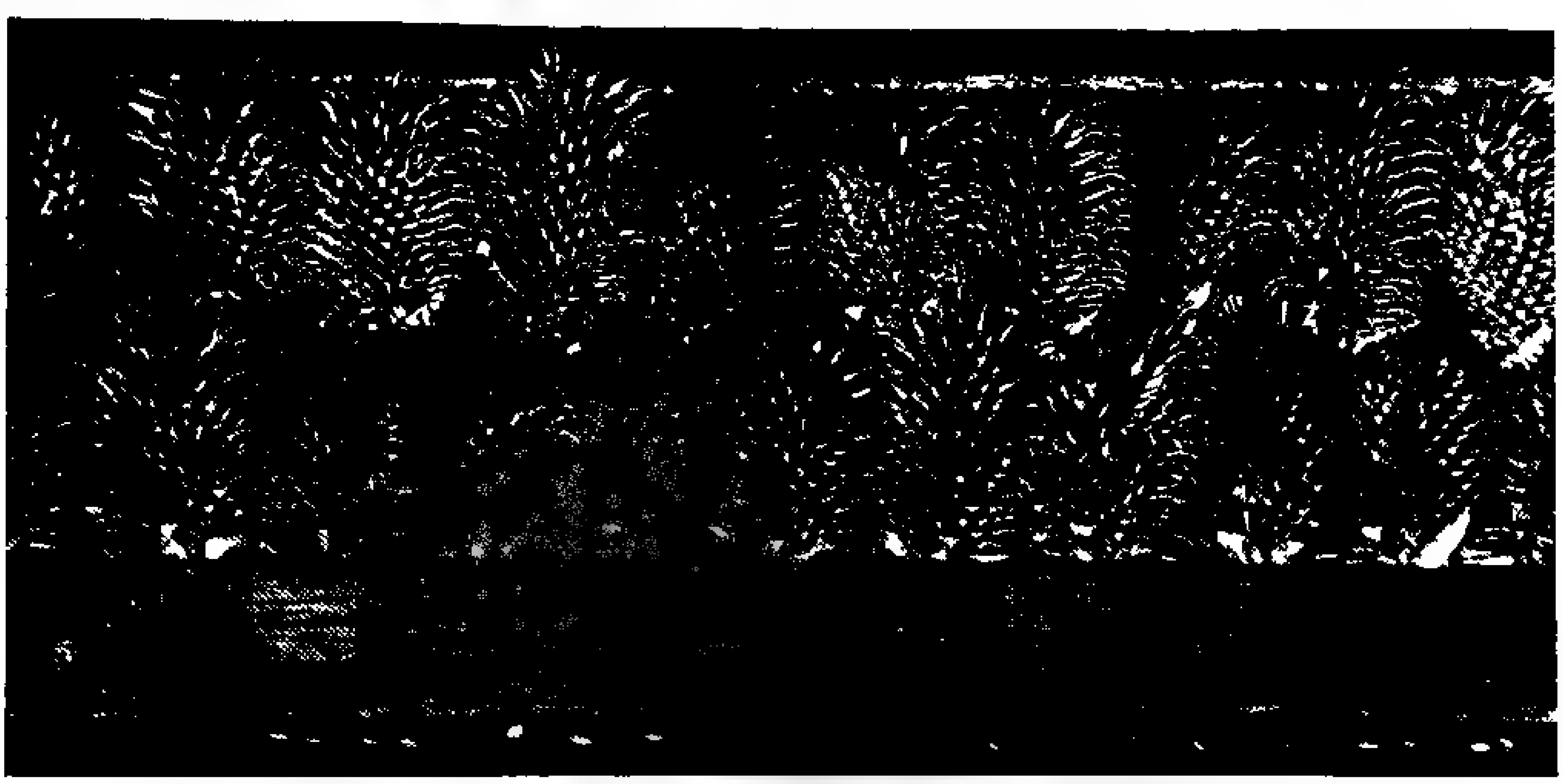
AS IT IS USED

IN THE

WOOLEN INDUSTRY







For description, see the opposite page.

These are gradually replaced by new or sharper ones until the required nap or pile is achieved. When the teasels become filled with wool fibers and have become weakened by the moisture, they are dried and brushed clean for re-use. If the teasels are worn out on one side of the frames, the frames are reversed. Badly worn teasels are meanwhile replaced by some which are still in fairly good condition. For this replacement it is necessary to sort teasels according to the degree of wear. That is, new teasels should never be mixed with older ones; if they are, streaks will develop in the fabrics.

Each length of cloth is run several times over the teasels, the number depending upon the type of fabric being gigged. As the cloth passes over the teasels, the cylinders revolve in the same direction, except for the first pair of cylinders, the first one of which revolves in the direction of the cloth and the second one in the opposite direction. After this, the cloth runs over these cylinders at a slower rate than the speed of the cylinders. For example: The cylinders revolve at 100 revolutions per minute and the cloth is fed over the cylinder at ten yards per minute. In this manner the points of the teasels are given an opportunity to lift and comb the fibers at the same time, always starting with worn teasels and gradually working toward new teasels.

Since the raised fibers will vary in length, the cloth after gigging has to be passed over a shear which cuts the protruding fibers at a predetermined length, thus assuring a uniform length of nap for the type of finish desired.*

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* The author acknowledges valuable assistance given by H. C. Templeton, A. J. Malley, and L. J. Gregory.

Something About Australian Orchids

By H. M. R. Rupp

IT is a novel experience for an Australian, well past the meridian of life, to be invited by the editor of a New York journal to tell its readers something about Australian orchids. But I am still young enough in spirit to like novelties, and therefore I shall do my best to comply. Orchids have fascinated me ever since, in the days of long ago, as a boy in the southern State of Victoria, I used to gather "spiders" and "double-tails" in the bush-lands near my father's home.

Australian orchids fetch no fancy prices. Most of them are very humble members of the great family to which they belong. In the tropic north of our continent, hundreds of leagues from where I write, we have some noble and beautiful species of *Dendrobium*, and a few others of like calibre; but these are a small company, and my knowledge of them comes from friends in the far north, or from professional growers—I have never been beyond Brisbane in that direction.

But orchids are orchids, whether they belong to the flamboyant battalions of cattleyas, cymbidiums, oncidiums, and their associates, or to the modestly clad rank and file of the terrestrials that inhabit our Australian heath-lands and open forests. It is the unique character of the orchid flower, irrespective of its size or colouring, that has always held me spellbound. As I write, there is blooming in my little bush-house a tiny aerial plant from Queensland which means as much to me as the latest giant cymbidium does to the professional. It has four wee flowers, pure white, with a delicate tuberose perfume; they opened at 9 a.m., and by 3 p.m. their brief life will be over. But next week there will be some more; and this goes on for about six weeks. There is no common name for this little gem, but it is known to botanists as *Thrixspermum album.*

The number of known Australian orchids is about 500; but there are vast areas in our tropics where probably several hundred more await discovery. Even in a comparatively well settled state like New South Wales, where 250 species have been described and published, new ones are being added practically every year. North in the tropics, as one would expect, epiphytes predominate, decreasing in numbers as one travels south. Thus Queensland has over 100 known epiphytes, New South Wales 52, Victoria 5, and Tasmania 2. There are none either in South Australia or in the southern portion of Western Australia: the northern parts of the last-named state are *terra incognita* to the orchidologist.

The majority of our orchids, then, are obviously terrestrials. It has always puzzled me why orchid growers despise most of the terrestrials. Not that I regret their attitude; for it means that many of our most charming wild flowers have a chance of survival in their own domains. But I feel sure that if some of our species of *Thelymitra, Diuris,* and *Caladenia* had elected to grow on trees, they would have been "snapped up" long ago. It is therefore a matter for thankfulness that, with certain exceptions, it is not considered good form among growers for an orchid to have its roots in the ground. One of the exceptions is our largest terrestrial, *Phaius Tankervilliae,* now almost exterminated in New South Wales, though still plentiful in parts of Queensland. This splendid orchid under favourable conditions exceeds seven feet in height. Its large, aspidistra-like leaves surround the tall scape with its terminal raceme of handsome flowers, each sometimes four inches in diameter. They are white outside, mottled or clear brown inside, with a large purple or magenta labellum. Phaius grows in swamps near the coast.

Australia can probably claim to possess the two most extraordinary orchids in the world; for they are, literally, *subterranean.* One was found at Corrigin in Western Australia, and the other two thousand miles across the continent at Bullahdelah (pronounced Bull-a-deela) in New South Wales.

Of the Western Australian plant I have no first-hand knowledge; it was described by the late Dr. R. S. Rogers in the Journal of the Royal Society of Western Australia in October, 1928. But it was my privilege to describe and name the Bullahdelah plant, which was "accidentally" discovered in 1932. Bullahdelah is near the coast about 150 miles north of Sydney, at the foot of a massive outcrop of alunite known as the Alum Mountain. I had lived there for a year or two; and when a young man by chance dug up the first specimens, they were sent to me as a curiosity. Subsequently, a grant from a Science Association enabled me to visit the scene of the discovery, and the local doctor and I succeeded in digging up six good specimens. We established the fact that the flowers of this most remarkable orchid actually develop and open beneath the surface of the soil. They are very small, massed together in heads at the tops of the thick rhizomes, which are not unlike stout asparagus shoots, more or less covered with white scaly bracts. Soon after exposure to light the plant gradually turns dingy purple. The western *Rhizanthella Gardneri* and the eastern *Cryptanthemis Slateri* differ so strangely from all other orchids, that a new tribe had to be erected to accommodate them. Notwithstanding certain structural affinities and their common subterranean habit, they are so distinct from one another that each had to be made the type of a new genus.

Among the most beautiful of our terrestrials are the "sun orchids" (*Thelymitra*), so called because most of them expand their flowers only on warm, sunny days. Some are robust plants up to three feet high, with racemes of fairly large star-shaped flowers. Colours range from blue, pink, and purple to yellow. The labellum in the sun orchids is only very

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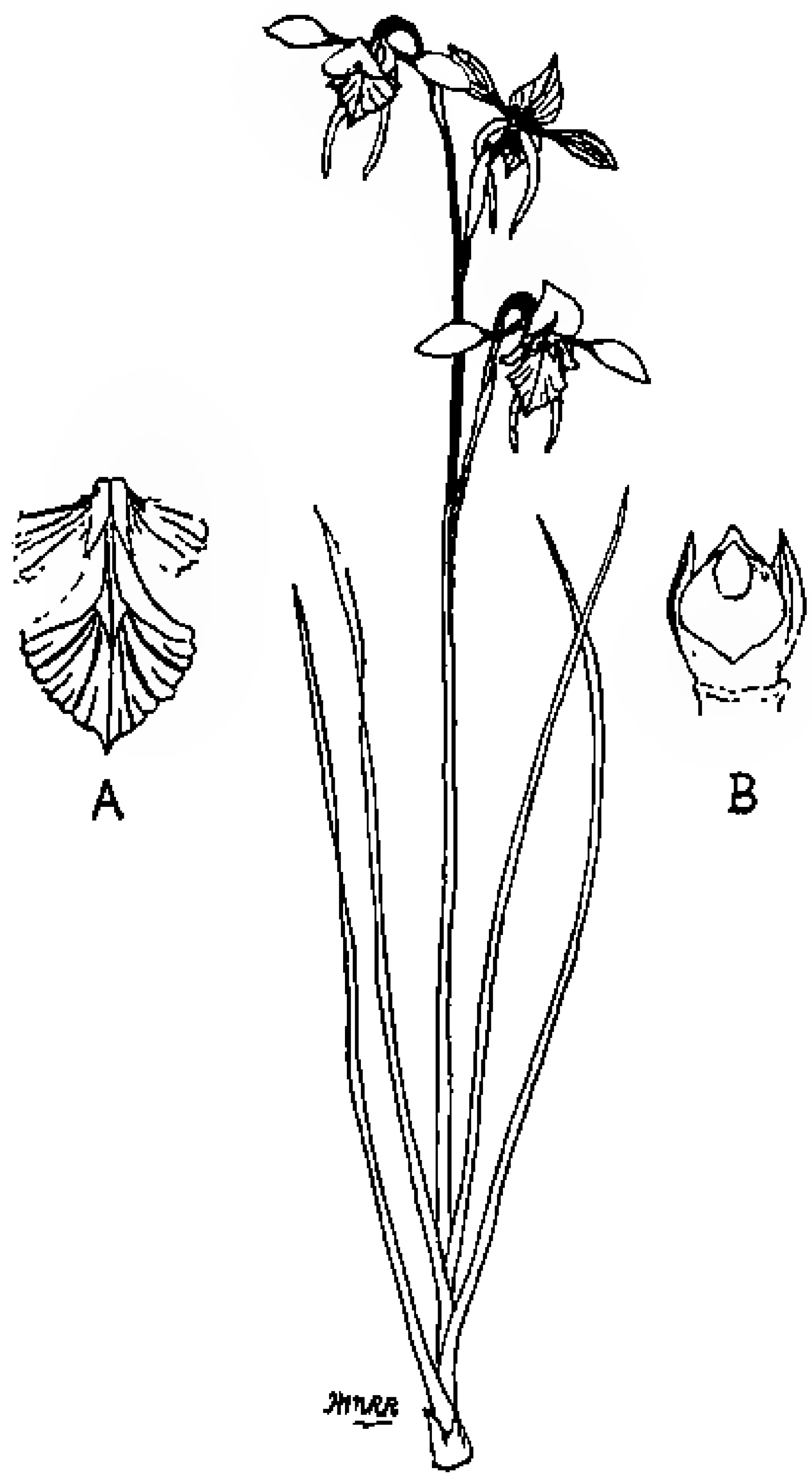
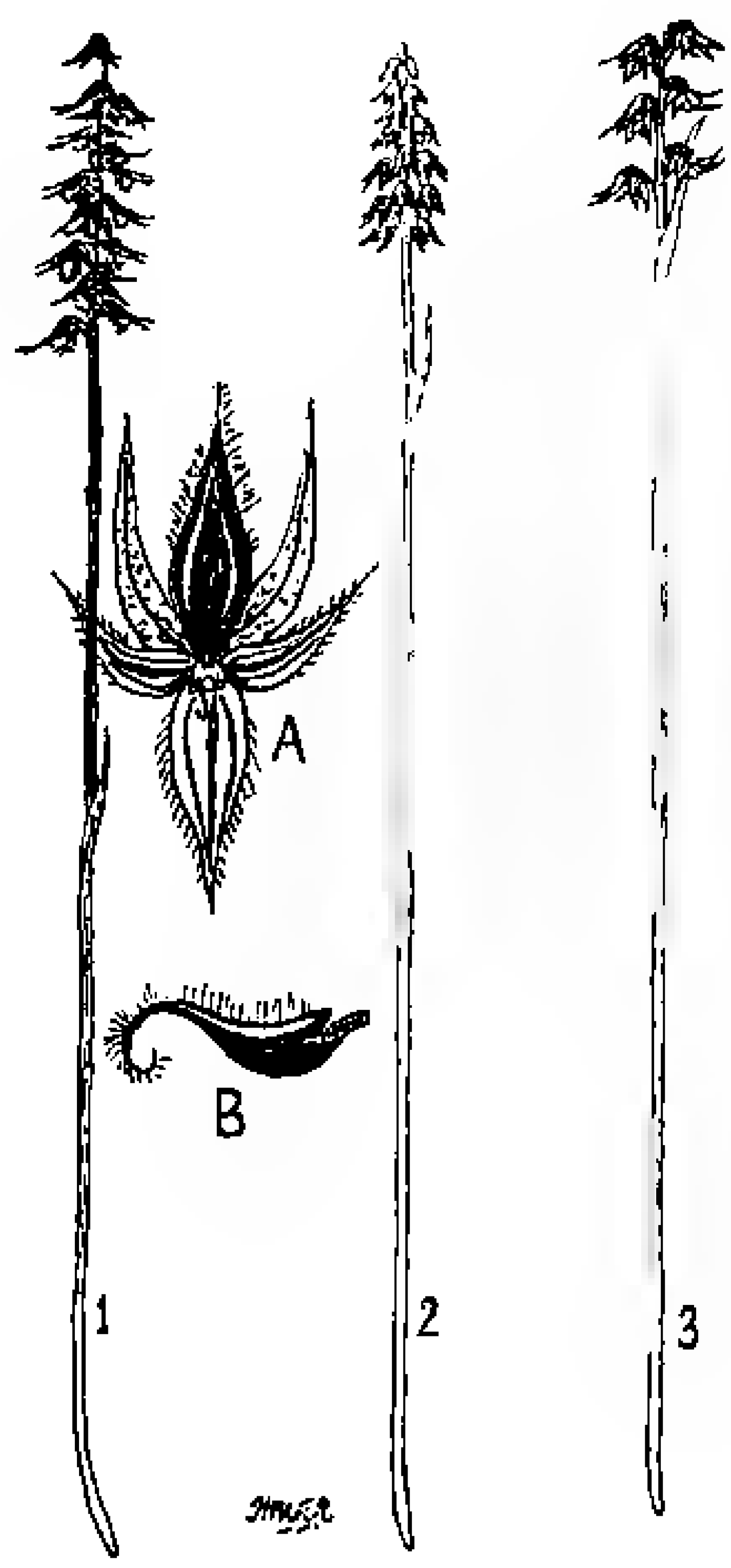
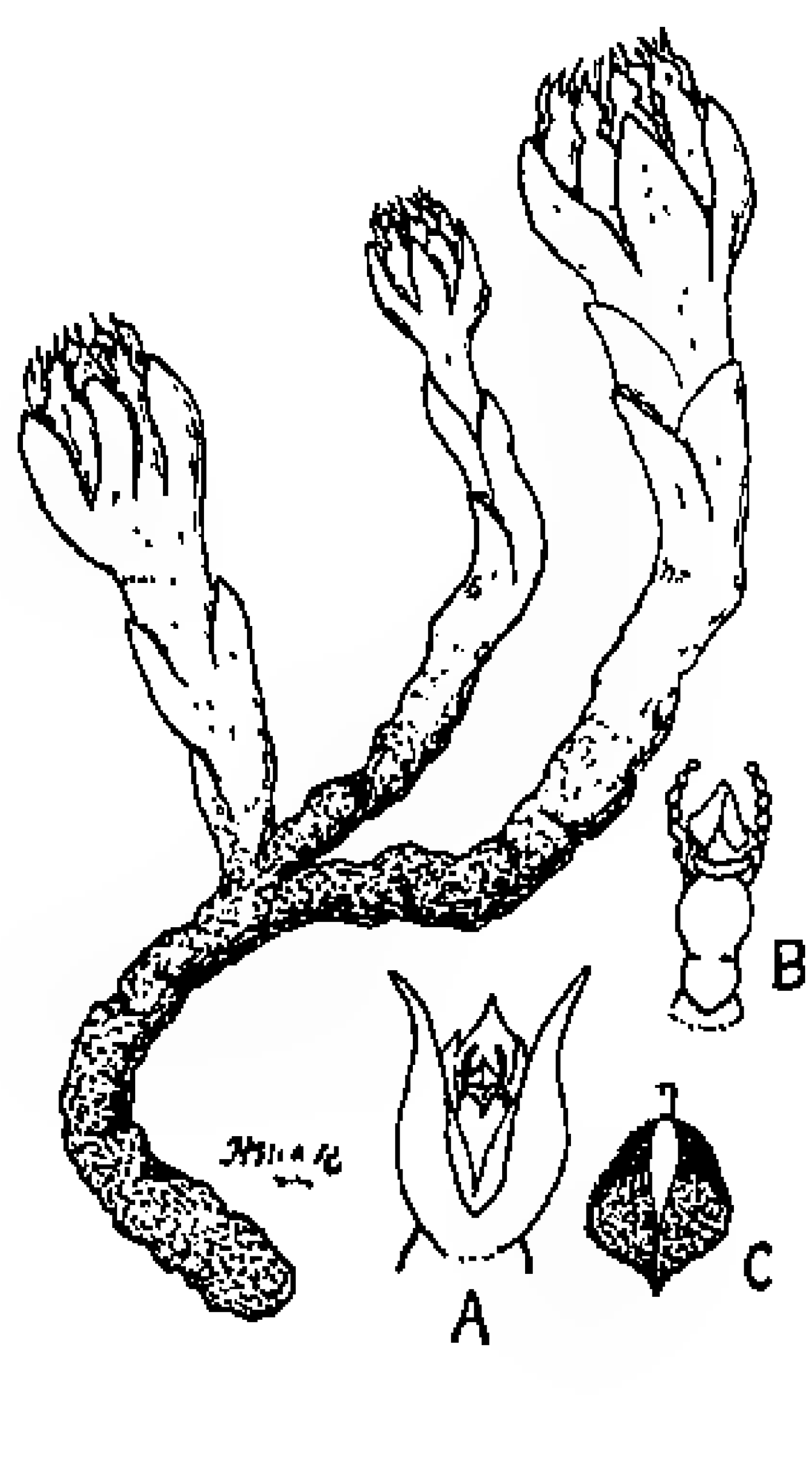
TERRESTRIAL ORCHIDS OF NEW SOUTH WALES

(On the opposite page)

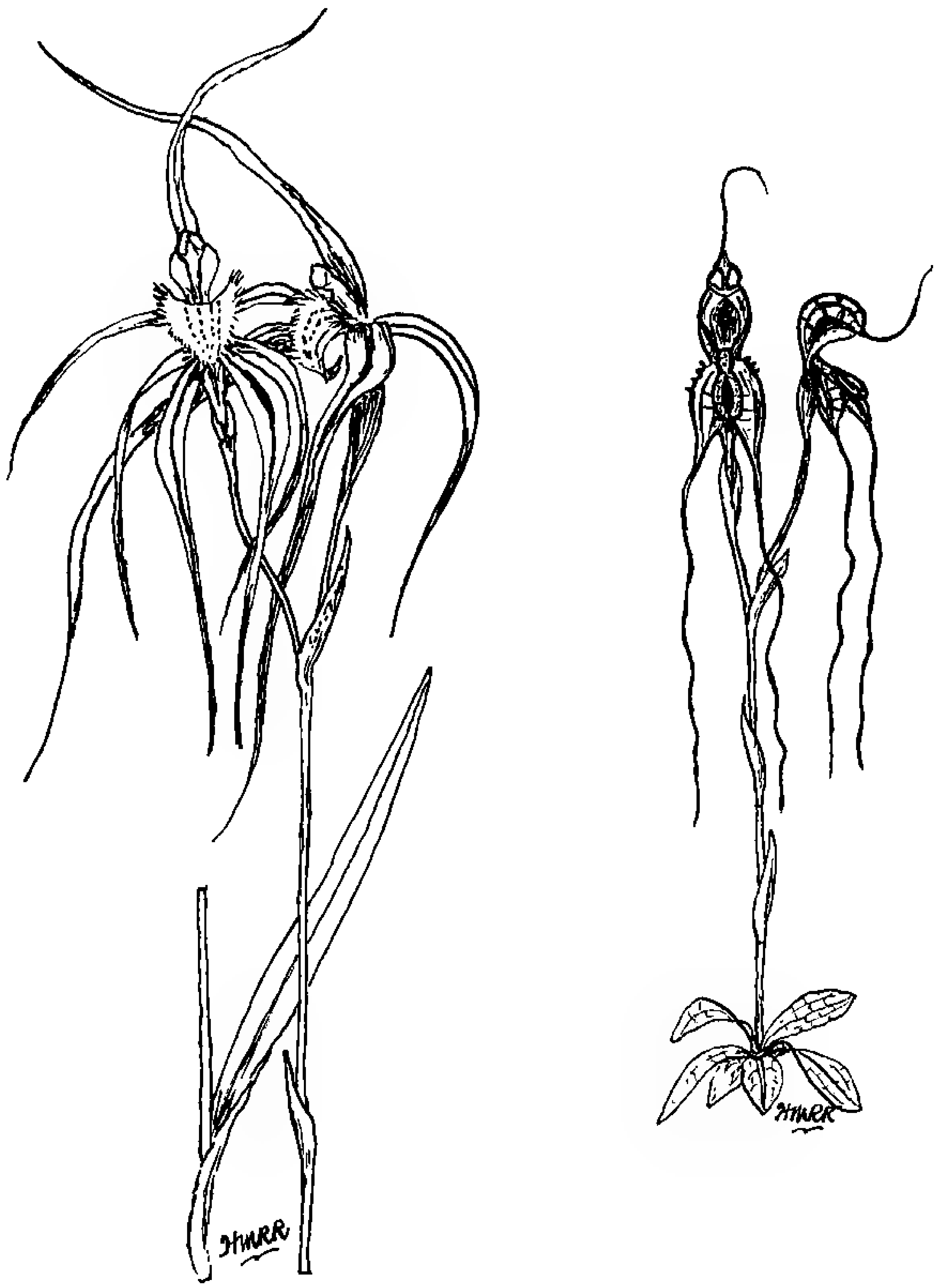
Upper left: *Diuris venosa*, a lilac or bluish-grey orchid with dark veins, is known only on the plateau of Barrington Tops at 5,000 feet altitude. The insets show enlargements of (A) the labellum from above and (B) the column from the front. *Upper right:* Three of the "little prassies": (1) *Prasophyllum acuminatum* with (A) the flower enlarged and flattened out and (B) the labellum from the side. (2) *P. trifidum*, (3) *P. Archeri*, all approximately ¼ natural size. *Lower left:* The "underground orchid" of Bullahdelah, which was named by the author *Cryptanthemis Slateri*. It grows and flowers completely beneath the surface of the soil. The insets show (A) a flower from the front, (B) the column from the front, and (C) the labellum from above. *Lower right:* The largest of the Australian "greenhoods," *Pterostylis Baptistii*, a pale green orchid with bands of dark brown. The enlarged drawings show (A) the labellum from above and (B) the labellum and column from the side.







TERRESTRIAL ORCHIDS OF NEW SOUTH WALES



THE SPIDER ORCHID AND THE DOUBLETAIL

Left: The principal spider orchid of the south and west of Australia is *Caladenia Patersonii.* It is extremely variable in color, occurring in white, pink, yellowish-green, rose-color or deep red. *Right:* A rare doubletail, though of wide distribution, from southern Queensland to Victoria, is *Pterostylis Woolsii.* The flowers are pale green, often tinted with red.

slightly modified from its original character as the third petal. The majority of the species are Australian, but the genus is represented in New Zealand, New Caledonia, Java, and the Philippines.

Almost exclusively Australian are the doubletails (*Diuris*), in most of which the lateral sepals hang down like two tails. One species occurs in Java. There are some very beautiful flowers in this genus. Yellow with brown markings is the predominant colour; but there are lilacs and purples also. One of the species illustrated (*D. venosa*) occurs in myriads on the plateau of Barrington Tops in New South Wales, at an altitude of 5,000 feet; yet the most persistent hunting has failed to discover it in any other locality.

The genus *Caladenia,* with upwards of 70 species, includes a bewildering variety of extremely attractive flowers, in which I think almost every known colour is represented. Caladenias are most strongly developed in the southern parts of Western Australia, and a whole article could be devoted to describing the lovely forms found there. But they are well represented in the eastern states too. The larger species are popularly known as "spider orchids," from their long slender sepals and petals. Flowers have been measured ten inches across from tip to tip of the sepals.

As the common name implies, the "greenhood orchids" (*Pterostylis*) have hooded flowers, which curve gracefully over the column and labellum. Though green is the prevailing colour (in varying shades), there are red and red-brown flowers, and one is almost dark purple. The finest species is *P Baptistii,* with a large solitary flower sometimes about three inches long, pale green with fawn or dark brown bands. It ranges from Queensland through New South Wales to eastern Victoria. Some of the greenhoods, such as *P. Woollsii,* with its amazingly long lateral sepals, have a very bizarre appearance, and are more curious than beautiful. The labellum in all species except two (there are over 60) is very sensitive. In some, it springs sharply back against the column at the slightest touch. This action of course is connected with the capture of pollinating agents.

The largest of all Australian orchid genera is *Prasophyllum,* with upwards of 80 known species. Roughly speaking, we may divide it into two sections, the large prasophylls and the small—often called the "little prassies." Many of the former are tall and robust plants with a solitary leaf like that of an onion. The flowers are relatively small, in more or less dense spikes of green or brown shades; a few are tinted with brighter colours, and some have a white labellum. In all species the flowers are reversed by a twist in the ovary during development, so that they come out upside down.

To me, by far the most interesting members of the genus are the little prassies, belonging to the section GENOPLESIUM. These are all rather dwarf, extremely attenuated plants, with a leaf closely sheathing the stem except for a very short free lamina high up towards the flowers. The latter are so diminutive that a powerful magnifier is essential for examining the structural details. Even with this aid, correct determination of the species is often very difficult: one of my friends told me he would either have to give up trying, or qualify for an asylum! Yet when one of these tiny flowers is placed under a strong magnifier, the observer cannot fail to be astonished at the beauty of colour and form and the complexity of structure which have been developed among the species in New South Wales, where thirty species have been described; but there are some in every Australian state, and one or two also occur in New Zealand. One needs the true "orchid eye" to find these elusive little imps of the orchid world; but once you know what to look for, the search becomes quite fascinating. They flower chiefly in summer and autumn, and their favourite haunts are moist places in open forests or on heathlands.

Our epiphytes deserve more space than I can give them. Some of the tropical species, as I have remarked, can hold their own with any exotic rivals. The most popular of these is the "Cooktown orchid" of North Queensland, *Dendrobium Phalaenopsis.* The flowers are large, bright mauve with a deep purple throat. The genus *Dendrobium* ranges along the whole length of eastern Australia, and one small species occurs in Tasmania. The most widely known of these orchids is the so-called "rock-lily"—a misnomer, since it is not a lily, and grows on trees as freely as on rocks. It is a large and bulky plant, and may bear as many as 100 racemes, from ten to twenty inches long, each with numerous yellow, cream, or white flowers. A large clump of this orchid in full bloom is a sight not easily forgotten.

But more beautiful than the rock-lily is the "beech orchid," *D. falcorostrum,* restricted to certain highlands in New South Wales and southern Queensland where there are forests of the Antarctic beech (*Nothofagus Moorei*). Although the beech orchid grows on several other trees, it has never been found outside these beech forests. It is a large plant, and a prolific bloomer: I once had a specimen with 103 racemes, averaging about 14 flowers each. These are above an inch in diameter, snowy white except for purple specks on the labellum, and with a powerful

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SOME GROUND- AND TREE-DWELLING ORCHIDS OF AUSTRALIA
(*On the opposite page*)

Upper left: The orange-blossom orchid, *Sarcochilus falcatus,* found on trees in coastal forests from Queensland to eastern Victoria. *Upper right:* The beech orchid, *Dendrobium falcorostrum,* which grows at altitudes mostly above 3,000 feet in northern New South Wales and southern Queensland. *Lower left:* The principal sun orchid, *Thelymitra ixioides,* of the bush lands around Port Jackson. It also grows in all other states of Australia and in New Zealand. The flower of bright blue is marked with specks of darker blue. *Lower right:* This lilac to reddish-purple orchid, *Diuris punctata,* is found in all the Australian states except Tasmania and Western Australia.

SOME GROUND- AND TREE-DWELLING ORCHIDS
OF AUSTRALIA

THE ALUM MOUNTAIN AT BULLAHDELAH, NEW SOUTH WALES

The subterranean orchid, *Cryptanthemis Slateri*, was discovered just behind the trees at the back of the old church.

but exquisite perfume, which is exhaled only during the warmer hours of the day.

Even more lovely than our dendrobes are some of our species of *Sarcochilus*, veritable gems of the bush. The finest of these is the "ravine orchid," *S. Fitzgeraldii*, which scrambles over the rocks in deep gorges. Its numerous flowers are white with deep crimson blotches and spots; one variety has flowers wholly crimson with darker red markings. Smaller, but rivalling it in beauty, is the "orange-blossom orchid," *S. falcatus*, with white flowers marked with purple and orange on the labellum. It is usually very sweetly scented, but one variety occurs with an objectionable odour.

Although the epiphytes are mostly showy-flowered plants, as a group they represent little more than a quarter of the 500 orchid species growing in Australia.

* * * *

For the past twenty years out of the half century that the Reverend Mr. Rupp has devoted to the flora of his native land, he has specialized on the orchids, and he is the author of an official publication of the National Herbarium at Sydney, "Orchids of New South Wales." This is the first volume of a projected series on the flora of that Australian state. Mr. Rupp is an honorary member of the staff of the New South Wales National Herbarium.

SUMMER CARE OF THE FLOWER GARDEN

This article has been adapted from a broadcast given by Francis Paterson, Superintendent of the estate of Mrs. A. G. Milbank (Panfield Corporation) at Huntington, Long Island, over WNYC June 7. Mr. Paterson, who has taught several classes in gardening for the New York Botanical Garden, appeared as the Garden's representative on this program, which was part of a series being presented by the American Women's Voluntary Services.

Cultivation

One of the first essentials of success in the flower garden is diligent cultivation, for it will eliminate weeds, conserve moisture for the plants, and promote deep and rapid root growth.

The question is frequently asked, "How often should I cultivate?" The answer is, "As often as weeds appear." This will be about every ten days during the active growing period of early summer, but less often as the plants develop and their expanding leaves smother the weeds in the ground beneath them.

The best tools to use are a flat hoe and a long-handled cultivator with from three to five claw-like prongs. Regular cultivation should be continued throughout the summer, especially in dry weather, as it will prevent the soil from becoming hard on top and cracking. It will also make a dust mulch on the surface which will stop evaporation of the soil moisture. A depth of from one-half to one inch is usually sufficient for cultivating in the flower garden. If the soil is scratched too deeply, the growing roots may be injured.

Mulching

In the flower garden mulching is not often practised, partly because it may become unsightly and partly because, as flowering plants develop, their leaves form a natural protection for the soil. However, when dahlia fanciers, for example, mulch their large flowering plants rather heavily with peatmoss, rotted leaves or other litter about the end of July, they find that the results make the mulch worth while. Rose growers also recommend mulching plants with peatmoss in hot, dry weather, especially where the soil is light or gravelly. Mulching, like cultivating, helps to conserve the moisture in the soil and make it available to the plant when it is most needed.

Watering

Many well-meaning suburban gardeners ruin what could otherwise be beautiful flower beds because they carry out the all too common practice of sprinkling the flowers a little every day. This method of watering is to be deplored, as the moisture does not penetrate the soil. Shallow rooting is encouraged and the soil surface is packed hard. Then, when the hot days come, the plants will suffer because they will not have developed the deep root system which is necessary if they are to reach a supply of moisture down in the soil. Also, these shallow-rooted plants are easily knocked over in a wind or washed out of the soil in a heavy rain.

It is only when watering is properly done that it is beneficial to flowers. When dry weather prevails and the plants need water, they should by all means have it, but they should be more than merely sprinkled. The ground should be given a thorough soaking to a depth of several inches. If a sprinkler can be put on the plants, it should be left for at least an hour before changing it to another location. Morning or evening is the time when water will be most beneficial, not during the heat of the day.

Feeding

Many gardeners ask whether feeding of plants is advisable during the summer. The tall, fast-growing plants such as dahlias, chrysanthemums, and delphiniums, among others, will respond agreeably to feeding during their active growing season. Any garden fertilizer with about a 5-8-5 analysis that is, 5% nitrogen, 8% phosphorus, and 5% potash —can be recommended, using about a cupful to every three plants and applying it just before rain or watering it well into the roots with a hose. Care should be taken to keep the fertilizer away from the foliage. Liquid feeding also can be done. A handful of 5-8-5 fertilizer is added to three gallons of water and applied to the roots of the plant. Fertilizing should be discontinued as soon as the flower buds show color.

Staking

In the growing of most tall perennials, it is important to provide stakes or supports early in the growth of the plant. A gardener should not wait until the rain and wind have beaten down the plants before he thinks of staking, for once a plant is bent down even an expert can't stake it up to look like its natural growth. The best method of supporting such plants as delphinium, phlox, peonies, or perennial asters, is to drive a stout stake firmly near the plant on the side which does not show from the garden walk, then tie the plant to it loosely with the kind of twine supplied by seedsmen for the purpose. Tall plants such as delphiniums will need tall stakes and the tying can be done as growth proceeds during the season. With large-flowering dahlias it is a splendid practice to put in the stakes before the roots or cuttings are set in the ground. This is the usual practice for sweet peas and annual climbers also. The art of staking is simply the knack of making stake and tie almost invisible.

Dividing

Early fall is an excellent time to divide such perennials as phlox, peonies, and others that have passed their blooming period. Pulling them apart carefully, leaving at least one eye or bud to each, and replanting them in enriched ground will improve their vigor. Fast growing plants such as phlox need to be split up and replanted in heavily manured ground every three or four years. Peonies can wait seven to ten years before they need dividing. Slower-growing plants do not require moving as often. If the dividing is not done in the fall, it can frequently be handled just as effectively in early spring.

Pest Control

Effective control of pests and diseases must take into consideration the various methods of attack. Some insects, often the softer-bodied sorts, suck the juices, and these must be combatted with a spray which will poison them upon contact with their bodies. Others, mostly beetles and their larvae, chew the leaves and flowers, and these require a stomach poison. The fungi which attack plants start their ravages at the surface, so these must be treated with some agent that will prevent their further growth. Thus, the following recommendations are made for maintaining general plant health.

Against aphids, red-spider, thrips, and other sucking insects, a spray containing nicotine, rotenone, or pyrethrum is best, applied according to the manufacturer's directions.

For the control of beetles, caterpillars, and other leaf-chewing insects, a spray with a poison base is needed, such as arsenate of lead. If there is objection to the use of poison in the garden, there are several sprays on the market with a rotenone or pyrethrum base, also quite effective against these pests.

The control of mildew on flowers such as delphinium and phlox can be effected by the use of a spray with a copper base, such as Bordeaux mixture. This spray is valuable for the control of many other fungus diseases also. Dusting with a finely powdered sulphur will similarly check the growth of fungi on leaves.

The best all-round rose spray is a mixture of a fungicide, stomach poison, and contact spray. Several spray manufacturers have such three-in-one combinations and they are to be highly recommended. All sprays should be diluted according to the manufacturer's directions.

Gladiolus thrips are very troublesome and hard to control. The most effective substance I have found to date is a tartar emetic spray, made by mixing ¼ ounce tartar emetic and ½ ounce sugar (or molasses if sugar is not available) with one gallon of water. All parts of the plants should be thoroughly sprayed, preferably in the morning.

REVIEWS AND NOTICES OF RECENT BOOKS

Biological Approach to Soil

PAY DIRT. Farming and Gardening with Composts. J. I. Rodale. 242 pages, bibliography. Devin-Adair Co., New York. 1945. $3.

This is the book of the year for soil microbiologists, scientists in various other fields, and for practical gardeners. It refutes the use of chemical fertilizers and makes a determined and dynamic plea for the return to the methods of by-gone centuries when preparing our soils for crops.

After reading it we can in no large way disagree with anything that is written there.

Perhaps irrational greed has been largely responsible for soil depreciation and we believe it is the duty of the scientist to prove or to provide the facts to governing bodies as well as to the man who tills the soil.

Mr. Rodale says that modern agriculture must get away from intensive chemical theories, and forward to a biologic conception of soil fertility. Be that as it may, there is no doubt that the subject is so complex and debatable as we know it today that it will be a long time before we can deny ourselves the use of 4-10-5 when planting potatoes or DDT to spray their haulms.

"Pay Dirt" is a book that will—or should—stir every reading gardener to thought and to experiment.

JAMES G. ESSON,
Editor, The Gardeners' Chronicle of America.

Designs for Planting

A GARDEN FOR YOU. Edited by Thomas C. O'Donnell. 160 pages, illustrated. Robert M. McBride & Co., New York, 1946.

"An all-round plan for garden building," Thomas C. O'Donnell, editor of "A Garden for You" calls this new contribution to garden literature. Its chapters are written by a dozen experts in various fields of horticulture and landscape art and cover subjects of garden design and selection of plant material more from the esthetic viewpoint than that of practical dirt gardening.

Garden design and ornamentation are treated, plants for various seasons, special situations and color schemes are discussed as well as new and old varieties. Roses, chrysanthemums, oriental poppies, succulents and grasses are among the subjects chosen for special chapters, while others list and discuss most favored annuals, perennials, bulbs, rock plants, aquatics, hedges, vines and trees, both ornamental and fruit bearing, the most favored having been selected by vote of several leading nurserymen.

The book is profusely illustrated and contains much interesting material but the press work is poor and there is no index.

RUTH N. WETZEL.

Touring from Mexico's Past To the Present

GARDENS AND HOMES OF MEXICO. Cora M. Oneal. 221 pages, illustrated. Banks Upshaw & Company, Dallas, Texas. 1945. $3 75.

Beginning with recent archaeological discoveries in the Valley of Oaxaca, at Monte Albán, Mrs. Oneal tells of Mexico's prehistoric gardens, dating back to 500 B. C., and points to the evidence that the patio existed there long before the Spanish conquest. She had the privilege of discussing these prehistoric sites with the distinguished Mexican archaeologist, Dr. Alfonso Caso, whose book, "Monte Albán," in the Mexican Arts and Crafts series, should be read by intending travelers.

Mrs. Oneal also quotes from the fascinating writings of Mrs. Zelia Nuttall, archaeologist, botanist, and historian. Mrs. Nuttall had such inexhaustible knowledge on these subjects, that her death before her book could be published has been a great loss. One is glad to see that so much of her information, passed on to the Garden Club of Mexico, is still in circulation.

The first part of Mrs. Oneal's book, depicting early life and times in Mexico, is most enjoyable; while the descriptions of modern houses and furniture are interesting, one is likely to prefer reading about the ancient customs, such as the habit of carrying bouquets on all occasions and presenting rare ones to the Emperor Moctezuma.

Mrs. Oneal devotes two chapters to the pre-conquest gardens of which records exist today. Rereading the stories of all these lovely places brings one a nostalgic craving to return; for instance, to Xochimilco's picturesque flower-bordered canals, Molino de las Flores, the gardens of Nezahualcoyotl, poet, philosopher and king, who must have had years of pleasure working on his mountain top, and contemplating from there the Valley of Texcoco, where he laid out superb gardens and where botanists still come from far countries to study the trees—especially the wonderful square enclosure of taxodium, called El Contador.

The final chapter (VIII), on Orchids and Orchid Hunting, tells of seeing these flowers on the famous Pueblo Highway, but they are probably tillandsias (Bromeliads), with their bright scarlet cones—sometimes called "pine orchids." It might be added that, while the descriptions in the chapter, Some Plants and Trees of Mexico, give an engaging picture, some of the spellings and botanical references are regrettably inaccurate.

There is so much to tell that one book could not hold all there is to hear of the lovely towns within easy reach of Mexico City. It is to be regretted that the author has passed Puebla by with merely a sentence, as the patio gardens of the famous Hidden Convent alone are worth a trip to Puebla to see.

In summing up, Mrs. Oneal has supplied us with information of great interest, but if one might be permitted a criticism, it would be more helpful to the intending traveler if the great amount of information collected on so many other different tours could be arranged in a more geographical and consecutive sequence.

MARGARET DOUGLAS.

From Vegetable Oil To Insecticide

SOAP IN INDUSTRY. Georgia Leffingwell and Milton A. Lesser. 181 pages, indexed. Chemical Publishing Co., Brooklyn. 1946. $4.

This practical treatise to acquaint chemists, manufacturers, technicians and students with the utilization of soap in manufacturing processes reveals in striking diversity the place filled in modern industry by this familiar material, of which vegetable oils are such an important ingredient.

One of the peculiar properties of soap that makes it useful in a great variety of manufacturing processes is its faculty of penetrating and carrying other substances with it. Another property of industrial significance is that of lowering surface tension. In many processes and products soap functions advantageously for other than detergent reasons due to its efficiency as a dispersing agent in a wide range of emulsions.

The efficiency of soap as a wetting agent because of its ability to lower surface tension, it is pointed out in the book, accounts for its extensive use as a "spreader" in various types of insecticidal sprays useful in guarding plant life. Soap too, as a sole active ingredient, frequently forms an efficient insecticide against a variety of plant pests, especially for small plantings.

A standard, frequently recommended spray reported in the text may be made by dissolving two ounces of soap in one gallon of water. Such a spray is useful against aphids, leafhoppers, thrips, and the younger stages of a number of other insects. This spray, it is pointed out, must not be used full strength on very tender plants such as young cabbage or cauliflower in seed beds, on garden peas, or on young beans, as it may affect the leaves. A half strength soap solution will suffice for such plants, but for use on hardy plants the amount of soap may be increased to kill larger insects.

Both the dispersing and wetting properties of soap are called into play in preparing insecticidal emulsions based on oils or kerosene. Included are a number of indicative formulas of specific interest, as for example one recommended for use against newly hatched scale insects on hardy shrubs, and another, fortified with nicotine sulfate, which is suggested for the protection of ornamental bushes.

WILLIAM F. LEGGETT.

Two New Volumes On Botany and Chemistry

PHYSICAL CHEMISTRY OF CELLS AND TISSUES. Rudolf Höber, D. I. Hitchcock, J. B. Bateman, David R. Goddard, W. O. Fenn. 676 pages, indexed. Blakiston Co. Philadelphia. 1945. $9.

Of the eight sections in this book on the physical chemistry of cells and tissues, four have been written by Rudolf Höber and deal principally with various aspects of cell structure, permeability, and secretion. The section on "Selected Principles of Physical Chemistry" would seem to belong more properly in a textbook of physical chemistry. The section on "Large Molecules" would interest anyone who works with the structural aspects of protoplasm.

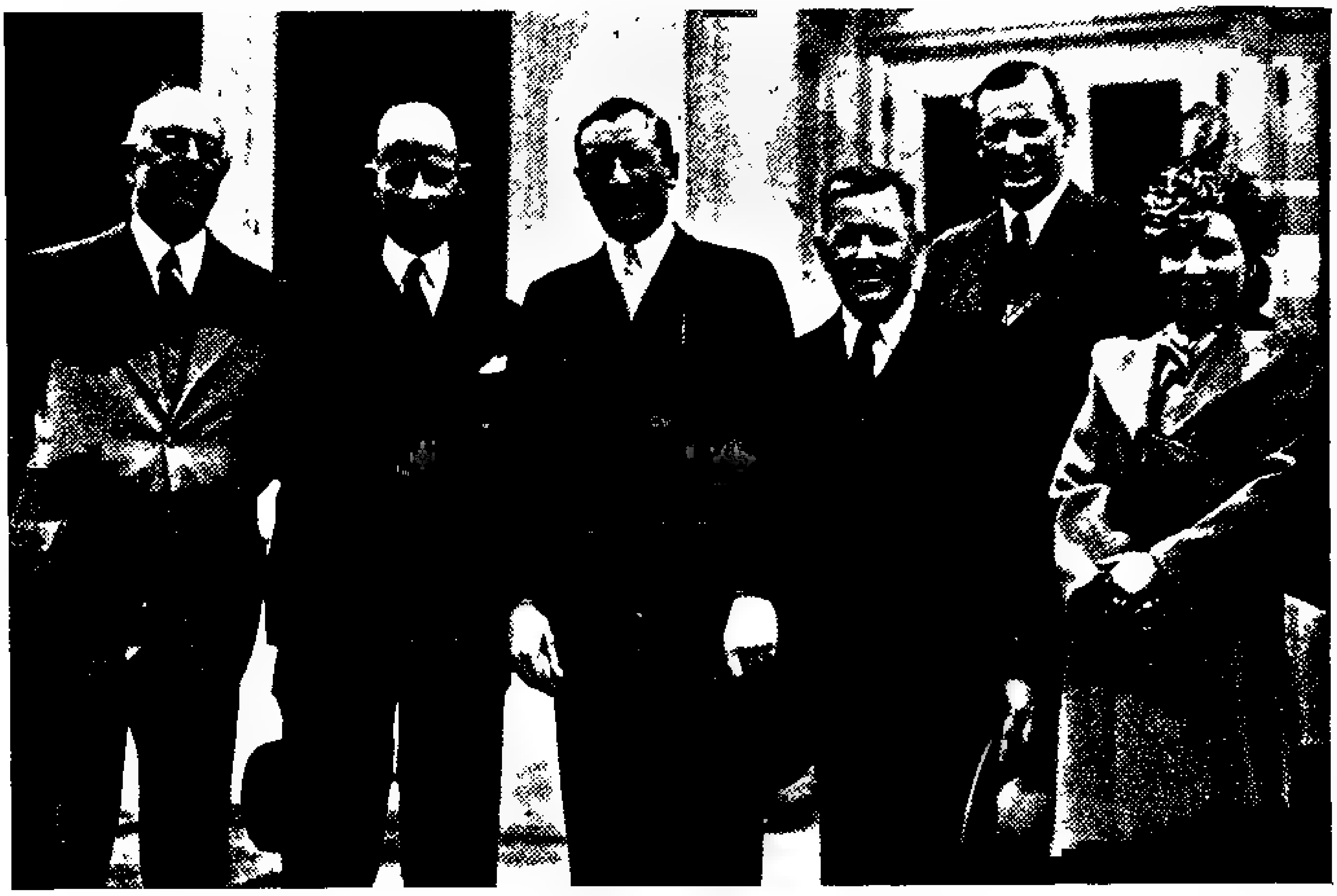
The section on "The Respiration of Cells and Tissues" by D. R. Goddard introduces the student to the modern ideas of respiration and the utilization of the energy which can be secured by the degradation of carbohydrates. It is to be hoped that this section, in an expanded form, can be made available as a separate publication which could be used in teaching students of plant physiology the elements of respiration.

Most of the manuscript seems to have been completed in 1942.

ADVANCES IN PROTEIN CHEMISTRY. Vol. II. M. L. Anson and John T. Edsall. 443 pages, indexed. Academic Press, Inc. New York. 1945. $6.50.

Here is another book of reviews of certain aspects of the chemistry of amino acids and proteins. The names of the editors and authors are a guarantee of the quality of the reviews. The chapters that might interest botanists are: Analytical Chemistry of the Proteins; The Microbiological Assay of Amino Acids; The Amino Acid Composition of Food Proteins; Wheat Gluten; X-Ray Difraction and Protein Structure; and The Copper Proteins.

F. W. KAVANAGH.



AT THE DEDICATION OF HOLLAND'S TULIPS

Left to right: Joseph R. Swan, President of the New York Botanical Garden; Dr. Eelco N. van Kleffens, Prime Minister of The Netherlands; G. R. G. van Swinderen, Acting Consul General for The Netherlands in New York; Dr. William J. Robbins, the Garden's Director; Walter Roozen of Haarlem, Holland, and Margaret Herbst of New York, both representing the Associated Bulb Growers of Holland in New York.

Holland Bulb Dedication

IN a ceremony attended by representatives of the Government of the Netherlands and of the Associated Bulb Growers of Holland, the display of Holland tulips at the New York Botanical Garden was dedicated the afternoon of May 6.

Invited guests were seated outside the Main Conservatory, near the borders where a large number of the 18,000 bulbs had been planted. Other bulbs were to be seen in the court of the Conservatory and along the path leading to the Museum Building. Throughout the spring, 6,000 other bulbs, also part of the gift, had been shown in the Main Conservatory. The collection received from Holland comprised some 60 varieties, most of them new to gardeners in the United States. They had been purchased from bulb growers by means of small contributions made by the people of Holland, to express thankfulness for the liberation of their country. The money was raised by a national committee working under the title, "Flowers Interpret Netherlands Gratitude." The bulbs were part of a large shipment sent also to the New York Park Department and three American war cemeteries for public display. The Committee is represented here by the office of the Associated Bulb Growers of Holland.

At the program, at which Joseph R. Swan, President of the Garden, presided, short addresses were given by G. R. G. van Swinderen, Acting Consul for the Netherlands in New York; Dr. Eelco N. van Kleffens, Prime Minister of the Netherlands, and Dr. William J. Robbins, the Garden's Director. Miss Margaret

Herbst, representing the Bulb Growers, then presented a bouquet of tulips to Mrs. Robert H. Fife, Chairman of the Garden's Advisory Council.

After an inspection of the tulip beds, the Garden's guests were entertained at tea in the Museum Building. Among those present were Walter Roozen, of the Associated Bulb Growers; Robbert Faile, A. M. van den Hoek, Edith G. Fricke, T. van Staveren, Mrs. Grafton H. Pyne, D. H. Rodrigues, T. J. Gomperts, Ann N. Freeman, F. J. van der Molen, Mr. and Mrs. J. S. Ten Eyck, Mrs. Edward J. Prest, Miss Viola Fox, Charles James Fox, Peter Vandermeyden, Mrs. Sam F. Trelease, E. L. D. Seymour, Dorothy H. Jenkins, Mrs. G. van Marx, V. van Marx, Mrs. John G. Winchester, Mrs. Charles Burlingham.

Notes, News, and Comment

Garden Club Day. Garden clubs of the vicinity of New York visited the New York Botanical Garden in a body May 21, for a special day of sightseeing, with a lecture and a motion picture in the morning and afternoon. The event, which attracted several hundred persons, was arranged by the Garden's Manhattan office, with Mrs. Reginald Fincke as chairman, Mrs. G. Eustis Paine, Mrs. Grafton H. Pyne, and Mrs. Philip B. Weld as vice-chairmen, and a committee of 27 to steer the program.

The morning hour was occupied with a lecture by Dr. W. H. Camp on "Plant Exploration," and in the afternoon Dr. H. W. Rickett served as commentator for the Garden's full-length motion picture in color. Simultaneously, both morning and afternoon, buses carried the visitors throughout the grounds and staff members conducted the guests through the Rock Garden, Conservatories, and Museum Building.

Rose Enthusiasts. Rose-Growers' Day brought around 200 people to the Garden June 12. Because of the rain, the program took place in the lecture hall in the Museum Building. The annual tour of the Rose Garden, under the guidance of L. C. Bobbink, donor of the majority of the roses there, was conducted in the afternoon, after the program was over and the sun had appeared. A more complete report of the day's events will be given in the next issue of the Journal.

Robert A. Harper. Three and a half years after his retirement from the Board of Managers of the New York Botanical Garden, Professor Robert A. Harper, formerly head of the Botany Department at Columbia University, died at his home in Bedford, Virginia, May 12. He was 84 years old. A tribute to his career will be published in an early number of the Journal.

Pacific Conference. Otto Degener attended the Pacific Science Conference of the National Research Council in Washington, D. C., June 6-8. Dr. E. D. Merrill of the Garden's Board of Managers was chairman of the division of plant sciences.

Board Members. Howard Bayne of 40 Wall St. and Charles B. Harding of 14 Wall St. were elected to the Board of Managers of the New York Botanical Garden at the meeting of June 10. Both will serve in the class of 1948.

Bryophyte Research. Dr. Margaret Fulford, Associate Professor of Botany at the University of Cincinnati, arrived at the Garden the first of June to spend the summer working on Latin American collections of liverworts. Mrs. Inez M. Haring of Poughkeepsie came June 11 to spend two weeks working on the Garden's collection of mosses.

National Academy. Dr. William J. Robbins and Dr. B. O. Dodge attended a meeting of the National Academy of Sciences in Washington, D. C., April 21-24.

Exhibits. A model of the projected Museum and Administration Building for the New York Botanical Garden was shown in an exhibit of the Metropolitan Association of Real Estate Boards, with which the Department of Public Works of the City of New York co-operated, at Grand Central Palace May 4 to 11.

Enlarged photographs showing scenes at the Garden the year round were exhibited by the Department of Parks and Recreation of Detroit as part of a pictorial presentation of outstanding botanical gardens of America, early in April.

Groups. Numerous garden clubs, school and college classes, and nature study groups have arranged for guided tours of the Botanical Garden in recent weeks: East Orange, Darien, and John Burroughs Garden Clubs, the Garden Department of the Ridgewood (N. J.) Women's Club, staff wives of the American Museum of Natural History, and the Wellesley College Club with Mrs. William J. Robbins in charge. The Torrey Botanical Club met in the lecture hall May 15.

Earlier, the Garden Club of Mount Desert, Maine, the Weeders Garden Club of Philadelphia, and the Irvington Garden Club, New York, were shown the Garden's short color film, "Plants and the Life of Man," had lunch in the Members' Room, and visited the Rock Garden, Conservatories, and other displays. Other recent visitors have been a school group from Selbyville, Del.; another from Teachers' College of Columbia University; one from the School of Education at New York University, and a class from P. S. 55 in the Bronx.

The biology classes of three New Jersey schools—Hasbrouck Heights, Ridgefield Park and Emerson high school (Union City), also an ecology class from Teachers College, the biology classes and teachers from Dalton School, New York City, and a group from Franklin Junior High School in New York, have had conducted tours of the Garden in the past month, besides Girl scouts from St. Albans and a class from P. S. 86, arranged by the School Nature League.

Lectures. Staff members who have given lectures for Garden Club Affiliates and other groups in recent weeks include Dr. Harold N. Moldenke, Watchung Nature Club May 22, "Grasses"; Elizabeth C. Hall, Rye Garden Club June 4, "Garden Books, Old and New"; Dr. H. W. Rickett, New Canaan Garden Club June 12, "The Plant Kingdom"; Dr. W. H. Camp, Greenwich Garden Club (at the Garden) June 12, "Exploring in Ecuador"; and Dr. E. E. Naylor, appearing as lecturer and commentator with the Garden's full-length motion picture June 19 before the Floriculture Club at the State Institute of Agriculture at Farmingdale, L. I. Miss Hall also spoke before the Flushing Garden Club June 20 on "Garden Books for Summer Reading."

Boulevard station; use the Bedford Park Bou
Third Avenue Elevated to the Botanical Gard

Membership in
THE NEW YORK BOTANICAL GARDEN
and what it means

TO THE INSTITUTION, membership means support of a program that reaches several hundreds of thousands of persons annually.

Briefly, this program comprises (1) horticultural display, (2) education, (3) scientific research, and (4) botanical exploration. To further this work and to disseminate useful information about plant life to the public, the Garden issues books and periodicals, both scientific and popular, and presents lectures, programs, radio broadcasts, and courses of study in gardening and botany. The laboratories and large herbarium and library serve the staff in its research and educational work, while the extensive plantings at the Garden give the public vistas of beauty to enjoy the year around. The public is also free to use the Botanical Garden's library, and, under direction, to consult the herbarium.

TO THE INDIVIDUAL, membership means, beyond the personal gratification of aiding such a program, these privileges:

Free enrollment in courses up to the amount of the annual membership fee paid.

A subscription to the Journal and to Addisonia.

Admission to Members' Day programs and use of the Members' Room also at other times.

A share of plants when made available for distribution. (These plants may include the Garden's new introductions into horticulture.)

Personal conferences with staff members, upon request, on problems related to botany and horticulture.

Free announcements of special displays, lectures, broadcasts, programs, and other events.

Use of lantern slides from the Garden's large collection, under established regulations for such loans.

A membership card which serves as identification at special functions at the Botanical Garden and also when visiting similar institutions in other cities.

* * * *

Garden clubs may become Affiliate Members of the New York Botanical Garden, and thus receive certain privileges for the club as a unit and others for individual members. Information on Garden Club Affiliation will be sent upon request.

Business firms may become Industrial Members of the New York Botanical Garden. Information on the classes of Industrial Membership and the privileges of membership will be sent upon request.

* * * *

Classes of membership in the New York Botanical Garden in addition to Industrial Memberships are:

	Annual Fee		*Single Contribution*
Annual Member	$ 10	Member for Life	$ 250
Sustaining Member	25	Fellow for Life	1,000
Garden Club Affiliation	25	Patron	5,000
Fellowship Member	100	Benefactor	25,000

Contributions to the Garden may be deducted from taxable incomes.

Contributions to the Garden are deductible in computing Federal and New York estate taxes.

A legally approved form of bequest is as follows:

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

Gifts may be made subject to a reservation of income from the gift property for the benefit of the donor or any designated beneficiary during his or her lifetime.

All requests for further information should be addressed to The New York Botanical Garden, Bronx Park, New York 58, *N. Y.*

JOURNAL

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AUGUST 1946

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

LATE SUMMER DISPLAYS AND EVENTS

Flowering Plants

Waterlilies—both tropical and hardy sorts in the two pools in the conservatory court.
Annuals—a colorful border on either side of the path adjacent to the conservatory.
Hardy asters—nearly 100 varieties, starting to bloom in September, near conservatory.
Heather in the Thompson Memorial Rock Garden.

Vegetables and Herbs

Approximately 30 food crops in the demonstration vegetable garden.
About 75 kinds of annual and perennial herbs in two separate plantings.

Members' Day Programs

Monthly meetings will be resumed on Wednesday, October 2.

Radio Programs

Alternate Fridays, 3:30 p.m., WNYC (830 on the dial)

Sept. 6 *Food From Field and Forest* — *Milton Hopkins*
Science Editor, Henry Holt & Company

Sept. 20 *Some Interesting New Jersey Gardens* — *Nancy Ruzicka Smith*
Gardener-Writer, Livingston, N. J.

FORTHCOMING EVENTS

Educational Program

In the *Two-Year Science Course for Gardeners*, classes in Ecology and Plant Geology and in Plant Pests and Diseases will start September 30.

In the *Two-Year Course in Practical Gardening*, the class in Cultivation of Trees and Shrubs will start October 10.

Autumn term in *Field Botany* will start September 14.

Autumn term in *Nature Study for Teachers* will start September 18.

Saturday Programs

The autumn series of free Saturday afternoon lectures and motion pictures will commence October 5.

Chrysanthemum Show—October 25 27

Second annual display and program at the Garden in co-operation with the Eastern States Chrysanthemum Society.

TABLE OF CONTENTS

AUGUST 1946

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.50. Single copies 15 cents.

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The Bur Oak Openings In Southern Wisconsin

By A. B. Stout

THIS article has been condensed from a paper of 20 pages published in the Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Volume 36, pages 141-161, 1944 (issued Jan. 12, 1946).

The parts here omitted include a discussion of:

(a) Early records for Dane County and Rock County.
(b) The oak openings in relation to the native vegetation of Wisconsin.
(c) The records of the second growth.
(d) The natural range and variations of the bur oak.
(e) Oak barrens, and
(f) Literature cited.

The two plates here reproduced were provided by the Wisconsin Academy of Sciences, Arts and Letters, from the author's photographs.

Since the appearance of the original article, official interest has been aroused in the preservation of the Babcock Oak Opening described here. In a letter recently sent to the author, Dr. Norman C. Fassett of the Department of Botany, University of Wisconsin, says:

"The emphasis which you have now put on Babcock Grove has convinced both the Natural Acres Committee and the Arboretum Committee that that place should be very high in our Conservation Department." Remarking that it would come under the Arboretum Committee, he writes further, "Administration would probably consist of maintaining fences and hiring a local farmer to keep an eye on the place. I think the region should continue to be lightly pastured. Light pasturing is what has kept it as a good oak opening. Heavy pasturing would be detrimental, and with no pasturing it would probably come up to underbrush."

Thus, as a result of the publication of this study of the bur oak openings, steps may be taken to preserve this example of a nearly extinct type of natural woodland in America.—C.H.W.

A Typical Oak Opening

Bur oak openings were the principal timbered lands over a considerable part of southern Wisconsin when this region was homesteaded about one hundred years ago. Today only a few remnants of these once numerous natural parks still survive. One of these, about 50 acres in extent and

View looking westward across a section of the Babcock Bur Oak Opening near Albion, Wisconsin. Photo in 1941 by the author.

still in good preservation, is situated a few miles to the north of the village of Albion in Dane County. A similar grove, now of smaller area, is located about a mile to the southwest. The illustrations, from photographs taken in this grove in 1941, show the stately grandeur and the rugged beauty of natural stands of this type of tree growth.

In this particular oak opening the trees are, I believe, all bur oaks (*Quercus macrocarpa* Michaux); but in some of the other oak openings of the area and especially on the belt of moraines there were trees of the white oak (*Quercus alba* L.). These oaks are all broad-topped and so spaced that seldom are the branches of two trees interlocked. Also they are rather uniform in size. There are no young trees or shrub growth anywhere in this grove nor has there been such growth here for at least one hundred years. Between the trees there is the firm turf of native grasses that has never been disturbed by cultivation. The entire area of this grove is almost level, as are the reaches of formerly prairie land that lie adjacent to the grove and which continue for some distance immediately to the east and the northeast. But many of the openings of the region were on the more rolling and undulating uplands. A small, shallow, and rather sluggish stream (Saunders Creek) flows close to the south of this oak opening, and along its banks, both above and below the grove, there are flat marshy grasslands that are often of considerable extent and occasionally there are areas of tamarack swamp. These lowlands and their water-table are, as a rule, only slightly below the general level of the uplands. Marshes are abundant throughout much of the prairie oak opening area that was glaciated and on which the drainage is geologically still young.

Oak Openings in Wisconsin

The Babcock Oak Opening as it stands today is typical of the groves which once covered a considerable part of an extensive area in Wisconsin. This region extended across the entire southern boundary of the state. Northward its width from east to west decreased, with irregular border limits, until it terminated near Rush Lake. Roughly the entire area in Wisconsin comprised about 5,000 square miles and it formed a broad-based wedge that projected northward into and almost through a wide belt of more dense forest growth in which oaks were, and still are, the dominant species.

Dane County, in the southeast corner of which is the township of Albion, is situated near the center of the area of oak openings. Rock County lies partly adjacent to Dane County and south of it. These two counties were quite typical of the best developments of the prairie-oak opening vegetation in Wisconsin.

The Vanishing of the Prairies and the Oak Openings in Wisconsin

The fertile prairie lands were ready for the plow of the settlers. But on many of the homesteads in Dane County and in neighboring counties the acreage was mostly oak openings and many of the trees were removed or at first merely killed by girdling to provide land for cultivation. For a time some of the oak openings were utilized as pasture lands for cattle, horses, and sheep, especially if there were no lowland meadows in a farm. Between the scattered trees of the oak openings the native grasses flourished and provided excellent grazing land.

Previous to 1900 many public gatherings, on such holidays as Decoration Day and Fourth of July, and community picnics were held in an oak opening where the checkered shade of the trees contributed much to the comfort of all. But the extension of cultivated farmland steadily reduced the area of the oak openings. To some extent the needs for timber for building homes, for the construction of rail fences, and for firewood contributed to the removal of the grand old trees of bur oak and white oak.

Natural Reforestation by Second Growth

While the bur oaks were rapidly being decimated and the areas of oak openings were disappearing in the region about Albion, as elsewhere in southern Wisconsin, there was a most remarkable spread and increase of new or "second growth" stands of "black oaks." This noteworthy and conspicuous natural reforestation entirely changed the character of the arboreal population in this particular area during the years between 1850 and 1890. Here this second growth was almost entirely composed of *Quercus rubra* L. and *Q. coccinea* Muench.

This second growth of timber appeared as seedlings which were often in such numbers that they formed thickets over many upland areas that were not cultivated or heavily pastured. Often the second growth invaded oak openings and filled in about the old trees of bur oak and white oak. As a result, in a span of some 40 years, nearly every large farm in the area about Albion possessed at least one "woodlot" of close-standing "black oaks" of which many were no more than 12 inches in diameter at the level of the ground.

Thus the second-growth oak forest composed of the so-called black oaks became the principal natural association of tree growth about Albion where the oak openings had formerly been abundant. Perhaps the largest acreage of this second growth was in existence here about 1880-1890.

Scattered through many of the second-growth woods there were, and still are, towering monarchs of white oak and somewhat lower trees of the bur oak whose gnarled trunks were usually from three to four feet in diameter. These had existed here when the site was an oak opening. In these trees the red-tailed hawks build their nests. The larger branches and trunks are often hollow and in such cavities the screech owls nest, and the abundant fox squirrels and the less frequent and more secretive flying squirrels make their homes.

The writer can attest that in these woods near the village of Albion, as well as in the oak openings, he has rarely observed, about one of the bur oak trees, any younger trees that could have grown from its acorns. However when second-growth woods were cut over and not severely pastured a "third-growth" reproduction often contained some seedling reproduction of both white oak and bur oak.

The Ecological Status of the Bur Oak Openings

Several features of the oak openings in Wisconsin are characteristic and conspicuous: (a) the trees are of nearly the same age and of good tree-like stature; (b) the trees are scattered or separated in a park or orchard-like disposition with dense sod of grasses between them; and (c) there has been for many years no reproduction from seed of the trees and no invasion by other woody species.

The trees in these bur oak openings, judging from those now in the Babcock grove, date back to about 200-250 years ago, a rather short and recent period of time when the entire interval of the post-glacial history of the area is considered.

Various writers have supported the view frequently expressed from an early date and already referred to in this article, that the prairie fires of the Indians were an important factor in destroying tree growth in the belt adjacent to the prairies and that one result of this was the development of the oak openings. Gleason [1] has supported this view and described the probable process as follows:

> "The fires destroyed seedling trees at the west margin of the forest, preventing further advance in that direction. It is doubtful if they penetrated far into the forest, but by destroying the undergrowth and killing the more susceptible species, they gradually reduced the forest to the park like condition known as oak openings."

According to this view the oak openings in Wisconsin and in neighboring states were remnants of an earlier and more dense marginal forest of which the older of the bur oaks and white oaks withstood destruction by fires.

But in the Babcock grove the character of the grove has remained quite unchanged since the last prairie fires swept the area. During this time in the area of this grove there continued to be no seed reproduction of the bur oaks already there; but there was also relatively little reproduction of bur oaks and white oaks over the entire area.

What became of all the acorns produced in this Babcock grove during the past one hundred years? From the general evidence at hand, especially summarized and presented by Korstian,[2] large numbers were eaten by rodents and weevils; perhaps a few germinated and had even a chance to live in competition with the sod; and finally it may be that seedlings of the bur oaks and of any invading woody species were destroyed in the browsings of cattle, horses and sheep. It would seem that the facts in this situation, as well as those for the decided selective reproduction of black oaks over white oaks, could yet be determined by direct observation and experimentation, and also that the matters of reforestation warrant such study.

It may be noted that the association of a dense sod of grasses with a scattering distribution of trees is a somewhat unstable and obligate relationship. An increase in the stand of the trees will eliminate the grass beneath the canopy of the branches. But the dense sod of grass roots and rhizomes make it difficult for seedlings of hardwoods to become established.

The rather robust growth of the bur oaks in the oak openings of Wisconsin is no doubt due to the fact that the trees have developed on rich fertile land that has received adequate rainfall for tree growth. The area of the tall grass prairies bulges eastward into southern Wisconsin and over most of Illinois. Over a considerable part of this area the amount of rainfall has in recent time become favorable to forest growth and the oak forests which were advancing to the west had in 1850 already become a belt of considerable width. The oak-hickory portion of the oak forest belt covered (a) much of the fine farm land of Ohio and Indiana, (b) portions

[1] Gleason, H. A., The vegetational history of the Middle West. Annals Ass'n. Am. Geographers, 12: 39-85. 1923.

[2] Korstian, Clarence F., Factors controlling germination and early survival in oaks. Bull. No. 19, Yale School of Forestry. 1927.

of southern Michigan and southern Wisconsin, (c) parts of Minnesota, Iowa and Illinois, and (d) portions of other states to the southwest.

The Matter of Terminology

Under the term "opening" Webster's *New International Dictionary,* Second Edition, 1934, Printing of 1942, gives the following definition:

> "**Opening** 3. A thinly wooded space, without undergrowth, in the midst of a forest or grove; as, oak *openings. U. S.*"

But the bur oak openings in Wisconsin were not in the midst of a forest; they were most often surrounded by or bordering on prairie grassland.

In the *Century Dictionary and Cyclopedia* (1900) there is the following definition:

> "**Opening** 5. A clear, unobstructed or unoccupied space or place; specifically, in the United States, a tract over which there is a deficiency of forest, trees being not entirely wanting, but thinly scattered over the surface as compared with their abundance in an adjacent region. The word is most frequently used with this meaning in Wisconsin and neighboring States on the west, and as the scattered trees are frequently oaks (*Quercus nigra,*[3] jack-oak, and *Q. obtusifolia,*[4] post oak, are the most common species), such openings are often designated as *oak-openings.* Similar tracts in the more southern States, especially in Kentucky, are called *barrens* and *oak-barrens.*"

There follows a quotation from Cooper's novel, *The Oak Openings,* in which there is mention of the bur oak. The two species of *Quercus* mentioned in the quotation above are the principal oaks of the Cross-Timbers area in Texas and Oklahoma, but neither was present in the extensive oak openings in Wisconsin nor is now found in the state.

It appears that the term "oak orchard" employed by Chamberlin[5] has had rather limited use in the literature of oak openings, and that the terms "park" and "grove" have rather wide applications which include other types of tree growth. The term chaparral[6] is especially applied to broad-leaved woodlands of the southwest which range from "an impenetrable thicket of low shrubs to open oak stands" some of which may somewhat resemble the oak openings of Wisconsin but are entirely composed of different species.

Since the oak openings of Wisconsin constituted a somewhat definite type of prairie grassland and oak forest association in which the bur oak was more abundant than the white oak it seems suitable to apply the term "bur oak openings."

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[3] = *Quercus marylandica* Muench.

[4] = *Quercus stellata* Wang.

[5] Chamberlin, T. C., Geology of Wisconsin, 2. Part 2. 1877. (The map of the native vegetation of Wisconsin, Plate No. II A, bears the date 1882.)

[6] Shantz, H. L. and Raphael Zon. Atlas of American Agriculture, Part 1. Section E. (Note especially Figures 6 and 7.) 1924.

View near the border of the Babcock Bur Oak Opening, looking eastward across an area of former prairie. In the distance a woodland of second growth is in sight. Photo in 1941 by the author.

A Commemoration of the Oak Opening in Literature

The bur oak openings received special mention and distinction in the historical novel *The Oak Openings* which was written by James Fenimore Cooper in 1848. The scene of the beginning of the story in the year 1812 was in a bur oak opening on the banks of the Kalamazoo River in Michigan. The description is as follows:

> "The country was what is termed 'rolling,' from some fancied resemblance to the surface of the ocean, when it is just undulating with a long 'ground-swell.' Although wooded, it was not, as the American forest is wont to grow, with tall straight trees towering toward the light, but with intervals between the low oaks that were scattered profusely over the view, and with much of that air of negligence that one is apt to see in grounds, where art is made to assume the character of nature. The trees, with very few exceptions, were what is called the 'burr-oak,' a small variety of a very extensive genus; and the spaces between them, always irregular, and often of singular beauty, have obtained the name of 'openings;' the two terms combined giving their appellation to this particular species of native forest, under the name of 'Oak Openings.'
>
> "These woods, so peculiar to certain districts of country, are not altogether without some variety, though possessing a general character of sameness. The trees were of very uniform size, being little taller than pear-trees, which they resemble a good deal in form; and having trunks that rarely attain two feet in diameter. The variety is produced by their distribution. In places they stand with a regularity resembling that of an orchard; then, again,

> they are more scattered and less formal, while wide breadths of the land are occasionally seen in which they stand in copses, with vacant spaces, that bear no small affinity to artificial lawns, being covered with verdure. The grasses are supposed to be owing to the fires lighted periodically by the Indians in order to clear their hunting-grounds."

This excellent description of an oak opening was based entirely "on the evidence of documents" furnished to Cooper by the "bee hunter" who was an important character of the novel, and later a well-known citizen of Michigan, General Benjamin Boden.

In the concluding chapter of the novel *The Oak Openings,* Cooper tells of his journey during the summer of 1848 from his home near Cooperstown, N. Y., to Kalamazoo. This, he states, was "an occasion which offered to verify the truth of some of our pictures, at least by personal observation." The portion of this journey from Detroit to Kalamazoo was by railroad and of the natural scenery Cooper makes comment as follows:

> "The whole country was a wheat-field, and we now began to understand how America could feed the world. Our road lay among the 'Openings' much of the way, and we found them undergoing the changes which are incident to the passage of civilised men. As the periodical fires had now ceased for many years, underbrush was growing in lieu of the natural grass, and in so much those groves are less attractive than formerly; but one easily comprehends the reason, and can picture to himself the aspect that these pleasant woods must have worn in times of old."

At Kalamazoo, Cooper found that "Those who had laid out this village, some fifteen years since, had the taste to preserve most of the trees" and that the houses and grounds were "pleasant to the eye, on account of the shade, and the rural features they present." But in this year of 1848 Cooper evidently saw few surviving trees of the bur oak openings that existed in the area about the Château au Miel 36 years earlier and evidently he did *not* find *any* sizable area of the oak openings still in a natural condition. But at this time there were thousands of acres of such oak openings in Wisconsin.

In regard to the present status of bur oak trees in the area about Kalamazoo the writer has received the following statement from the Forestry Department of the City of Kalamazoo: "The Forestry Department reports no real stand of bur oaks in this vicinity. Scattered trees are found throughout the city, perhaps the largest group being that of eight or ten in Bronson Park. Formerly groves of bur oaks were found near Kalamazoo including a large stand near Oshtemo on route U. S. 12."

The total area of the prairies and of the oak openings in southern Michigan was relatively small in comparison to the area in southern Wisconsin but evidently the character of the bur oak openings was quite the same in both regions.

Concluding Remarks

The early records are particularly complete and accurate for the main facts regarding the character, location, and extent of the bur oak openings in Wisconsin. Their relations and ecological status in the so-called oak-hickory belt which constitutes the western margin of the extensive eastern forests of North America are now well recognized.

For perhaps a hundred years before the advent of the white settlers into southern Wisconsin the oak opening-prairie association was a somewhat static feature in the midst of a region where there had been dynamic changes in post-glacial plant migrations. Both the prairie and the forest are decidedly static and self-sustaining and the two tend to be mutually exclusive. In the bur oak openings these two sharply contrasted types of vegetation are combined in a somewhat balanced and static relationship that is indeed noteworthy and of special interest.

But the coming of the white man spelled the doom of the oak openings. The land they occupied was fertile, there was sufficient timber for the immediate needs of the settlers, yet the stands of the trees were so sparse that the clearing involved relatively little labor. Within fifty years most of the oak openings were converted into fields of corn, wheat, oats, and tobacco or were filled in by the second growth which was mostly of invading black oaks. At the present time, after another fifty years, there exist only few scattered remnants of the once numerous bur oak openings. Of these the Babcock grove now occupies about fifty acres and is still in an excellent state of preservation. It is the memory of the grandeur and the beauty of the extensive groves, of which this is a remnant, that has prompted this epitome which perhaps may be considered an obituary of the bur oak openings in Wisconsin.

Audubon Originals on View

ORIGINAL water colors made by John James Audubon for his "Birds of America" may be seen on exhibition at the New York Historical Society's building, 170 Central Park West (at 76th St.) between Sept. 3 and 14. This information comes from Donald A. Shelley, Curator of Paintings and Sculpture for the Society, as a result of reading the article by Mrs. Mortimer J. Fox, "Some Notes on the Flowers and Trees in Audubon's 'Birds of America'," in the June Journal.

"Mrs. Fox has touched upon a very interesting angle of Audubon's work, and one which could be extended some time to include the various insects, shells, and other accessories which occur in his wonderful designs," he writes, saying further, "The *original water colors* for the 'Birds of America' have been here in our possession since 1863. . . . These originals will be on exhibition here until Sept. 14 (except during August when our building is closed)."

Rose Growers Meet Again at Garden

FOR the fourth successive year, amateur and professional gardeners gathered at the New York Botanical Garden on June 12 for the annual Rose-Growers' Day in co-operation with the second district of the American Rose Society.

Although the day opened with rain, necessitating having the program in the lecture hall in the Museum Building, nearly 200 persons attended.

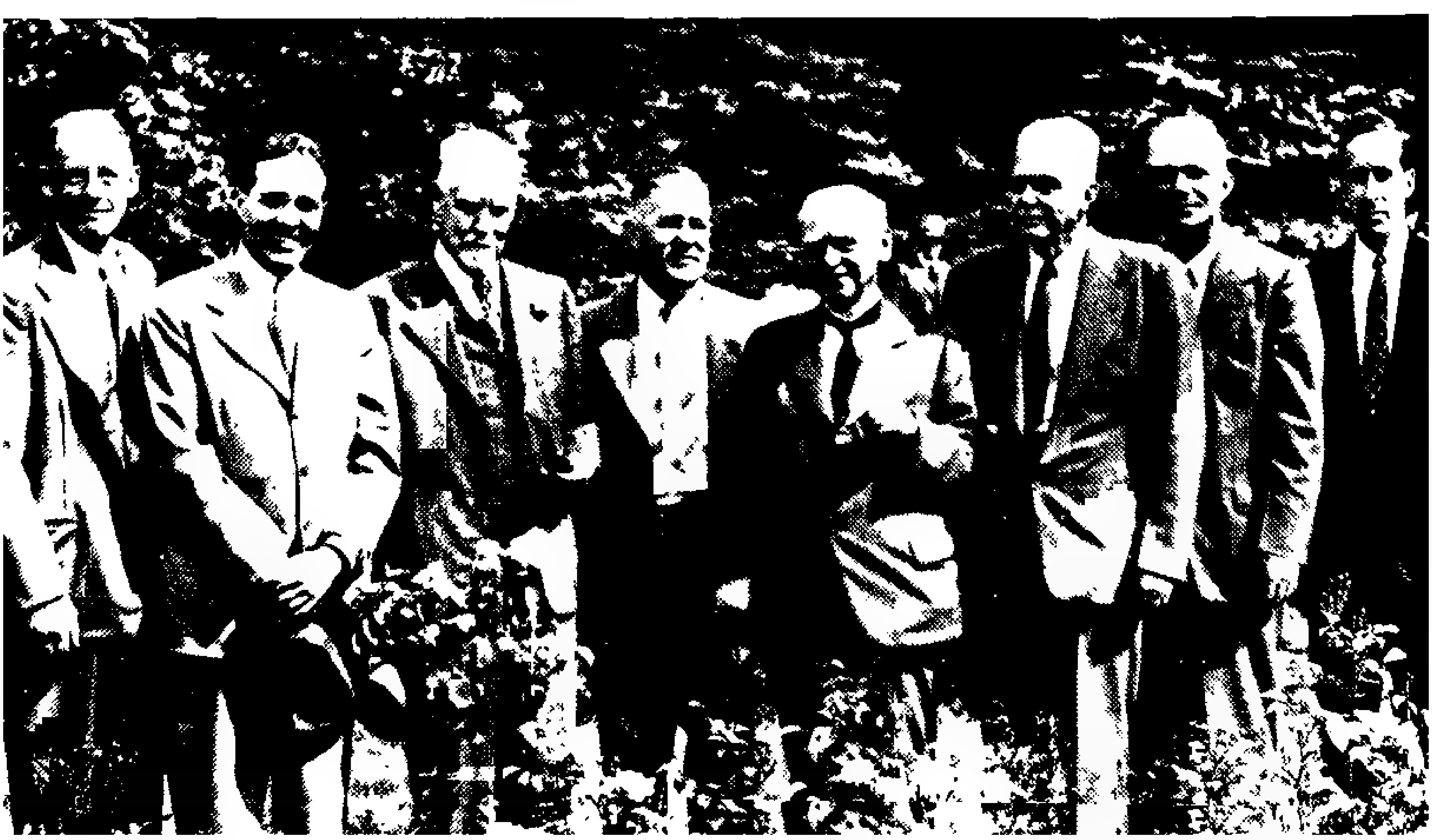
Paul F. Frese, Editor of *Flower Grower* magazine and chairman of the second district of the American Rose Society, presided during the morning session, at which F. F. Rockwell, Editor-in-Chief of *Home Garden* magazine, talked informally on "Roses for the Beginner" and answered many questions from the audience. Preceding the program on roses, the Garden's short colored motion picture, "Plants and the Life of Man," was shown.

The picnic lunches were eaten in the members' room and class room in the Museum Building.

At the afternoon session, which consisted of a clinic and demonstration on rose diseases and culture, J. W. Johnston, Horticulture Editor of the

PROMINENT FIGURES AT THE FOURTH ANNUAL ROSE GROWERS' DAY AT THE NEW YORK BOTANICAL GARDEN

Left to right: Sidney B. Hutton of Conard-Pyle Co., Robert W. Eisenbrown of Bobbink & Atkins, Arthur Herrington, William J. Robbins, Lambertus C. Bobbink, B. O. Dodge, A. J. Riker, Professor of Plant Pathology, University of Wisconsin, and Paul F. Frese, Editor of Flower Grower magazine and chairman of the second district, American Rose Society.



New York *Herald Tribune,* acted as moderator. Questions from the audience were answered by Robert W. Eisenbrown, of the firm of Bobbink & Atkins; James G. Esson, Editor of the *Gardeners' Chronicle of America,* Head Gardener on the estate of Mrs. Roswell Eldridge, and an instructor in practical gardening in the Garden's Educational Program; C. C. Hamilton, Chief Entomologist, and P. P. Pirone, Plant Pathologist, both at the New Jersey State College of Agriculture; and Dr. B. O. Dodge, the Garden's Plant Pathologist.

The sun appeared in time for the annual inspection of the Rose Garden to take place at the conclusion of the clinic. In former years the guided tour of the garden has always preceded the morning program. Led by Lambertus C. Bobbink, patron of the Rose Garden and donor of the majority of the 7,000 or more roses growing there, the crowd of rose enthusiasts walked among the beds and borders, commenting on new and old roses as they progressed. At one side of the garden, Dr. B. O. Dodge conducted demonstrations of the proper use of sprays and dusts with hand- and machine-propelled equipment. He was assisted by Florian Hines and John Horvath, who were surrounded the rest of the afternoon with a crowd of rose growers eager to learn the technique of disease and pest control.

At the entrance to the Rose Garden a display of new rose varieties attracted much attention. Totty's of Madison, N. J., exhibited Bountiful, a pink floribunda, and Vanity Fair, a hydrid tea; Jackson & Perkins of Newark, New York, showed Rubaiyat, a red hybrid tea, and Goldilocks, a floribunda; and Martin R. Jacobus of Ridgefield, N. J., exhibited three new hybrids—two tall pillar roses, one a salmon-colored cross between Mary Wallace and Herbert Hoover, the other Mary Wallace crossed with Talisman, and the offspring crossed again with Autumn; and an unnamed everblooming pink climber, created out of New Dawn and Crimson Glory, to be introduced by Bobbink & Atkins.

Below are given the answers to some of the principal questions asked during the clinic on rose diseases and culture.

CLINIC ON ROSE DISEASES AND CULTURE

Suckers

How do you distinguish a rose sucker from the true variety, and then what do you do about it?

If the nurseryman "de-eyes" his stocks carefully (and there are practically only two kinds being used on a large scale, *Rosa multiflora* in the East and Ragged Robin on the West Coast) suckers seldom occur. If they do, the *Rosa* *multiflora* produces a comparatively small leaf, a light, sickly green color ofttimes showing seven leaflets. However, the number of leaflets is not always a sure guide. Simply cut the sucker off close to the butt with a sharp knife; sometimes it can be torn off with a quick jerk if not allowed to remain on too long. Ragged Robin seldom suckers here in the East and while the leaves are a little larger than on *R. multiflora,* the flower produced is a reddish-magenta color and is single.

During the early and late fall season, what are sometimes taken for suckers are really luscious flowering shoots of the true variety coming from way down near the base of the plant, and these shoots sometimes appear to come from below the bud or knuckle. These valuable shoots produce the very finest blooms in October and therefore should never be removed. Naturally, when one sees their large leaves and stout stems, there is no doubt they are the real variety and not a sucker. No person with any rose experience would ever think of removing them.

Planting Losses

What causes loss of dormant roses when planted?

The question has been asked hundreds of times why it is that the home gardener may plant one or two dozen roses at the same time in the same bed, all being given exactly the same care, and perhaps one or two or more fail to thrive. They stay dormant so long that they must eventually be pronounced dead. I am still looking for a direct answer that would be accepted by the amateur rose grower.

Comparing this behavior with human life, perhaps a few losses from time to time may not be so unusual. It is true that dormant roses, from the very minute they are harvested in the nursery field until the time they reach the customer, require very careful handling all along the line. The nurseryman tries hard to give them this attention they deserve and still it may be that in storage or in packing there may be one or two plants out of many that are on the outside and unintentionally allowed to dry out. Sometimes unexpected hard freezes occur and the roots may be affected so that in the end a loss or two may occur, the real cause of which happened months before. It may be claimed the rose has a disease of some kind that might be present in the plant and still no outward evidence of the fact is shown; it is too late to do anything about it and consequently the plant is lost.

On the other hand, I know of many instances where a quantity of roses are planted and, because they are to be well watered after they are set, the planter feels it is not necessary to protect them from wind and sunshine; right then and there a few moments of exposure does severe damage to the roots. Then there is this question of over-feeding and over-kindness to a newly planted rose in order to grow the best roses in the neighborhood. Experienced planters know this causes "plant indigestion" and, while the rose will send out some leaves, most of them will soon sag and wilt because the roots themselves are not able to absorb so much food until they become better established. The mistake is often made, that a backward rose plant is given all kinds of fancy care and feeding in an effort to help it along. Usually the remedy lies in applying water and more water. Would it not be just as silly for the doctor to give us poor human beings a whole lot of rich food as soon as we report sick or indisposed?

Soil Cultivation

How deep can roses be cultivated without damaging surface roots?

It is really the understocks that we cultivate and feed, and they are comparatively deep-rooted. Much has been said and written about a permanent artificial mulch vs. soil cultivation, but I still feel there is no substitute for the latter. Using a flat hoe or pronged hoe to cultivate properly simply means keeping the upper few inches of soil loose; this depth may be three inches or more in light soils and I have never seen any evidence that such cultivation does harm to roses, but on the other hand is always beneficial because soil aeration is so important for all plants, not only roses. Moisture is held in the soil with the aid of a soil mulch so that the water does not continue to rise and evaporate at the surface, which happens when soil is allowed to remain packed and firm. I still believe that keeping the soil cultivated is a much better practice than applying a mulch such as peatmoss, buckwheat hulls, etc., in early summer with the idea that all cultivation troubles and weeds will be eliminated.

ROBERT W. EISENBROWN.

Fermate

Do you recommend Fermate for roses?

In the past gardeners have depended largely on sulfur or copper compounds to curb the two most prevalent fungus diseases of rose-leaves, namely black spot and mildew. Within the past few years the material sold under the trade name of Fermate (ferric dimethyl dithiocarbamate) has also proved to be an excellent fungicide for roses, fruit trees and other plants.

To prepare three gallons of Fermate spray, first add a teaspoonful of a suitable spreader such as Dreft or Swerl Synthetic Suds (sold in most grocery stores), to the three gallons of water. Then draw off a pint or so of this mixture into a quart jar, add 3 tablespoonfuls of Fermate powder and shake very thoroughly for a few minutes. Finally pour this mixture back into the water-spreader mixture and the spray is ready for application.

The Fermate spray should be used about as frequently as the older copper or sulfur sprays, namely every week or 10 days.

One of the principal advantages of Fermate over the older sprays is that it does not cause plant injury. Copper sprays injure roses if cool wet weather follows their application and sulfur compounds often damage rose foliage if the temperatures are above 85 degrees at the time of application.

Fermate is a black powder and when used on open blooms it tends to leave blackish, spotty areas.

It is compatible with other fungicides and insecticides commonly used on ornamental plants. An excellent combination spray that will control most insect pests, except aphis, as well as black spot and mildew is made up as follows:

Spreader .... 1 teaspoonful
Fermate .... .3 tablespoonfuls
DDT 50% ......1½ tablespoonfuls
Wettable sulfur
1½ tablespoonfuls

These ingredients should be added, as described above, to three gallons of water.

P. P. PIRONE.

Rooting Cuttings

How can cuttings of hybrid tea roses be rooted?

Rose cuttings may be rooted under glass jars. Select strong side growths. Pull them sharply from the main stems by pushing downwards. By so doing a piece of the cambium layer from the main stem will have adhered to the selected growth. This is usually spoken of as "taking a cutting with a heel."

The soil in which the cuttings are rooted should be of a sandy nature and preferably in a shady place. Three or four cuttings may be set under the same jar. They should be inserted firmly in the soil medium at least three inches deep. A cutting about six inches long is most desirable. Leaves on the wood that is to be in the soil should be removed. Place the glass jar over the cuttings and refrain from examining them by removing the jar. Evaporation is a problem even though the location is shady. If the stems remain green they are likely to root.

Cutting-wood taken from growths that have just finished flowering is at the best stage of growth for this method of propagation. When the wood is very young it is much more difficult to handle successfully.

Matured wood responds too slowly. When new growth is observed it is likely that roots have been made. Transplanting then to richer soil is desirable. Shade from strong sunshine for a day or two.

J. G. ESSON.

Five Graduates Receive Certificates

FIVE graduates in the New York Botanical Garden's two two-year courses for gardeners received certificates at exercises conducted in the Members' Room the evening of June 27. After a brief introduction by Dr. William J. Robbins, James G. Esson, Editor of the *Gardeners' Chronicle of America* and a graduate of the first class, in 1934, gave the address of the evening. Refreshments were served to the graduates, their families and friends, and members of the staff who attended.

Those receiving certificates in the Two-Year Course in Practical Gardening were Clara R. Fritz of Brooklyn, Frank Mihal of the Bronx, and Mrs. Josephine Newman Quigg of Brooklyn. In the Two-Year Science Course for Gardeners, certificates were granted to Henry W. Dunwoody of Rutland, Mass., who was a temporary gardener at the Botanical Garden from September 1944 until last March, and Mrs. Elsie Phelon Phillips of the Bronx, who has also been a temporary gardener since September 1944, working chiefly in the Thompson Memorial Rock Garden.

Mr. Esson's address is given below.

Address to the Graduates

By James G. Esson

WHEN we first start in a gardening career, it seems that the profession is filled with harsh, despotic enigmas. We are told this plant requires constant moisture, that one requires a humusy soil, this other must be fed at certain seasons, but we ponder and cannot probe the mystery any more than we can explain that, while the flowers or fruits may be colorful, there is often an albino form.

We look upon the experienced gardener who told us some of these things as a kind of wizard and look forward to the day when we, too, can do the miraculous things we imagine he can do. We admire the way he handles plants and seems to know from very instinct all their needs. And it is true that the best gardeners do seem to have the ability to succeed with plants that are new to them, succeeding in what is to the uninitiated a surprising way.

But it is only after knowledge and experience have been well molded that a gardener can with any degree of certainty succeed. Experience and study of books relating to plants tells him much of what he has to do. Experience, for example, will tell him at a glance that some plants are native to South Africa or certain parts of Australia and so experience and knowledge combined will tell him their cultural needs. That, of course, also applies in the raising of seeds. His knowledge, gained from books, of the kind of plant, the altitude at which it grows in its native habitat, and other hints as to its environment will be his guide to success.

Enthusiasm Succeeds

There are no born gardeners as some would have us believe. Only men born with enthusiasm and the desire to acquire this kind of knowledge succeed as gardeners. That is why one gardener sometimes succeeds with a plant when a less passionate one will fail. The gardener who loves plants of all kinds and who is constantly looking at them, no matter whether in the garden, the meadow or the mountain, is most likely to succeed.

He trains himself in the habit of observation and very soon will find himself unconsciously looking at plants. So intensive does this observance of plants become that in time he will have trained himself to see any untoward condition in the physical appearance of his own plants. In other words, he can enter a greenhouse and see immediately by the look of the plant if all is well or not. That is something that cannot be learned from books. Interest and experience are the only teachers. I have known many graduates of such institutions as this. I can think of two who are proof of what I have just said. One is full of enthusiasm and interest and has gone far; the other after many years can only be considered a plodding gardener, *not* having cultivated the seeing eye, and consequently losing the little interest with which he may have started.

The love of plants and the close scrutiny of them not only makes a man a good gardener but it has been the means of his turning his profession into a science. Keen observation is the very basis of science and art, and gardening is both a science and an art no less comprehensive and important than any science practised in the great field of biology.

Pitfalls of Routine

The fault with most professional gardeners is that they are the slaves of routine. They were trained to practice in given ways and have accepted these without questioning why. The result is that they do not seem to have the ability to apply their training outside of their experience. If you were trained, for example, to plant petunias as the sure flower for the hot summer months and have been contented to leave it at that, your usefulness is going to be limited. The best gardener is not contented with the fact that the petunia is one of the best hot weather plants. He has observed so many others that can be as useful as petunias that he will keep on experimenting all his life.

This is one way in which botanical and gardening books are extremely useful to the gardener. Without the use of them you become a dated gardener, able only to achieve that which you were trained to do in the beginning. I have known many gardeners who have actually believed that books on gardening were of no value. They claim that books are all done by people who were not themselves good gardeners and that one was simply a copy or a paraphrase of those that had already been published. We all admit readily that many good gardening books are done by authors who have not been trained in gardening. They may have excelled as amateurs specializing in a single genus. We will agree too, that many books should never have been published; but books broaden our outlook, widen our horizon and tell us what the other fellow is thinking.

Books and Experience

Apart altogether from the value of textbooks, have you ever tried your skill by sitting down with a copy of the *Botanical Magazine* and testing your knowledge by looking at the colored plates of plants and telling to which family they belong? Then by reading the text of such books, you can, as someone has so eloquently said, "Sit down and travel," since plants from every corner of the globe are described.

And too there are books devoted to one genus that cannot fail to help the skilled gardener. In fact, almost every important genus has one or more books to its credit. Rhododendron, magnolia, clematis, ceanothus, daffodil, lily and iris are some that immediately come to mind. These have been written by experts and all professional gardeners can benefit by reading them. The old theory that books are written by people who could not grow a row of beans is an erroneous and dangerous one. The interested gardener will soon observe which are written by those who know and by those who do not.

Reading books, however, is but one advantage. We should learn how to use them. I believe that just as in the tool shed the gardener knows where to look for the manual tools needed in the art of gardening, so he should be able to find and use the mental tools that will further his knowledge and improve his skill.

Understanding Plants

I spoke before of something that cannot be taught from books. We must agree, however, that the experience of others acquired from the written word will be of immense value to all of us. This, coupled with our own judgment, will usually be our guide.

For example, a good gardener may seek to know a new plant by the nature of its roots and from this he can at least guess closely as to its treatment. He knows that a surface-rooting plant is more likely to suffer from drought than one that has its roots tunneling deep into the soil.

An experienced gardener knows also that the kind of roots will give him a hint as to the time it should be transplanted. If a plant has thick fleshy roots he will guess rightly that before a likely spell of drought would be a bad time. Yet we find many gardeners attempting to transplant oriental poppies in April just as they would do with pansies; and usually if the poppies remain half alive through summer he does not account for it by his own inexperience. Of course, if a fleshy rooted plant is not very hardy and can be damaged by transplanting, it is always better done in the spring. On the other hand, surface rooting plants can usually be moved in spring without any damage at all. As a rule, plants may be moved at any time, provided they are protected from drought and cold until they are again established.

I have heard it said that plants may not be moved when in flower. This is not so, however. Indeed, azaleas and some others requiring thought as to color combinations are safer planted in flower. There are plants like the bearded iris that are best moved immediately after flowering, so that they have time to make good growth before next season's flowering. There are plants that require planting often because of their habit of growth and rooting. Perennial phloxes and asters are good examples. Bulbous plants should usually be planted before they start a new season's growth—and so there is something to be found out about every one of them. Madonna lilies start to grow soon after the growth has died down. *Lycoris squamigera* should be replanted in early September as soon as the flower stalks have died down. At that time we have found that new root growth will soon begin. These are a few of the more common examples and for the gardener there is an unending field from which he can gain experience.

Avoid Conservatism

My plea to you of this year's class is to avoid becoming conservative. No two employers will be found alike and so an elasticity of thought and action are of vital importance.

Here I believe I can say that gardening is very difficult work, much more difficult than the irresponsible amateur and the uninterested rich employer, or indeed in some instances, the administration generally, is apt to suppose. Amateurs play with the plants that amuse them and find them easy and delightful. They forget that the gardener must do many things that are not amusing—he must mow the lawn, sweep the paths, produce fruit and vegetables as well as flowers, and above all, he is expected not to fail in his attempts.

Perhaps this consciousness that he must not fail makes him averse to experiment, and it is rather obvious that the consciousness that he can fail if he chooses makes the amateur more eager for experiment.

If the gardener knows a sure way of producing the fruit, vegetables and flowers he is hired to produce, there is no good reason why he should experiment. Thus, there is a cause for horticultural routine. It is the business of criticism to be clever. It is the business of practice to produce, and practice will usually take the line of least resistance.

All of this can be converted to an unending debate. I would only emphasize—*do not become conservative,* and let your lives be governed thus. You will miss so much that is available. From real experience, I can recommend the suggestion I gave in the beginning—*train yourselves to look at plants,* and in time through study that you will find pleasant and by reading what others have written, you will see much that you are likely to be blind to today. Then if it is your lot to produce year in year out, you will at least be rewarded for your choice in art and science.

NOTICES AND REVIEWS OF RECENT BOOKS

The Botany of Toxic Pollen Producers

HAYFEVER PLANTS. Roger P. Wodehouse. 245 pages, illustrations, index, bibliography. Chronica Botanica Co., Waltham, Mass., 1945 Distributed by G. E. Stechert & Co., New York. $4.75.

Dr. Wodehouse, the outstanding student of pollen grain morphology, has now brought to us his new book, "Hayfever Plants," effectively complementary to his scholarly "Pollen Grains." It was the author's intent, in his own words, ". . . to interpret the botanical facts of hayfever in terms of their clinical significance," the clinical aspects of that field having been by far more thoroughly studied and reported upon than the botanical aspects.

The work consists largely of a descriptive enumeration of plants and plant groups (genera or families) actually known to be, or reputed to be, the causes of hayfever. In addition, the geographic distribution of these plants, the abundance and potency of pollen, and their period of pollination are given.

An introductory chapter offers a statement of basic flower anatomy sufficient to provide a background for discussion of the mechanism of pollination. Brief consideration is given to the toxicity of pollens. Greatest emphasis, however, is placed upon the method of collection and study. A brief statement on the preparation of pollen extracts and on their clinical efficacy by so critical a student of pollens would have been of great interest to the uninformed reader.

The book is well organized and attractively printed. All illustrations are by the author, and the drawings of pollen grains are accurate and beautiful. The habit sketches will be helpful to those seeking identity of possible hayfever plants.

An ample bibliography shows the author to have been familiar with the more important floristic works of the country, the monographic or revisionary studies, embracing the more important hayfever groups, where available, and a considerable amount of current literature largely by investigators of hayfever.

The present volume, unlike the classic "Pollen Grains" which resulted chiefly from the author's own researches, is essentially a collation of data from numerous botanical works and specific studies of hayfever. As such, it can be no more accurate than the sources of information.

If one is to find fault with the lack of consistency in nomenclature, in statements of distribution, or sources of species' identity, one must lay this fault largely at the door of the diverse character of the literature consulted, rather than at the discrimination of the writer. Dr. Wodehouse has been bedeviled by the dilemma of interpreting and presenting exhaustive data on plant distribution for the entire country—a task that few taxonomists or plant geographers are prepared adequately to do. Recourse to generalized statements of distribution in standard floras and to the perhaps unverified records of non-botanical investigators, has occasionally led to statements that are in error or misleading. A few instances, taken from those pages dealing with the floras that the reviewer knows most intimately, will serve to make the point, although there is no intention to labor the matter.

On page 207 one reads that "The common sagebrush . . . is absent from . . . western Idaho." But from where I now sit in the field in Owyhee County, Idaho, near the Oregon state line, I gaze over extensive slopes dominated by sagebrush.

Writing of greasewood (*Sarcobatus vermiculatus*), the range is given (page 102) as "throughout the Rocky Mountain region south of Montana." But greasewood is abundant to the westward of Utah and Idaho in the lowlands of Nevada, eastern Oregon, and eastern Washington.

Again, *Allenrolfia occidentalis* (page 102) is said to be "common in salt marshes in Utah, Arizona, and southern California, being particularly abundant along irrigation ditches," and on page 206: "*Allenrolfia occidentalis* is recorded by Anderson (1930) for parts of Utah. Elsewhere it appears to be unimportant or absent." But *Allenrolfia* likewise is abundant in saline areas of shallow water-table in Nevada and extends into southeastern Oregon, and irrigation ditches are hardly to be found in salt flats where the plant naturally abounds.

Salicornia ambigua, it is said (page 200), "occurs only in salt marshes principally along the coast." No mention is made of the Great Basin's cogener, *S. rubra,* which is abundant in low, moist, saline areas throughout this immense area, and particularly so in the vicinity of its most populated area, namely, Salt Lake and Ogden, Utah.

And, lastly, *Acer Negundo* (page 206) "is reported to be the commonest tree in Salt Lake City . . ." True, it is common in Salt Lake, but it is abundant, growing naturally in all the larger water-bearing canyons of the entire central and most populated parts of Utah, a fact to which the reviewer's own sensitive nose has made him most uncomfortably aware.

More consistent consultation with botanists familiar with the floras of discrete areas might have to some degree obviated such minor errors, ambiguities, or omissions. These faults, so much the responsibility of taxonomists, do little to impair the great wealth of accurate and important data provided, and detract inappreciably from the real value of the book, which should receive wide use and general approbation.

BASSETT MAGUIRE.

Native Edible Plants

INDIAN HARVEST. Wild Food Plants of America. Jannette May Lucas. 118 pages, illustrated by Helene Carter. J. B. Lippincott Company, Philadelphia and New York. 1945. $2.

Many plants known to have served the Indians as food are presented more or less in the order in which they became available as the seasons progressed. Interesting information about them, their history, legends, use and recipes are included. The illustrations are really beautiful and the little book very attractively planned. With the amount of work which went into it, it is too bad that more care was not taken with the actual writing. Far too many clumsy sentences, meaningless phrases and dangling constructions occur, which make the reading rough going.

For example:

"It was not grass leaves, and only in times of famine the roots, which the Indians used for food."

"Earlier than the lilies, summer brought another plant—or rather several species of another plant—to serve as food for the Indians, although to us they are only a nuisance."

"Whether called cane or merely grass the seeds of all the American grasses ripen with the summer's warmth."

"The Buffalo Berry is no western cousin of any eastern fruit."

THERESA RICKETT.

Notes, News, and Comment

Century Plant. The Garden's large blue century plant (*Agave neglecta*) opened the first of its flowers above the roof of the New World Succulent House July 15. For several days, only the buds in the lowest cluster of the raceme expanded. The flowering period lasted four weeks, as the opening of the buds proceeded from the base toward the tip of the tall inflorescence.

Meanwhile, the smaller century plant (*Agave rupicola*), which had confined itself within the walls and roof of the conservatory, had come into full flower. The stalk of this was 8 ft. 6 in. high. This plant was grown from seed acquired in 1923 from the botanical garden at La Mortola, Italy. The age of the larger plant is not known.

Staff. Dr. W. H. Camp has been named Associate Curator, effective as of July 1. He first became a member of the Garden's Staff as Assistant Curator in September 1935, after doing special work at the Garden on the genus *Vaccinium* for several months during the preceding winter. In addition to his taxonomic work, chiefly on the Ericaceae, and his studies on the concept of the species and on evolution and continent migration, he has carried on expeditions in southern Mexico, the southern Appalachians, and Ecuador during his years at the Garden, and during the war was absent on leave for three years for government work on economic plants of strategic value.

Student. Amy B. H. Greenwell, a former student at the University of Hawaii and at Stanford University, came to the Garden July 10 to study Hawaiian botany and is now collaborating with Otto Degener in the writing of Book 5 of his *Flora Hawaiiensis.*

Radio. For the Garden's radio program of June 14 over WNYC, Mrs. John D. Beals, Jr., took the place of Mrs. Melvin Sawin, with whom she is co-chairman of the Garden's lecture committee, organized by the Manhattan office. Marie S. Tufts of the Manhattan office assisted on the program, which was entitled "Your 230-Acre Garden."

Visitors. Ady R. da Silva of Curitiba, Brazil, who has been working for the past two years in the laboratory of Dr. E. C. Stakman at the University of Minnesota on rusts and the breeding of rust-resistant crop plants, stopped at the Garden to confer with several staff members June 7 on his way back to Brazil. Other Brazilian visitors of recent weeks, all of Rio de Janeiro, have included Luzia Thomas, Mrs. Flora de Campos Porto Castaño Ferreira, daughter of P. Campos Porto, the recently retired Director of the Botanical Garden of Rio de Janeiro, and her cousin, Rodrigo Claudio de Campos Goulard.

From the Hawaiian Islands, directly or indirectly, have come several other visitors, in addition to Amy Greenwell, who has come to the Garden to study: Seth S. Lau, an orchid fancier of Honolulu, Philip J. Westgate of Homestead, Fla., and Harold Shigeura, both formerly of the University of Hawaii, and Lucy Cranwell Smith of Cambridge, Mass., formerly of Auckland, New Zealand, and at one time a collaborator with Carl Skottsberg on Hawaiian botany.

Esther Zimmer, former student and volunteer worker at the Garden, stopped by in July on her way from California, where she has been working on the bread-mold, *Neurospora,* in the laboratory of Dr. G. W. Beadle and has just received an M.A. degree at Stanford University. She is going to the Osborn Botanical Laboratory at Yale, where she will work under Dr. E. L. Tatum.

Thorvaldur Johnson of the Dominion Rust Research Laboratory at Winnipeg and John J. Miller of the Dominion Laboratory of Plant Pathology at St. Catherine's, Ontario, stopped at the Garden after giving papers at a conference at Cold Spring Harbor in July.

Th. van Eck of the General Agricultural Experiment Station at Buitenzorg, Java, who for three and one-half years was a prisoner of war in Singapore, visited the Garden July 15.

Among other visitors have been R. Maheshwari of the University of Dacca, India; S. B. Cober of Angola, West Africa; H. Pittier of the Botanical Institute at Caracas, Venezuela; Cosette Marcoux, Montreal Botanical Garden; Veronica J. Sexton, Librarian for the California Acadamy of Sciences; Mr. and Mrs. Worth A. Brown, Capitola, Calif.; Nell A. Unger, Portland, Oregon; Earl Camp, Texas Technical College; John P. Miller, Chicago Natural History Museum; C. A. Weatherby, Gray Herbarium, Cambridge, Mass.; Harry K. Phinney, Yale; John D. Dwyer, Albany College of Pharmacy at Union University; John Bachman of Ventura, Calif., a former student gardener, with Mrs. Bachman; Major Thomas Laskaris, now of Newark, Delaware, a former fellowship student who worked on diseases of delphinium under Dr. B. O. Dodge; and Edwin M. Betts and J. L. Edwards of the University of Virginia.

Scholarship. Françoise A. Kelz, a Barnard graduate of 1944 who since then has been graduate assistant in botany at Wellesley and at the Columbia University College of Pharmacy, has been granted a one-month scholarship this summer to work on sterilities and fertilities under Dr. A. B. Stout.

Volunteer. Margaret Vicario, a student at the Chapin School in New York and daughter of Carlo Vicario, a member of the Garden, is doing two days a week of volunteer work in the plant pathology laboratory under Dr. B. O. Dodge during her summer vacation.

Mrs. Andrew Carnegie

THE only remaining contemporary representative of a Founder of the New York Botanical Garden, Mrs. Andrew Carnegie, died June 24 at the age of 89. When the Act of Incorporation was presented to "The People of the State of New York, represented in Senate and Assembly" in 1891, the names of 48 prominent men were listed as comprising the "body corporate," or Corporation, of the New York Botanical Garden. Among these names was that of Andrew Carnegie, whose contribution to the founding of the Garden had been $25,000. All of these men are now gone; and so far as is known, all of their wives have gone too. Last year, during the Fiftieth Anniversary Garden Week Celebration, Mrs. Andrew Carnegie was the guest of honor on Founders' and Members' Day, as being the only remaining representative of that noteworthy body. She was accompanied that day by her daughter, Mrs. Roswell Miller, who has long been a member of the Garden and of the Corporation and Advisory Council.

Over a period of years, Andrew Carnegie continued to make gifts to the New York Botanical Garden, presenting $5,000 to the Science and Education Fund, besides $1,250 in five instalments designated for other special purposes.

Mrs. Carnegie herself, whose Manhattan garden at 2 East 92nd St. was always notable, had been a Fellow for Life in the New York Botanical Garden since 1926. Previously she had made five contributions totaling $950 for special funds, and on June 1, 1945, she gave the Garden $1,000 for its Fiftieth Anniversary Fund. Mrs. Carnegie became a member of the Garden's Advisory Council in 1921 and of the Corporation ten years later.

Plants from Africa

PROPAGATING material of a number of trees and herbaceous plants from the Belgian Congo and from Nyasaland, where L. J. Brass is collecting for the Garden on the Vernay Nyasaland Expedition, has been sent by air to the New York Botanical Garden. Trees from the Belgian Congo include *Chlorophora excelsa* (called KAMBA, KAMBALA, or Chêne d'Afrique), giving a hardwood construction timber; *Erythrina Gillettii,* a small tree with corky bark; *Newboldia laevis* (PESE-PESE), used for living fences; *Erythrophloeum guineense,* the bark of which is used by natives as an ordeal poison; and a species of *Citropsis,* which in the Congo is used as an understock for citrus fruits.

Seeds and cuttings of herbaceous plants collected on Zomba Plateau in Nyasaland include two species of *Crassula,* a *Gladiolus, Begonia, Dracaena, Helichrysum,* and *Streptocarpus,* and plants from the Lily, Mint, and Orchid families. Other orchids which Mr. Brass has collected are being kept alive at the Grahamstown Museum. Cape Province, until he is ready to return.

Cover Picture

Photographed at the New York Botanical Garden, the specimens of *Hypericum Moserianum* shown on this month's cover were blooming a year ago in a bed near the entrance to the Museum Building. The flowers are shown here in approximately natural size.

Hypericum Moserianum is a hybrid between *H. calycinum* and *H. patulum,* developed at Versailles, France, in the Moser nursery about 1887.

BROADCAST

By E. E. Naylor

IN PLACE *of the usual style of converting the dialogue of a radio script into paragraphs of monologue, as has been done previously in presenting the Garden's broadcasts to Journal readers, the program entitled "Sugar is the Foundation of all Life" given June 28, in which exceptional interest was shown, is being printed here exactly as it was spoken over the air.*

Sugar is the Foundation of All Life

ANNOUNCER—The New York Botanical Garden is on the air with one of its bi-weekly programs on topics concerned with plant life. Today's subject is SUGAR—a most important one, not only because of its present scarcity, but because, according to the title announced by the New York Botanical Garden, *"Sugar is the foundation of all life."*

Your speaker will be Dr. E. E. Naylor, of the Botanical Garden's scientific staff. He will be questioned by Celia Kramer, also an employee of the Garden. But before they come to the microphone, we will have a word from Carol H. Woodward, Editor of the Journal of the New York Botanical Garden, who has arranged this program for you. Miss Woodward . .

WOODWARD—In some of our previous broadcasts we have emphasized the fact that plants are essential to all life on the earth. Today we are telling you that *sugar is the foundation of all life.* Both statements are true, and there is a closer connection between them than you may realize, because all the sugar in the world comes originally from plants, and because the life process of *every* green plant involves the production of sugar within the plant itself.

KRAMER—Miss Woodward, I have often heard you and Dr. Naylor and others at the Garden say that without green plants, mankind could not live. Can you explain this statement and tell me whether it is actually true?

W—Dr. Naylor . .

N—It is certainly a true statement. We and other members of the animal world are absolutely dependent upon green plants, not only for all of our foods and vitamins, but also for the very oxygen we breathe.

K—Do you mean to say we could not draw a breath if there were no green plants?

N—Yes, that is correct. We would actually suffocate, if we did not first starve to death or succumb to a combination of deficiency diseases. For all the food we eat, whether it be fruits, grains, or vegetables, fish, fowl, or meat, comes directly or indirectly from plants.

K—You didn't mention sugar in that list of foods, Dr. Naylor, yet it was just implied that sugar is the most important substance in the world. Where and how does sugar come into the picture?

N—Well, the answer to your question is simple enough, for the green plants make sugar, and green plants are essential to life; but an explanation of the answer is more complicated.

K—But I still would like to know. Won't you please try to explain it to me?

N—All right, I'll do my best.

Plants, you see, are like miniature factories. Those which contain the green pigment, chlorophyll, have the power to manufacture sugar within their leaves. This sugar is made from two simple materials—water and carbon dioxide. The factory works only in the daytime—or in the presence of light. The process of sugar manufacture is called *photosynthesis*—meaning putting together, or building, with the aid of light. You remember some of your chemistry from college, don't you?

K—Yes, a little of it, at least.

N—Then you may remember that water is composed of two parts of hydrogen to one of oxygen, and that carbon dioxide contains one part of carbon and two of oxygen.

K—Yes; that's H_2O and CO_2

N -Correct. Now ordinary sugar is $C_6H_{12}O_6$. That is, there are 6 parts of carbon, 12 of hydrogen, and 6 of oxygen. So, if we multiply our water and carbon dioxide by 6, then add them together, we have 6 parts of carbon (from the carbon dioxide), 12 parts of hydrogen (from the water), plus 18 parts of oxygen (from the two together). But sugar requires only six of these 18 parts of oxygen, so the rest is set free in the air. This is the oxygen we breathe.

K The oxygen then is the by-product. Is that right?

N—Yes, and the sun with its energy provides the motive power in the leaf factory. The *chlorophyll* or green coloring matter in the plants, helps to transfer this energy to the carbon dioxide and water, out of which the sugar is compounded.

K—But how do the leaves of the plant get this carbon dioxide and water?

N—Near the tip of every root is a fine, fuzzy coating of root hairs. These are difficult to see when a plant is pulled from the ground, but they are there, just the same. The water from the soil enters the plant through these delicate hairs, passes along the length of the main root to the stem, and finally moves out into the green cells of the leaf.

K—Then where does the carbon dioxide come from?

N—The carbon dioxide travels a very different road. This raw material is found in the air. You are familiar with carbon dioxide gas, aren't you?

K—Oh, yes. Isn't it the gas that gives the sparkle to champagne—and also to soft drinks at the soda fountain?

N—Yes, and it is also the gas returned to the air when animals (and human beings) breathe, and when fuels burn. Particles of this gas enter the leaves of a plant through microscopic openings, or pores, called stomata. There are thousands of these pores on each square inch of leaf surface. The doors to these stomata open and shut under different conditions of light, temperature, and moisture. Once inside the leaf, the carbon dioxide unites with the water to form a weak solution of carbonic acid. . .

W—And you don't mean carbolic acid.

N—No, *carbonic*, with an *N*. This weak carbonic acid solution moves into all the green cells of the leaf.

K—And is sugar made only in the leaves?

N—No. Some plants, such as the cacti and some of the euphorbias, have no true leaves, so in them the sugar is made directly beneath the surface of the green stem.

K—But some plants that I have seen in the greenhouses have red or brown or purple leaves.

N—Yes, and in the beautiful copper beech, outdoors, you can scarcely see a trace of green. But it is there all the time; it is merely covered over with a translucent pigment. The chlorophyll is contained in very minute bodies called *chloroplasts* — that is, *green bodies*. These chloroplasts occur mostly in a special layer of cells directly beneath the supper surface of the leaf.

K—Oh, then is that the reason why the upper side of a leaf is often of a more intense green than the lower side?

N—Exactly. You are a very observant young lady. It is within the chloroplasts near the upper side of the leaf that the carbon dioxide and water actually come together, and, with the aid of light, form the basic food . . . SUGAR.

K—But again . . . why do you call sugar *basic?*

N—Sugar is basic because from it all other foods are derived. With a rearrangement or with the addition of other chemical elements, starches, proteins, fats and oils, and other substances are built inside the plant. Also, sugar furnishes our bodies with *energy.* This is the energy which keeps us warm and makes it possible to move. And this energy is originally stored in the sugar that is made in the leaf.

K—But if I nibble a leaf it doesn't taste sweet.

N—No. In the first place, a very small percentage of sugar is present—except in such plants as sugar-cane or such fruits as bananas and strawberries. In the second place, most of the sugar manufactured is instantly converted into starch and other products.

K—Is the sugar made in the leaves like the sugar we have on the table?

N—It may or may not be. Many different types of sugars are formed in plants. One of the principal kinds is *glucose,* or grape sugar. Then there is *fructose,* or fruit sugar, sometimes called levulose; and also *sucrose* or cane sugar. Cane sugar is present in most plants and is especially abundant in sugar-cane, sorghum, the sugar beet, and the sugar maple. This, of course, is the kind we use on the table.

K—What happens to the sugar after it is made in the plant?

N—Well, any one of many things may happen. The sun's energy contained in the sugar is required, first of all, for the plant's growth and increase of complexity and the formation of new parts. The rapid growth of a fern, or the opening of a flower, demonstrates a use of the energy that a plant derives from the sugar it makes. Some of this energy is used to build up its architectural structure—like the veins which hold up the broad surface of a leaf, or the woody trunk of a tree which supports the great crown of leaves and branches.

A very large part of the plant's sugar, as we have said, is converted at once into starch. If you have taken a beginning course in science, I am sure you have performed experiments to prove that there is starch in leaves.

K—Oh, yes.

N—Starch is often stored in large amounts in other parts of plants, such as in root vegetables, like turnips and beets; in tubers such as potatoes, and in seeds, such as wheat and corn. In some plants, after undergoing chemical changes, the converted sugar is stored as fats, or oils, as in olives and coconuts.

Starches, fats and oils are made in the plant from sugar alone, by a series of chemical changes in this unique and marvelous factory, but proteins are made from sugar plus certain salts of nitrogen, sulfur, and sometimes phosphorus.

K—Where do these other chemicals come from?

N—They are absorbed by the root system from the soil. Dissolved in the water which enters the root hairs, they are carried through the stem to the factories in the leaves. The resulting proteins are often stored in the seeds or fruits, as peas and beans.

K—Didn't you say that vitamins are also made by plants?

N—Yes, that's right. You may buy yours from the drugstore, but they are all initially made by living plants. As with the other substances, they are manufactured within the plant by the combination of certain chemicals with sugar as the basic element. By still other transformations, the plant's sugar goes to form many useful drugs. From cinchona bark comes quinine. Digitalis, morphine, belladonna, and strychnine are only a few of the other drugs which come from plants.

K—Dr. Naylor, we seem to depend on plants for most of our vital necessities . but I didn't know before that sugar played such an important role.

N—Sugar is the basic organic substance formed in the plant during photosynthesis from the water and carbon dioxide that are drawn into the leaves. . . But I haven't finished yet, by any means, in telling of the products made by and in green plants.

K—Then still other things may happen to the sugar?

N—Oh, yes! You no doubt like the odor of a rose, or the sweet scent ot the honeysuckle.

K—Indeed I do.

N—Well, the fragrance of flowers comes directly from the sugar made in the green parts of the plant. The nectaries of the flower also hold enough sugar to attract bees and other insects. In addition, the color of flowers and fruits is made from pigments that are developed from sugar.

K—That is very interesting . . . but I still want to know more about plants that store sugar *as sugar* in large amounts.

N—Man depends chiefly on only two for the bulk of his sugar supply. One of these is the sugar-cane, a kind of giant grass. The other is the sugar beet, whose sugar chemically is identical with that found in the stalk of the sugar-cane. This sugar, which gives us energy when we consume it, also gives the plant the energy with which to grow.

K—I see.

W—Dr. Naylor -I hope you are not going to overlook the important energy from plants that is used to run our factories and to heat our houses and office buildings in winter.

N—That is certainly worth mentioning. . .

K—How do you mean. . .

N—Why, the energy in coal and petroleum is the sun's energy that was stored in plants millions of years ago. These plants have become fossilized and greatly changed in chemical composition, but the energy from the sun is still there, safely stored through the aeons of time that have elapsed. And from these remains of plants of an earlier time come our greatest sources of industrial power today.

K—Green plants, then, of the past as well as the present, seem to provide us with our means of life today . . . and the fundamental substance in all life seems to be sugar.

N—Yes, in the final analysis, it is the sugar made by green plants with the aid of light which provides both the plant and animal world with energy from the sun in a usable form. It also serves as the source of the food that keeps us alive, and, as a by-product, with the oxygen we breathe. We . . . and other animals . . have no chlorophyll, or green coloring matter, and therefore can not produce sugar or oxygen, no matter how long we may bathe in the sun.

So, the next time you see a leaf with the sun shining on it, pause and consider . . . it is more than something green; it is *Nature's greatest and most efficient factory* at work. Its products are essential, not only for the plant, but for all living things, including ourselves.

THE NEW YORK BOTANICAL GARDEN

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

An Illustrated Flora of the Northern United States and Canada, by Nathaniel Lord Britton and Addison Brown. Three volumes, giving descriptions and illustrations of 4,666 species. Second edition, reprinted. $13.50.

Flora of the Prairies and Plains of Central North America, by P. A. Rydberg. 969 pages and 601 figures. 1932. Price, $5.50 postpaid.

The Bahama Flora, by Nathaniel Lord Britton and Charles Frederick Millspaugh. 695 pages. Descriptions of the spermatophytes, pteridophytes, bryophytes, and thallophytes of the Bahamas, with keys, notes on explorations and collections, bibliography, and index. 1920. $6.25.

North American Cariceae, by Kenneth K. Mackenzie, containing 539 plates of *Carex* and related plants by Harry C. Creutzburg, with a description of each species. Indexed. 1940. Two volumes, 10¾ x 13½ inches; bound $17.50; unbound $15.50.

Keys to the North American Species of Carex by K. K. Mackenzie. From Vol. 19, Part 1, of *North American Flora.* $1.25.

Food and Drug Plants of the North American Indian. Two illustrated articles by Marion A. & G. L. Wittrock in the Journal for March 1942. 15 cents.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal, 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 15 cents.

The Flora of the Unicorn Tapestries by E. J. Alexander and Carol H. Woodward. 28 pages, illustrated with photographs and drawings; bound with paper. 1941. 25 cents.

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Succulent Plants of New and Old World Deserts by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. Second edition 1944. 50 cents.

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Addisonia, annually, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Now in its twenty-second volume. Subscription price, $10 a volume (four years). Not offered in exchange. Free to members of the Garden.

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

AUTUMN EVENTS AT THE GARDEN

Chrysanthemum Show and Program, Oct. 25-27

For details of the program, see the opposite page.

Radio Programs

Beginning the first of October, the Garden's radio programs over Station WNYC (830 on the dial) *will be given on alternate* Wednesdays *at* 5:45 *p.m.*

Sept. 6 *Food from Field and Forest* — *Milton Hopkins*, Science Editor, Henry Holt & Co.

Sept. 20 *Some Interesting New Jersey Gardens* — *Nancy Ruzicka Smith*, Gardener—Writer, Livingston, N. J.

Oct. 2 *Plant Products from Brazil* — *José Garrido Torres*, Assistant Director, Brazilian Government Trade Bureau

Oct. 16 *Suitable Trees for the Home Grounds* — *J. H. Beale*, Superintendent of the Arboretum, Boyce Thompson Institute

Saturday Afternoon Programs

3 p.m. each Saturday in the lecture hall. Free.

Oct. 5 *"They Said it with Tulips"* and *"Holland Blooms Again"*
Two motion picture films in sound and color
With comment by *E. L. D. Seymour*
Horticultural Editor, American Home

Oct. 12 *Exploring in Southern Mexico*
Illustrated with Kodachromes
E. J. Alexander
Assistant Curator

Oct. 19 *Wild Flowers of the Jersey Hills* — *Harold N. Moldenke*, Associate Curator

Members' Day Program

Oct. 2
Opening of exhibit of 19th century flower paintings by Pancrace Bessa
With comment by *H. W. Rickett*
Bibliographer

Courses

Field Botany, G. L. Wittrock, Instructor, 1:30 **p.m. Sept. 14**
Nature Study for Teachers, E. E. Naylor, Instructor 4 **p.m. Sept. 18**
Plant Pests and Diseases, Chris G. Schmitt, Instructor, 8 **p.m. Sept. 30**
Ecology and Plant Geography, W. H. Camp, Instructor, 9 **p.m. Sept 30**
Cultivation of Trees and Shrubs, J. H. Beale, Instructor, 8 **p.m. Oct. 10**

TABLE OF CONTENTS

September 1946

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.50. Single copies 15 cents.

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THE NEW YORK BOTANICAL GARDEN

VOL. 47 SEPTEMBER 1946 No. 561

Chrysanthemum Show and Program Oct. 25-27

REPEATING the successful autumn event of 1945, the New York Botanical Garden is again co-operating with the Eastern States Chrysanthemum Society in presenting a program on chrysanthemum culture, combined with a three-day indoor and outdoor display. The indoor display will comprise the competitive exhibits staged by the Society; the outdoor display will be the Garden's own collection of hardy chrysanthemums, which are expected to be at their peak at that time.

Representatives of the Garden and of the Chrysanthemum Society will conduct a tour of the Garden's plantings at 11 a.m. the opening day. A box luncheon, each person bringing his own, will precede the afternoon program.

S. L. Emsweller, Principal Horticulturist at the Plant Industry Station of the U. S. Department of Agriculture at Beltsville, Md., will be the principal speaker on the program to take place at 2:30 Friday afternoon, Oct. 25. His talk will be followed by a clinic on chrysanthemum culture and control of diseases and pests, to be led by T. H. Everett, assisted by Alex Cumming, B. O. Dodge, Stuart Longmuir, and Louis Pyenson.

At the close of the program, a new chrysanthemum will be dedicated to Mary MacArthur, daughter of Helen Hayes and Charles MacArthur. The flower is a creation of V. R. de Petris of Grosse Pointe Farms, Mich., chrysanthemum hybridizer. The presentation will be made by Ernest L. Scott, President of the Eastern States Chrysanthemum Society.

Tea will then be served in the Members' Room for members of the two co-operating organizations.

On Saturday and Sunday, the exhibits in the Museum Building will be open to the public without charge from 10 a.m. to 5 p.m ; the Garden's outdoor displays will be on view daily until 6:30 p.m.

Three Neglected Andean Tubers

By W. H. Hodge

Illustrated with photographs by the author

THERE is something about the Andean environment that has favored the evolution of tuber-producing plants, for in the highland valleys of that mighty cordillera four important species, representing four different genera, have been grown by ancient aboriginal civilizations for their edible tubers. One of this quartet, the familiar potato (*Solanum tuberosum*), has wandered to many parts of the globe to become not only the world's most important tuber crop but also one of the most valued of all food plants. On the other hand, the potato's companions—the OCA (*Oxalis tuberosa*), MELLOCO (*Ullucus tuberosus*), and AÑU (*Tropaeolum tuberosum*)—have remained in their homeland as species once widely known but being gradually abandoned. This is unfortunate for, although these three tubers may not merit comparison with the potato, they do possess flavorsome qualities. And who can tell where these plants might be in the world's esteem had they received the wide distribution and selective breeding that has been accorded the potato?

The oca, melloco and añu are plants of the high Andes, producing their best crops in the potato zone—that is, at elevations lying roughly between 9,000 and 14,000 feet. However, the trio lacks the extensive latitudinal range of the potato in South America, and none is to be found for any great distance south of the Bolivian highlands, at approximately 20° south latitude. The three species thus enjoy the short daylight hours characteristic of low latitudes, and their successful introduction to north temperate regions with the long daylight hours that prevail during the growing season is problematical.

Relative of the Wood-Sorrel

Of these lesser tubers the oca (or occa)[1] is the most popular species today, with melloco a close runner-up. In several widely separated areas (especially in the Colombian Department of Nariño that of Puno in Peru) the oca is nearly as important as the potato. The most intensive center of oca culture known to me is the village of Cuyo-Cuyo, which lies at the head of the Sandia ravine just east of the northern end of Lake Titicaca. From Cuyo-Cuyo, which is situated at an elevation of 11,500 feet in the bottom of a narrow, steep-walled QUEBRADA, or gully, ancient terraces rise in series for several thousand feet, making an impressive display on the precipitous mountainsides. They indicate that the valley has long been an important agricultural site. Today ocas are the principal crop grown on these terraces.

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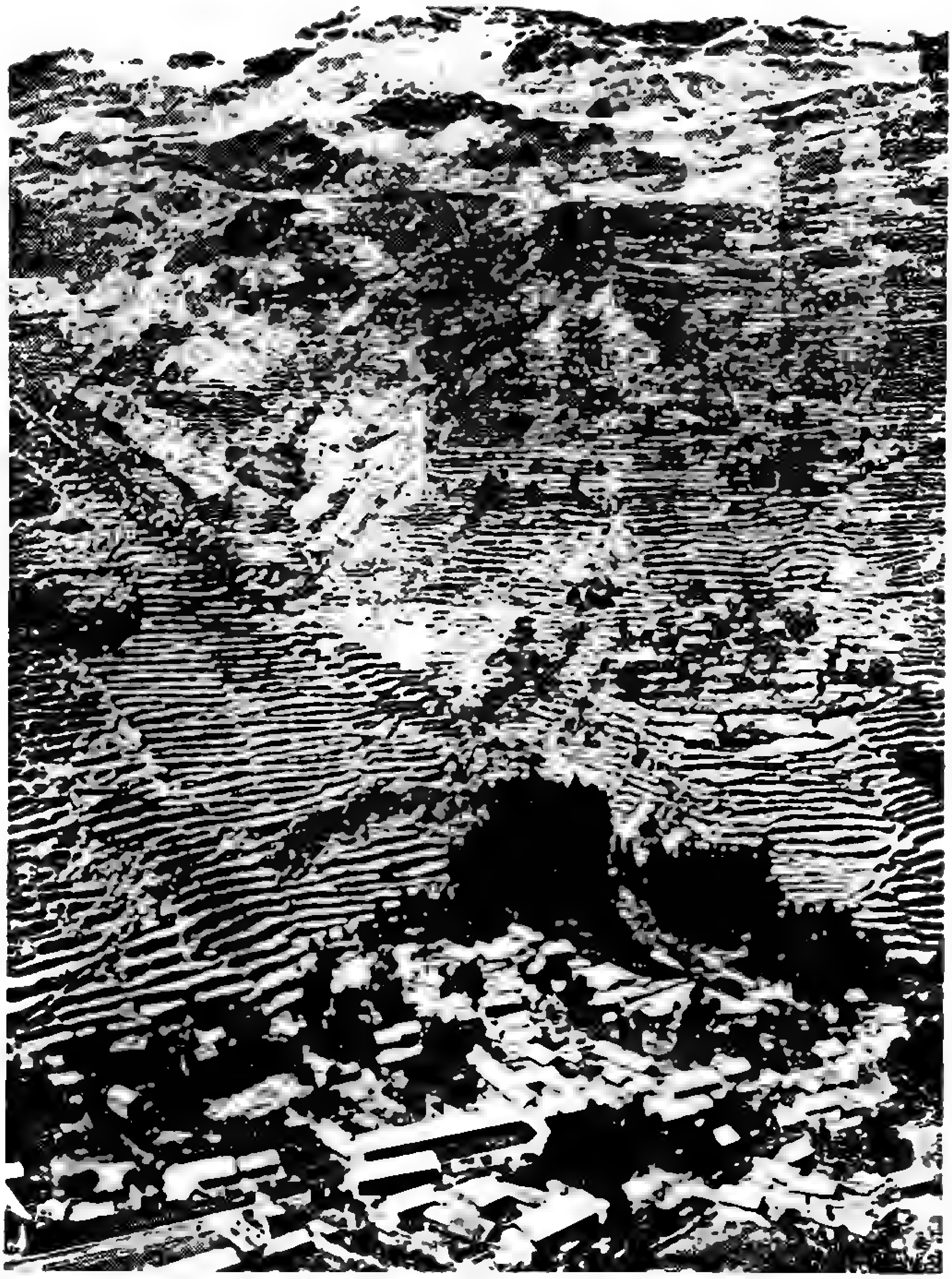
[1] Around Bogotá *Oxalis tuberosa* is called HÍBIA, while in the Venezuelan highlands of Merída the commonest name is CUÍBA.



OLD INCAIC TERRACES ON THE MOUNTAINSIDE AT CUYO-CUYO

These spectacular series of ancient terraces, in the Department of Puno, Peru (only a portion of which can be seen here), are used today, much as they were originally, for the cultivation of the indigenous tuber plants as staple food crops.

Oxalis tuberosa is an upright, branching, succulent herb, more or less the size of a potato plant. The species is a cousin of our weedy species of *Oxalis,* or wood-sorrel, and like them possesses reddish-colored stems. It has trifoliate leaves and orange-yellow flowers whose petals are generally marked with fine purplish lines. The plant does not appear to set seed, a characteristic not uncommon in species long cultivated by man. Thus, like the potato, the oca is reproduced by means of its tubers, which are cut into several sections at the time of planting. They average 2 to 3 inches long and 1 to 1½ inches in diameter, and are cylindrical to turbinate in shape and at times bifurcate. Scale leaves conceal the deep-set eyes.

Several varieties of oca are recognized by the Peruvian Indians. A bitter form with white tubers, called CJAYA-OCA, is used to prepare CJAYA, or oca CHUÑO, a dried product common in the regions of the ALTIPLANO, or high plain. Of sweet ocas there are several color varieties: SAPALLU-OCA with yellow to orange tubers which bear red-margined scale leaves; CHACHAPEA-OCA with grayish tubers; PAUCCAR-OCA and LLUCHCHO-OCA which are reddish-colored; and MESTIZA-OCA with white tubers. Hill[2] notes that in Bolivia the color varieties are associated with floral differences, and that yellow ocas have long-styled flowers; white ones, medium-styled flowers; and red, short-styled flowers.

Oca is planted at the beginning of the rainy period. At Cuyo-Cuyo this date falls in August or September, but elsewhere in the Andes planting may be delayed several months, depending on when the rains arrive. The crop is treated exactly like potatoes, the plants being hilled up with deep intervening trenches which run down the slope. The species is often interplanted or rotated in following years with potatoes, mellocos, or beans called HABAS (*Vicia faba*). When grown at lower elevations, as in Ecuador or Colombia, one often sees ocas planted alternately with maize. In Peru the plants are cultivated with crude hoes or with the primitive foot-plow called TACLLA. In eight months the tubers are mature and during April and May whole Indian families, from grandparents to children, are seen on the terraces at Cuyo-Cuyo harvesting the colorful crop.

[2] Hill, Arthur W. The Oca and its varieties. Bull. Misc. Inform. Kew. 169-173. 1939.

CULTIVATING, HARVESTING, AND PREPARING THE OCA

(On opposite page)

Upper left: A flowering oca plant (*Oxalis tuberosa*) growing in the Andes near Quito, Ecuador. *Upper right*: Digging ocas and papaslisas (mellocos) at Cuyo-Cuyo, Peru. *Lower left*: Temporary rock pens in the brook at Cuyo-Cuyo. Oca tubers from which chuño is to be made are placed to soak in the cold running water immediately after they are harvested. *Lower right*: A field of oca plants in cultivation near Concepción in Central Peru.

CULTIVATING, HARVESTING, AND PREPARING THE OCA
(For description see the opposite page)

The starchy oca tuber is typical of the genus *Oxalis* in containing crystals of calcium oxalate. These are especially abundant in the bitter variety, and their presence makes it necessary to cure or ripen the tubers before they can be eaten. Mellowing is brought about by placing them in the sun for several days, after which the ocas, now sweet, may be eaten—either raw or, more commonly, boiled in the stews and thick soups that constitute a basic portion of the SERRANO's diet. Ocas have a very pleasant flavor when prepared in this fashion, and remind one of boiled sweet potatoes; they are also delicious prepared like candied sweet potatoes. The sweet varieties are sometimes split longitudinally and placed in the sun to dry to form a product called CAVI, which is cooked slowly in a crude double boiler and afterwards eaten with honey or homemade cane syrup as a dessert.

Inasmuch as harvests come only once a year, the Indians of the high Andes must store their tuber crops in a dessicated form called CHUÑO, which will keep indefinitely without spoiling. Chuño can be made by essentially the same method either from potatoes, from mellocos, or from ocas. The bitter variety of *Oxalis* makes the best oca chuño and for this reason this form constitutes the greater part of the Peruvian crop.

Bitter ocas earmarked for chuño are submerged in water immediately after harvesting and are left there for three to four weeks, or until the eyes take on a purplish color. At Cuyo-Cuyo temporary pens of rocks are built in the swift mountain stream which courses through the village, and during May and June quantities of tubers may be seen submerged in these bins. After soaking, the tubers are spread out in the open in any available area for about a week, and during this period they receive periodic freezing by frost at night and drying by the sun during the day. The flesh of the wizened, dessicated product becomes grayish-white in color. Chuño can be stored for long periods, but like most dried foods it has to be soaked overnight in water before it can be cooked.

Melloco, Rival of the Potato

Next to ocas in importance are the tubers of *Ullucus tuberosus.* In certain areas, (notably the Departments of Nariño in Colombia and Cuzco in Peru) *Ullucus* is outranked as a crop plant only by the potato. The species goes under different names in various parts of the Andes, but one of the most common of these is MELLOCO.[3]

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[3] Caldas modified the Quechua appelation, ULLUCU, to give us the generic name, but in Ecuador and in the neighboring regions of Colombia (Nariño) the plant is now called MELLOCO. At Cuzco it is known as OLLUCO, while in southern Peru and Bolivia the names LISAS or PAPASLISAS are invariably used. CHUGUAS and ROJAS are the local names around Bogotá; while Pittier (in his "Plantas Usuales de Venezuela") states that in the Venezuelan Andes near Merída the species is called RUBA or TIMBOS.

THE MELLOCO AS IT GROWS AND IS HARVESTED IN SOUTH AMERICA
Above: A young plant of melloco (*Ullucus tuberosus*) in an Indian garden near Quito. The species was originally described from this part of Ecuador. *Below*: One of the forms of rójas or melloco in the Bogotá market.

Melloco tubers often look like small potatoes, and the casual observer in an Indian produce market might easily pass them up as just another of the many varieties of potato that are so common throughout the Andes. Several color variations exist, just as with the oca, the commonest being a pale magenta form which has apparently suggested the Bogotá name, ROJAS. An all-yellow tuber is also seen, as well as a curious yellow variety with magenta spots—common in Quito. The color variants may be found in one of two general shapes: 1) as spherical potato-like tubers or, 2) as elongate, curved tubers. The Quechua populations of the Urubamba region near Cuzco prefer the latter variety and call it CHCHUC-CHANLISAS. In its upright branching habit, *Ullucus tuberosus* resembles plants of both the potato and oca, with which it is usually associated. The branches are similarly succulent, the simple leaves broad and heart-shaped, and the insignificant flowers are borne on axillary racemes.

The melloco is popular with the highland Indians for several reasons. In the first place, it is more resistant to frost than any other Andean tuber plant. Secondly, any species which gives a high yield in number of tubers per plant is always favored. It does not seem to matter that the tubers are small, for serranos are not impressed by large-sized tubers, such as potatoes and ocas produce in smaller quantity. Consequently, in their selection of even potato varieties, their choice invariably is with those races which yield abundantly of small tubers—the types most common in the markets. Tubers of *Ullucus* have the same range of culinary uses as do potatoes, and like them they can be prepared as dessicated chuño, which in this species is known as LINGLI. In Quito I have also eaten the tubers sliced and prepared with vinegar in cucumber fashion.

An Edible Nasturtium Tuber

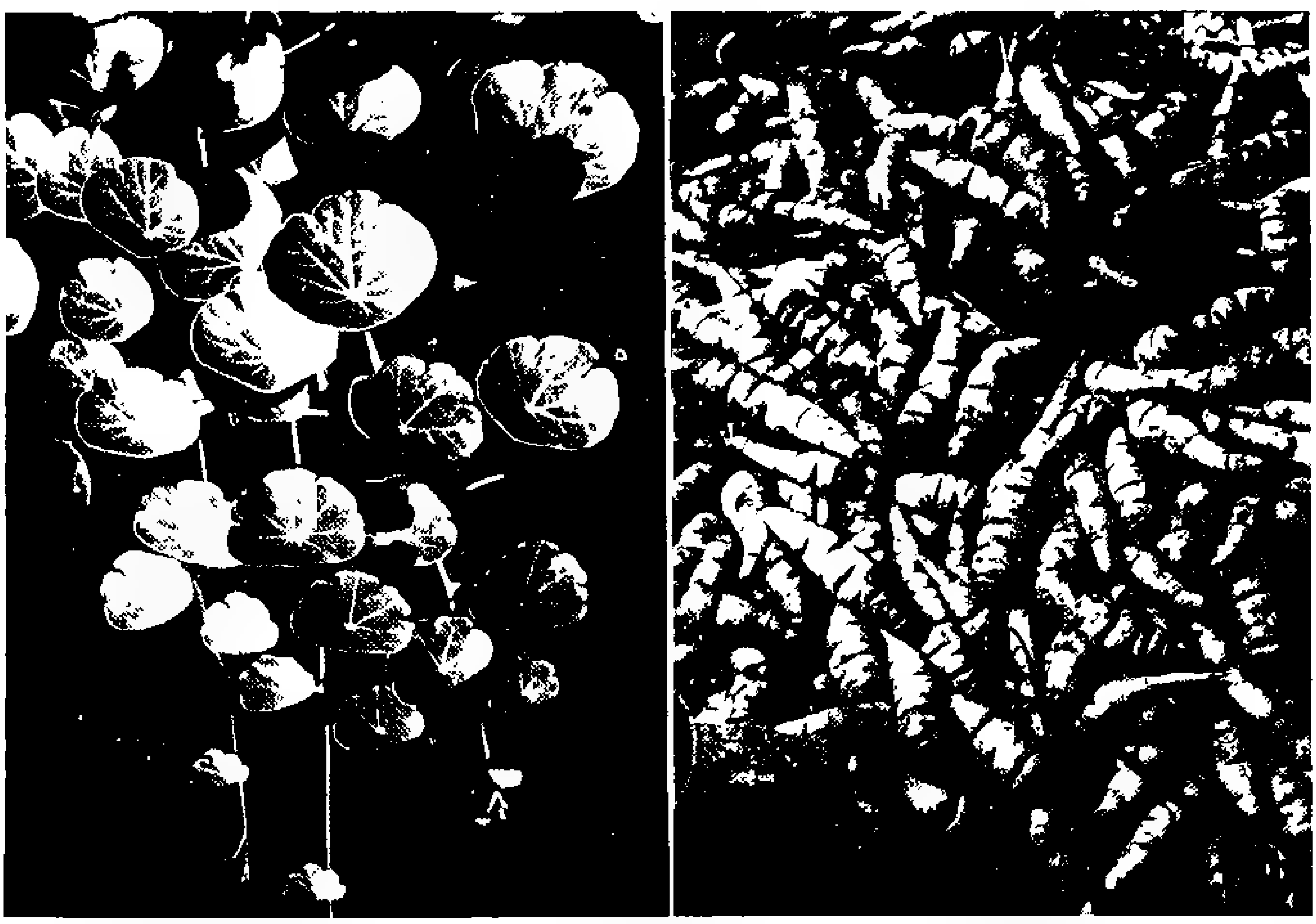
The tubers of the añu [4] closely resemble those of *Oxalis tuberosa.* In fact, so nearly alike can forms of these two tubers be with their white to yellowish coloring which is often mottled with red, especially on the margins of the eyes, that on one occasion I have had to plant a questionable one in order to be sure of its identity. Ordinarily the añu tubers are slightly more conical than oca tubers. In the fresh state they give off a somewhat disagreeable odor, making it impossible to eat them raw, as is done with certain of the oca varieties.

The añu is a first cousin to the familiar garden nasturtium (*Tropaeolum majus*) which also claims the Andes as its native home. In Indian gardens the two species are sometimes found growing together, one as a crop, the

[4] The Quechua word AÑU has the greatest usage in southern Peru, but MASHUAR is the name encountered from central Peru to Ecuador and southern Colombia. The names APINA-MAMA (in Paucartambo and Calca) and ISAÑA (an Aymará appelation used in the Titicaca basin) are also used in Peru, though infrequently. At Bogotá the tubers are known as CUBIOS.

other as a weed. And *Tropaeolum tuberosum,* like the gardener's favorite, tends to be a twiner, clambering and anchoring itself on other vegetation by its tactile petioles, in this way covering the area of its growth with its tiny five-lobed green umbrellas. The orange-red to scarlet flowers are smaller and less showy than those of the horticultural *Tropaeolum.*

The añu has never been as important as the other species as a crop plant. Nevertheless its tubers can usually be found in most Andean vegetable markets, for they can be prepared in the usual boiled form to serve as an occasional sierra food. Perhaps *Tropaeolum tuberosum* serves the highland folk more along medicinal lines, for an Indian woman in Quito assured me that the cooked tubers are "especially good for bad liver or kidneys." The chroniclers record even more unusual, if mystical, uses prevailing in their time, for both Inca Garcilaso de la Vega [5] and Padre Cobo [6] state that the Indians believed that the tubers exerted anti-aphrodisiacal properties, when used as food. However, Garcilaso affirms



ABOVE- AND BELOW-GROUND PORTIONS OF THE ANU

Left: Trailing tips of a young plant of añu (*Tropaeolum tuberosum*) growing in the highlands near Bogotá. *Right*: Characteristic tubers of añu from Quito.

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[5] Garcilaso de la Vega, Inca. Comentarios Reales. Lisbon, 1609.

[6] Cobo, Fr. Bernabe. Historiá del Nuevo Mundo. Seville, 1891-1893.

that Indian gallants could counteract this influence by "holding a small stick in the hand while eating the tubers." This magic property of a small stick was apparently not known to the Inca's soldiery who, according to Cobo, were regularly fed this food during campaigns, on the Inca's orders, "that they might forget their womenfolk."

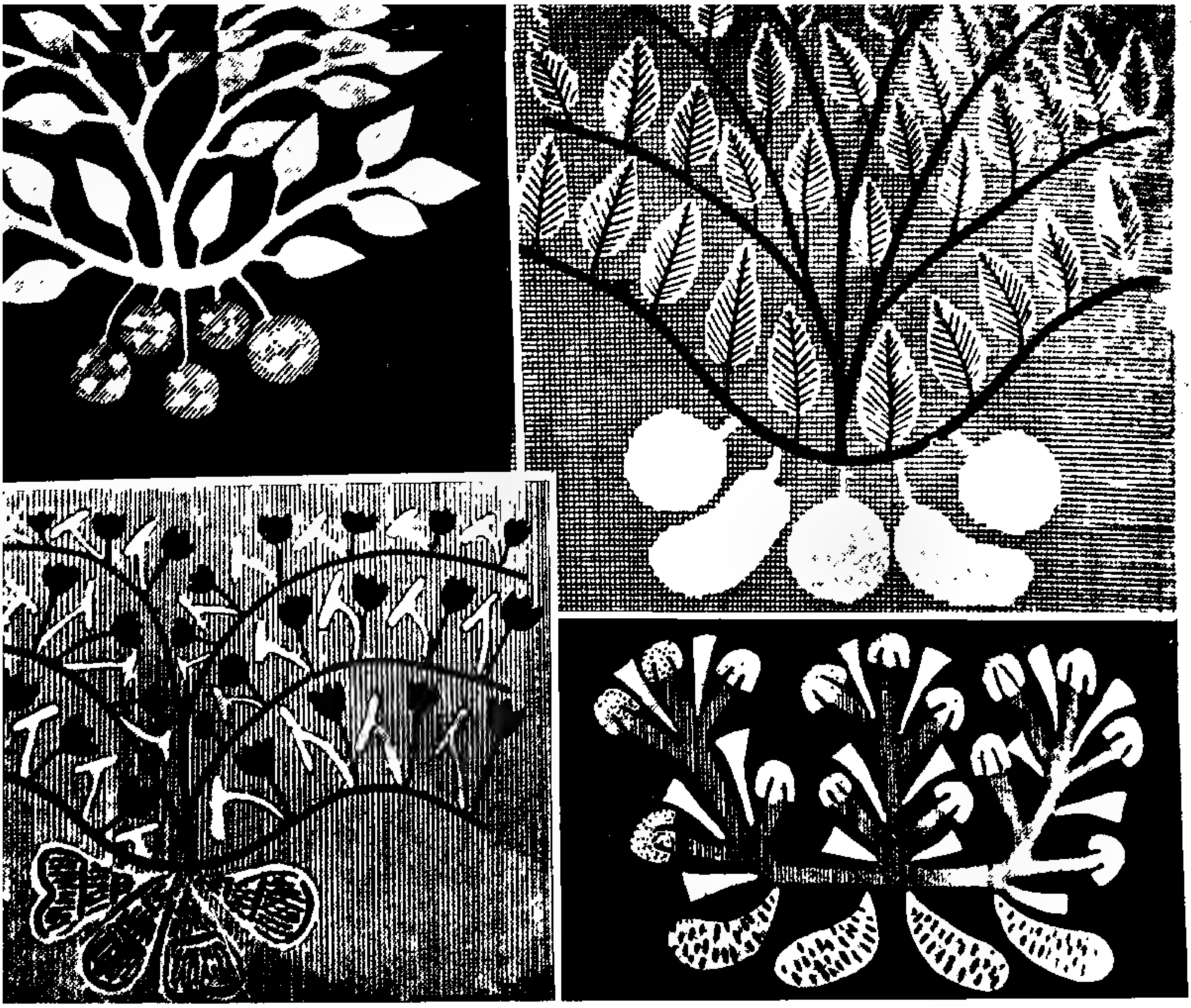
Ancient History of the Trio

The original home of these three tubers appears to have been in the old Inca heartland lying in the vicinity of the Titicaca basin. In this area today more varieties are recognized and a greater number of native names are applied to the three species. Moreover, it is this very region which has supplied us with proof of their use in pre-Columbian times, for Andean tubers, like many other economic plants, served as pictorial motifs—chiefly on pottery—for the people of the old highland civilizations. Among a race which left no written records, such pictograms have been our best evidence of the importance of these tubers in those days. Also, from Tiahuanaco, generally considered to be one of the oldest pre-Inca highland sites, colored paintings are known which appear to represent the potato, añu, and oca. Only pictures of the melloco are lacking.

From the highlands of southern Peru, where presumably grew their wild ancestors, the cultivated range of the oca, añu, and melloco was gradually expanded northward. This migration may have taken place in pre-Incaic time or it may have coincided with the northerly extension of Inca arms and the accompanying agricultural influence. At the time of, or very soon after, the Spanish Conquest the three plants were in cultivation in the fertile Quito highlands, northern bastion of the Inca Empire. However, the ancient Chibcha peoples of the northern Andes (who occupied the central portion of present-day Colombia) appear not to have known our trio, and the movement of these species into the highlands of Colombia and adjacent Venezuela, where they now are grown, apparently took place after the Conquest.

What evidence is available concerning distribution of the species in the years immediately following the arrival of the Spaniards comes from the writings of the chroniclers. *Oxalis, Ullucus,* and *Tropaeolum* appear in the literature in that order, which is more or less the order of their importance as crops. Potatoes were mentioned first by Oviedo in 1535; four years later Valverde writes of the oca as occurring in the region of Cuzco; while the melloco and añu do not appear in the chronicles until 1582[7] when they were recorded from Cuenca, now in Ecuador. But indirect evidence of the tubers' northernmost extension is presented unknowingly in the writings of certain individuals who traveled overland

[7] This chronology is taken from Yacovleff, E. and F. L. Herrera. El Mundo Vegetal de los Antiguos Peruanos. Rev. Museo Nac. 1935, Lima.



PRE-INCAIC PICTOGRAMS OF ANDEAN TUBEROUS PLANTS

(*Illustration from Yacovleff and Herrera, "El Mundo Vegetal de los Antiguos Peruanos"*)

These early illustrations from Tiahuanaco, near Lake Titicaca, show that tuber plants were familiar to the ancient Andean peoples. *Upper left*: The potato (*Solanum tuberosum*). *Upper right*: Yacovleff and Herrera have identified this design as representing the melloco (*Ullucus tuberosus*). However, the leaves are not cordate as in *Ullucus* (see photo of living plant) and the present writer believes this figure more likely represents the potato. *Lower left*: The añu (*Tropaeolum tuberosum*), with its characteristic peltate leaves and conical tubers. *Lower right*: The oca (*Oxalis tuberosa*), with trifoliately compound leaves, schematic flowers, and stubby tubers.

from present-day Colombia to Peru. Cieza de Leon,[8] writing in 1553 of a trip south through the Andes, fails to mention specifically any of our trio of tubers until after his arrival in Peru. However, near Ipiales (now on the Colombian-Ecuadorean frontier) he records that "the people grow an abundance of potatoes and 'otras raizes'." These "other roots" were probably mellocos and ocas, which today are grown extensively in this area. More specific data on distribution come not from the chroniclers but from Colombia's famed patriot-botanist, Francisco José de Caldas.[9] Being a

[8] Cieza de Leon, Pedro: Crónica General del Peru. Sevilla, 1553.

[9] Caldas, Francisco José de. El Semanario del Nuevo Reino de Granada. Bogotá, 1808-1811.

MARKETING HOME-GROWN FOOD PRODUCTS IN PERU
Left: At Cuyo-Cuyo freshly dug oca tubers are placed in a man's poncho or a woman's LLYCLLA, universal carry-alls of the Peruvian Indians. *Right*: At Huancayo in Central Peru Indian women sell their tubers in the famous Sunday market.

native of Popayán in southern Colombia, Caldas presumably was more than familiar with the crop plants of his country, and especially with those occurring in the vicinity of his birthplace. Yet not until the early eighteen hundreds, when he made a trip overland to not-so-distant Quito, did he become familiar with the tuber plants. He recognized the melloco as an undescribed species, so gave it its present binomial, *Ullucus tuberosus*. In commenting upon this species and upon its value to the Indians of the Quito region, he lamented that it (as well as the añu and oca, which were also popular in Ecuador) had not been introduced into his homeland, New Granada (now Colombia). Thus, if we are to believe Caldas, our tubers had progressed only as far as northern Ecuador by the end of the 18th century.

Though they deserve a far wider distribution, to this day they have traveled relatively little beyond the region of their origin. We can only speculate on how we might be using them today, had these three neglected tubers been submitted to the widespread cultivation that was accorded the potato, carried afar from the same native Andean home.

At the time of writing this article, Dr. Hodge was Visiting Professor on the Faculdad de Agronomía, Universidad Nacional de Colombia.

Plants and Plastics

The Role of Plant Cellulose and Lignocellulose In the Development of the Plastics Industry

By R. V. Williamson

WHEN, just 100 years ago, a practical method was discovered for making cellulose nitrate by treating cotton with nitric and sulphuric acids, a plant product became one of the parents of the plastics industry. This start, made by Schenbein in Basle, Switzerland, was followed by the epochal discovery 22 years later by an American, John Wesley Hyatt, who combined cellulose nitrate with another plant product—camphor—and our modern plastics industry was born. Hyatt had produced what we know as celluloid. Growth and development of our modern plastics industry has continued from that day to this, at least from a practical standpoint, through the use of plants or plant products as essential sources of derivatives for, or physical components of, plastics products.

One of the early uses of Hyatt's plastic was in the production of billiard balls, but it flowered most conspicuously in its early history in the form of a detachable collar for men's shirts. The modern version of this type of plastics may be seen in accessories like attractive dresser sets or in the more utilitarian articles such as tool handles, hammer heads, and transparent cases for wet storage batteries. Another combination of materials—cellulose nitrate, castor oil, and pigments—produces artificial leather, which is used in large quantities as upholstery for theatre, bus, and car seats.

Other cellulose derivatives have been developed in recent years, such as cellulose acetate, butyrate, propionate, and ethyl cellulose, which have individual properties that make them valuable as plastics for specific industrial uses such as steering wheels, instrument panel trim in automobiles, and for the laminating film in safety glass.

Cotton, which is a rather pure form of cellulose, is no longer the only source of cellulose for the production of cellulose plastics. Methods have been developed for the production of high grade cellulose from many different plants and trees. The particular plant or tree that may be used depends upon many factors, such as convenience and ease of processing

The author is in charge of the Plastics and Building Materials Section, Agricultural Residues Division, at the Northern Regional Research Laboratory, Peoria, Illinois, one of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

by present pulping methods, yield of cellulose, and the economics of collecting the raw material, manufacturing, and distributing the finished product.

Thermoplastics

The cellulose plastics, described above, are classified under the general plastics classification known as THERMOPLASTICS. Thermoplastics are characterized by softening under the action of heat so that they can be molded under heat and pressure, but they must be cooled below the softening point in the mold before the mold is opened and the specimen removed.

Thermosetting Plastics

A marked advance was made in the plastics industry about 1909 when Dr. L. H. Baekeland discovered that a resinous product of phenol and formaldehyde, when molded under heat and pressure, first softened and then set to a hard, rigid condition in the hot mold, making it unnecessary to cool the mold before removing the specimen. Plastics of this type are known in the industry as THERMOSETTING PLASTICS. These resins could be molded into attractive transparent articles that were strong and durable, but rather expensive. In order to reduce the cost and increase the industrial possibilities of the new resin, experiments were conducted on the use of the resin as a binder for less expensive materials, and again plant products came into the picture.

Phenol-formaldehyde-woodflour Molding Compounds

Combinations of roughly equal parts of finely ground woods and phenol-formaldehyde resins were found to produce stronger and tougher molded products than those molded from the resin alone. The cost of the resin-woodflour combination was decidedly less, greatly broadening the industrial possibilities of the new plastics. This new type of plastic was just getting started at the beginning of World War I. The war intensified the need for increased production of the new plastics, but very little phenol was produced in the United States at that time and importations were cut off. As a result, synthetic phenol production was developed and phenol production from coke ovens was expanded greatly. The plastics industry steadily increased after World War I and by the beginning of World War II molded plastics were in evidence in every home and office. The properties of phenol-formaldehyde-woodflour plastics had been developed to a high degree by extensive research on both the resin and woodflour to produce the best possible product from these materials.

Phenol-formaldehyde-agricultural-residues-flour Compounds

Attempts have been made from time to time in the past to use various agricultural residues, such as ground cornstalks, wheat straw, flax shives, and corncobs in place of woodflour in phenol-formaldehyde plastics com-

PHENOL . . . FURFURAL . . . FORMALDEHYDE

Phenol is the technical term for the substance popularly known as carbolic acid. Before being liquefied with water it occurs as a colorless or pinkish crystalline compound. One way of producing it is by the destructive distillation of organic substances such as wood or coal.

Furfural is a colorless oily liquid, obtained in similar manner to phenol, by distillation of such products as corncobs, bran, sugar, and wood. It is of pleasant odor.

Formaldehyde is a colorless gas of unpleasant odor, familiar in the form of an aqueous solution. Originally used chiefly as a preservative and disinfectant, today it plays an important part in the manufacture of synthetic resins.

pounds, but the properties of the resulting compounds were inferior to those made with woodflour. The usual procedure was the substitution of the agricultural residue flour for the woodflour in a formulation that produced good results when woodflour was used. If the results were inferior, no special effort was made to determine whether or not a formulation could be found that would produce good results with the agricultural residue flour.

When the Northern Regional Research Laboratory at Peoria, Illinois, was completed and research work started in the early months of 1941, one of the many research projects of the Laboratory was the use of agricultural residues in phenol-formaldehyde plastics molding compounds. The experimental results soon showed a marked difference in behavior of the different agricultural residues when used with the same resin binder. This was especially true of corncob flour, which appeared to be so worthless in the early experiments that it was abandoned for a time. Further study of the effect of different resins on the properties of agricultural residue compounds resulted in the production of corncob compounds with strength properties not only superior to other agricultural residue compounds, but superior also to woodflour compounds.

The amount of resin normally used in general purpose molding compounds ranges from 47 to 50%. Therefore, a series of compounds was prepared with six different agricultural residues and 47.2% of a resin that produced good results with corncob flour. Molded specimens from these compounds were tested for water absorption, flexural and tensile strength.

The results of these tests are shown in Table I. The minimum A.S.T.M. (American Society for Testing Materials) specifications for general-purpose woodflour phenolic plastics are shown for comparison.

TABLE I—Properties of compositions with a phenol-formaldehyde resin content of 47.2% and an agricultural residue content of 50% plus 2.8% of dye, lubricant, and catalyst.

Agricultural residue	*Flexural strength P.s.i.*[a]	*Tensile strength P.s.i.*[a]	*Water absorption*[b] *Percent*
A.S.T.M. specifications for general-purpose woodflour phenolics	9,000	7,000	0.80
Corncob	11,990	10,240	0.49
Wheat straw	10,450	9,080	0.42
Peanut shell	10,200	9,320	0.35
Hemp hurd	9,680	7,460	0.37
Flax shive	9,530	8,730	0.36
Corn stover	9,570	7,600	0.69

[a] Pounds per square inch.
[b] Twenty-four-hour immersion at 70° F.

The results in Table I show that all of the agricultural residues tested can be used to produce plastics which meet general purpose specifications. Considerable difference is shown by the different agricultural residues in strength properties, probably due to small amounts of oils or waxes, which in some cases adversely affect the strength properties. This is corroborated in the cases of the peanut shell, hemp hurd, and flax shive compounds, which show relatively low water absorption. The relatively high water absorption of the corn stover compound is probably the result of the leaves on the cornstalks, inasmuch as various experiments have shown that the leafy portions of plants behave quite differently in plastics compounds from the stem, stalk, or trunk.

The war emergency prevented a more detailed study of the causes of variations in properties of different agricultural residues in plastics, as research had to be directed toward producing plastics with a lower phenol-formaldehyde resin content because of the possible shortage of phenol and formaldehyde.

The phenol-formaldehyde resin content of molding compounds cannot be reduced materially by replacing it with an agricultural residue flour, because molding properties, strength, and water absorption are not satisfactory in such compounds. Therefore, a search was made to find other organic or inorganic materials that could be substituted for the phenolic resin and still meet the specifications for general purpose molding compounds. The various residues did not give best results in plastics molding compounds by simply substituting one residue for another in otherwise the same formulation. However, it was possible to produce compounds with only 25% phenolic resin, or approximately one-half the amount normally used, which met the specifications for water absorption, and tensile and flexural strengths in the case of each residue that was used.

Table II shows the results obtained with seven different agricultural residue compounds. Each compound contained 50% agricultural residue flour, 25% phenol-formaldehyde resin with organic and inorganic extenders for the resin, plus dye and lubricant, in some cases. The compositions other than residue and resin are shown in footnotes to the table.

TABLE II—Properties of compositions with a phenol-formaldehyde content of 25%, an agricultural residue content of 50%, plus organic or inorganic extenders, dye, and lubricant.

Agricultural residues	*Flexural strength P.s.i.*[a]	*Tensile strength P.s.i.*[a]	*Water absorption Percent*
Minimum A.S.T.M. specifications for general purpose woodflour phenolics	9,000	7,000	0.80
Corncob[b]	13,100	9,700	0.60
Wheat straw[b]	10,420	8,100	0.48
Peanut shell[c]	9,290	7,180	0.69
Hemp hurd[d]	10,840	8,350	0.57
Flax shive[b]	9,500	8,200	0.54
Corn stover[b]	10,580	7,090	0.62
Rice hull[c]	10,800	7,140	0.43

[a] Pounds per square inch.
[b] 20.4% Vinsol, 2.1% precipitated chalk, 2.0% black dye, 0.5% zinc stearate.
[c] 22.5% precipitated chalk, 2.0% black dye, 0.5% zinc stearate.
[d] 15.0% precipitated chalk, 10% titanium dioxide.

A comparison of the results in Table II with those in Table I shows that the strength of the 25% resin compounds in Table II is superior in some cases to that of the 47% compounds in Table I, and all of the 25% resin compounds meet the minimum specifications for general purpose woodflour phenolics. These results show clearly that agricultural residues can be used to produce high grade plastics when properly formulated.

Plastics Based on the Natural Constituents of Plants

Plants are composed primarily of three constituents: cellulose, hemicellulose, and lignin.

Cellulose is composed of chains of molecules with six carbon atoms. When cellulose is heated with strong acids it breaks down to form the simple sugar, glucose, also having six carbon atoms. Glucose may be reacted with phenol and other materials to form resins, which have potentialities for plastics production. Although no industrial plastics process based on these reactions has been developed, cellulose is, as previously stated, widely used in plastics in the form of nitrates, acetates, and butyrates.

Hemicellulose contains pentosans, or five-carbon compounds, that may be converted to furfural by the action of dilute acids. Furfural may be reacted with phenol and other materials to produce resins suitable for plastics production, and plastics molding compounds of this type are in commercial production.

Lignin is considered to be the binding material that cements the cellulose fibers together to form the plant structure. Lignin can be separated from the other plant constituents by several different methods. It may be dissolved and separated in the form of a solution, leaving the cellulose as a fibrous residue, as is done in the manufacture of paper pulp; or the cellulose may be dissolved and separated in the form of a glucose solution, leaving the lignin as a granular residue. The properties of lignin depend upon the method of separation. In some cases the isolated lignin has the property of softening under heat and may be used as a binder in plastics molding compounds. However, the properties of such molded products are inferior and no industrial process has been developed so far in which isolated lignin is used as the sole binder in plastics compounds.

Scientists have recognized the possibilities of lignin plastics for many years because nature provides ample evidence that lignin can be used with other plant constituents to produce a wide variety of plants, including trees, which may be used as construction materials in a great many ways. Much research has been done on the problem of treating waste wood, such as sawdust, to convert the lignin into a plastic condition within the woody fibers so that the material could be molded into satisfactory products without the addition of other binders.

In 1925 W. H. Mason discovered that heating wood chips for a short time under high-pressure steam, and then suddenly releasing the pressure of the steam, caused the chips to explode into a mass of fine fibers that could be molded under heat and pressure to produce a strong sheet or board. In recent years, improvements in the process have been made so that boards 4 feet wide and 12 feet long can be molded to produce a black, strong, high-gloss, water-resistant product. Other simple shapes such as rods and bars can be molded, but the product does not have sufficient plastic flow to produce intricate molded objects. The theory of the process is that the high-temperature steam softens the lignin bond in the wood so that when the wood explodes the fiber bundles separate at the lignin bonded surface. When these fiber bundles are molded under heat and pressure, they are welded together again through the lignin bond. The high-pressure steam treatment also converts some of the materials in the wood to water-soluble products. These products are removed in the refining process with the result that a more water-resistant product is produced.

The Forest Products Laboratory at Madison, Wisconsin, has done considerable research on the hydrolysis of wood at moderate steam pressures, in the presence of water alone, water and a small amount of sulphuric acid, and water and aniline. This treatment, with subsequent washing operations, removes water-soluble materials and produces a product with increased concentration of lignin. In aniline hydrolysis, a possibility exists for a reaction between the aniline and lignin and the aniline and furfural-producing pentosans. The hydrolyzed wood products can be used in plastics with a reduced resin content. A paper mill is producing lignin-enriched wood pulp in sheet form, which when laminated under heat and pressure produces panel board products.

The Agricultural Byproducts Laboratory at Ames, Iowa, carried out a research project on agricultural residues similar to that of the Forest Products Laboratory on wood. As a result of this work, plastics molding compounds are being produced commercially by a modified process from sugar-cane bagasse, which is the crushed, juiceless sugar-cane waste from the sugar mill.

Through research, information is accumulating steadily in regard to the usefulness of different plants and different parts of the same plant in plastics. Though we can not yet determine from a chemical analysis all of the possibilities of a plant in plastics, we can determine some of the possibilities.

Table III shows the analysis of several agricultural residues with respect to ash, lignin, and pentosans.

TABLE III—Ash, lignin, and pentosan content of several agricultural residues.

Agricultural residue	*Ash* *Percent*	*Lignin* *Percent*	*Pentosans* *Percent*
Corn stover	8.11	12.60	25.95
Cornstalks	4.11	15.65	24.36
Corncobs	1.67	12.48	38.90
Wheat straw	8.94	14.69	31.20
Oat straw	5.05	17.40	30.20
Rye straw	4.51	16.38	30.70
Flax shives	3.89	24.93	26.60
Bagasse	3.00	20.50	26.60
Tobacco stalks	10.20	13.68	19.80

An examination of Table III shows that corncobs are outstanding in pentosan content, which is just about double that of tobacco stalks. Pentosans are the raw materials for furfural manufacture, and furfural is attaining importance rapidly as a chemical for plastics resin manufacture and for many other uses in the chemical industry.

The Northern Regional Research Laboratory has developed a continuous process for converting corncobs into alcohol, furfural, and lignin. From one ton of corncobs approximately 40 gallons of alcohol, 300 pounds of furfural, and 300 pounds of lignin concentrate can be produced. Industrial uses for alcohol and furfural are already known, and research is under way to find new and more extended industrial uses for lignin. If this process is successful on an industrial scale, the common corncob will attain new importance as an industrial raw material.

The ideal goal for the use of agricultural crops is to find profitable use for the whole plant instead of only a portion of it, such as the seed. The utilization of the flax plant is a good example of what may be accomplished. The seed is pressed to produce linseed oil and the seed residue is used as feed. The straw is run through machines which remove the tow or outside layer of the straw. The tow is used for the manufacture of cigarette and other fine papers. The straw residue, or shives, can be used to produce high grade plastics, as shown by the recent work at the Northern Regional Laboratory.

As knowledge accumulates through research, we may confidently expect to find profitable uses for the whole plant in cases of other agricultural crops, which in turn will place an even greater abundance of annually replaceable and low-cost plant materials at the disposal of industry.

Exhibit of Bessa Flower Paintings

DURING the 18th and early 19th centuries, plants of distant regions, particularly plants for horticultural use, were of paramount interest to men and women of culture in Europe. Expeditions to foreign lands were initiated and many books and periodicals were devoted to descriptions of exotic and ornamental plants. During this period the art of flower painting reached its zenith.

In France, one of the leading works in this field was the "Herbier Général de l'Amateur," begun about 1810 by Mordant de Launay and continued later by Loiseleur Deslongchamps. Until 1827, the paintings illustrating these volumes were made by Pancrace Bessa, pupil and associate of Redouté, renowned painter of roses.

The watercolors made for this work, all on parchment with a heavy gold-leaf border, have been in Brazil for approximately a century. This fall they were brought to America by Mrs. Flora Castaño Campos-Porto Ferreira, daughter of the former Director of the Rio de Janeiro Botanical Garden, Paulo Campos-Porto, in whose possession they have been since 1922.

The New York Botanical Garden will present the first public exhibition of these paintings in North America. Opening with the Members' Day program of Oct. 2, the exhibit will continue for six weeks. One hundred paintings which have particular interest are being selected from a collection of 500. With them will be shown some of their reproductions which are in the Botanical Garden's library; also pages from the original text, and other materials of historical interest.

The paintings were originally made by order of Charles X of France and were presented to his daughter-in-law, the Duchess of Berry, as a New Year's gift in 1826. The Duchess, who was the patroness of the artist, was the sister of Teresa Cristina, second Empress of Brazil, and it was with her that the Bessa paintings, along with 60 originals of Redouté, reached the New World a century ago.

NOTICES AND REVIEWS OF RECENT BOOKS

The Story of the Quinine Tree

THE FEVER BARK TREE: The Pageant of Quinine. M. L. Duran-Reynals. 275 pages. Doubleday & Co., Inc. Garden City, N. Y. 1946. $2.75.

Here, briefly and interestingly told, is the history of quinine and its relation to the disease malaria. "It is a tale of hatred, greed, prejudice, generosity, and heroism; it is not a new tale because man, who is a monotonous animal, fights against his own salvation every time opportunity affords itself. But it is an unfinished tale . . ." It is and will remain an unfinished tale until humankind takes it upon itself to be rid of this dread scourge.

In her story Mrs. Duran-Reynals has not sacrificed fact for fiction; she quite wisely realized that the facts themselves are of sufficient interest and drama to carry the story along. And we are indeed fortunate to have an author able to bring the tale together in a highly readable manner. The story begins not in the beginning, for that is shrouded in the mystery of the past, but with Alexander, King of Macedonia, who — quite unmistakably—died of malaria and so lost the world which his genius had conquered. The story ends with the present and the problem which confronts us—the staggering problem of making effective anti-malarial substances available to the three hundred million people who today suffer from this debilitating and dread disease.

For those interested in botanical history the poignant story of Jussieu will be of interest (Chapter VI); and of even greater concern will be the review of "The Botanical Institute of the New Kingdom of Granada" (Chapter VII) wherein is given an account of the trials of Mutis, who labored so ineffectually in what is now Colombia and who, by Linnaeus, was called the "Prince of American Naturalists." Nor are the stories of those who took the first cinchona trees from their home in the New World to the Old World neglected, for they are told with sufficient fullness. And through it all—as a throbbing and insistent jungle drum—will run the sorry history of governmental red-tape and official indifference.

Toward the end of the book also will be found parts of the account of the Kina Bureau and its nefarious machinations—a story which certain historians of quinine (perhaps for reasons of their own) have not seen fit to place on the record; a story of hundreds of millions of good yellow guilders for the few, while hundreds of millions of poor devils rotted and died in the pestilential fever areas throughout the world.

Look at the world today—for example at India, where one out of every four (or about one hundred million) inhabitants are afflicted and where about two million people die each year from malaria . . . look at British India where the plantations of the red-bark, *Cinchona succirubra*, were torn up because they were not sufficiently profitable . . . because the Dutch were growing the more profitable Calisaya and Ledgeriana in Java. Thus the established and successful Indian plantations of the red-bark fever tree were destroyed, in spite of the fact that it was even then well known that from it a very acceptable totaquina (a mixture of the various anti-malarial alkaloids) could be made, and not only made locally in India but also at considerably less cost than that of the single alkaloid quinine. Clever salesmen, these gentlemen in the Kina Bureau, for we somehow had been convinced that only one of these alkaloids was effective—namely, quinine. It is somewhat interesting also to note that these gentlemen of the Kina Bureau controlled about 90% of the plantations of those kinds of trees which happened to produce this particular alkaloid in much greater abundance than the others.

If you wish to read of this series of little breezes which, when gathered together, could start a veritable whirlwind, then read the author's discussion from Chapter X to the end . . . and at the same time read between the lines in the light of present political conditions in the Indo-Malayasian region. If you have never laid in some stinking, dirty hole in the tropics, cut down with a good case of "black-water" malaria, with all the fires of Hell pent up and raging inside you—and all because no quinine was available—and this because of the short-sightedness and abysmal indifference of governments and their timidity and inability to face the situation in a realistic manner—I say, if you never have been in this position—along with the other three hundred million seared and only half-living souls who have or have had malaria—you probably will not quite realize what this is all about. This reviewer does.

Naturally, in a book of this type—covering as it does the whole subject in a single sweep—there will be a few minor errors of interpretation, but these are relatively so small that they do not detract from the panoramic mural of the story of malaria and quinine laid out before us and are of no great consequence, even to those interested in the more technical phases of *Cinchona*. Here is no reformer with an axe to grind, but a historian giving us the facts in a straightforward manner. And besides, it is interestingly written and therefore will be read by a wider public than the rather dry and dusty accounts published by those of us concerned with the technical phases of the problem. And this is as it should be.

W. H. CAMP.

Agricultural Essential

PHOSPHATES AND SUPERPHOSPHATE. A. N. Gray 416 pages, indexed. Interscience Publishing Co. New York Second edition, 1943. $7.

Concerned with phosphates for agricultural purposes, this book first covers briefly the history of the phosphate industry in each producing country. Results of the chemical analysis of the important phosphate rocks are given for as many as 17 elements. There are chapters on phosphate deposits and reserves, consumption, trade, superphosphate, basic slag, and phosphoric acid. The final third of the book consists of 155 tables concerned mainly with the statistics of the phosphate industry on a country-by-country basis. This is truly a book for one who wants a world-wide picture of an agricultural essential.

F. W. KAVANAGH.

Sesquicentennial

STUDIES IN SCIENCE. Edited by W. C. Coker. 300 pages, illustrations, list of publications. University of North Carolina Press, Chapel Hill, 1946. $3.

Under the title "Studies in Science" the University of North Carolina has issued a volume of sesquicentennial publications. All the papers in this volume are original publications of members of the Elisha Mitchell Scientific Society and were first published in the Journal of the Society as Volume 61.

The following botanical articles are included in the "Studies in Science": Penicillin: V. Mycological aspects of penicillin production—Kenneth B. Raper and Dorothy F. Alexander; Nutritional studies of representatives of five genera in the Saprolegniaceae—Alma J. Wiffen; and Revision of the genus *Coleomyces,* parasitic in insect larvae—J. N. Couch.

FRED J. SEAVER.

Notes, News, and Comment

Staff. Robert S. de Ropp has been appointed to the scientific staff of the New York Botanical Garden as Assistant Curator, to work on growth problems in the laboratory for plant physiology. He began his work Aug. 1. A graduate of the University of London in 1936 with a Bachelor of Science degree, Dr. de Ropp received his Ph.D. from there in 1940. He is also an Associate of the Royal College of Sciences of London and holds the Diploma of the Imperial College of Science and Technology of London.

African Collections. Plants collected for the Garden by Leonard J. Brass on the Vernay Nyasaland Expedition numbered 3,621 sheets by July 10, after six weeks of exploring, according to the diary which he has sent back to New York. These amounted to 760 numbers, including about 100 cellular cryptogams. Ten days later he wrote that the number had reached 4,000. Meanwhile, the mammals collected by other members of the party totaled 900 specimens of 57 species. Collecting has been done chiefly on Zomba Plateau, Mlanje Mountain, and Chambe Peak, for which the timber depot in Likubula Gorge was used as the base camp.

Lectures. The Lutheran Alumni Association of New York City was addressed by Dr. Harold N. Moldenke in a meeting at the Garden June 22 on "Plants of the Bible."

At Villa Rosa, the home of Mrs. W. Henry Williams at Newport, R. I., Dr. William J. Robbins addressed the Newport Garden Club Aug. 15.

The Lake and Valley Garden Club of Cooperstown, N. Y., a new Affiliate of the Botanical Garden, was shown the Garden's full-length film in color by Dr. A. B. Stout July 8. Another Affiliate, the Millbrook Garden Club, of which Mr. and Mrs. Joseph R. Swan are members, heard a talk by Dr. Stout Aug. 15 on "Lilies for Garden Beauty." The meeting was at the home of Mrs. Charles C. Townsend at Claremont, N. Y.

The Garden's short motion picture film was shown by Dr. E. E. Naylor, to 75 children from Public School No. 35 of the Bronx June 21, after a visit to the rose garden and conservatory.

Visitors. Among the August visitors to the Garden was Dr. Norman W. Radforth, formerly on the staff of the Department of Botany at Toronto University, on his way to Hamilton, Ontario, to become head of the Department of Botany at McMaster University and Curator of the new Royal Botanic Garden there. Accompanying him were Leslie Laking, who on July 1 was appointed Administrator of the Royal Botanic Garden at Hamilton, and Barbara Tarver, a former student at Studley College of Horticulture for Women in Warwickshire, England, also at the Royal Botanic Gardens at Kew, and until recently a teacher of horticulture at Midland Agricultural College in England. Miss Tarver is also enroute to Hamilton. Mr. Laking is a graduate of Ontario Agricultural College, and during recent years he has worked at Kew.

Others visitors of recent weeks have included Richard A. Howard of the Gray Herbarium, on his way to spend several months in the Dominican Republic; Rev. John A. Blatchford, S.J., of St.

George College, Kingston, Jamaica; Rafael A. Toro, head of the Biology Department at Mayaguez, Puerto Rico, who will be at George Washington University for the coming scholastic year; Jose Vera Santos, Botany Department, University of the Philippines at Manila; K. L. Yang of the National Medical College in Shanghai, China; Noël Robertson of the British Colonial Service; W. V. H. Berry, Florida Southern College at Lakeland; Robert K. Zuck, Biology Department, Drew University; Elbert L. Little, Jr., U. S. Forest Service; Rolf Singer, Farlow Herbarium at Harvard; Robert T. Clausen, Cornell; Robert L. Hulbary, Columbia; Lazella Schwarten, Librarian at the Arnold Arboretum; Donald F. Jones, Connecticut Agricultural Experiment Station; H. G. Seyler, Farr Nursery Co., Weiser Park, Pa.; and Dr. and Mrs. Charles Thom, Port Jefferson, Long Island. In addition, present and former residents of Honolulu who have lately been visitors at the Garden include Mrs. J. P. Morgan and her daughter, J. Patricia Morgan (Mrs. Eric) Swenson, Evanita Sumner, and Morton Cassidy, now of Cambridge, Mass.

Desmond Arboretum. The private arboretum of New York State Senator Thomas C. Desmond of Newburgh is again open to the public, after having been closed during the war. Permission to visit this collection of trees may be obtained from Senator Desmond at 94 Broadway, Newburgh, N. Y., or from the arboretum superintendent, Rudolph M. Nocker.

The aim of the owner is to include all native American trees and shrubs which may prove hardy in the Newburgh climate, as well as some interesting hardy foreign trees and shrubs. The collection, started in 1939, now contains 499 species.

Herbarium Gift

EIGHTEEN hundred specimens of plants that were collected half a century ago on the estate of William Rockefeller, north of Tarrytown, N. Y., have been given to the New York Botanical Garden. This unique herbarium, neatly mounted and enclosed tightly in metal cases, contains more than a thousand species of plants. Most of the common wildflowers native to the region are there, as well as the familiar weeds, with the exception of two which now are common but which perhaps had not yet invaded the area. These are *Hieracium pratense* and *Galinsoga parviflora,* both brought into American fields and gardens from other countries. There are few grasses and sedges in the collection, but apparently all specimens grown in the garden were collected and carefully pressed. A few greenhouse plants have also been included. An interesting group of specimens shows twigs of trees and shrubs in winter condition, collected in the early part of 1896.

About 20 years ago this private herbarium came into the possession of Crosby Gaige, theatrical producer, author and editor, who mounted the specimens more securely and put them inside manila covers. This spring, because of his interest in the institution, he made the New York Botanical Garden a gift of the collection.

To reach the Botanical Garden, **take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.**

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

The New York Botanical Garden was incorporated by a special act of the Legislature of the State of New York in 1891. The Act of Incorporation provides, among other things, for a self-perpetuating body of incorporators, who meet annually to elect members of the Board of Managers. They also elect new members of their own body, the present roster of which is given below.

The Advisory Council consists of 12 or more women who are elected by the Board. By custom, they are also elected to the Corporation. Officers are: Mrs. Robert H. Fife, Chairman; Mrs. Elon Huntington Hooker, First Vice-Chairman; Mrs. William A. Lockwood, Second Vice-Chairman; Mrs. Nelson B. Williams, Recording Secretary; Mrs. Townsend Scudder, Corresponding Secretary; and Mrs. F. Leonard Kellogg, Treasurer.

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Mrs. Arthur M. Anderson
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Charles W. Ballard
Mrs. James Barnes
William Felton Barrett
Mrs. William Felton Barrett
Edwin De T. Bechtel
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Prof. Charles P. Berkey
Prof. Marston T. Bogert
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Dr. E. D. Merrill
John L. Merrill
Roswell Miller, Jr.
Mrs. Roswell Miller, Jr.
Mrs. Roswell Miller, Sr.
S. P. Miller
George M. Moffett
H. de la Montagne
Col. Robert H. Montgomery
Mrs. Robert H. Montgomery
Barrington Moore
Mrs. William H. Moore
B. Y. Morrison
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JOURNAL

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IN TWO SECTIONS
SECTION ONE

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

EVENTS—OCTOBER AND EARLY NOVEMBER 1946

Chrysanthemum Show and Program

October 25

11 a.m —Inspection of outdoor plantings
2 p.m.—Inspection of competitive exhibits in the Museum
2:30 p.m.—Address on "Chrysanthemum Breeding" by S. L. Emsweller
3:15 p.m.—Clinic on chrysanthemum culture and control of diseases and pests
4:15 p.m.—Dedication of new chrysanthemum to Mary MacArthur
4:30 p.m. -Tea for members

October 26 and 27

Indoor displays open in Museum Building 10 a.m. to 5 p.m.
Outdoor chrysanthemum displays on view 10 a.m. to 6:30 p.m.

Members' Day Program

Nov. 6 -*"The Compleat Gardener"*
Exhibit of early garden books and herbals with address by *Albert E. Lownes*

Saturday Afternoon Programs

Oct. 19—*Wild Flowers of the Jersey Hills* — *Harold N. Moldenke*, Associate Curator

Oct. 26—*The Gift of Green*
A new motion picture in sound and color.

Nov. 2—*Autumn Coloration* — *A. B. Stout*, Curator of Education & Laboratories

Nov. 9—*Gardens of Canada* — *Dorothea G. Norton*, Canadian Lecturer

Nov. 16—*The Art of Paper-Making*
A demonstration and exhibit of hand-made paper and its method of manufacture — *Harrison Elliott*, Stevens-Nelson Paper Company

Radio Programs

Oct. 16 *Suitable Trees for the Home Grounds* — *J. H. Beale*, Boyce Thompson Institute

Oct. 30—*Planning a Woodland Garden for next Spring* — *Helen S. Hull*, Garden Consultant and Writer

Nov. 13—*Books for the Gardener's Pleasure* — *Mrs. John L. Kuser, Jr.*, Member of the New York Botanical Garden

TABLE OF CONTENTS

October 1946

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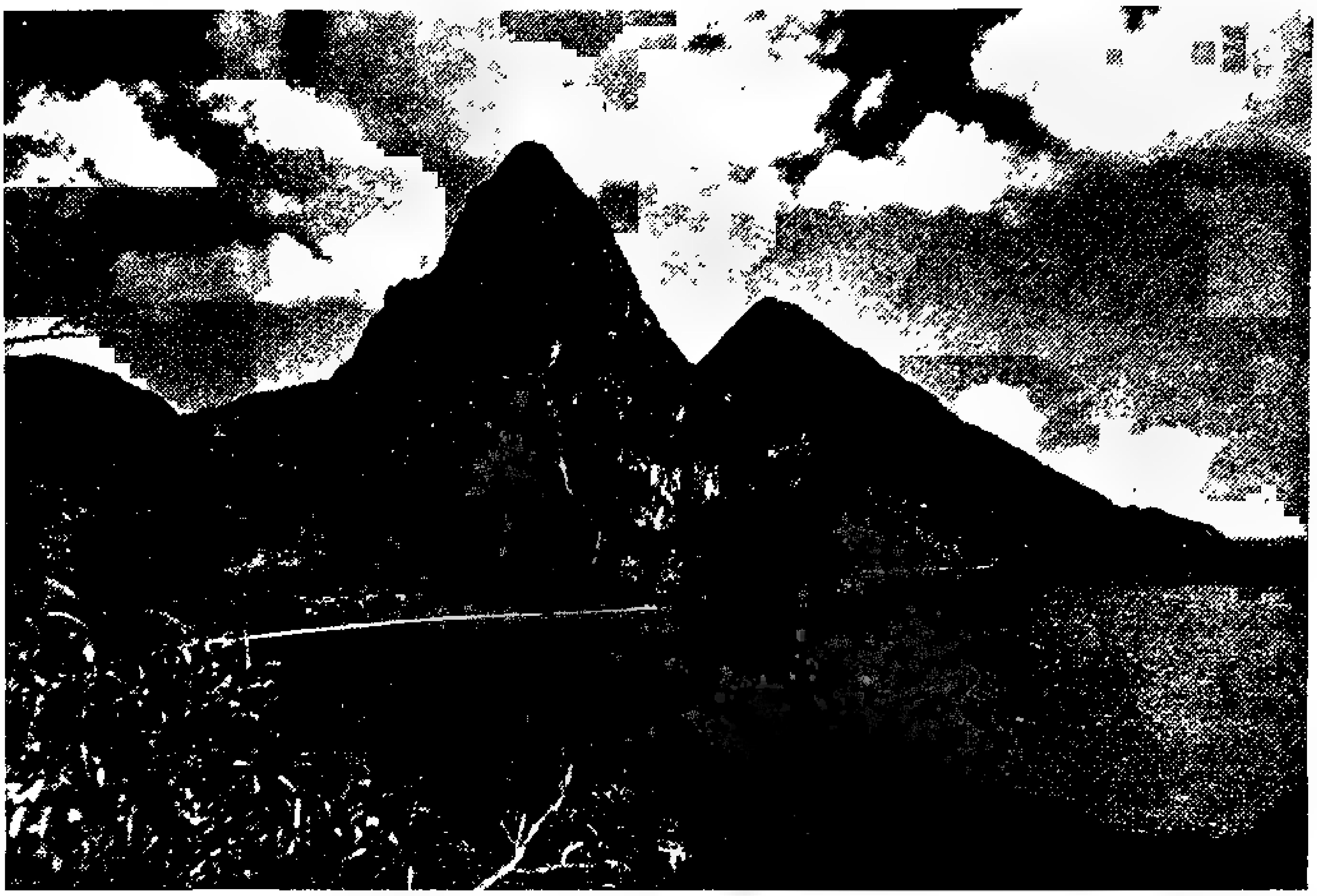
A Forest-Lover in the Caribbee Islands

V. *The Helen of the West Indies*

By J. S. Beard

THE somewhat pretentious title of "Helen of the West Indies" is one which the inhabitants of St. Lucia, second largest of the British Windward Islands, like to claim for their island, because she was fought over so bitterly during the eighteenth century struggles of French and English. St. Lucia is the next island to the southward of Martinique, which was always the great French stronghold. In taking St. Lucia, therefore, the English achieved the object of installing themselves on the Frenchmen's doorstep and it was to the French interest to keep the English at arm's length. Thus St. Lucia did change hands many times. The island was finally made over to Britain by the Treaty of Paris of 1814, but before that date it had been predominantly in French occupation and had acquired a French character which persists to this day. All place names on the island are French, old French law is still in force, and the current language is creole French, many country people having no English at all. All local plant names, some of which we shall be mentioning later, are in creole French, and to a person speaking the French of France many of them will seem very odd: for this PATOIS, as it is called, is not just a French dialect or an illiterate French as is often thought. It is a language compounded of a French vocabulary and a West African syntax, a rather interesting hybrid tongue. To a Frenchman words may be familiar, but not the construction.

It is very difficult to believe from the St. Lucia of today that the island was ever so bitterly contested. The greater bulk of the soils of St. Lucia are extremely infertile, including the worst soils in the Lesser Antilles. Accordingly there are few stretches of the island that are intensively cultivated, most of the land being covered with a dreary and monotonous secondary bush in which the peasantry periodically clear small patches



St. Lucia's Petit Piton towers straight up from the sea over Soufrière Bay.

and plant food gardens. This lack of agricultural productivity has naturally sunk the island in a depressing poverty.

Scenically St. Lucia is quite attractive. Twenty-five miles long and twelve wide, it is covered with low mountains not exceeding 1,600 feet in altitude for the most part. These are geologically old, and the original volcanoes have been so worn away that their hard basaltic cores now project as pyramidal spikes. This type of peak is called a PITON locally and is very characteristic. The pitons and their connecting ridges are divided by long and deeply cut valleys with alluvial plains at their mouths. The southwestern corner of the island, around the town of Soufrière, is geologically younger and contains some more striking formations, including Morne Gimie (3,145 feet) the highest peak of this island, the Sulphur Springs (a solfatara) and the famous Gros Piton and Petit Piton. These peaks, 2,500 and 2,000 feet high respectively, form, in the writer's opinion, the most spectacular piece of scenery in the whole West Indies. They are quite isolated and tower straight up from the very edge of the sea in precipitous tree-clad slopes and tiers of bare cliffs. The Petit Piton is the more striking, a veritable Matterhorn with an apical angle of 70°!

On such slopes one does not expect to find a very tall or dense tree growth. The forest is, actually, of a "dry" type about 50 feet high with many deciduous species. *Lonchocarpus caribaeus* (SAVONETTE) is dominant, with the red-trunked *Bursera simaruba* (GOMMIER MAUDIT), *Cedrela mexicana* (ACAJOU ROUGE or Spanish cedar), prickly *Fagara martinicensis* (L'ÉPINEUX), blue-flowered *Cornutia pyramidata* (BOIS CASSAVE), and *Coccoloba* species (RAISINIER or wild grape). *Coccoloba diversifolia* becomes dominant at the summit of the Gros Piton. Cloud conditions here make humidity very high, and the woodland features an extraordinary abundance of epiphytes, particularly *Anthurium Hookeri.* On rocky places on the slopes there is a most interesting ground layer to the forest. The surfaces of the boulders are densly covered with mats of a *Peperomia,* a white-flowered orchid (*Epidendrum ciliare*), moss, ferns, a large bromeliad, and two species of *Anthurium.* The association of such a hygrophilous ground layer with a dry type of overwood is a curious one. Botanical records show that *Juniperus barbadensis* has been collected on the Pitons but the writer has not been able to find it. This is the sole modern record of this species in the Lesser Antilles, for it is now extinct in Barbados.

There is an interesting vegetation around the Sulphur Springs, since only special plants can withstand the poisonous sulphurous gases given off. Closest to the fumaroles appear scattered tufts of the bromeliad *Pitcairnia angustifolia* and the sedge *Cyperus ligularis* growing in a white and yellow stratum of rock rotted soft by the gases. Slightly further back, bushes of *Clusia alba* and *C. Plukenetii* show their deep green leaves and pretty flowers. Slopes around the perimeter are densely covered with ferns of several species.

To find virgin rain forests one must, as in all these islands, penetrate the somewhat inaccessible interior. About 15,000 acres of the interior remain unsold for agriculture and in theory now constitute a Forest Reserve. Unfortunately, only about a third of the area has been legally constituted and there is inadequate control over the remainder so that considerable damage continues to be done by the shifting cultivator. About 10,000 acres carry good quality rain forest, some of it, in the most inaccessible parts, absolutely virgin. There is one detached Forest Reserve of 2,300 acres in the north which covers Piton Flore and the adjoining mountain La Sorcière, protecting the catchment of the Castries water supply. This forest is easily visited by car from Castries, the capital, a drive of five miles over a very bad road, setting one down at Forestière schoolhouse on the very edge of the forest. From here the old French road across the island may be followed on foot, for it is only a bridle trail, through the forest round the slopes of Piton Flore.

The southern block of forest may be entered where the modern motor road crosses the Barre de l'Ile or central watershed (about 900 feet elevation). In both directions, north and south, a track follows the top of the ridge and one soon arrives in virgin forest of the *Licania* type which has not known the axe. The southward trail executes a steep climb over Piton Lacombe and continues for miles into the depths of the forest. A more difficult entry but more interesting lies up the Roseau river. If the course of this stream be followed, man's disturbances are in due time left behind and the river is seen in the best of its wild beauty between densely forested banks. One of the commonest river bank trees is an endemic of St. Lucia, *Chrysochlamys caribaea* (BOIS MANGLE), a stilt-rooted tree of the family Guttiferae. While not particularly beautiful, it is interesting as a botanical rarity.

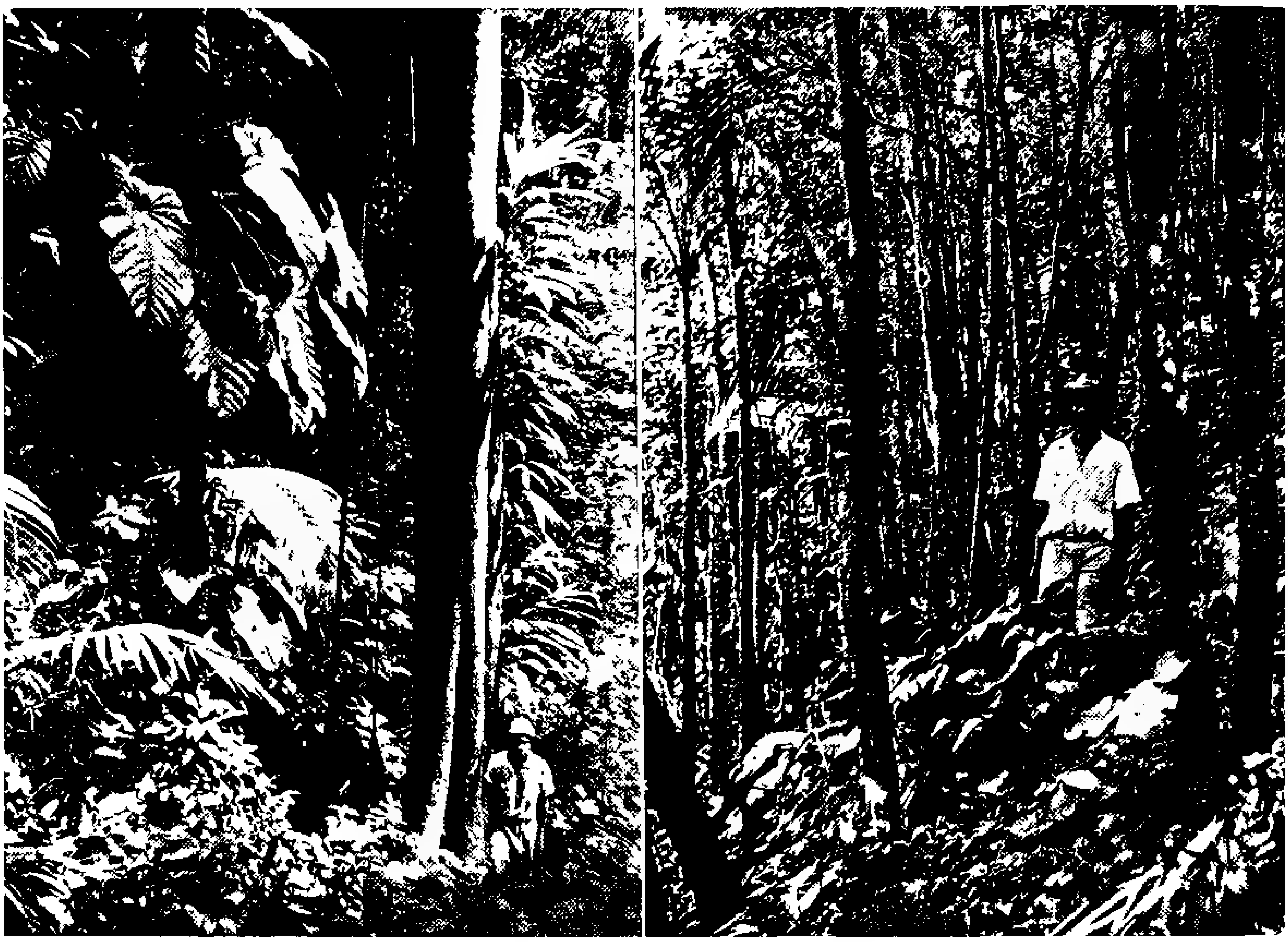
A third approach to the forests is by way of the bridle road crossing the island from Micoud to Soufrière. It involves a walk of twelve miles along a muddy track and it is advisable to stop en route at the forest rest hut at Quilesse. Actually there is relatively little virgin forest to see on this route because of past depredations of the shifting cultivator.

There are two quite distinct associations in the rain forest of St. Lucia, each with its own flora. On the most favourable sites, sheltered, with a deep, porous soil, the *Dacryodes-Sloanea* association is well developed. On the least favourable sites, exposed to wind and with compact, badly aerated red clay soil, the *Licania-Oxythece* association is found. On intermediate sites, which of course predominate, the two floras mingle, only separating out at the more extreme conditions. Both types form a high dense rain forest 90 to 100 or more feet tall. The *Licania* type gives a more crowded impression and is less rich in epiphytes, but apart from flora the differences are quite minor.

In the *Dacryodes-Sloanea* forest the chief dominant is *Dacryodes excelsa* (GOMMIER), closely followed by *Sloanea caribaea* (CHATAIGNIER) and *Sterculia caribaea* (MAHOT COCHON). Others less common include a species of *Ocotea* (LAURIER CANELLE), *Simaruba amara* (BOIS BLANC) and *Talauma dodecapetala* (BOIS PAIN MARRON). Those who have followed this series of accounts of the Lesser Antilles vegetation will already be very familiar with the resin-yielding *Dacryodes* and the heavily buttressed *Sloanea*. *Sterculia caribaea* is a tree whose bark yields a useful fibre for cordage. The other three mentioned are useful timber trees. *Talauma* is that rarity, a rain-forest tree with showy flowers—huge, white, magnolia-like blossoms four inches in diameter. Unfortunately, one rarely sees a tree sufficiently isolated to show off to best advantage. A very common but smaller tree in this forest is *Tapura antillana* (BOIS COTE) with a lobed and fluted trunk. The palm *Euterpe globosa* (PALMISTE) forms the bulk of the lower storey together with stilt rooted *Tovomita plumieri* (PALÉTUVIER) and *Swartzia caribaea* (CASSE). There are numerous big-leaved epiphytes belonging to *Anthurium*, *Philodendron* and *Carludovica*. Orchids are inconspicuous.

The *Licania-Oxythece* forest is quite differently composed. *Euterpe globosa* is still often very common in the lower layer and so is *Tovomita*, but several small myrtaceous trees have joined them. The chief dominants are now *Licania ternatensis* (BOIS DE MASSE) and *Oxythece pallida* (BALATA CHIEN). *Dacryodes* is still fairly common but *Sloanea* almost disappears. Neither *Licània* nor *Oxythece* yields timber of any value. Typical associated dominants include *Protium attenuatum* (L'ENCENS), *Ternstroemia oligostemon* (MERISE), *Micropholis chrysophylloides* (FEUILLE DORÉE), *Manilkara bidentata* (BALATA) and *Guatteria caribaea* (COROSSOL MARRON). Of these eight dominants mentioned, two secrete an aromatic gum and three a latex. Except for *Dacryodes* itself these peculiarities are uncommon in the *Dacryodes* forest. Epiphytic vegetation is scarce but includes the unusual climbing fern *Blechnum volubile*. A

The dense growth of giant epiphytes, mostly Anthurium Hookeri, at the base of Gros Piton is shown at the left. Beside it is a boiling mud pool, surrounded by bare sulphur-encrusted rock, which forms part of the Sulphur Springs. At the top is a sad sight all too common in the interior—forest destroyed by peasantry for vegetable gardens.



The slender palm trunk at the extreme left of the first rain-forest scene is festooned with huge leaves of Philodendron, while the big Dacryodes tree at the right carries the climbing palm, Carludovica, and several rope-like lianes. At the right is seen the dwarfed rain forest high up on Sorcière mountain. Dominant trees are Licania oligantha and Micropholis chrysophylloides, with Anthurium on the ground.

species of *Smilax* is among the common lianes and trails its prickly tendrils about the ground to the peril of the bare-legged intruder. Its patois name is BOYAU DIABLE.

Some interesting rare plants in the St. Lucia forests besides the *Chrysochlamys* along rivers include the tree *Dussia martinicensis* (POMMIER), sole species of an endemic Antillean genus, and the shrub *Exostemma sanctae-Luciae* (QUINA GRAND BOIS) whose huge heads of purple flowers are a most beautiful sight. Its bark is used locally as a febrifuge. There is a small prickly palm, an *Aiphanes,* which is probably endemic but so far undescribed, and two new species recently collected by the writer, *Miconia luciana* Gleason and *Licania oligantha* A. C. Smith. The latter becomes dominant in the dwarfed rain forest at the tops of peaks and high ridges, as for example at the top of La Sorcière.

The St. Lucian flora has been relatively poorly collected, and undoubtedly a number of novelties still await discovery.

The Oiticica Tree of Brazil And the Oil from its Seeds

By George S. Jamieson

ONE of the South American trees most recently to be exploited is the *oiticica*, member of the Rose family, whose seeds yield an oil that is comparable to tung oil in making paints and varnishes. In twenty years the commercial output of this oil has grown from virtually zero to 15,000 metric tons in a favorable year. Plantation production is now beginning in Brazil, the oiticica's native home.

Dr. Jamieson, the country's authority on oil-producing plants and their products, here tells briefly the story of the oiticica tree and its useful oil-bearing seeds.—C. H. W.

THE OITICICA TREE, which is indigenous to the interior regions of northern Brazil, is a tropical member of the Rose family, classified as *Licania rigida.* Large numbers of the trees are growing wild in the states of Ceará, Piauí, Paraíba, and Rio Grande do Norte—that is, throughout the "nose" of Brazil which pushes eastward into the Atlantic. The most extensive stands of them are along the banks of the Jaguaribe and Acarahú rivers in Ceará, and of the Assú, Apody, Piranhas, and Ipenema in Rio Grande do Norte.

A considerable portion of the country in which the oiticica is found, particularly Ceará, is semi-arid and subject to long periods of drought. Most of the trees in these regions stand close to streams, some of which are dry much of the time. Even in these places, they frequently reach a height of about fifty feet, but in more favorable situations they grow much higher. During the dry periods, their dense foliage is usually the only green vegetation seen. Their general appearance is similar to mango trees.

Since ancient times the dense shade of these evergreen trees has been greatly appreciated both by man and beast. In later years, much use was made of oiticica lumber for carpentry purposes by the natives; however, for some years now it has been unlawful to cut the trees.

As early as 1860, some attention was given to extracting the oil from the seeds for making soap, but the disagreeable odor of the oil, which persisted in the soap, discouraged further experimentation for many years. Nevertheless, there followed several further attempts to produce the oil on a small commercial scale, with the chief idea of converting it into soap, but these were also unsuccessful.

By 1918, chemists had found that oiticica was a strong drying oil, and

Oiticica trees resemble mango trees in appearance, their breadth often equaling their height. (This and the photograph on the following page are reproduced by courtesy of the Scientific Section of the National Paint, Varnish and Lacquer Association.

experiments began to be made in order to find how to use it for making paint, then varnish. After much time and effort had been spent, satisfactory methods were developed for using the oil for these purposes. However, it was not until 1927 that the oil began to be successfully produced in commercial quantities. By 1931, its production had increased so that some of the oil could be exported to the United States and Europe. Since 1939, following years of large seed crops the annual production of oil has at times amounted up to nearly 15,000 metric tons. It should be mentioned, however, that it is characteristic of the oiticica tree to bear a very small crop or none the year following a heavy crop.

Oiticica trees blossom during August and September. The fruits are collected from December to March and transported to the oil mills, the majority of which (fourteen or more) are located in the state of Ceará. The matured fruits are oval, varying in length from 1.2 to 2 inches and from 0.5 to 0.75 inches in diameter at the middle. They consist of easily friable thin shells in which is enclosed a single seed or kernel of a more or less reddish-brown color throughout. They constitute from about 65 to 75 percent of the weight of the fruits. The average weight of the seeds examined was 3.7 grams and the oil content of different lots of seeds varied from 55 to 62 percent.

A characteristic of the oil is its solidification shortly after expression. In order to render it permanently liquid for convenience in handling and using it, the oil is heated to 210-220° C. for about 30 minutes. As with other strong drying oils, in order to keep it in good condition until used, it needs to be stored in well filled closed drums or tanks.

A few years ago, an experiment station was established in Paraíba for studying the propagation of these trees. As a result of investigations there, thousands of seedlings are now being budded with buds taken from high yielding mature trees, for setting out in plantations. Many of the trees begin to blossom two years after budding, whereas seedlings not budded, in many instances, do not blossom until nine years old or more.

This procedure is also being extensively used in the establishment of the newer tung tree plantations in our southern states, southern Brazil and probably by now elsewhere, thus ensuring for the trees uniform bearing characteristics, which could not be obtained from seedlings not budded. It appears probable that in a few more years the crops from budded specimens will supplement to a notable extent the seeds collected from the wild oiticica trees.

In view of the value of the oil for manufacturing paints and other protective coatings, the possibility of growing the tree in the southern part of Florida was suggested some years ago. At that time one attempt was

The nut-like fruits of the oiticica tree, which grow up to 2 inches long, consist of a thin shell enclosing a single seed, or kernel, with an oil content of around 60 percent.

made to grow it there, but without success. Somewhat later, Brazil passed a law which prohibits sending any oiticica seeds to other countries. This will have little bearing, however, on production in other countries, for prior to this decree, not one percent of the seeds sent here or to England could be germinated. These experiences show the obvious need of getting seedlings instead of seeds from Brazil for plantings to be established in other countries, on any commercial scale.

Lesion Nematodes On Roots of Japanese Iris

By B. O. Dodge

FOR nearly twenty years the cause of the death of Japanese iris plants has been a repeated puzzle. Time after time, as cultures have been made from the rhizomes, we have thought we had the answer, but the results were never quite conclusive. Now, again, we think we know at least one of the basic causes, and it is an agent previously unsuspected by us.

It was back in 1928 that Professor R. A. Harper first asked me to examine his Japanese iris planting at Ridgewood, New Jersey. The plants in many clumps were dying out after having grown beautifully for some years. The leaves of some plants gradually turned rusty brown prematurely during the summer months. In many cases the whole clump had died out or was doomed. We found that the fungus *Sclerotium Delphinii,* along with some species of *Fusarium,* occasionally developed on rhizomes kept in moist chambers. Thrips were also frequently found working in the leaf sheaths. Since we found more consistently maggots of the small fly *Chaetopsis fulvifrons* infesting the base of leaves, it was thought that they were probably responsible for much of the injury.[1] Dr. G. H. Reed, Plant Pathologist at the Brooklyn Botanic Garden, had also found the same fly in his iris plantings.

We cleaned up a number of rhizomes, the leaves from which were brown, and kept them in damp chambers for several weeks. On most of them new leaves began to develop. When these rhizomes were planted out after having sent out some roots, good plants were forthcoming the following year. Professor Harper also found that if he uprooted his dying plants, cleaned them off and replanted them in a new plot, they usually recovered and flowered again for a few years.

At that time Japanese iris in our own limited plantings at the Botanical Garden suffered some infestation by thrips, but the fly was not often found. During the past two or three years we have noticed that our Japanese iris in

[1] Dodge, B. O. Notes on some iris troubles. Jour. N. Y. Bot. Gard. 30: 5-10. 1929.

more recent plantings were not doing very well. Although some small flowers developed here and there, the plants were generally stunted and many leaves were rusty brown. This summer during June and July it was found that the plants in some of the clumps either were dying or were already dead. We found that neither thrips, the sclerotium disease, nor the chaetopsis fly could be the cause of so much dying out. So some of the rhizomes with all roots attached were thoroughly washed. The short stubby tufted rootlets looked much like those of our boxwood which Dr. G. Steiner at Beltsville, Md., had found were badly infested with two new species of meadow nematode. Thinking that perhaps nematodes were also injuring these iris plants, we sent Dr. Steiner specimens from three different gardens from which trouble had been reported. He found meadow nematodes badly infesting the roots of each, and pointed out that the species of nematode on iris was causing lesions on the roots. He had previously written me that the meadow nematodes in the roots of boxwood usually infested the tips of the roots, thereby not causing lesions.

Having this knowledge, we now may believe that the injury to the Japanese iris in Professor Harper's New Jersey plantings might have been due to the lesion nematode, not primarily to the chaetopsis fly or to thrips.

Godfrey and Young[2] have shown that when soil infested with the lesion

[2] Godfrey, G. H. and P. A. Young. Texas Agr. Exp. Sta. Bull. 628: 16. 1943.

Roots of two Japanese iris plants, the leaves of which had turned brown and died, are shown at the left. The tufted or matted rootlets are characteristic of those infested with the lesion nematode. Some of the larger and more turgid roots show the reddish lesions caused by the nematodes. At the right is a root on which most of the rootlets have been killed by nematode infestation. If left in the garden, plants like this will die completely. Nematodes are now believed to be the cause of some iris troubles previously misunderstood.

nematode is properly fumigated with tear gas (chloropicrin), the nematodes are mostly killed. It is therefore reasonable to suppose that when rootlets of Japanese iris are infested by these organisms, one could save his plants by removing the infested tufts of roots, dipping the plants for an hour in normal solution of Semesan or in corrosive sublimate 1:1000, just as when iris is infected with sclerotium rot. The plants should then be set out in soil that has been sterilized with tear gas or some other effective fumigant.

Exploration . . .

The Process and the Result

THE TWO ADDRESSES *printed below were presented by two of the Garden's staff members who had recently returned from extensive botanical expeditions in tropical America, at the Annual Meeting of the Corporation of the New York Botanical Garden Jan. 22. They are published in this number of the Journal in order to accompany the Annual Report, being issued as Part Two of the October number, and distributed without extra charge to members of the Garden and to others who may be interested in following the year's activities at the institution.*

ON THE TECHNIQUE OF BOTANICAL EXPLORATION

By E. J. Alexander

EARLY collectors in Latin America did not make advance preparations for their trips other than studying maps and obtaining standard equipment. This, of course, must still be done, but now it is desirable to learn in advance, on the basis of the collections of the early explorers, something of the flora of the region to be visited. The kind of studies undertaken will depend upon the objectives of the trip. Since I was to maintain a balance between botanical and horticultural material, I needed to know what had been collected in both fields, so as not to gather common things, as well as where to look for rare plants and for new horticultural subjects, also the location of unexplored areas where new materials might be found. This necessitated long study in the herbarium, taking copious notes for field use.

Collectors in the countries below the border must obtain permits from the government of the country in which they wish to collect. These should be requested in person immediately upon arrival. Since Latin Americans never do anything at a fast pace, it is not possible to get the permits upon short notice, and it may be days, weeks, or in some cases, months before they arrive. For dried specimens, live plants and seeds, I needed permits from the Departments of Agriculture and Forestry, as well as letters to their field officers in the areas into which I expected to go. With the aid of U. S. Embassy officers, I obtained these in ten days.

Upon arrival in the field center, it is well to present these papers to the Presidente (Mayor) and ask for men who know the surrounding country, are available for work, and also willing to undertake it. Assistants are then chosen from those who present themselves, always selecting one number-one man, and allowing him to choose his assistants. On my trip this was easy, for Thomas MacDougall, with whom I was traveling, was well acquainted and had several partly trained men already informed by mail. It required several weeks to teach these men botanical collecting, as it was a new line to them, they being farmers and hunters by trade. Latin American helpers must be made completely acquainted with what one is doing, in detail, and why, for they have great difficulty understanding why one does things in which there is no financial gain. One must answer all questions and allow them to see all processes of the work in order to retain their good-will and loyalty. Frequent consultations are held, for the natives know their seasons and conditions of growth, and can give advice as to what areas to visit and when. It is to this native knowledge that I must give credit for the large quantity of seeds obtained, as well as many rarities, both horticultural and botanical.

Transportation Problems

Accessibility of places and ways of transportation thereto and back are also very important. Since Mexico is honeycombed with trails and bus lines, major jumps are best made by bus or train, and there are usually trails into any area where one wishes to collect. However, there are individual mountain areas and some jungle sections where trail-cutting is necessary. In one place, on Cerro Guiengola near Tehuantepec, there was a trail up one side of the mountain, but it was necessary to cut a trail across and down the other side in order to make a complete traverse of this triple-topped peak. Since these mountains rarely have water, it was also necessary to carry a supply of that, in addition to food, camping and collecting equipment. In fact, this carrying of water is necessary all over Mexico in the dry season, except in a few areas. Often we had to hire a horse or burro with its owner for heavy or long transport—occasionally two burros. When trails are too steep, the men carry the equipment. On the trip to the Sierra Juarez northeast of Oaxaca City, it required three men to carry the equipment and collections out. On the trip over the Sierra Tres Cruces to the Pacific coast of Oaxaca, we used two collecting assistants, and hired a local man at each village to carry the material to the next one, thus working it so that when we came out at Miahuatlan it was all waiting in a hotel room. The letters and permits from the officials proved useful in Comitán near the Guatemala border, where the local forester went with us himself as guide to insure us the courtesy of the natives for food and lodging. In the Cañon de la Mano Negra near Iguala in Guerrero the "Vice-Mayor" sent an armed deputy along to act as guard, carrier and guide.

Collecting Technique

In collecting, it is always advisable not to gather parts for herbarium specimens without first going over an entire colony in order to select representative material. This should be gotten into the press as soon as possible. Notes must also be taken of flower and fruit color and texture, odor if present, size, general appearance and type of plant, habit, habitat, and uses if any. In collecting seed, clean mature seed is always selected, and for plants, good healthy propagating material must be chosen. Labeling and wrapping are best done on the spot to avoid future confusion. Authenticating herbarium specimens should also be made from the same plants, if they are in identifiable condition. Since an experienced botanist can usually identify in the field a plant in flower or fruit as to family, and frequently as to genus, it is possible to have a reasonably good idea as to what group a plant belongs when only seeds are present. This must of course be confirmed by growing from seed and study of herbarium specimens. Full identity as to species is rarely possible in the field.

After the Plants are Gathered

Drying of herbarium specimens is one of the most tedious of the field-collector's many tasks. Each evening after the day's collecting, every one of the specimens must be gone over, carefully arranged in the position in which it is desired to dry, all surplus parts removed, each sheet numbered, and all placed in presses between newspaper sheets for the final drying. A stove for supplying artificial heat is usually carried along for field work, in order to speed the drying, which often takes two or three days in damp regions or during rainy periods, occasionally longer for thick stems and leaves. Since it was the dry season and I had ideal natural drying conditions in Tehuantepec and in Oaxaca, the two field centers, no artificial heat was needed, as all material dried in two or three days. Later in the season, with Mexico city as a center, the rainy season was on, and artificial heat was needed.

After all the day's specimens are put away to dry, which usually takes until midnight or later, it is then necessary to write up the day's notes, journal and records, and plan for the next day. Seeds must be washed clean of fleshy material to avoid rotting, and then laid out to dry, and live plants must be heeled into sand to prevent drying. Thus it is often two or three o'clock in the morning before one gets to bed, to be up again at daylight. Four or five hours of sleep were the most we usually had in the field, after a heavy day's collecting.

When all these tasks are finished, dried material and seeds must then be packed for storage in a dry place. We had storage places for this purpose in Tehuantepec, Oaxaca, and Mexico City, and a temporary one in San Cristobal Las Casas when working in Chiapas. It was finally necessary to get all of the material packed and shipped to Mexico City; then the final clearing job was ready to begin.

There it was necessary to clean all the live plants and dry off surface moisture to prevent rot in transit. Seeds must also be given a final cleaning to remove any diseased or insect-infested ones and to remove surplus material to lighten the weight. Dried living specimens must be sorted and also cleaned to facilitate passage through the U. S. Plant Quarantine Stations and thus avoid delay in reaching destination. Then permits were again required for each shipment, each permit taking about a week to obtain. All of these tasks demand a surprising amount of time and tedium which one must undergo himself to appreciate fully.

The collector then returns and awaits the arrival of the specimens. Next comes the work of identification, rounding up of reports, and analyzing the results obtained. This usually takes the longest time of all—sometimes years, especially as one must always wait for plants grown from seed to reach identifiable maturity.

Some of the results which may be reasonably expected from this particular Mexican trip are briefly:

Introduction to horticulture of many new or rare subjects of ornamental or economic value. Some of those which offer special promise are a fine red-flowered lobelia twelve feet tall; a golden-flowered tree mentzelia; an exceptionally fine-flavored persimmon; a fine pure white day-blooming epiphyllum; several fine morning-glories with royal purple, lilac, rose-purple, and buff-yellow flowers; a fragrant, white-flowered, shrubby eupatorium; a rich blue-flowered shrubby salvia; a fine large purple-flowered shrubby vernonia; a thistle-like plant with nodding red flowers; an intensely orange marigold-relative; a passion-flower with highly ornamental red fruit; an orange-yellow thistle-like shrub; a beautiful golden-flowered, fragrant, willow-leaved tree bignonia; and the famous hand-flower tree.

There can also be expected a fair percentage of species new to science, rare plants of which the institution has no specimen; important range extensions, and new collections of little known species, besides much learned of the flora of Mexico, particularly some little visited sections, all of which will serve towards a future rounding-up of our knowledge of the flora of our neighboring republic.

ON THE IDENTIFICATION OF MATERIAL IN THE HERBARIUM

By W. H. Camp

DURING the war there were numerous calls for exact information from systematic botanists concerning a great variety of strategic plants, particularly regarding their exact distribution and abundance. Some of this could be furnished at once, but, as in so many other fields, we were unprepared. In my opinion this unpreparedness cannot be laid entirely at the door of the systematists themselves; rather, it is because the field is so large and the workers so few. Ironically enough, had even half the amount spent during the war emergency been expended previously in bringing the basic data together on even the more important of the economic plants, additional amounts extending into the multiplied thousands of dollars wasted in unnecessary fumbling without this essential data could have been saved.

Furthermore, although we might easily disregard the dollars lost, we cannot lightly pass over the lives lost by our unpreparedness in the matter of certain medical supplies and *matériel.* This war demonstrated as never before that the namer of plants—the systematist—in his herbarium is not an "ivory tower" scientist but an important cog in our civilization.

Certainly the problems of a civilization at peace are no less than one at war. It therefore would seem advisable that we continue the work of systematizing our knowledge of the relationships, distribution and availability of plants with all the energy at our command.

From Mountainside to Printed Page

Of the various things which happen between the time a plant is growing on some distant mountainside and the time it becomes officially "christened" only two of the things which happen to it have received any publicity. These are its collection by some plant explorer on an expedition (and the words "explorer" and "expedition" always have carried a sufficient aura of romanticism) and later when it becomes officially "christened" by having its diagnostic characters and name laid out in cold and impersonal black and white on the printed page (an event noted only by a few of the describer's fellow systematists). For the explorer and systematist (who may be and often are one and the same person), these two operations—the collecting and publication—are only a small part of the story. Let us, therefore, for a brief moment consider just what happens between the time a specimen is received in the herbarium and the day it has an official Latin (botanical) name attached to it.

Contrary to popular supposition, the world's land surface has not been adequately covered by means of manuals, floras, or even lists. So much has yet to be dealt with in an organized manner that, for the most part, the systematist working over the material brought back by the latest expedition has almost literally to dig out his identifications as best he can.

Confronted with a specimen, the systematist must first make a tentative identification as to the family. This rarely presents any great problem, but there are cases where almost complete bafflement occurs. If flowers are present one or several of these dry and shriveled husks must first be carefully boiled so as to be made once again pliable and to bring the parts back to something of their normal shape. Then the flowers must be dissected under the powerful lenses of special microscopes to determine the number of parts and their arrangement. This usually clinches the position, so far as the family is concerned.

For the next step—the identification as to genus and species—the systematist can consider himself indeed lucky if there is anything approaching a recent monograph of the group or family in which he has ascertained the plant belongs. At times in the older and necessarily very incomplete works he is able to place the material in its genus; all too often, however, he has but one recourse and that is to take his specimen into the herbarium and begin the laborious and time-consuming process of "matching."

In one of the larger herbaria, such as that of the New York Botanical Garden, he may be fortunate enough to match his specimen with others previously collected and (he hopes) correctly labeled. If the group to which the plant belongs is relatively small, there usually is but little trouble and the matching is done in a relatively short time; but if large—say with several hundred species already known from that general part of the world—then all he can do is grind down through the herbarium, species after species and case after case, until he chances upon a perfect match. When one recalls that this matching often has to be done with the aid of a magnifier or microscope it is easy to envision the days it sometimes takes to identify a single specimen. On the other hand—and this is especially true if the material came from one of the lesser known areas of the world—there is a great likelihood that he is unable to match it; if so, his troubles have just begun.

If in his search through the herbarium the systematist fails to match the specimen, then he must go to the literature. But first he must pore over the various indexes so that he can assemble and check the available literature pertaining to this group of plants to ascertain what other species not in the herbarium have been previously described from the same region. If so, then he goes into the library, digs out the literature and carefully translates the descriptions (which may be in Latin or one of several modern languages) to see if any of them apply to his material. Again, if he does find in any reasonably short time that the species already has been described, he can count himself lucky. If he does not find a suitable description he yet is not positive that he has a new species and must go through the literature in ever-widening circles and along natural lines of plant distribution to make certain that it is not a species with a wider distribution than known to the original describer. For example: a specimen from the Sierra Madre Range of southern Mexico must be checked against material from the rest of Mexico as well as from all of Central America and even into northern South America; if it comes from the eastern side of the same range the careful taxonomist can feel that he has been thorough only after he has checked the plants from certain areas in the Caribbean and in Venezuela.

If there still is no suitable description, then comes an even more laborious type of work. None of the indexing services possibly can keep completely up to date, so the next step entails a careful search through the more recent literature, covering possibly the last five years. And when one remembers that there are about 1,200 journals which publish botanical material, one can envision the task confronting the researcher who does not desire to burden the literature further with a confusing duplication of described species.

During the work of identifying a single specimen, sometimes so much detailed work has to be done on even a small group that it is advantageous to bring this material together in printed form in a preliminary study or revision of the group. If there is ample material available in the way of specimens and if the work in the past has been at all creditable, the systematist can, on the average, plow through the material at the rate of one or possibly two species per day; but the organization of the background literature and its evaluation in the light of the collections present is such a task that it usually proceeds at a considerably slower rate. The conscientious systematist knows that to force the work along at a more rapid rate usually results in a sloppy text needing revision as soon as it is published. These preliminary revisions are a natural outcome of the identification of materials from the lesser known parts of the world; they are perhaps the most valuable immediate results obtained.

Thus it is that months or even years after it is collected—and after a long and often tedious process of checking against collections in the herbarium as well as all the literature available—there appears in print in some botanical journal the description of a "new species"—new only in the sense that it has heretofore never been known to the scientific world.

BROADCAST

By William H. Ukers

TEA MANUFACTURE *and consumption through the ages was the subject of the broadcast given for the New York Botanical Garden over* WNYC *July* 12 *by William H. Ukers, Editor of the Tea & Coffee Trade Journal, and author of "All About Tea," "All About Coffee," and "The Romance of Tea." The paragraphs below have been adapted from his script, which was entitled:*

Sixteen Centuries of Tea Drinking

WE of course have no way of telling how long the people of China and other countries may have been drinking tea. But we do know that they have been using it for at least 1,600 years, for from the year 350 A.D., when we have the first reliable literary reference to tea, we have a continuous story of its cultivation and use.

The Earliest Reference

The first authentic mention of tea appears in a Chinese dictionary annotated by the celebrated Chinese scholar Kuo P'o. Tea is defined there and the information is added: "A beverage is made from the leaves by boiling." In this dictionary it is called KIA; but later it became CH'A, which in the dialect of Amoy was pronounced "tay." Some countries—Portugal and Russia for example, also Arabia and Turkey—have taken their word for tea from the CH'A of the Cantonese dialect. Others have taken it from the Amoy, and thus we get in several familiar languages, such as French and German, a word that sounds like "tay," or in the English language, *tea*. But the botanical name of the tea plant has a different sort of derivation. The German botanist Kaempfer, who in the 17th century first applied to the plant the name *Thea,* chose a classical name which would sound as much as possible like the Oriental name. When Linnaeus, from whom all modern botanical names are dated, in 1753 adopted Kaempfer's name for the tea plant, he, being a good classicist, did so for a double reason: first, because it represented the barbarian name (as he put it), and also because it was the same as the Greek word for *goddess*—an appropriate name, he felt, for this particular plant, which man might well conceive to be divine.

Geographical Origin

The birthplace of tea is believed to be in south central Asia, occupying Yunnan in China, part of Indo-China and Burma, and Assam in the eastern part of India, in what is known as the monsoon district. It is very mountainous there, and the best teas come from mountainous regions.

Tea was brought into cultivation from its home in the wild very early in its history. From the time we have that first Chinese dictionary reference to tea—350 A.D.—we know that tea was being grown in the Yangtze valley, and from there it gradually moved eastward to the sea.

An Ancient Publicity Stunt

Another book about tea appeared in the 7th century, but a more important one came about 100 years later, in 780. It is a wonderful book—an entire volume devoted to tea—its history, cultivation and uses. It was a good publicity venture written at the request of the tea merchants, who induced the author, Lu Yu, to quote an emperor as saying, "The use of tea grows upon me surprisingly; I know not how it is, but my fancy is awakened and my spirits exhilarated as if with wine."

Although the Chinese tea growers hoped to keep their methods a secret from the prying eyes of the world, it was the tea book of Lu Yu which gave the information later to foreigners who wanted to learn how to grow tea in their own countries. Lu Yu not only told his readers how tea should be drunk, but he was the one who created or formulated the Code of Tea out of which grew the Japanese Tea Ceremony.

The Formal Drinking of Tea

This ceremony, as it is practised in the best social circles, is like this:

After the tea is prepared, the tea-drinker receives the dish of tea from the hands of the serving maid with great solemnity, raising it to his lips with both hands in a very dignified fashion. The guest may slowly take several sips, but he must be careful to leave a small sip in the bowl. Then, as he tosses off this final sip, he is expected to throw back his head and drain the divine nectar into his gullet with a distinct sucking noise, to attest his great delight with the draught.

As the Tea Ceremony was originally practised, the chief guest takes a sip first, then the teabowl is passed to the next person, who in turn passes it round until it reaches the host, who drinks last. Sometimes a cloth or napkin is provided for handling the bowl and for wiping the cup after each person has drunk. The bowl is held in the palm of the left hand, supported by the thumb and fingers of the right. The proper procedure is this: The guest takes the bowl; raises it to the level of his forehead; lowers it; drinks; lowers it again; returns to the first position. During the last four positions the bowl is gradually given half a turn toward the right, so that the next guest has a clean spot from which to drink.

When the host has finished drinking, it is the proper thing for him to apologize for the tea, saying what poor stuff it is, and so on. After that, the empty bowl is passed around for the guests to admire, as it is often a piece of great antiquity or of historical interest. With this the ceremony closes. The guests take their leave, the host kneeling at the door of the tea-room as they pass out, receiving their compliments and farewells with many bows and obeisances.

This, of course, does not go on every time that one uses tea in Japan, for the entire population drinks it almost continuously, usually with very ordinary tea made from coarse, cheap leaves. It is only for special occasions that the ceremony is brought into play.

Tea in Europe and America

Tea first made its way from the Orient into England about 1650. It was very expensive then, costing from six to ten pounds—that is 30 to 50 dollars—a pound. In 1660, Samuel Pepys records in his diary that he had his first cup of tea. About this time a quantity of tea was brought to England from the Netherlands, where the serving of this drink already represented social elegance. Gradually, tea began to replace coffee in the coffee houses, and in the better class homes the drink began to be accepted. But it was about the 18th century before it became such a popular drink that tea-gardens were established. Here at places such as the Belvedere, Kensington, and Marlboro, the tea-gardens provided flowered walks, shaded arbors, music for dancing, bowling greens, entertainments, concerts, even opportunity for gambling.

In the meantime, tea had become of sufficient importance as a beverage in homes to create a stir among the colonists in America. Tea was known in the Massachusetts colony as early as 1670. It was first sold at Boston in 1690 by two dealers, Benjamin Harris and Daniel Vernon, who had to take out licenses to sell tea "in publique" in accordance with the English law requiring every purveyor of tea to have a license for its sale.

Although tea has been a popular drink through the ages, there were a number of reformers in Great Britain in the 18th century who talked against it. No less a figure than the preacher John Wesley declared tea to be harmful to both body and soul. We might add, however, that Wesley late in his life became a tea drinker and even is said to have given tea parties. On Sunday mornings he would entertain all the Methodist preachers of London at breakfast, and he would serve them tea from a half-gallon teapot especially made for him by the famous potter, Josiah Wedgwood. It is just another example of how the art of drinking tea has made its influence felt in pottery, painting, and poetry.

Making Black and Green Tea

Several different kinds of tea can be bought in American stores, among them plain green and black tea. These two can be obtained from the same leaves. After plucking, if black or fermented tea is desired, the leaves are withered. This is the first manufacturing process, the object of which is to develop the fermenting principle.

The second step is rolling by hand or by machine, to break open the cells of the leaf in which the tea juices are stored. This must be done without tearing the leaf.

The third process is fermentation. As soon as the juices produced are exposed to the air, oxidation starts and the leaf assumes a bright copper color. During fermentation the leaves are spread out on tile or cement floors or tables.

The fourth step in producing black tea is drying or firing, which may be done in baskets over charcoal fires or in tea-firing machines.

If green tea is desired, fermentation is stopped by panning or steaming the leaves soon after plucking. In Ceylon and India the freshly plucked leaf is steamed in revolving perforated cylinders. In China, Japan, and Formosa, where hand manufacture is more common, the leaves are tossed about by hand in an iron vessel built into a charcoal stove. As soon as they become soft they are taken out, steaming hot, and rolled by hand on a bamboo mat or paper tray, only to be returned to the pan again in a few minutes, the steaming and rolling continuing alternately until the leaves begin to crisp, when they are put into trays and thoroughly dried over slow charcoal fires.

In the manufacture of Oolong tea, which is halfway between these two, the leaf is given a light wither to permit a slight ferment, after which it is panned and rolled by hand and then fired in hour-glass-shaped bamboo baskets over charcoal fires.

The Meaning of "Pekoe"

Pekoe and orange pekoe are names for the housewife to conjure with. Orange pekoe has nothing to do with oranges as fruit, nor is it a particular kind or quality of tea. The term was originally applied to a tea in China scented with orange blossoms. It was later broadened to cover a more or less well twisted leaf, with or without a tip. Generally speaking, today, it is a *grade* which results from sifting the tea, after firing, through a sieve which has a mesh of a certain size. In no sense is the term a description of quality. PEKOE, Chinese for "white hair," originally meant the earliest tea pickings, —those of leaves so young that they were still covered with down. Now it too means a leaf grade, lower than orange pekoe, which results from sifting.

A Choice of Tea

The best kind of tea to use depends entirely upon one's personal taste, and to determine that, one should first try the best known kinds—such as the fermented or black, the unfermented or green, and the semi-fermented or Oolong teas. In each of these classifications there are many different grades, and eventually one can find the tea to suit his taste. My own personal choice is either a Darjeeling which is the finest and most delicately flavored of the India teas, or a Formosa Oolong. I also like the Keemun tea of north China, which is black, and I find the mountain-grown Ceylon hard to resist.

How To Make Good Tea

The best way to make tea is to use freshly drawn, slightly soft or slightly hard cold water from the faucet. Bring it to a bubbling boil. Allow one rounded, standard teaspoonful of tea for each cup of tea required. Pour freshly boiling water over the tea leaves in a heated earthenware, porcelain, or glass pot and let them steep for three to five minutes, depending upon the kind of tea used. Stir while infusing. Pour off the liquor into another heated china vessel and never use the leaves a second time.

NOTICES AND REVIEWS OF RECENT BOOKS

Root Disease Fungi

ROOT DISEASE FUNGI. S. D. Garrett. 177 pages, illustrations, index, bibliography. Chronica Botanica Co. Waltham, Mass. G. E. Stechert & Co., New York, 1944. $4.50.

This book was written by a mycologist who had himself made extensive studies regarding the spread and control of soil-borne diseases, especially of crop plants. While only a few of the most important root diseases are discussed in detail, the author has brought out the basic principles which apply equally well one way or another to the control of a great many other plant diseases. Under the topic "Parasitic Specialization" in root infecting fungi, the question of mycorrhizal activities is clearly explained. He brings out the fact without prejudice as to one theory or the other that under certain environmental conditions which provide the essential nutrient material in forms available to the plant, no mycorrhizal fungus is necessary. On the other hand, there are many situations where the same plant would not find the materials in available form. The plant then sickens and dies. It is in such an environment that the natural mycorrhizal fungus, if present, brings about the necessary chemical changes so that the plants receive adequate amounts of available foodstuffs and so thrive. It is not a question of whether or not an orchid, for example, *can* be grown and made to blossom beautifully without mycorrhizal fungi. That question has been settled once and for all in the affirmative. The question is: when is there a *must* call for mycorrhizal assistance?

Among the important topics discussed we find that of soil environment, especially as it pertains to the spread of root diseases. Cabbage yellows, tomato and flax wilts, and the *Gibberella* seedling blight of wheat are favored by high soil temperatures. Onion smut, tobacco root rot and stem canker of potato are favored by low temperatures. One is at first surprised to find that the author places the seedling blight of wheat in one group and the seedling blight of corn in the other group when both diseases are caused by the same *Gibberella* fungus. The point is brought out that wheat and corn are not at all alike in their susceptibility to initial attack under high and low soil temperatures.

More than 20 diseases favored by high soil moisture condition are listed. Among them we find root rot of corn, pineapple wilt, and foot rot of cereals. Of the 13 diseases favored by low soil moisture we find that 10 are smut diseases of cereals. The reason for this, the author points out, is that the initial infection by smuts is especially favored by the better aeration in drier soils.

The author also discusses very clearly those diseases favored by light soil as contrasted with heavy soils, and those favored by alkaline soils over acid soils. Methods of control must therefore be varied to meet such environmental conditions. Some root rot diseases of plants are favored by applications of organic matter, while other diseases like "take all" of wheat, and cotton root rot are *controlled* by applying organic matter. The author shows that one must also vary his methods of control where plantation crops are grown in virgin areas as contrasted with crops in old plantations.

The book is of the type which will be found especially valuable to those younger plant pathologists who are in need of a comprehensive review of that phase of plant pathology about which they are likely to be less well informed, especially as the book deals in general terms where methods of control involve basic principles widely applicable.

A good bibliography of about 400 titles and rather complete general and author indexes make the book all the more valuable as a reference work on root diseases caused by soil-borne organisms.

B. O. DODGE.

As Tom Barbour Lives On

A NATURALIST'S SCRAPBOOK. Thomas Barbour. 208 pages, illustrated, indexed. Harvard University Press, Cambridge, Mass. 1946. $3.

In Thomas Barbour's "A Naturalist's Scrapbook," published a few months after his death, one feels the all-absorbing enthusiasm which carried this big kindly man all over the world in search of specimens to enrich the collections of his beloved museums. The book is a series of sketches and anecdotes of people and interesting experiences connected with his long years as Director of the Museum of Comparative Zoology at Harvard and Director of the Peabody Museum at Salem and the Boston Museum. He gave his time to these museums purely for the love of the work. Few people with independent means ever do as much as he did to help young scientists achieve their goals.

We knew him intimately, for he spent many winters in Coconut Grove, Fla., at the Kampong, home of Dr. and Mrs. David Fairchild. He had a little house which we called "Tom's house." There he was free to get up early, go off marketing in search of strange things to bring home to cook, and to study and write. Many of the chapters of his earlier books were written there under the big old *Ficus* trees that shaded his house. With the help of some of his young museum friends he set up the Palm Products Museum at the Fairchild Tropical Garden, of which he was a director. He called himself a "pack rat" for he was always on the lookout for new specimens. Several times, in the back of our car, we had the company of a large live snake which he had picked up on the Tamiami Trail.

We are grateful that Tom Barbour lives on so vividly in his four splendid, human books, and I feel sure that they will bring stimulus to the imagination and inspiration to many young men and women in the years to come.

ELEANOR F. MONTGOMERY.

A Many-Faceted Garden

WITHIN MY GARDEN WALLS. Georgia Squires Whitman. 156 pages, indexed, illustrated. The Tool Shed Press, Bedford, N. Y., 1939. Distributed by Wm. S. Heinman & Co., New York 10, N. Y. $1.

This is a book for the experienced gardener who likes to compare gardens and is familiar with plants, their botanical and common names, and with the making of gardens.

The large garden of the author includes many smaller gardens devoted to the growing of certain plants. The book describes these various gardens in detail. To the beginner or those who can devote only a small amount of time or money, the book is confusing and discouraging.

The picking garden is a good suggestion, as flowers may be gathered there without disturbing those growing in the more formal gardens. The green garden appeals to those who love to be out of doors, yet haven't the time to cultivate many flowers.

LETHE BIZZELL HUNTER.

Plants of Primitive Use

ETHNOBOTANY OF WESTERN WASHINGTON. Erna Gunther. University of Washington. Publications in Anthropology 10:1-62. 1945. $1.50

A summary is given here of the common names and uses of plants of western Washington employed by various tribes of the indigenous population as medicines and food, and in their economy and ceremonials. As often occurs among primitive peoples, some of the materials they used as medicines would seem to have little use except as psycho-palliatives; conversely, a goodly number either are part of our pharmacopoeia today or are closely related species which may be presumed to contain at least slight amounts of similarly useful substances.

For the Beginning Herb Gardener

TRY GROWING HERBS. Helen M. Whitman. Unpaged. The Tool Shed Press, Bedford, N. Y., 1942. Distributed by Wm. S. Heinman & Co., New York 10, N. Y. $1.

This book is useful to those who are starting to study or grow herbs and are interested in botany as well as gardening. The information is brief and simply told and encourages further study by giving the botanical name and family of the herb, habitat, part used, and description of the plant. The page devoted to personal experience with each kind is helpful in the keeping of records of herbs in the garden.

An excellent book, even allowing for errata at the end. The title is exceptionally well chosen.

LETHE BIZZELL HUNTER.

Photosynthesis in Simple Terms

PLANT FACTORIES. Bertha M. Parker and Orlin D. Frank. 36 pages, illustrated in color. Row, Peterson & Co., Evanston, Ill. 1944. 32 cents.

This is one of the Basic Science Education series prepared by scientific authorities on the staff of the Laboratory Schools of the University of Chicago, that is definitely a contribution to all teachers of beginning courses in biology and to those in charge of nature rooms. The booklet tells the story of photosynthesis in such a way that young minds can easily grasp an understanding of this fundamental process. The formation of sugar and starch in the living chloroplasts from the essential raw materials of nature is accurately described without textbook terminology.

A very attractive feature of the publication is the numerous colored illustrations by Matilda Brewer. The teaching profession should welcome all the other botanical subjects in this series.

E. E. NAYLOR.

Notes, News, and Comment

Annual Report. The Annual Report of the New York Botanical Garden is being distributed to members with this number of the Journal. Others who wish to read it may obtain a copy without cost by writing to the editor. This year's publication, in addition to the annual reports of the Director and the Treasurer, the titles of papers published by staff members, illustrations, and the list of members, contains a list of all expeditions sponsored by the Garden since 1897. Nearly 250 collecting trips are recorded.

Fifteenth Trip. When he returned from the West in early September, Dr. Bassett Maguire had completed his fifteenth summer of exploring in the Intermountain Region. His work this year with Professor A. H. Holmgren, Utah State College, was largely in Oregon, with Burns and Baker as headquarters. He also worked out from Boise, Idaho, during late June and early July.

To Georgia. Dr. Arthur Cronquist, who had been a member of the scientific staff at the New York Botanical Garden since June 15, 1943, first as Technical Assistant, then as Assistant Curator, left Sept. 1 for Athens, Georgia, to become Assistant Professor of Botany at the University there.

Staff. Marjorie Anchel has been appointed Research Associate at the New York Botanical Garden, effective Oct. 1. Dr. Anchel (Mrs. Herbert Rackow) was working until recently on the chemistry of penicillin at the Squibb Institute for Medical Research in New Brunswick. She obtained her Ph.D. degree at the Physicians' & Surgeons' Hospital of Columbia University, working under the late Dr. R. Schoenheimer. Later she was associated there with Dr. H. Waelsch. For a while she did organic chemical research at Queens College. At the Garden she will co-operate on the chemical aspects of the work being done on antibiotics and nutrition.

Visitors. Dr. G. Ledyard Stebbins, Jr., Professor of Genetics at the University of California, who is in New York to deliver the annual series of Jesup Lectures at Columbia University, is spending some of his time at the Garden. The lectures are being given on Tuesdays at 5 p.m., starting Oct. 15 and concluding Nov. 26. Dr. Stebbins' subject is "Variation and Evolution in Plants."

Dr. Lulu O. Gaiser of McMaster University, Hamilton, Ontario, spent the last of August at the Garden working on the cytology of *Liatris*.

Dr. Jacques Maton, a student of plant physiology at the University of Ghent, came to the Garden Sept. 23 to visit the laboratories. Dr. Maton is spending a year in the United States as a Fellow of the Belgian American Educational Foundation.

Dr. Shuh-wei Hwang spent three weeks during September becoming acquainted with work in the physiology and plant pathology laboratories before she returned to China.

Dr. William D. Valleau, University of Kentucky, visited the Garden and its laboratories Sept. 20.

D. F. Lunsingh Scheurleer of The Hague, Government Adviser for the Museums, Ton Koot, Secretary of the Rijksmuseum in Amsterdam, and Dr. R. van Luttervelt, Curator of the Department of History of the Rijksmuseum, were visitors at the Garden Sept. 13.

Dr. H. S. Reed of the University of California, author of "A Short History of the Plant Sciences," was at the Garden Sept. 20.

Other visitors of recent weeks have included José Vera Santos of the botany department, University of the Philippines; K. L. Yang, National Medical College, Shanghai; Elizabeth Buell, biology department, Eastern Illinois State Teachers' College; Robert K. Zuck, Drew University, Madison, N. J.; Elbert L. Little, Jr., U. S. Forest Service; Harry C. Fink, Iowa State College; A. Lwoff, Institut

Pasteur, Paris; M. A. Donk, of the Herbarium at Buitenzorg, Java; Thomas D. Grieve, Edinburgh, Scotland; Arne Müntzing, Lund, Sweden; Camilla Bradley, Editor of *Home Gardening in the South,* New Orleans; Geneva Sayre, Russell Sage College; Wu Chung-huen and Hsiung Wen-yue of Szechwan, China; Elizabeth A. Valentine, University of Pennsylvania; Harry K. Phinney, Chicago Natural History Museum; J. D. Padwick, mycologist, of London, formerly of India; F. Hyland and E. C. Ogden, botany department, University of Maine.

Plants for Pacific Islands. Through Otto Degener, the New York Botanical Garden is assisting the Navy Department in selecting suitable plants for the devastated islands of the Pacific. Stimulated by his four articles entitled "Tropical Plants the World Around" published in the Journal in 1945, Captain W. F. Jennings, Assistant Chief of Naval Operations (Island Governments) wrote to Mr. Degener for further information. The reply took the form of a list of more than a hundred names, with brief descriptions, of plants recommended for soil conservation, ornament, and food on the islands where much of the native vegetation has been destroyed by bombs. The list was prepared in co-operation with Amy Greenwell. "The information furnished by you was most valuable and interesting," Captain Jennings wrote in appreciation. "The letter and its enclosure have been reproduced in quantity and forwarded to the Military Government officers in the field for information and guidance. A number of copies were sent to the School of Naval Administration at Stanford University where I am sure they will be a valuable addition to the textual matter used at the school."

Convocation. Dr. William J. Robbins was invited this year to give the address for the opening convocation at Columbia University Sept. 25. He spoke on "The Challenge of Science."

Africa. Notes from the diary of L. J. Brass, who is collecting in Nyasaland, in southeastern Africa, for the New York Botanical Garden, show that he spent about two weeks collecting on Nchisi mountain, the last of July and first of August, then about two weeks on Nyika, which is a high plateau practically unknown botanically. At Nchisi, which stands some 6,000 feet above sea level, on the edge of the western escarpment of the Great Rift Valley, approximately one-third of the plants, he reports, are of the same species found on the lower plateau of Zomba, while the remainder are new. At about 5,000 feet the mountain is covered with brachystegia woodlands.

Microfilm Reader. The Garden has acquired a microfilm reader for the Library, and is having films made of some of its own books and of borrowed volumes that it does not possess. It is planned to continue having old and rare works photographed, and to use the films rather than the books for reference, in order to save wear and tear on irreplaceable volumes. Whenever a book has been microfilmed, the card catalog will bear a notation.

Birthday. Professor Cassiano Conzatti of Oaxaca, the dean of Mexican botanists, who has become the cherished friend of every botanist from the United States who has done collecting in southern Mexico, observed his 84th birthday August 13. Many of those who have been associated with him through the years, among them members of the staff of the New York Botanical Garden, recognized the occasion with letters of remembrance. A biographical note and appreciation of Professor Conzatti, written by Dr. W. H. Camp after his return from Mexico, appeared in this Journal in May 1937.

Storm in Missouri. In a letter thanking the Garden for two living specimens of *Pitcairnia nuda,* collected on Table Mountain, Surinam, in 1944 by Dr. Bassett Maguire, Ladislaus Cutak, who is in charge of succulents at the Missouri Botanical Garden, described a storm which did severe damage at the Garden Sept. 1. "Although approximately 1,200 lights were broken on the greenhouses," he wrote, "no damage was made to the indoor plants. The grounds were hit hard instead. Hundreds of trees were damaged and uprooted, fences and rock walls ruined, all the roses, bedding plants and waterlilies defoliated by the pounding hail. The grounds looked like a battlefield after a heavy artillery fire."

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

Third Avenue Elevated to the Botanical Garden
York Central to the Botanical Garden station

Membership in
THE NEW YORK BOTANICAL GARDEN
and what it means

TO THE INSTITUTION, membership means support of a program that reaches several hundreds of thousands of persons annually.

Briefly, this program comprises (1) horticultural display, (2) education, (3) scientific research, and (4) botanical exploration. To further this work and to disseminate useful information about plant life to the public, the Garden issues books and periodicals, both scientific and popular, and presents lectures, programs, radio broadcasts, and courses of study in gardening and botany. The laboratories and large herbarium and library serve the staff in its research and educational work, while the extensive plantings at the Garden give the public vistas of beauty to enjoy the year around. The public is also free to use the Botanical Garden's library, and, under direction, to consult the herbarium.

TO THE INDIVIDUAL, membership means, beyond the personal gratification of aiding such a program, these privileges:

Free enrollment in courses up to the amount of the annual membership fee paid.

A subscription to the Journal and to Addisonia.

Admission to Members' Day programs and use of the Members' Room also at other times.

A share of plants when made available for distribution. (These plants may include the Garden's new introductions into horticulture.)

Personal conferences with staff members, upon request, on problems related to botany and horticulture.

Free announcements of special displays, lectures, broadcasts, programs, and other events.

Use of lantern slides from the Garden's large collection, under established regulations for such loans.

A membership card which serves as identification at special functions at the Botanical Garden and also when visiting similar institutions in other cities.

* * * *

Garden clubs may become Affiliate Members of the New York Botanical Garden, and thus receive certain privileges for the club as a unit and others for individual members. Information on Garden Club Affiliation will be sent upon request.

Business firms may become Industrial Members of the New York Botanical Garden. Information on the classes of Industrial Membership and the privileges of membership will be sent upon request.

* * * *

Classes of membership in the New York Botanical Garden in addition to Industrial Memberships are:

	Annual Fee		*Single Contribution*
Annual Member	$ 10	Member for Life	$ 250
Sustaining Member	25	Fellow for Life	1,000
Garden Club Affiliation	25	Patron	5,000
Fellowship Member	100	Benefactor	25,000

Contributions to the Garden may be deducted from taxable incomes.

Contributions to the Garden are deductible in computing Federal and New York estate taxes.

A legally approved form of bequest is as follows:

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

Gifts may be made subject to a reservation of income from the gift property for the benefit of the donor or any designated beneficiary during his or her lifetime.

All requests for further information should be addressed to The New York Botanical Garden, Bronx Park, New York 58, *N. Y.*

The Fiftieth Anniversary Daylily

THE NEW YORK BOTANICAL GARDEN

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ANNUAL REPORT OF THE DIRECTOR

FOR 1945

★ ★ ★

Comprising a separately paged part of

The Journal of the New York Botanical Garden

VOLUME 47 · NUMBER 562 · OCTOBER 1946 · IN TWO SECTIONS: SECTION TWO

TABLE OF CONTENTS

ON THE COVER

THE FIFTIETH ANNIVERSARY DAYLILY, shown on the cover, was selected during 1945 from among the hybrids developed at the Garden by Dr. A. B. Stout as one of the outstanding flowers to be named during the year. It was first described in the *Journal* for April 1945. The flowers, which have a spread of five inches, are of orange-red with a broad midzone of oxblood red in the petals and a greenish-orange throat. The plant is evergreen in habit. While this daylily is now being propagated by the Farr Nursery Company, it has not yet been distributed to gardeners.

JOURNAL
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SECTION TWO

ANNUAL REPORT OF THE DIRECTOR FOR 1945

William J. Robbins

THE year 1945 has been marked by the celebration of our 50th anniversary. Incorporated in 1891, the New York Botanical Garden began active operations in 1895[1] and celebrated its 20th anniversary in 1915. The New York Botanical Garden in its first 50 years of existence has fulfilled the hopes of its founders and justified the public and private support it has received. As Mr. Henry de Forest Baldwin so aptly said during part of the Fiftieth Anniversary Celebration: "We are no longer a speculation. An investment in the New York Botanical Garden is a sound and seasoned investment."

This is not the place to detail the accomplishments of this institution. For 50 years its grounds and displays have been a pleasant place of resort for millions and an inspiration to those who enjoy the beauty of flowers or who are interested in the variety and extent of the plant kingdom. Through the labors of its staff it has established a reputation for scientific work of high

[1] The New York Botanical Garden might well trace its origin to the Elgin Botanic Garden which was established in 1801, purchased by the State of New York in 1811, transferred to Columbia College in 1814, and abandoned as a botanical garden about that time. Dr. Marshall A. Howe in an article published in 1929 referred to the New York Botanical Garden as the legitimate and permanent successor of the Elgin Botanic Garden. When the history of the two gardens is examined it is easy to understand the statement. Dr. David Hosack, founder of the Elgin Garden, was Professor of Botany and Materia Medica in Columbia College. He hoped that his garden would become a well supported public institution comparable to the Jardin des Plantes in Paris and in the preface of his "Hortus Elginensis" published in 1811 he stated that as soon as the Regents of the University had made provision for the permanent preservation of the garden he intended to publish an American Botany or Flora of the United States, which was to be illustrated.

Nathaniel Lord Britton, who was instrumental in founding the New York Botanical Garden, was Professor of Botany in Columbia College. He had taken the Royal Botanic Gardens at Kew as his ideal and through the Floras published by Britton and Brown, Small and Rydberg as well as the ambitious North American Flora which is still to be completed, the New York Botanical Garden has largely accomplished the Flora of the United States which Dr. Hosack expected his botanical garden to produce.

Further parallels could be drawn indicating that the New York Botanical Garden is the spiritual if not the material descendant of the Elgin Botanic Garden.

caliber and has accumulated a library, herbarium, and collection of tender and hardy plants which attract professional and amateur students from this country and abroad. Its popular and technical publications, amounting to more than 100,000 pages, have materially contributed to the development of botany and horticulture. Former students and members of its staff have utilized the experience gained here to play important roles in other organizations. Its living collections have served through the years as a source of material for other institutions. It has carried on or taken part in nearly 250 expeditions to various parts of this country and other countries of the world. Its service in furnishing authoritative information on plants has steadily increased. In short, the New York Botanical Garden in 50 years has developed into an institution of national and international importance and played its part in preserving, disseminating and increasing man's knowledge of plants and in encouraging the people to enjoy and appreciate the recreational value of plants and their culture.

This record was made by those devoted men and women who founded the Garden, obtained support for it, formulated its policies, and were responsible for its accomplishments. Many of them are gone from us forever; others have made their contribution and have retired from active service; some are laboring elsewhere; few of the old guard are still on duty. Those of us more recently associated with the Garden — and others who will come after — have an obligation to make the next 50 years as fruitful in public service, in the art of horticulture, and in the science of botany as the last 50 years have been.

Completion of plans made by the Board of Managers for strengthening and expanding our educational, scientific, and horticultural work and, in cooperation with the Department of Parks, for improving the grounds and buildings, will give the Garden better facilities and more opportunity than it has enjoyed in the past. An organized effort to obtain the funds needed to bring these plans into being has been under way for the past year.

Reconversion from a wartime to a peacetime status is as necessary in a botanical garden as elsewhere. We are progressing in that direction. Some of our former employees have already returned from service with the armed forces, but it will take time to re-establish our organization and to return all our activities to a prewar status.

Last spring the Board of Managers established a new class of membership, Industrial Membership, the purpose of which is to bring industries concerned with plants or plant products into closer relationship with the New York Botanical Garden for mutual benefit. Industrial Members are recorded in the membership list.

Partly in connection with the 50th anniversary and partly independent of it, the past year has included some outstanding events. A special program and display for the Red Cross in March, a special ceremony at Rockefeller Center and the 50th Anniversary Garden Week in May, Rose-Growers' Day in

June, a folk dance festival for the New York National War Fund in September, and a two-day meeting of the Eastern States Chrysanthemum Society in October, in addition to our regular monthly Members' Day programs and a continuous stream of special visitors, including Sir Alexander Fleming, the discoverer of penicillin, have kept us occupied.

Dr. Moldenke reassumed his duties after nearly three years' absence on leave; Dr. Camp returned from Ecuador with 26,000 herbarium specimens in nearly 6,000 numbers besides a number of interesting living plants; Mr. Alexander returned from eleven months in Mexico where, in addition to about 1,200 numbers of herbarium specimens in an average of five sets, he collected seeds or propagating material of about 1,000 kinds of plants. Dr. Maguire spent a summer collecting in the Great Basin and Dr. Cronquist in the Midwest. We have planned for the spring of 1946 in conjunction with the American Museum of Natural History an expedition to Nyasaland, our first to the continent of Africa. This is made possible through the generosity of Mr. Arthur Vernay, a Life Member of the Garden and a member of the Corporation, who will lead the expedition.

Other noteworthy events of the past year included the deposit at the New York Botanical Garden of the Princeton Herbarium estimated at 50,000 specimens; the gift of 24,000 tulip bulbs from the Associated Bulb Growers of Holland; and gifts to the library of approximately 22,000 items, a record not only in volume but in the number of donors. Especially noteworthy were a collection of about 15,000 reprints donated by Dr. R. A. Harper, the forestry library of the late C. D. Mell, a gift of over 800 items from Mr. Robert Sturtevant, and an extremely interesting group of books and pamphlets dealing with botanical gardens of the world from Mr. Clarence Lewis.

I regret to report the death on October 22, 1945, of Mr. Robert Hagelstein, who for many years was Honorary Curator of Myxomycetes at the Garden, and on March 13, 1945, of Mr. Robert S. Williams, who was appointed to the Garden staff in December, 1899.

The Garden has suffered other losses during the year in the death of Dr. Robert T. Morris, January 9, and of Mrs. Harold McL. Turner, September 27, both for many years members of the Corporation, and also in the death on January 19 of Thomas Little, superintendent on the estate of Colonel Robert H. Montgomery, who had taught a number of classes in practical gardening at the Garden.

During the year Mrs. Inez M. Haring was named Assistant Honorary Curator of Mosses; Dr. Ilda McVeigh and Mary Stebbins were made Technical Assistants in the laboratory of plant physiology, and Dr. F. W. Kavanagh, Assistant Curator there.

Two new board members were appointed during 1945: Mrs. Albert D. Lasker and Sidney J. Weinberg, while resignations were accepted from Dr. E. C. Auchter and Pierre Jay. New members elected to the Corporation in 1945 included William H. Bell, Mrs. Melvin E. Sawin, Manfred Wahl, Alain C. White, and Mrs. Lee Krauss.

BUILDINGS AND GROUNDS

Under the supervision of Mr. A. C. Pfander, Superintendent of Buildings and Grounds, and his assistant, Mr. George Moran, a program of painting was instituted for the conservatory and other buildings, which will improve their appearance and add materially to their life span. An emergency steam line from the power house to Range 1 was installed. The Pelham Parkway boundary fence was repaired and painted by contract. Additional pipe lines were laid for the azalea garden and the walk along the lower Bronx River was repaired and reinforced. The area on which the propagating houses are located was fenced. Much of the hurricane damage was cleared away. Vandalism and nuisances were kept at a minimum by the city police force supplemented by our own employees. In addition, assistance for various Garden activities was furnished to the limit of available labor, and minor repairs were made as general upkeep.

LIVING PLANT COLLECTIONS AND DISPLAYS

The living collections and displays were maintained under the direction of Mr. T. H. Everett, Horticulturist. I regret to report the loss by resignation of Mr. Joseph W. Tansey, who had been in our employ for 10½ years, and of Mr. Harold J. Wilson, who had been in charge of the label department for 16 years. Mr. Stuart Longmuir succeeded Mr. Tansey as Chief Assistant to the Horticulturist. Mr. Erich Dietrich was appointed Greenhouse Foreman, and Mr. Harry Ahles assumed charge of the labeling. The disruption of our garden staff caused by the war, general unsettled conditions, and extra duties required of the Horticulturist and his staff have resulted in some deterioration of the living plant collections and displays.

Outdoor Plantings

The main features have been retained. Replanting the Advisory Council Border was again postponed though 800 annuals and 600 tulips were set out. The Perennial Border and Beds were maintained as usual. Approximately 750 delphinium plants in eight varieties made a magnificent display. Dahlias, some 728 plants in 189 varieties, did poorly because of heavy infection with virus diseases. The asters were mediocre; neither the plants nor their arrangement attained as high a standard as heretofore. On the other hand, the chrysanthemums, 2,654 plants in 58 varieties, were excellent and a trial border containing 420 plants in 127 varieties attracted much favorable attention. The plants in the trial border were supplied by Totty's, Madison, N.J.; Bristol Nurseries, Bristol, Conn.; The Conard-Pyle Company, West Grove, Pa.; J. J. Styer Nurseries, Concordville, Pa.; De Petris, Inc., Grosse Pointe Farms, Mich.; W. D. Holley, Durham, N.H.; A. E. Curtis, Cincinnati, Ohio; and H. Roy Mosnot, Belle Plaine, Iowa. The irises did well. Five beds (2,440 square feet) were lifted, divided, and replanted. We are indebted to Mrs. W. H. Peckham for assistance in identifying some varieties.

Spring bedding in the Conservatory Courtyard included 4,100 myosotis plants, 1,100 pansies, 60 doronicums, and 900 tulips. The summer bedding consisted of 1,200 specimens of *Plumbago capensis,* 1,000 *Hunnemannia fumariaefolia,* 200 *Heliotropium,* 160 *Lantana Camara,* and 35 *Grevillea robusta.* In addition, the beds flanking the main conservatory entrance were planted with 1,595 plants of a variety of interesting subjects, including *Luffa cylindrica, Cleome lutea, Helenium tenuifolium,* and *Nierembergia caerulea.*

The Annual Border made a fine display during the summer and fall months. It accommodated 10,514 plants (exclusive of those sown *in situ*) representing 175 species and varieties. The Peony and Lily Border was forked over and fertilized with bonemeal. The display in the Rose Garden was very good. While 33 out of 44 standard roses were completely killed in spite of protection with salt hay and building paper, other losses numbered only 139 plants. Bobbink and Atkins supplied 223 rose plants during the year. Few losses occurred in the Thompson Memorial Rock Garden. New plants and bulbs set out totaled 2,740 individuals in 141 species and varieties; 1,686 cuttings were inserted, and 120 seed numbers sown. The "rootery" installed in 1944 has proved successful in maintaining difficult subjects, including *Epigaea repens, Polygala paucifolia,* and *Cornus canadensis.* The waterlily display was less extensive than usual because of lack of attention to changing soil for the hardy varieties and the loss of many of the tropicals because of the failure of the heating system in the propagating houses. The Demonstration Vegetable Garden was continued and 1,654 pounds of edible produce were obtained. On the whole the leaf crops did better than the root crops. The Annual and Perennial Herb Borders proved to be satisfactory features. The amount of new planting in the Arboretum was smaller than previously; 739 plants were set out, 51 in the Azalea Garden, 417 as hedges, 21 in the botanical collections, 215 as ground cover, and 35 for general decorative material. In addition, 176 trees and shrubs were moved and 1,960 plants added to the nursery.

Indoor Plantings

A considerable strain was placed on the propagating houses because of changes in personnel, the reception of considerable quantities of new material from the collections of Alexander, Camp and Maguire, and increasing demands from various sources for material of economic or ornamental value not available in the trade. The Horticulturist has been engaged in a series of experiments on plant propagation with interesting and encouraging results on a variety of items. No success has been obtained, however, on the cultivation of the blue amaryllis (*Hippeastrum procerum*). Electric heating cable was installed in a portion of the propagating benches.

Main Conservatory

The only major flower exhibit was a Red Cross Show installed in March as a tribute to the American Red Cross. It consisted of a typical Red Cross hut in a Philippine jungle setting and a large floral red cross formed of 161 plants of the new red azalea "Lambertus C. Bobbink" set in a field of 262 specimens of the azalea "Snow." The plants were provided by Bobbink and Atkins, Rutherford, N.J. An Easter display included 564 plants in 33 species and varieties. During the year 3,594 plants in 308 species and varieties exclusive of 369 orchids in 129 species and varieties were displayed.

Labels, Accessions, and Records

Few realize the amount of time required by this important aspect of the Garden. In 1945 more than three man-years were devoted to this work, not including the records and files kept by the secretary or the labor of gardeners in removing and installing or on occasion making incidental labels. In 1945 there were 2,244 new labels placed in the outdoor collections, 1,075 zinc labels made, and 458 display and lead labels installed in the Conservatory. New accessions to the collections numbered 1,122.

Seed Exchange

The 1945 seed exchange list was sent to 380 correspondents and 4,629 packets of seed of 500 different kinds were sent to 77 botanical institutions and 28 individuals. We received 226 packets of seed in exchange and 406 from other sources. There were 365 specimens collected for the herbarium of cultivated plants.

Plant Distribution

One regular plant distribution was made to members, at which 206 individuals received plants of *Oxalis Ortgiesii, Eriogonum Alleni,* and *Pelargonium* "Chlorinda." More than 20,000 items were given to universities and colleges, New York schools and other institutions, and to various commercial concerns.

Gifts and exchanges were received from 87 individuals and institutions.

HERBARIUM

Accessions to the herbarium during the year were as follows:

Phanerogams		
General herbarium	20,341	
Oriental herbarium	2,630	
		22,971
Cryptogams (not including ferns)		
Fungi (and lichens)	1,167	
Algae	3,645	
Mosses	11,903	
Hepatics	2,118	
		18,833

The total number of specimens in the herbarium is now 2,167,464. The most noteworthy addition in 1945 was the Princeton collection deposited in agreement with Princeton University on indefinite loan. This collection amounts to about 50,000 specimens.

More than 10,000 specimens were lent during the year to 37 different institutions.

In addition to routine duties, *Dr. Fred J. Seaver, Head Curator,* collaborated with Mr. J. M. Waterston, Pathologist for the Bermuda Department of Agriculture, in a final summary of the fungi of Bermuda and continued his researches on the Discomycetes. He served also as Editor-in-Chief and as Managing Editor of *Mycologia* and as President of the Torrey Botanical Club.

Dr. H. A. Gleason, Assistant Director and Curator, continued work on the new "Illustrated Flora of the Northeastern States." Work on illustrations was carried on during the year by Mr. Walter Graham, Mary Content Easton, Anne Rogelberg, and Natalie Harlan Davis.

Dr. Bassett Maguire, Curator, spent from May 2 to August 17 on the fourteenth field season in the botanical survey of the Intermountain Region. He was accompanied by Professor Arthur H. Holmgren of Utah State Agricultural College. Nearly 1,100 numbers totaling 8,000 herbarium specimens were collected. In addition, Dr. Maguire devoted attention to his collections made in British Guiana and Surinam.

Dr. H. N. Moldenke, Associate Curator, returned to active duty and has resumed work on the Verbenaceae, Avicenniaceae, and Eriocaulaceae, as well as a number of other projects.

Dr. W. H. Camp, Assistant Curator, spent the first months of 1945 in Ecuador in search of wild stands of *Cinchona* for the Foreign Economic Administration (U.S. Commercial Company) of the United States Government and from May to October on general plant exploration in south-central Ecuador. In addition to living plants and seeds, more than 26,000 herbarium specimens were brought back for study and exchange.

Mr. E. J. Alexander, Assistant Curator, devoted the major portion of the year to collecting in southern Mexico. He returned with extensive collections of living plants as well as herbarium material.

Dr. Arthur Cronquist, Assistant Curator, concluded his studies on the Sapotaceae and continued studies on the Compositae. Two months were spent collecting in the Middle West.

Dr. Frances E. Wynne, Assistant Curator, assisted with the preparation of the text for the "Illustrated Flora" and continued research on mosses.

Mr. G. L. Wittrock, Custodian of the Herbarium, cared for the herbarium as well as the distribution of loans and exchanges. In addition he has served as docent, conducted a course in Field Botany, and performed many miscellaneous duties.

Miss Rosalie Weikert, Technical Assistant, continued her usual services in the cryptogamic herbarium.

Mr. Otto Degener, Collaborator in Hawaiian Botany, continued his studies centering on the plants of Hawaii, Fiji, and other parts of the tropics.

Dr. A. J. Grout, Honorary Curator of Mosses, and *Mrs. Inez M. Haring, Assistant Honorary Curator of Mosses,* devoted attention to the moss collection, and *Mr. Joseph F. Burke, Honorary Curator of the Diatoms,* to the diatoms. *Mr. B. A. Krukoff, Honorary Curator of Economic Botany,* with the assistance of Mr. Joseph Monachino, continued research on groups of economic plants.

PHOTOGRAPHY

The Garden Photographer, Mr. E. N. Mitchell, in addition to taking 300 feet of kodachrome film, made 1,221 negatives, 3,112 prints and enlargements, and 112 lantern slides.

MEMBERSHIP

Membership in the Garden remained at approximately the same level as for 1944. The total was 908 distributed as of December 5, 1945, as follows:

Annual	729
Sustaining	40
Garden Clubs	20
Life, Benefactors, Patrons, etc.	110
Industrial	9
Total	908

MUSEUM

Dr. E. E. Naylor, Assistant Curator, devoted part of his time to revamping the public museum. Progress on this program is slow because of limitation of funds. In addition, Dr. Naylor served as docent, conducted a course in Nature Garden Science, and in co-operation with Miss Carol H. Woodward, supervised the Saturday afternoon lectures and assisted in publicity.

PLANT DISEASES

Dr. B. O. Dodge co-operated with Dr. L. M. Massey on the control of black spot and mildew of roses using fermate with both talc and dusting sulfur as carriers. Fermate gave good control of black spot but left a white spotting on the rose leaves.

Diseases of boxwood have received considerable attention. In co-operation with Dr. G. Steiner and his associates, the presence of two species of nematode has been found to be associated with bronzed or wilted boxwood. Dr. Steiner believes that these new nematodes which he has discovered are the primary cause of many boxwood troubles formerly attributed to wilt, canker fungi, or winter injury.

Leaf nematodes of chrysanthemum have been fairly well controlled in the past by fumigating the soil each spring with formaldehyde and taking cuttings from uninfested plants. Bordeaux mixture plus 40% nicotine sulfate helps to prevent the nematodes from swimming up the stem and from leaf to leaf. Apids are controlled in the same way.

Considerable areas of the lawn have been treated with spore dust of the milky disease of the grubs of Japanese beetle. The results of this treatment will be watched with interest. However, very little damage to lawns or to the foliage of other plants was caused in the Garden by Japanese beetles in 1945. Few grubs were found in the ground.

In 1944 the Plant Pathologist reported a new disease of pachysandra caused by a species of *Pseudonectria*. Scale insects were thought to open the way for invasion by this parasite. Spraying pachysandra with a dormant 1 to 16 oil spray, followed at intervals during the summer with Bordeaux mixture as a fungicide and 40% nicotine sulfate as an insecticide, seems to have given good control.

Infestation of cotoneaster with lacebugs was noted for the first time this year. Black Leaf 40 with soap gave good control.

An unidentified leaf-eating caterpillar on Japanese iris is being studied in co-operation with Mr. Brayton Eddy of the Zoological Garden.

Study of the control of delphinium rootrot was shifted to the border plantings. The soil was treated with chloropicrin with no damage to adjacent shrubs. No case of sclerotium rot was discovered during the summer though some plants at one end of the plot were killed by fusarium rot.

LIBRARY

Miss Elizabeth C. Hall and her assistant, Miss Barbara Hoskins, received valuable volunteer assistance from Mrs. Harry A. Jennison and Gilda Potenza. Special mention should be made of a group of school children, including Ronald Finne, Irwin Bosch, Richard Cunningham, Isabel Dempsey, Geoffrey Dennehy, Daniel DeSimone, Salvatore DeSimone, Evelyn Dunne, Joseph Katz, Dicky Newman, Otto Newman, Raphael Newman, Thomas Maguire, Donald Randall, Betsy Reynolds, and Robert Seigel for assistance in labeling, filing, and doing other routine work in the library. Treatment with a leather dressing was given to a considerable portion of the leather-bound books.

During the year 21,314 unbound volumes and pamphlets and 666 bound volumes were added to the library, which now contains 51,935 bound volumes. The periodicals and continuations received amounted to 399; additions to the main catalog were 9,288 and to the special card files 1,400. Sixty institutions received 294 volumes from our library on loan. Flower and fruit prints, totaling 783, were borrowed from the picture collection by artists, advertising concerns, publishing houses, garden clubs, public libraries, art departments, pharmaceutical concerns, and designers of jewelry, china, textiles, and wall paper. In addition the library participated in ten exhibits here and elsewhere, in which books, illustrations, and other materials were shown.

Nearly 22,000 items from over 150 donors were received during the year. Each gift has been acknowledged separately.

BIBLIOGRAPHIC WORK

Dr. H. W. Rickett edited *Brittonia* and *North American Flora,* taught in our Educational Program, and edited the *Bulletin of the Torrey Botanical Club* in addition to carrying on his own researches and the routine duties of his position.

FINANCES

The complete financial report of the Garden is printed on pages 16–22.

PUBLICATIONS

Two numbers of *Brittonia* — No. 3 and No. 4 of Volume 5 — edited by Dr. H. W. Rickett, were published. These totaled 266 pages and included eight articles, three by members of the staff of the New York Botanical Garden.

Since the last report, two numbers of *North American Flora,* edited by Dr. Rickett, have appeared. These — Parts 1 and 2 of Volume 28B — were chiefly devoted to a taxonomic study of the Umbellales by Mildred E. Mathias and Lincoln Constance and covered 397 pages.

The *Journal of The New York Botanical Garden,* edited by Carol H. Woodward, was published in 12 numbers and totaled 380 pages, including two supplements — the Annual Report and a Garden Week Report.

One number of *Addisonia* — No. 3 of Volume 22 — edited by Mr. E. J. Alexander, appeared.

The 1945 volume of *Mycologia,* edited by Dr. Fred J. Seaver, appeared in six numbers and amounted to 815 pages.

In addition to these publications, numerous popular and scientific articles were published by members of the staff, as may be noted in the list appended to this report.

EDUCATION

The educational program was continued under the supervision of Dr. A. B. Stout, Mr. T. H. Everett, Miss Carol H. Woodward, and Dr. E. E. Naylor, with the assistance of numerous members of the staff and others who have co-operated with the Garden.

The following table summarizes the subjects taught in 1945:

	Number of Meetings	Registration or Average Attendance
TWO-YEAR SCIENCE COURSE FOR GARDENERS		
1A *Systematic Botany* (A. Cronquist)	12	25
1C *General Botany I* (H. W. Rickett)	12	21
1E *Plant Breeding* (A. B. Stout)	12	23
1H *Economic Botany* (G .L. Wittrock)	12	19
TWO-YEAR COURSE IN PRACTICAL GARDENING		
2A *Fundamentals of Gardening* (T. H. Everett)	6 (2 hrs. each)	37
2E *Cultivation of Greenhouse Plants* (J. W. Tansey)	6 (2 hrs. each)	26
2F *Indoor Gardening Practice* (E. Beckett)	8 (2 hrs. each)	15
FIELD BOTANY (G. L. Wittrock)		
6A *Spring*	7 (2 hrs. each)	24
6B *Autumn*	7 (2 hrs. each)	20
NATURE GARDEN SCIENCE (Nature Study for Teachers)		
19A *Spring* (E. E. Naylor, E. C. Hall, M. M. Brooks, B. O. Dodge)	15 (2 hrs. each)	24
19B *Autumn* (E. E. Naylor, M. M. Brooks, G. L. Wittrock)	15 (2 hrs. each)	22
FREE SATURDAY AFTERNOON LECTURES		
Winter	8	141 (average)
Spring	8	136 (average)
Autumn	10	144 (average)

One student, Mrs. Annette Hervey, registered in graduate courses offered in cooperation with Columbia University. A Garden scholarship was awarded to Dr. Geneva Sayre of Russell Sage College, Troy, N.Y., who worked for a month on material in the cryptogamic herbarium.

Nine showings of the kodachrome motion picture reel were made to various groups.

Thirty-one groups totaling 1,197 individuals visited the Garden under the supervision of some member of the staff.

Twenty-two radio programs arranged by Miss Woodward were presented as a regular feature over WNYC, and members of the staff have participated in other broadcasts, some over national networks.

Numerous lectures have been given to Garden Club Affiliates and other groups.

Graduation exercises were held on June 21, 1945. Certificates were presented to four students who had successfully completed the Two-Year Science Course for Gardeners and to three who had completed the Two-Year Course in Practical Gardening. Mr. P. J. van Melle addressed the graduates and their friends.

SCIENTIFIC WORK

Space does not permit an adequate presentation of the scientific work of the Garden. The contributions of some of the staff have been referred to elsewhere in this report or can be deduced from the list of publications which follows. One of the important and necessary aspects of the scientific work of the Garden is exploration and plant introduction. Exploration always involves expense beyond the regular budget of the Garden and each expedition necessitates more or less independent financing. In spite of this handicap the Garden has almost continuously participated in or conducted expeditions from its establishment up to the present, and a list so far as it can be prepared from available records is appended to this report. The importance of this activity cannot be overemphasized. It results in an extension of man's knowledge of the flora of the earth, the acquisition of information on the medical and other uses of plants, incidental geographical discoveries, and invaluable field experience for the men who participate.

In concluding this report may I express my appreciation for the assistance received from many people within and without the Garden organization. It would be impossible to carry on without the devoted and loyal support of the employees and without the help of members of the Board of Managers, the Advisory Council and the Corporation, and from the many friends of the Garden.

PUBLICATIONS OF MEMBERS OF THE STAFF

And Others Associated with the Garden During 1945*

Compiled by H. W. Rickett

Alexander, Edward Johnston (Editor of ADDISONIA)
A new genus in Cactaceae. Cactus & Succ. Jour. **16**: 175–178. *f. 161–163.* D 1944.
Gerardia acuta. Addisonia **22**: 33, 34. *pl. 721.* 4 Ap 1945.
Rubus linkianus. Double white bramble. Addisonia **22**: 35, 36. *pl. 722.* 4 Ap 1945.
Gentiana linearis. Addisonia **22**: 43, 44. *pl. 726.* 4 Ap 1945.
Habranthus andersonii. Bronze fairy-lily. Addisonia **22**: 45, 46. *pl. 727.* 4 Ap 1945.

Barnhart, John Hendley
Robert S. Williams. Jour. N.Y. Bot. Gard. **46**: 146, 147. 3 Jl 1945.

Burke, Joseph Francis
Robert Hagelstein. Jour. N.Y. Bot. Gard. **46**: 288–290. *port.* 26 D 1945.

Camp, Wendell Holmes (Editor of the TAXONOMIC INDEX)
Vaccinium hybrids and the development of new horticultural materials. Bull. Torrey Club **72**: 1–21. *f. 1, 2.* 29 D 1944. (With GEORGE MCMILLAN DARROW.)
The North American blueberries with notes on other groups of Vacciniaceae. Brittonia **5**: 203–275. *f. 1–30.* 9 Mr 1945.
A river is named. Jour. N.Y. Bot. Gard. **46**: 144, 145. *illust.* 3 Jl 1945.

Cronquist, Arthur
The goldenrods of Minnesota: a floristic study. Am. Midl. Nat. **33**: 244–253. "Ja" [Mr] 1945. (With CARL OTTO ROSENDAHL.)
Studies in the Sapotaceae—I. The North American species of *Chrysophyllum.* Bull. Torrey Club **72**: 191–204. 13 Mr 1945.
Notes on Compositae of the northeastern United States, I. Inuleae. Rhodora **47**: 182–184. 14 My; II. Heliantheae and Helenieae. 396–403. 18 D 1945.
A new *Aster* from Yukon. Madrono **8**: 97–99. 7 Au 1945.
Studies in the Sapotaceae, III. *Dipholis* and *Bumelia.* Jour. Arnold Arb. **26**: 435–471. 15 O 1945.
Studies in the Sapotaceae—IV. The North American species of Manilkara. Bull. Torrey Club **72**: 550–562. 27 N 1945.

*A few articles omitted from the report for 1944 are here included. Besides the titles here reported, members of the staff published 41 reviews, short notes, and announcements.

Degener, Otto

Dodonaea eriocarpa λ *pallida* Degener & Sherff . . . Am. Jour. Bot. **32**: 210–212. 13 Ap 1945. [*In:* Earl Edward Sherff, Some additions to the genus *Dodonaea* L. (fam. Sapindaceae).]

Tropical plants the world around. Jour. N.Y. Bot. Gard. **46**: 74–91. *illust.* 2 My; 110–125. *illust.* 7 Je; 132–143. *illust.* 3 Jl; 158–167. *illust.* 24 Jl 1945. [Modified and reissued as "Tropical plants of the world" in Am. Eagle **40**[26]: 1, 3, 4. 18 O; **40**[27]: 1, 3, 4. 28 O; **40**[28]: 1, 3, 4. 1 N 1945.]

A botanist leaves Hawaii. Torreya **45**: 72–78. 28 S 1945.

Cruise of the "Cheng-Ho." Am. Eagle **40**[29]: 1, 3, 4. 8 N 1945. [Modified from Jour. N.Y. Bot. Gard. **44**: 197–213, 221–232.]

Plants of Hawaii National Park illustrative of plants and customs of the South Seas. i–xv, 1–314. *f. 1–45, pl. 1–95, 2 unnumb. maps.* [Second edition, revised, of "Ferns and flowering plants of Hawaii National Park." 1930.] Photo-lith., Ann Arbor, Mich. 1945. [The "plates" occupy numbered pages.]

Dodge, Bernard Ogilvie

Some remarks on mycogenetic terminology. Mycologia **37**: 360–369. 11 Je 1945.

Further remarks on mycogenetic terminology. Mycologia **37**: 629–635. 1 O; 784–791. *f. 1.* 10 D 1945.

Inheritance of factors involved in one type of heterocaryotic vigor. Proc. Am. Phil. Soc. **89**: 575–589. *f. 1–6, tables 1–5.* D 1945. (With Mary Amelia Bartley Schmitt and Anita Appel.)

Everett, Thomas Henry

Oenothera drummondii. Gard. Chron. Am. **49**: 25. Ja 1945.

Annuals that benefit from early indoor sowing. Home Garden **5**[1]: 70–74. *illust.* Ja 1945.

Two yellow-flowered Epimediums. Gard. Chron. Am. **49**: 53. F 1945.

Cymbalaria muralis maxima. Gard. Chron. Am. **49**: 85. F 1945.

Perennials from winter-sown seeds. Home Garden **5**[2]: 74–76. "F" 1945.

Preparations for planting. Home Garden **5**[3]: 40–45. *illust.* "Mr" 1945.

Fritillaria pudica. Addisonia **22**: 37, 38. *pl. 723.* 4 Ap 1945.

Kalanchoë grandiflora. Addisonia **22**: 41, 42. *pl. 725.* 4 Ap 1945.

Sedum chrysanthum. Gard. Chron. Am. **49**: 112. Ap 1945.

Bedding plants for summer gardens. Home Garden **5**[4]: 59–63. Ap 1945.

Grow your own hard-to-get perennials. Home Garden **5**[6]: 39–42. *illust.* Je 1945.

Basic soil improvement. Yearb. Men's Gard. Club Am. **1945**: 36–39. [Je] 1945.

Biennials. Home Garden **6**[1]: 65, 66. Jl 1945.

Bongardia Rauwolfii. Gard. Chron. Am. **49**: 221. Au 1945.

Get your indoor soil indoors. Home Garden **6**[3]: 44, 45. S 1945.

Fall renovation in the perennial border. Home Garden **6**[3]: 63–66. *illust.* S 1945.

The alpine flax. Gard. Chron. Am. **49**: 277. O 1945.

Darwin tulips. Home Garden **6**[4]: 89. O 1945. (Anonymous.)

Some dwarf willow-herbs. Gard. Chron. Am. **49**: 305. N 1945.

Plant portraits. Gard. Chron. Am. **49**: 12, 13. *illust.* Ja; 40, 41. *illust.* F; 68, 69. *illust.* Mr; 100, 101. *illust.* Ap; 130, 131. *illust.* My; 160, 161. *illust.* Je; 186, 187. *illust.* Jl; 210, 211. *illust.* Au; 236, 237. *illust.* S; 264, 265. *illust.* O; 292, 293. *illust.* N 1945.

The gardener's forum. N.Y. Herald-Trib. **105** (**36092**[4]): 6. 9 S; (**36099**[4]): 8. 16 S; (**36106**[4]): 8. 23 S; (**36113**[4]): 10. 30 S; (**36120**[4]): 9. 7 O; (**36127**[4]): 9. 14 O; (**36134**[5]): 8. 21 O; (**36141**[5]): 9. 28 O; (**36148**[5]): 10. 4 N; (**36155**[5]): 9. 11 N; (**36162**[5]): 9. 18 N; (**36169**[5]): 10. 25 N; (**36176**[5]): 10. 2 D; (**36183**[5]): 10. 9 D; (**36190**[5]): 10. 16 D; (**36204**[5]): 9. 30 D 1945.

A guide to garden flowers. 3–60. *illust.* Racine, Wis. 1945.

A guide to wild flowers. Field flowers. 3–60. *illust.* Racine, Wis. 1945.

A guide to wild flowers. Woodland flowers. 3–60. *illust.* Racine, Wis. 1945.

Fulling, Edmund Henry (Editor of THE BOTANICAL REVIEW; co-editor of AMERICAN JOURNAL OF BOTANY)
Thomas Jefferson, his interest in plant life as revealed in his writings—II. Bull. Torrey Club **72**: 248–270. 9 My 1945.

Gleason, Henry Allan (Co-editor of NORTH AMERICAN FLORA; associate editor of the Torrey Botanical Club)
On *Blakea* and *Topobea*. Bull. Torrey Club **72**: 385–398. 3 Jl 1945.
Some Melastomaceae of Colombia. Bull. Torrey Club **72**: 472–479. 5 S 1945.
A botanist looks at a rose. Jour. N.Y. Bot. Gard. **46**: 215–220. 1 O 1945.

Grout, Abel Joel (Associate editor of THE BRYOLOGIST)
Two new species of *Acaulon* from Texas. Bryologist **48**: 25, 26. 23 Mr 1945.
A revision of the North American species of *Stereophyllum* and *Pilosium*, with descriptions of some South American species. Bryologist **48**: 60–69. 25 Au 1945.

Hall, Elizabeth Cornelia
The 1944–1945 review of garden books. Libr. Jour. **70**: 235–240. *illust.* 15 Mr 1945.
Book shopping notes. Fl. Grower **32**: 539. "N" [O] 1945.

Hervey, Annette (Hochberg)
A survey of some wood-destroying and other fungi for antibacterial activity. Bull. Torrey Club **72**: 165–190. *f. 1–4, tables 1, 2.* 13 Mr 1945. (With WILLIAM JACOB ROBBINS, ROSS WALLACE DAVIDSON, ROBERTA MA and WILLIAM CLINTON ROBBINS.)

Kavanagh, Frederick Walker
On the toxicity of streptothricin. Am. Jour. Med. Sci. **210**: 61–66. Jl 1945. (With GEOFFREY RAKE, DOROTHY HAMRE, WALTER L. KOERBER and RICHARD DONOVICK.)

CROWDS, EVENTS, AND PERSONALITIES PROMINENT DURING 1945

(On the opposite page)

A PORTION OF THE CROWD which attended the rededication ceremony at the New York Botanical Garden, Sunday afternoon, May 13, inaugurating the Fiftieth Anniversary Garden Week celebration, is shown at the top. Just below is one of the many classes of school children that visited the conservatory and outdoor plantings during the year. To the left is Lambertus C. Bobbink, dean of American rose growers and patron of the Garden's planting of nearly 8,000 roses, as he appeared at Rose-Growers' Day, June 13, 1945. Below, Mr. Bobbink is seen again at the first annual Chrysanthemum Show at the Garden, in company with Arthur Herrington (left) of Madison, New Jersey, and Dr. B. O. Dodge, the Garden's Plant Pathologist.

CROWDS, EVENTS, AND PERSONALITIES PROMINENT DURING 1945




Krukoff, Boris Alexander
The genus *Strychnos* in Venezuela. Darwiniana **7**:185–193. 15 D 1945. (With JOSEPH MONACHINO.)

Longmuir, Stuart Neilson
Plants for damp soil. Home Garden **5**[5]:61–63. My 1945.

Ma, Roberta Mohling
A survey of some wood-destroying and other fungi for antibacterial activity. Bull. Torrey Club **72**:165–190. *f. 1–4, tables 1, 2.* 13 Mr 1945. (With WILLIAM JACOB ROBBINS, ANNETTE [HOCHBERG] HERVEY, ROSS WALLACE DAVIDSON and WILLIAM CLINTON ROBBINS.)

Maguire, Bassett
Notes on the geology and geography of Tafelberg, Surinam. Geog. Rev. **35**:563–579. O 1945.
The first botanical exploration of Table Mountain in Surinam. Jour. N.Y. Bot. Gard. **46**:253–272. *illust.* 14 D; 277–287. *illust.* 26 D 1945.

Moldenke, Harold Norman (Editor of PHYTOLOGIA)
Vital vegetable oils. Vegetarian News [London] **24**:113–117. *illust.* 1944. [Repr. from Nat. Hist. **53**:231–237.]
Contributions to the flora of extra-tropical South America VI. Lilloa **10**:363–385. 29 D 1944.

PLANT EXPLORATION SPONSORED BY THE GARDEN —AND SOME OF THE RESULTS

(On the opposite page)

SOME OF THE LIVING PLANTS sent back from Mexico by E. J. Alexander, principally cacti and other types of succulents, are seen at the upper right. Foreman Erich Deitrich is showing a pot of *Hymenocallis* bulbs to Assistant Foreman Michael Griffin in the Garden's propagating house. Below, at the right, is one of the *Hymenocallis* bulbs which flowered a few months later. To the left of this is a flowering branch of *Spironema fragrans* collected in Mexico by Thomas MacDougall, who was Mr. Alexander's companion on the Mexican expedition.

Above is one of three species of *Tropaeolum* (the genus to which the garden nasturtium belongs) acquired by Dr. W. H. Camp during his sojourn in Ecuador. With flowers of scarlet, orange and clear yellow, these three nasturtiums, which were raised from seed sent back by Dr. Camp, climbed to a height of more than six feet and were covered with bloom last December.

For plants sent back from another expedition of the Garden, see the illustrations facing page 28.

Additional common and vernacular names recorded for members of the Verbenaceae and Avicenniaceae. Phytologia **2**: 65–89. "D 1944" [7 Ja 1945].
The recorded common and vernacular names of Verbenaceae and Avicenniaceae arranged according to genera and species. Phytologia **2**: 89–123. "D 1944" [7 Ja 1945].
Supplementary notes on the Eriocaulaceae, Avicenniaceae, and Verbenaceae of Texas. I. Phytologia **2**: 123–128. "D 1944" [7 Ja 1945].
A contribution to our knowledge of the wild and cultivated flora of Florida—I. Am. Midl. Nat. **32**: 529–590. "N 1944" [Ja 1945].
The known geographic distribution of the members of the Verbenaceae and Avicenniaceae. Supplement 2. Bot. Gaz. **106**: 158–164. "D 1944" [Ja 1945].
The known distribution of the members of the Verbenaceae and Avicenniaceae, supplement 3. Castanea **10**: 35–46. Je 1945.
A contribution to our knowledge of the wild and cultivated flora of Maryland—I. Torreya **45**: 79–92. 28 S 1945.
The known geographic distribution of the members of the Verbenaceae and Avicenniaceae: Supplement 4. Am. Jour. Bot. **32**: 609–612. D 1945.

Monachino, Joseph

A revision of *Laemellia*, and the transfer of *Zschokkea* (Apocynaceae). Lloydia **7**: 275–302. "D 1944" [25 Ja 1945].
A revision of *Ambelania*, inclusive of *Neocouma* (Apocynaceae). Lloydia **8**: 109–130. "Je" [Au] 1945.
Jussiaea uruguayensis in Staten Island, New York. Rhodora **47**: 237–239. 6 Au 1945.
The genus *Strychnos* in Venezuela. Darwiniana **7**: 185–193. 15 D 1945. (With Boris Alexander Krukoff.)

Naylor, Ernst Elliott

Air plants and their problems of survival. Jour. N.Y. Bot. Gard. **46**: 55–65. *illust.* 29 Mr 1945.

Rickett, Harold William (Editor of the Torrey Botanical Club; managing editor of Brittonia; co-editor of North American Flora)

New combinations in *Cornus*. Bull. Torrey Club **72**: 223. 13 Mr 1945.
Crataegus egglestoni. Eggleston's thorn. Addisonia **22**: 47, 48. *pl. 728.* 4 Ap 1945.
Publications of members of the staff. Jour. N.Y. Bot. Gard. **46** (545[2]): 19–23. (Anonymous.)
Cornales. N. Am. Flora **28B**: 297–316. 28 D 1945.
Bibliography: Volume 28B. N. Am. Flora **28B**: 317–374. 28 D 1945.

Robbins, William Jacob

Effect of cotton on the germination of *Phycomyces* spores. Bull. Torrey Club **72**: 76–85. *f. 1, 2, tables 1–5.* 29 D 1944.
More on anti-malarials. Jour. N.Y. Bot. Gard. **46** (541): cover. 29 Ja 1945. (Anonymous.)
A survey of some wood-destroying and other fungi for antibacterial activity. Bull. Torrey Club **72**: 165–190. *f. 1–4, tables 1, 2.* 13 Mr 1945. (With Annette [Hochberg] Hervey, Ross Wallace Davidson, Roberta Ma and William Clinton Robbins.)
Annual report of the director for 1944. Jour. N.Y. Bot. Gard. **46** (545[2]): 1–18. *illust.* 23 My 1945.
Plants and their significance in the life of man. Jour. N.Y. Bot. Gard. **46**: 170–173. 24 Jl 1945.
Sugar is the foundation of all life. Cubelet Press **10** (14): 2 unnumb. p. *illust.* 9 Au 1945.

Growth factors for *Trichophyton mentagrophytes*. Am. Jour. Bot. **32**: 509–523. *f. 1–8, tables 1–8*. "O" [N] 1945.
[Address] *in*: Some facts about the Sugar Research Foundation, Inc. and its Prize Award Program, 47, 48. O 1945.

Seaver, Fred Jay (Editor of MYCOLOGIA; co-editor of NORTH AMERICA FLORA)
What is a herbarium, and why? Jour. N.Y. Bot. Gard. **46** (547): cover. 24 Jl 1945.
Photographs and descriptions of cup-fungi—XXXIX. A new *Helotium*. Mycologia **37**: 267–269. *f. 1*. 6 Ap; "XXXIX" [XL]. The genus *Godronia* and its allies. 333–359. *f. 1–3*. 7 Je 1945.
Mycophagy. Gourmet **5**[6]: 10, 11, 76–78. *illust*. My 1945.
Arthur Henry Reginald Buller. Mycologia **37**: 275–277. *port*. 11 Je 1945.
Sclerotinia bifrons. Mycologia **37**: 641–647. *f. 1 (frontisp.), 2*. 10 D 1945.

Stout, Arlow Burdette
The bur oak openings in southern Wisconsin. Trans. Wis. Acad. **36**: 141–161. *pl. 1, 2*. 1944.
Inactivation of incompatibilities in tetraploid progenies of *Petunia axillaris*. Torreya **44**: 45–51. *f. 1*. "D 1944" [31 Ja 1945].
Daylilies: old and new. Mo. Bull. Hort. Soc. N.Y. **16**: 7–9. My 1945.
Better plants for human needs. Jour. N.Y. Bot. Gard. **46** (548): cover. 22 Au 1945.
Classes and types of intraspecific incompatibilities. Am. Nat. **79**: 481–508. N 1945.
Fruits and seeds of the lily-of-the-valley. Jour. N.Y. Bot. Gard. **46**: 205–214. *illust*. 1 O 1945.

Woodward, Carol Helen (Editor of the JOURNAL OF THE NEW YORK BOTANICAL GARDEN)
Seeds of antiquity. Jour. N.Y. Bot. Gard. **46**: 25, 26. 26 F 1945. [Intro. to Longevity of seeds.]
New York Botanical Garden's fiftieth anniversary. Parks & Recr. **28**: 149–153. *illust*. Je 1945.
L. C. Bobbink honored with medal at rose-growers' program. Jour. N.Y. Bot. Gard. **46**: 168–170. *illust*. 24 Jl 1945. (Anonymous.)
Garden Week report. Jour. N.Y. Bot. Gard. **46** (548[2]): 1–36. *illust*. 24 Au 1945. (Anonymous.)
American gardeners receiving Holland bulbs this fall. Jour. N.Y. Bot. Gard. **46**: 220–222. 1 O 1945. (Anonymous.)
[Introduction to] Plants of the Surinam coastland. Jour. N.Y. Bot. Gard. **46**: 229. 2 N 1945. (Anonymous.)
Thousands view mum show in New York. Parks & Recr. **28**: 361–364. *illust*. D 1945.
The New York Botanical Garden. *In:* Rebecca B. Rankin, ed., New York advancing, 251–254. *illust*. 1945. (Anonymous.)

Wynne, Frances Elizabeth
Studies in *Drepanocladus*. IV. Taxonomy. Bryologist **47**: 147–189. *maps 1–5. "pl." 1–10*. "D 1944" [2 Ja 1945].
Studies in *Drepanocladus*. II. Phytogeography. Am. Midl. Nat. **32**: 643–668. *maps 1, 2*. "N 1944" [26 Ja 1945].
Three weeks in Shenandoah National Park. Bull. Potomac Appal. Trail Club **14**: 5–9, 20–25. "Ja" 1945. (With IRMA SCHNOOBERGER.)
Drosera filiformis. Addisonia **22**: 39, 40. *pl. 724*. 4 Ap 1945.
Studies in *Calliergon* and related genera. Bryologist **48**: 131–155. *maps 1–5*. 29 O 1945.
The bryophytes of Shenandoah National Park, Virginia. Bull. Torrey Club **72**: 506–520. 27 N 1945. (With IRMA SCHNOOBERGER.)

REPORT OF THE TREASURER

Arthur M. Anderson

THE NEW YORK BOTANICAL GARDEN

Exhibit I — BALANCE SHEET

ASSETS

JUNE 30, 1945

Permanent Fund Assets:			
Investments at cost or appraisal at time of acquisition, having a value of $3,037,441 based on June 30, 1945, market quotations (Exhibit III)		$2,637,052.79	
Cash awaiting investment		37,693.59	$2,674,746.38
Current and Working Assets:			
Cash in bank and on hand:			
For general purposes		$ 21,787.02	
For special purposes:			
Cash in banks	$72,707.16		
U.S. Government securities at cost (plus accrued interest $72.92)	20,590.92	93,298.08	
Accounts receivable:			
City maintenance	$44,931.88		
Employees and others	63.95	44,995.83	
Interest and dividends receivable on investments of permanent funds (Exhibit III)		18,608.50	
Prepaid insurance premiums, etc.		1,650.17	180,339.60
			$2,855,085.98

To the Board of Managers of

The New York Botanical Garden

We have examined the balance sheet of The New York Botanical Garden as of June 30, 1945, and the statement of operations for the fiscal year then ended. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances, and included such tests of the accounting records and other supporting evidence and such other procedures as we considered necessary.

Exhibit I — *BALANCE SHEET*

LIABILITIES

JUNE 30, 1945

Permanent Funds (Exhibit IV):			
Restricted endowments		$ 285,513.16	
Unrestricted endowments, including bequests set aside by the Board of Managers as permanent funds		2,389,233.22	$2,674,746.38
Current Liabilities and Special Funds:			
Current liabilities:			
Accounts payable		$ 12,366.83	
Special funds (Exhibit V):			
Unexpended income of restricted permanent funds	$18,261.26		
Unexpended special funds designated for specific purposes	75,036.82	93,298.08	
Deferred income credit:			
Subscriptions and memberships paid in advance		29.50	
Working fund:			
Balance at June 30, 1944	$74,391.17		
Add—Excess of unrestricted income over expenditures for the year ended June 30, 1945 (Exhibit II)	254.02	74,645.19	180,339.60
			$2,855,085.98

In our opinion, the accompanying balance sheet (Exhibit I) and related statements (Exhibits II to V, inclusive) present fairly the position of The New York Botanical Garden at June 30, 1945, and the result of its operations for the fiscal year.

PRICE, WATERHOUSE & CO.

56 Pine Street,
New York 5, N.Y.,
November 20, 1945.

Exhibit II — STATEMENT OF OPERATIONS, UNRESTRICTED FUNDS

FOR THE FISCAL YEAR ENDED JUNE 30, 1945

Income:		
Income from investment of permanent funds		$ 98,825.24
Contributions:		
City maintenance		264,641.65
Other		815.00
Membership dues:		
Annual		6,970.00
Sustaining, garden clubs, etc.		1,625.00
Sundry sales, fees, etc.		3,565.31
Subscriptions and sales of publications		2,885.47
Total income		$379,327.67
Expenses:		
Horticulture:		
Salaries	$144,416.18	
Wages	32,121.57	
Plants, seeds, supplies, etc.	10,626.68	
		$187,164.43
Botanical science:		
Salaries	$ 33,223.77	
Supplies, research, publications, etc.	1,150.89	
		34,374.66
Public service in education, instruction and information:		
Salaries	$ 35,432.20	
Instructions, lectures, etc.	6,007.66	
		41,439.86
Administration:		
Salaries	$ 24,933.39	
Stationery, telephone, postage, etc.	11,794.47	
		36,727.86
Repairs and maintenance of buildings:		
Salaries	$ 41,997.25	
Fuel, material, supplies, etc.	27,918.95	
		69,916.20
Equipment purchased		56.50
Special retirement allowances		9,394.14
		$379,073.65
Excess of income for the year ended June 30, 1945, carried to working fund (Exhibit I)		$ 254.02

Exhibit III — SUMMARY OF INVESTMENTS OF PERMANENT FUNDS

JUNE 30, 1945

	Par value (no par value stock at book value)	Approximate quoted value	Book value, representing cost or appraisal at date of acquisition	Accrued interest and dividends June 30, 1945	Average annual yield on basis of Quoted value %	Average annual yield on basis of Book value %
General Funds:						
Bonds	$ 450,000.00	$ 503,811.00	$ 452,659.86	$ 3,756.14	3.10	3.45
Stocks:						
Preferred	40,830.00	50,486.00	43,080.00		4.11	4.82
Common	163,648.00	297,166.00	259,051.21	278.25	3.55	4.07
	$ 654,478.00	$ 851,463.00	$ 754,791.07	$ 4,034.39	3.32	3.74
Sage Fund:						
Bonds	$ 399,000.00	$ 453,895.00	$ 423,073.95	$ 4,038.96	3.48	3.73
Stocks:						
Preferred	181,255.00	226,432.00	190,739.47	663.75	4.15	4.93
Common	134,769.00	287,322.00	197,827.67	2,014.75	4.24	6.16
	$ 715,024.00	$ 967,649.00	$ 811,641.09	$ 6,717.46	3.86	4.60
Special Endowment Fund:						
Bonds	$ 396,000.00	$ 408,085.00	$ 387,932.71	$ 4,036.03	3.00	3.16
Stocks:						
Preferred	51,500.00	90,211.00	65,533.00	350.00	3.96	5.46
Common	72,789.00	116,481.00	105,260.77	600.00	3.78	4.18
	$ 520,289.00	$ 614,777.00	$ 558,726.48	$ 4,986.03	3.29	3.62
John D. Rockefeller, Jr., Fund:						
Bonds	$ 157,000.00	$ 159,541.00	$ 158,392.82	$ 1,151.87	2.65	2.67
Stocks:						
Preferred	153,500.00	251,731.00	186,162.51	1,243.75	3.84	5.20
Common	81,778.00	190,280.00	167,338.82	475.00	3.68	4.19
	$ 392,278.00	$ 601,552.00	$ 511,894.15	$ 2,870.62	3.48	4.08
	$2,282,069.00	$3,035,441.00	$2,637,052.79	$18,608.50	3.52	4.05
Recapitulation by types of securities:						
Bonds	$1,402,000.00	$1,525,332.00	$1,422,059.34	$12,983.00	3.14	3.37
Stocks:						
Preferred	427,085.00	618,860.00	485,514.98	2,257.50	3.99	5.09
Common	452,984.00	891,249.00	729,478.47	3,368.00	3.83	4.68
	$2,282,069.00	$3,035,441.00	$2,637,052.79	$18,608.50	3.52	4.05

Exhibit IV — STATEMENT OF PERMANENT FUNDS

SHOWING CHANGES DURING THE FISCAL YEAR ENDED JUNE 30, 1945

	Balance June 30, 1944	Net additions	Balance June 30, 1945
Restricted endowments:			
Endowment for science and education	$ 89,115.49		$ 89,115.49
Addison Brown Fund	21,149.31		21,149.31
John Innes Kane Fund	41,347.63		41,347.63
Maria DeWitt Jesup Fund	25,000.00		25,000.00
Olivia E. and Caroline Phelps Stokes Fund	5,030.63		5,030.63
Charles Budd Robinson Fund	755.04		755.04
The H. H. Memorial Fund	5,000.00		5,000.00
Alexander P. Anderson and Lydia Anderson Research and Fellowship Fund	25,000.00		25,000.00
Students' Research Fund	12,074.50	$ 100.00	12,174.50
Endowment for the publication of "Mycologia"	10,000.00	1,000.00	11,000.00
Nathaniel Lord Britton and Elizabeth Gertrude Britton Fund	48,057.20		48,057.20
Elizabeth Gertrude Britton Fund	1,883.36		1,883.36
	$ 284,413.16	$ 1,100.00	$ 285,513.16
Unrestricted endowments:			
Endowment Fund	$ 248,005.07	$ 7,554.43	$ 255,559.50
David Lydig Fund	34,337.86		34,337.86
William R. Sands Fund	10,000.00		10,000.00
Darius Ogden Mills Fund	48,099.17		48,099.17
Henry Iden Fund	10,000.00		10,000.00
Fanny Bridgham Fund	30,000.00		30,000.00
Frances Lynde Stetson Fund	25,000.00		25,000.00
Russell Sage and Margaret Olivia Sage Memorial Fund	784,575.48	29,554.02	814,129.50
Frances Griscom Parsons Fund	2,304.67		2,304.67
Special Endowment Fund	578,090.83	4,521.38	582,612.21
John D. Rockefeller, Jr., Fund	497,747.29	18,981.75	516,729.04
The Charles Patrick Daly and Maria Lydig Daly Fund	19,636.34		19,636.34
The James A. Scrymser and Mary C. Scrymser Fund	33,908.82		33,908.82
The George N. Best Fund	3,000.00		3,000.00
The Mary Strong Shattuck Fund	3,916.11		3,916.11
	$2,328,621.64	$60,611.58	$2,389,233.22
	$2,613,034.80	$61,711.58	$2,674,746.38

Exhibit V — SPECIAL FUNDS

STATEMENT OF RECEIPTS AND EXPENDITURES OF RESTRICTED PERMANENT FUNDS AND SPECIAL FUNDS DESIGNATED FOR SPECIFIC PURPOSES FOR THE FISCAL YEAR ENDED JUNE 30, 1945

BY FUNDS:	Balance June 30, 1944	Receipts (contributions and income)	Expenditures	Balance June 30, 1945
Restricted permanent funds:				
Endowment for science and education:				
Public lectures and instruction, research and publications	$ 6,247.17	$ 3,325.00	$ 3,358.91	$ 6,213.26
Addison Brown Fund:				
Publication of "Addisonia"	110.48	1,565.66	1,546.70	129.44
John Innes Kane Fund:				
Purchases of living plants and related expenses	1,809.40	1,543.00	1,026.92	2,325.48
Maria De Witt Jesup Fund:				
Botanical collections		931.00	927.85	3.15
Olivia E. and Caroline Phelps Stokes Fund:				
Investigation and preservation of native plants		187.00	186.84	.16
Charles Budd Robinson Fund:				
Exploration		28.00	27.45	.55
The H. H. Memorial Fund:				
Development of model gardens		186.00	186.00	
Alexander P. Anderson and Lydia Anderson Research and Fellowship Fund	1,167.87	931.00	1,372.75	726.12
Students' Research Fund:				
Scholarships and prizes	1,578.22	453.00	275.00	1,756.22
Mycologia Fund:				
Publication of "Mycologia"	2,892.53	5,832.87	4,541.89	
Transfer to Mycologia Fund (Exhibit IV)			1,000.00	3,183.51
Nathaniel Lord Britton and Elizabeth Gertrude Britton Fund:				
Research, exploration, publication, purchase of plants, books, specimens, etc.	4,207.53	1,791.00	2,075.16	3,923.37
Elizabeth Gertrude Britton Fund:				
Wild flower area		70.00	70.00	
	$18,013.20	$16,843.53	$16,595.47	$18,261.26
Special funds designated for specific purposes:				
School for gardeners	$ 2,237.30	$ 215.00	$ 173.78	$ 2,278.52
Contributions for scientific fund	1,045.12	100.00	324.48	820.64
Contribution towards fund for specific improvements and developments	10,000.00			10,000.00
Contribution of Mrs. E. Huntington Hooker:				
Exploration and other purposes	11,500.00		1,500.00	10,000.00
Contribution of Mr. J. R. Swan:				
Exploration	5,000.00		5,000.00	
Dr. Robbins' Research Fund	3,286.22	2,520.52	525.98	5,280.76
Fiftieth anniversary fund		3,351.00		3,351.00
Expense fund for Fiftieth anniversary campaign		48,000.00	24,234.43	23,765.57
Other	4,935.78	18,493.12	3,888.57	19,540.33
	$38,004.42	$72,679.64	$35,647.24	$75,036.82
	$56,017.62	$89,523.17	$52,242.71	$93,298.08

	Expenditures	Balance
BY FUNCTIONAL CLASSIFICATION:		
Receipts (contributions and income):		
Income from investments of permanent funds		$10,645.00
Contributions:		
General		16,719.58
For expenses of Fiftieth anniversary campaign		48,000.00
Fiftieth anniversary fund		3,351.00
Industrial membership dues		2,000.00
Sundry sales, fees, etc.		894.29
Subscriptions and sales of publications		7,913.30
Total per statement by funds		$89,523.17
Expenditures:		
Horticulture:		
Wages	$ 256.00	
Plants, seeds, supplies	1,481.88	
Architects' fees	1,500.00	
		$ 3,237.88
Botanical science:		
Salaries	$ 4,695.25	
Specimens, supplies, etc.	14,828.92	
		19,524.17
Public service in education, instruction and information:		
Instructions, lectures, etc.		4,246.23
Expenses of Fiftieth anniversary campaign:		
Salaries	$ 4,522.90	
Supplies, publicity, etc.	19,711.53	
		24,234.43
Total expenditures		$51,242.71
Amount transferred to Mycologia Endowment Fund (Exhibit IV)		1,000.00
Total per statement by funds		$52,242.71
Excess of receipts for the year ended June 30, 1945		$37,280.46

BOTANICAL EXPLORATION FROM THE NEW YORK BOTANICAL GARDEN

1897–1946

Compiled by H. A. Gleason

THE information presented below has been obtained from reports and news items in the *Journal of the New York Botanical Garden* and from official mention by the Director of the Garden in his annual reports, which originally were published in the Garden's Bulletin. Apparently neither source gives a complete record. For the earlier years of the Garden, the chief function of the *Journal* was the current history of the institution, and the movements of the staff were punctiliously recorded. In most instances, each expedition was followed by an official report to the Director, while the Director made a similar formal report to the Board of Managers. Less attention has been given to such details in the later volumes of the *Journal*. The report of the Director has also been condensed and details of expeditions are often lacking.

The degree to which the Garden has been officially concerned with expeditions also varies. It may have paid the entire expense of the trip and the salary of the explorer, or only fractions of either or both of these items. As a minimum of expense, the Garden may have contributed only the collecting outfit. Also, expeditions have been undertaken by our staff, especially by Dr. and Mrs. Britton in the past, entirely without expense to the Garden, or by other persons under our sponsorship only and without financial cost. It has been impossible to classify the various expeditions according to the degree of sponsorship, except a few with which the compiler is personally familiar.

One of the early expeditions from which the Garden reaped extensive collections, now in the Herbarium, was that of H. H. Smith to Colombia, just before the end of the century. No record seems to exist, however, of the part the Garden played financially in this expedition, and no report of it was published in the Garden's periodicals, none of which had been established at the time of the trip.

In the list below, 248 separate expeditions can be counted.

1897

P. A. Rydberg to Montana. Funds from W. E. Dodge

1898

A. A. Heller and Mrs. Heller to Puerto Rico (Funds from Cornelius Vanderbilt)

1899

Samuel Henshaw to Puerto Rico for living plants

1900

P. A. Rydberg to southeastern Colorado
D. T. MacDougal to northern Idaho
M. A. Howe to Bermuda
M. A. Howe to coast of New England
C. C. Curtiss to western Wyoming
F. E. Lloyd and S. M. Tracy to coast of Mississippi and Louisiana
W. W. Clute to Jamaica

1901

J. K. Small and G. V. Nash to southern Florida

Samuel Henshaw to West Indies for living plants
G. V. Nash to Kew for living plants
D. T. MacDougal to Montana
L. M. Underwood and O. F. Cook to Puerto Rico
M. A. Howe to Nova Scotia and Newfoundland
Percy Wilson to East Indies for museum material
N. L. Britton to St. Kitts
L. M. Underwood to Colorado

1902

D. T. MacDougal to Arizona and Sonora
F. S. Earle to western Texas and New Mexico
Percy Wilson (and A. W. Evans) to Puerto Rico
M. A. Howe to Florida Keys
F. S. Earle to Jamaica
Percy Wilson to Honduras
R. S. Williams to Bolivia (18 months)
S. H. Hamilton to Cuba ("commissioned" by the Garden)
Albert de Lautreppe to Peru ("commissioned" by the Garden)

1903

F. S. Earle (L. M. Underwood, E. W. D. Holway) to eastern Cuba
L. M. Underwood to Jamaica
D. T. MacDougal to Arizona
M. A. Howe to Puerto Rico
F. E. Lloyd to Dominica
G. V. Nash, H. F. Baker to Haiti
N. L. Britton, Mrs. Britton, J. A. Shafer to Cuba
N. L. Britton, Mrs. Britton, Percy Wilson to Cuba
R. S. Williams to the Philippines (25 months)
J. K. Small to southern Florida
Arthur Hollick to Alaska (probably not a Garden expedition)
D. T. MacDougal to Jamaica

1904

F. S. Earle to Cuba
D. T. MacDougal to Lower California
N. L. Britton, Mrs. Britton, M. A. Howe (and C. F. Millspaugh) to Florida and Bahamas
G. V. Nash, Norman Taylor to Bahamas
J. K. Small, Percy Wilson to Florida (spring)
J. K. Small to Florida (autumn)
N. L. Britton, Mrs. Britton, L. J. K. Brace to Bahamas

1905

N. L. Britton, Mrs. Britton, M. A. Howe, C. F. Millspaugh to Bahamas
W. A. Murrill, F. S. Earle to Cuba
J. F. Cowell to Panama
D. T. MacDougal to Arizona
Forrest Shreve to Jamaica
P. A. Rydberg to Utah
G. V. Nash, Norman Taylor to Haiti
N. L. Britton, Mrs. Britton to Bermuda
W. A. Murrill to Maine
L. J. K. Brace to Bahamas (first trip)
J. N. Rose to southern Mexico
L. J. K. Brace to Bahamas (second trip)

1906

N. L. Britton, Mrs. Britton, M. A. Howe, J. F. Cowell, Delia Marble to Puerto Rico
W. R. Maxon to Costa Rica
C. B. Robinson to Nova Scotia (possibly a vacation trip)
N. L. Britton, Mrs. Britton, L. M. Underwood to Jamaica
J. K. Small, J. J. Carter to Florida
Norman Taylor to eastern Cuba
L. J. K. Brace to Andros Island of the Bahamas
Arthur Hollick to Atlantic seacoast of eastern states
J. N. Rose to Mexico

1907

M. A. Howe to Jamaica
N. L. Britton, Mrs. Britton, C. F. Millspaugh to Bahamas
M. A. Howe, Percy Wilson to Bahamas
J. A. Shafer to Montserrat
N. L. Britton, Mrs. Britton to Jamaica
Arthur Hollick to Atlantic seacoast of eastern states

1908

R. S. Williams to Panama
N. L. Britton, Mrs. Britton, Arthur Hollick to Jamaica
N. L. Britton, Mrs. Britton to Jamaica
W. A. Murrill to southern Appalachians
P. A. Rydberg, New York to Virginia
W. A. Murrill to Jamaica

1909

J. A. Shafer to Cuba
N. L. Britton, Mrs. Britton, M. A. Howe to Jamaica
M. A. Howe to Cuba
Percy Wilson to Bahamas
J. K. Small, J. J. Carter to southern Florida
W. W. Eggleston to western Kentucky
W. A. Murrill to southern Appalachians
M. A. Howe, Mrs. Howe to Panama
W. W. Eggleston to southern states
W. A. Murrill to southern Mexico
S. Brown to Bermuda
Norman Taylor to Santo Domingo

1910

N. L. Britton, Mrs. Britton, Percy Wilson, F. S. Earle to Cuba
N. L. Britton, Mrs. Britton, S. Brown to Bermuda
N. L. Britton, Mrs. Britton, C. S. Gager to Cuba
H. H. Rusby to Mexico (probably not financed by the Garden)
W. A. Murrill to Virginia (probably on vacation only)
F. J. Seaver to Colorado
J. K. Small, J. J. Carter to Bahamas
J. A. Shafer to eastern Cuba (early winter)
Percy Wilson, Brother León to Cuba
J. A. Shafer to eastern Cuba (second trip)
J. N. Rose to southwestern states and northwestern Mexico

1911

N. L. Britton, Mrs. Britton to Cuba
J. K. Small to southern Florida
C. F. Millspaugh to Bahamas
J. N. Rose to Lower California
J. A. Shafer to Cuba
P. A. Rydberg to Utah
W. A. Murrill to Oregon, Washington and California
Percy Wilson to western Cuba

1912

N. L. Britton, Mrs. Britton, J. F. Cowell to Cuba
W. A. Murrill to Adirondacks (July)
W. A. Murrill to Adirondacks (October)
N. L. Britton, Mrs. Britton, Stewardson Brown to Bermuda (August, September)
N. L. Britton, Mrs. Britton, S. Brown, F. J. Seaver to Bermuda (December)
J. A. Shafer to Cuba
J. K. Small (and Hugo de Vries) to southern Florida

1913

N. L. Britton, Mrs. Britton, J. N. Rose, J. A. Shafer, Delia Marble to Puerto Rico and Virgin Islands
J. K. Small to Florida
N. L. Britton, Mrs. Britton, S. Brown to Bermuda

1914

N. L. Britton, Mrs. Britton, J. F. Cowell, F. E. Lutz to Puerto Rico
M. A. Howe to Georgia and Florida
J. A. Shafer to Vieques
N. L. Britton, S. Brown to Bermuda
J. A. Shafer to Puerto Rico
J. N. Rose to Peru, Bolivia, and Chile

1915

N. L. Britton, Mrs. Britton, S. Brown, J. F. Cowell to Puerto Rico
J. K. Small to Florida (February, March)
N. Wille to Puerto Rico
F. W. Pennell to Rocky Mountains
J. K. Small to Florida (June, July)
M. A. Howe to Puerto Rico
W. A. Murrill to Adirondacks
J. N. Rose to eastern Brazil and Argentina
Percy Wilson to Delaware County, N.Y.

1916

N. L. Britton, Mrs. Britton, Percy Wilson to Cuba and Isle of Pines

J. K. Small to southern Florida (January)
J. K. Small to Florida (April)
F. L. Stevens to Puerto Rico
W. A. Murrill to Catskill Mountains
W. A. Murrill to southern Appalachians
J. N. Rose to Venezuela

1917

H. H. Rusby, F. W. Pennell to Colombia
J. A. Shafer to Argentina, Paraguay, Uruguay, Bolivia (financed by Dr. Britton)
J. K. Small to Florida (April, May)
J. K. Small to Florida (December)
F. W. Pennell to Georgia and northern Florida
A. B. Stout through several eastern states

1918

J. K. Small to Florida (July)
J. K. Small to Florida (December)
J. N. Rose to Ecuador

1919

J. K. Small to southeastern states (February)
J. K. Small to Florida (April, May)
N. L. Britton, Mrs. Britton, J. K. Small to Florida (December)
A. S. Hitchcock to British Guiana

1920

N. L. Britton, Mrs. Britton, Dorothy Coker, W. Mendelson to Trinidad
J. K. Small to Florida (April, May)
F. W. Pennell to south-central states
J. K. Small to Florida (autumn)

1921

N. L. Britton, Mrs. Britton, F. J. Seaver to Trinidad
H. A. Gleason to British Guiana
H. H. Rusby to Bolivia (no financial support)
W. E. Broadway to French Guiana
J. K. Small to Florida

1922

P. C. Standley to Guatemala and Salvador
N. L. Britton, Mrs. Britton, Margaret S. Brown to Puerto Rico
F. W. Pennell, E. P. Killip, T. E. Hazen to Colombia
J. K. Small to Florida (spring)
J. K. Small to Florida (December)
G. C. Bucher to eastern Cuba (possibly not sponsored)

1923

N. L. Britton, Mrs. Britton, F. J. Seaver to Puerto Rico and the American Virgin Islands, St. Thomas and St. Croix
Brother León to Pico Turquino, Cuba (possibly not sponsored)
W. A. Murrill to Florida
W. E. Broadway to Venezuela
J. K. Small to Florida (May)
J. K. Small to Florida (fall)

1924

N. L. Britton, Mrs. Britton to Puerto Rico
W. A. Murrill to Argentina
J. K. Small to Florida (spring)
J. Roig to western Cuba (possibly not sponsored)
J. K. Small to Florida (summer)
Agnes Chase to Brazil
F. W. Pennell to Peru and Chile (probably not sponsored)

1925

A. B. Stout to Florida
N. L. Britton, Mrs. Britton, K. R. Boynton to Puerto Rico
J. K. Small to Oklahoma, Arkansas, Texas
P. A. Rydberg to southern Alleghenies
J. K. Small to southern coastal plain

1926

N. L. Britton, Mrs. Britton to Puerto Rico
H. A. Gleason to Puerto Rico
F. J. Seaver to Bermuda
Arthur Hollick to Puerto Rico
J. K. Small to Florida (spring)
J. K. Small to Florida (fall)
P. A. Rydberg to west-central states
E. P. Killip, A. C. Smith to Colombia

1927

N. L. Britton, Mrs. Britton to Puerto Rico
J. K. Small to Florida (spring)
J. K. Small to Florida (fall)

1928

N. L. Britton, Mrs. Britton to Puerto Rico
J. K. Small to Florida (winter)
J. K. Small to Florida (spring)

1929

N. L. Britton, Mrs. Britton to Puerto Rico
J. K. Small to Florida (spring)
P. A. Rydberg to Kansas and Minnesota
J. K. Small to Florida (summer)
A. C. Smith, E. P. Killip to Peru and Amazonian Brazil
F. J. Seaver to Colorado

1930

N. L. Britton, Mrs. Britton to Puerto Rico
J. K. Small to southern states (3 trips)
W. Y. Chun to Hainan, China

1931

J. K. Small, E. J. Alexander to Louisiana
A. N. Steward to Anhwei Province, China
W. Y. Chun to Hainan, China

1932

G. Proctor Cooper, 3rd, to West Indies (sponsored only)
W. Y. Chun to Hainan, China

1933

A. C. Smith to Fiji Islands
T. H. Everett, E. J. Alexander to southern Appalachians for plants and seeds
W. Y. Chun to Hainan, China

1935

Otto Degener to Koolau Range, Oahu, T.H.

1936

W. H. Camp to southern Appalachians
T. H. Everett, E. J. Alexander to Rocky Mountains
Otto Degener to Oahu, T.H.

1937

A. C. Smith to British Guiana
W. H. Camp to southern Mexico
Otto Degener to Waianae Range, Oahu, T.H.

1938

F. J. Seaver to Bermuda
Otto Degener to Oahu, T.H.

1939

Otto Degener to Haleakala, Maui, T.H.
W. H. Camp to Florida and the Carolinas

1940

H. A. Gleason, J. D. Dwyer through northeastern states
F. J. Seaver to Bermuda
Otto Degener to Kauai, T.H.

1941

Otto Degener to Fiji Islands

1942

F. J. Seaver to Mt. Desert Island, Maine
Otto Degener to western states

1943

Bassett Maguire, Arthur Holmgren to Intermountain region

1944

Bassett Maguire to Surinam and British Guiana
E. J. Alexander, Thomas MacDougall, to southern Mexico

1945

W. H. Camp to Ecuador
Bassett Maguire, Arthur Holmgren to Intermountain region
Arthur Cronquist to middle western states and Virginia

1946

L. J. Brass to Nyasaland
Bassett Maguire, Arthur Holmgren to Intermountain region
Otto Degener to New Providence Island, Bahamas

NEW YORK BOTANICAL GARDEN
MEMBERSHIP — 1945

BENEFACTORS

*Edward D. Adams
*Mrs. Fanny Bridgham
*N. L. Britton
*Addison Brown
*Andrew Carnegie
Columbia University
*Charles P. Daly
*James B. Ford
*Daniel Guggenheim
*Murry Guggenheim
*Edward S. Harkness
*Mrs. John Innes Kane
*D. O. Mills
*J. Pierpont Morgan, Sr.
*J. P. Morgan
*John D. Rockefeller
John D. Rockefeller, Jr.
*Mrs. Russell Sage
*Francis Lynde Stetson
*Cornelius Vanderbilt

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*Alexander P. Anderson
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*Samuel R. Betts
*Catharine A. Bliss
*Emil C. Bondy
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*Mrs. Louisa Combe
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*Charles Deering
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*Mrs. Mary J. Kingsland
*Mrs. Frederic S. Lee
*Frederic S. Lee
Clarence McK. Lewis
Col. Robert H. Montgomery
*Lewis R. Morris
Charles A. Munroe
*Oswald Ottendorfer
*Lowell M. Palmer

* — Deceased.

TREASURES FROM SURINAM

(On the opposite page)

IN THE CENTER are some of the sawarie nuts (*Caryocar nuciferum*) sent to the New York Botanical Garden from Surinam last year by Dr. Gerold Stahel, Director of the Agriculture Experiment Station at Paramaribo, who furnished assistance to Dr. Bassett Maguire on his 1944 exploration of Table Mountain, in the country's interior. The other illustrations represent some of the orchids sent back from Surinam by Dr. Maguire. When they arrived, they were uninteresting-looking, dried, brown pseudobulbs. These are among the nine that have flowered since then in the Garden's propagating houses. Numbers 1 and 3 are of two species of *Catasetum*. No. 2 represents a new species of *Polycycnis*. No. 4 is *Bifrenaria aurantiaca;* No. 5, a species of *Brassavola;* No. 6, a previously undescribed species of *Malaxis*, and No. 7, *Peristeria pendula*.

TREASURES FROM SURINAM

IN THE MAIN CONSERVATORY

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*Ogden Mills
Mrs. Paul T. Moore
Mrs. Lewis R. Morris
Elizabeth E. Morse

* — Deceased.

IN THE MAIN CONSERVATORY

(On the opposite page)

THE GARDEN'S FIRST EMPLOYEE to complete fifty years of continuous service was Joseph W. Smith, who was honored by his fellow employees at a brief ceremony, March 21, 1946, in the Palm House where he has worked for many years. With him, left to right, during the presentation of the check to which his fellow employees subscribed are T. H. Everett, Horticulturist, Patrick J. Connolly, Foreman of Range 1 (the main conservatory), and Dr. William J. Robbins, Director. The framed watercolor, which also was presented to Mr. Smith, was painted by one of the temporary gardeners, Marjorie Tobin.

Below, Mrs. Elsie Phillips, a temporary gardener, is shown with a specimen of *Crassula argentea,* a South African succulent plant which is common in cultivation as a house plant but which seldom blooms or attains this size except under greenhouse conditions.

At the right is Mrs. Helen Scott, secretary to the Horticulturist, with a specimen of the giant squill (*Urginea maritima*) from which the Garden was able to furnish seed for propagation to an agency of the United States Government for the production of an important rodenticide and drug, supplies of which had been cut off because of the war.

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*M. F. Plant
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*William D. Sloane
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EVENTS OF 1945 AT THE NEW YORK BOTANICAL GARDEN

Jan. 16	Annual meeting in the office of President Joseph R. Swan.
Mar. 4	Opening of conservatory display for the benefit of the American Red Cross, the display lasting nearly a month and attracting 100,000 visitors.
May 10	Presentation of English holly trees to Rockefeller Center.
May 13	Rededication Day, inaugurating the Fiftieth Anniversary Garden Week celebration.
May 14 to 20	Garden Week, including Founders' and Members' Day — May 13 Children's Day — May 16 Army and Navy Day — May 17 International Day — May 19 Commemoration Day — May 20 (A complete report of Garden Week was issued as Section 2 of the Journal for August 1945.)
May 24	Awarding of Honorary Degree of Doctor of Science to Dr. William J. Robbins by Fordham University.
May 31	Industrial Memberships created by action of the Board of Managers.
June 13	Third Annual Rose-Growers' Day.
June 21	Graduating exercises for students in the Garden's Two-Year Courses, with P. J. van Melle as speaker.
Aug. 2	Visit of Sir Alexander Fleming, discoverer of penicillin.
Sept. 30	International Folk Dance Festival for benefit of the New York National War Fund.
Oct. 26 to 28	First Annual Chrysanthemum Show and Program in cooperation with Eastern States Chrysanthemum Society, accompanied by an exhibit of paintings of chrysanthemums by Wang Chi-Yuan.

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

The New York Botanical Garden was incorporated by a special act of the Legislature of the State of New York in 1891. The Act of Incorporation provides, among other things, for a self-perpetuating body of incorporators, who meet annually to elect members of the Board of Managers. They also elect new members of their own body, the present roster of which is given below.

The Advisory Council consists of 12 or more women who are elected by the Board. By custom, they are also elected to the Corporation. Officers are: Mrs. Robert H. Fife, Chairman; Mrs. Elon Huntington Hooker, First Vice-Chairman; Mrs. William A. Lockwood, Second Vice-Chairman; Mrs. Nelson B. Williams, Recording Secretary; Mrs. Townsend Scudder, Corresponding Secretary; and Mrs. F. Leonard Kellogg, Treasurer.

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PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

An Illustrated Flora of the Northern United States and Canada, by Nathaniel Lord Britton and Addison Brown. Three volumes, giving descriptions and illustrations of 4,666 species. Second edition, reprinted. $13.50.

The Bahama Flora, by Nathaniel Lord Britton and Charles Frederick Millspaugh. 695 pages. Descriptions of the spermatophytes, pteridophytes, bryophytes, and thallophytes of the Bahamas, with keys, notes on explorations and collections, bibliography, and index. 1920. $6.25.

North American Cariceae, by Kenneth K. Mackenzie, containing 539 plates of *Carex* and related plants by Harry C. Creutzburg, with a description of each species. Indexed. 1940. Two volumes, 10¾ x 13½ inches; bound $17.50; unbound $15.50.

Keys to the North American Species of Carex, by K. K. Mackenzie. From Vol. 19, Part 1, of *North American Flora*. $1.25.

A Text-Book of General Lichenology, by Albert Schneider. 230 pages. 76 plates. 1897. $2.50.

Food and Drug Plants of the North American Indian. Two illustrated articles by Marion A. & G. L. Wittrock in the Journal for March 1942. 15 cents.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal, 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 15 cents.

The Flora of the Unicorn Tapestries, by E. J. Alexander and Carol H. Woodward. 28 pages, illustrated with photographs and drawings; bound with paper. 1941. 25 cents.

Catalog of Hardy Trees and Shrubs. A list of the woody plants being grown outdoors at the New York Botanical Garden in 1942, in 127 pages with notes, a map, and 20 illustrations. 75 cents.

Succulent Plants of New and Old World Deserts, by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. Second edition 1944. 50 cents.

Periodicals

Addisonia, annually, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Now in its twenty-second volume. Subscription price, $10 a volume (four years). Not offered in exchange. Free to members of the Garden.

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1.50 a year; single copies 15 cents. Free to members of the Garden. Now in its 47th volume.

Mycologia, bimonthly, illustrated in color and otherwise; devoted to fungi, including lichens, containing technical articles and news and notes of general interest. $7 a year; single copies $1.50 each. Now in its thirty-eighth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers published in co-operation with the American Society of Plant Taxonomists. Subscription price, $5 a volume ($4 to members of the Society). Now in its fifth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 94 parts now issued. Not offered in exchange. Prices of the separate parts on request.

Contributions from The New York Botanical Garden. A series of technical papers reprinted from journals other than the above. 25 cents each, $5 a volume.

Memoirs of The New York Botanical Garden. A collection of scientific papers. Contents and prices on request.

JOURNAL
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No. 563 1946 261—284

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

EVENTS—LATE NOVEMBER AND DECEMBER 1946

History of Paper-Making

An exhibit covering several thousand years of paper-making, arranged by Harrison Elliott, the speaker on the Garden's Saturday afternoon program of Nov. 16, will be on view on the main floor of the Museum Building until mid-December. Samples of the earliest paper made in the pioneering countries of Asia, Europe, and North America are shown, with informative labels explaining the process of manufacture by hand and by machine. Hand-made papers produced by Mr. Elliott himself are included in the exhibit, also some rare books printed on paper made from different kinds of pulp.

Conservatory Displays

Chrysanthemums and other late autumn-flowering plants, in addition to the permanent exhibits. Open daily, 10 a.m. to 4 p.m.

Members' Day Program

Dec. 4—***Report of the Garden's First Expedition to Africa***
The Vernay Nyasaland Expedition — *L. J. Brass*

Radio Programs

Alternate Wednesdays at 5:45 p.m. over WNYC (830 on the dial).

Nov. 27—***Amino Acids—And You*** — *F. W. Kavanagh*, Assistant Curator

Dec. 11—***Farm and Garden Crops of Colonial America*** — *Anne Dorrance*, Author of "Green Cargoes" and other books

Dec. 25—***After-Christmas Care of Christmas Plants*** — *Montague Free*, Staff Horticulturist, Home Garden Magazine

Saturday Afternoon Programs

3 p.m. in the lecture hall.

Nov. 23—***Air Plants and How They Grow*** — *E. E. Naylor*, Assistant Curator

Nov. 30—***The Romance of the Hudson*** — *Mrs. Gordon Wightman*, Hudson River Conservation Society

Dec. 7—***Careers for Cellulose***
A motion picture in sound and color, with comment by *W. D. Turner*, Technical Consultant on Plastics.

Programs to be resumed after the holidays.

TABLE OF CONTENTS

November 1946

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VOL. 47 NOVEMBER 1946 NO. 563

Foods from Fermented Soybeans . . .
As Prepared in the Netherlands Indies

I—Taohoo, A Cheese-Like Substance, and Some Other Products

By Gerold Stahel
Director, Agricultural Experiment Station, Paramaribo, Surinam

IN East Asia—and here in Surinam too—soybeans are planted for seed production alone, chiefly for human consumption, in contrast to the diverse uses made of the crop in North America, where much of it is fed as hay to cattle and a large proportion also goes into plastics and other products. Relatively few soybeans are eaten in the United States. Despite intensive advertising campaigns, western peoples seem to prefer to convert their soybeans into meat and cow's milk. This may be a less economical way to use them, but to them these products are more palatable.

Eastern peoples have developed other means for overcoming the rather bitter taste of soybeans and their failure to cook soft. They have learned to ferment the soybeans with quick-growing fungi, thus making several palatable and wholesome foods.

Most important of these foods are TAOHOO and TEMPE; also TAOKOAN, a cheese made from taohoo; TAOTJO, a fermented paste-like condiment, and KETJAP, which is soy sauce. Soybean milk is also made, but without a fungus, and sprouted soybeans are widely used by orientals.

Sprouts and Milk from Soybeans

In the Netherlands East Indies sprouted soybeans are called TOKOLÁN or TAOGÉ. They are one of the ingredients of every "rijst-tafel" (rice table, or combination of rice dishes) and therefore are never lacking in the "passar" (market). Even in our Paramaribo market, tokolán is displayed for sale every day.*

* Directions for the sprouting of soybeans were published in this Journal for November, 1943.

To make soy milk, beans of the yellow variety are soaked in water and ground in a mill. The product is diluted with water and filtered through cheesecloth. The milk obtained in this way has about the same properties and nearly the same composition and proteins as cow's milk. In China it is used in the same manner as cow's milk. In the United States too soy milk is consumed, though on a very limited scale. In the Netherlands East Indies this milk is only slightly known as food, but it is produced in large quantities for the manufacturing of soy cheese, called TAOHOO or TAHOO.

Cheese-Like Products

Just as in making cheese with common milk, a kind of starter is added to the warm soy milk, which immediately begins to coagulate. Most of this curd, or taohoo, is either eaten fresh or baked in oil or lard. In China it is sometimes processed further into a kind of real cheese by impregnating the curd with turmeric and reducing the water content by heavier pressing. This cheese, called TAOKOAN, has a yellow color and can be shipped abroad.

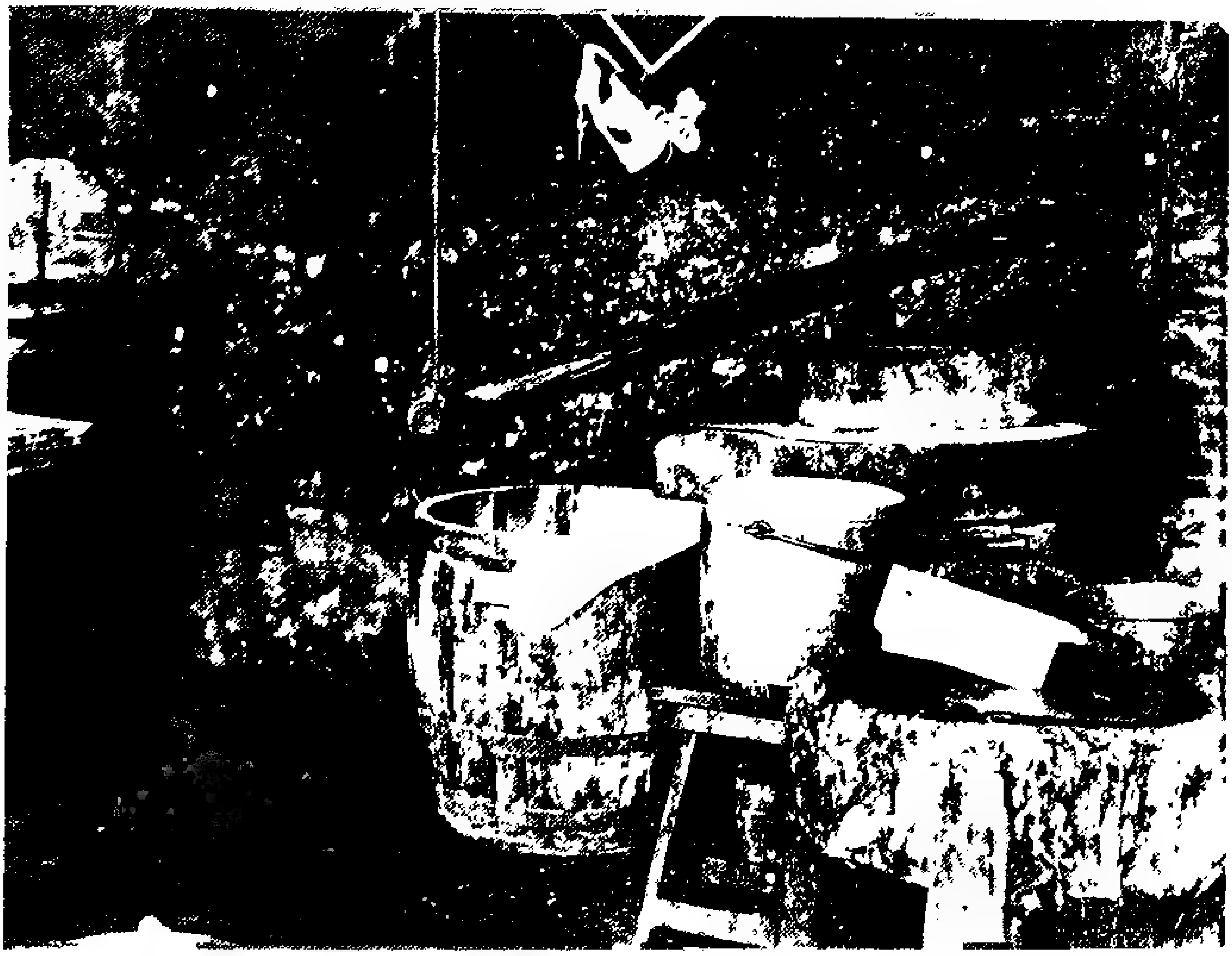
TEMPE is a typical product of the Netherlands East Indies and is unknown in China and elsewhere. To make tempe, soybeans are molded by the very quick-growing fungus, *Rhizopus Oryzae,* which grows at its best only at the permanently high temperatures of the tropics. For this reason the manufacture of tempe is restricted to tropical countries. Here in Surinam, as in the East Indies, most of the soybeans are consumed in this form. In this Journal I propose to give an account of the preparation of taohoo, and in the next one, of tempe.

How Taohoo Is Made

After tempe, taohoo is the most common form of soybean product eaten in the Netherlands East Indies. In China, it is the most important soy product. Taohoo is manufactured here in Surinam only on a very limited scale, by a single Chinese store-keeper close to the Paramaribo market-halls along the Surinam River. Twice daily, between 2 and 4 o'clock in the morning and again in the afternoon, he manufactures 11½ kilograms of taohoo, to be sold after 6 o'clock the next morning. We visited this Chinese kitchen in February in the early morning and again in the afternoon to see the whole procedure.

At about 8 o'clock in the morning and evening 5.8 kilograms of soybeans are put into a pail containing about 4½ times this amount of water. As in East Asia, the yellow variety is used for this purpose. The black one is just as suitable, but has to be peeled very carefully before milling, otherwise the curd turns a dark color. For this reason the yellow soya fetches higher prices here than the black one.

In water the beans swell considerably and after six hours they have a volume two and one half times that of the dry beans. The actual manufacture of taohoo then begins.



CHINESE KITCHEN EQUIPPED WITH IMPLEMENTS FOR TAOHOO MANUFACTURE

In the drain of the lower millstone, the white soybean mash can be seen flowing slowly into the bag of cheesecloth hanging in the wooden barrel. At the left, a part of the square plank, and on the wall, parts of two frames for use in making taohoo, are discernible. Also on the left stands a large earthenware pot filled with brine to be used for coagulation of the curd.

The thoroughly soaked beans, whose water content is now 63.3% instead of 15.9% as in the dry beans, are milled in a small stone-mill with two stones of 50 centimeters diameter. The upper stone rotates, whereas the lower is fixed and possesses an all-round drain. This mill comes from Hongkong, from where others have been sent all over the world, wherever Chinese people live. The upper stone is turned by a man with the aid of a long wooden lever. Every time that a ladle with wet soybeans and water is brought into the hole in the upper stone, rotation has to be stopped.

The thick fluid in the mill streams slowly through the drain into a bag of cheesecloth which hangs in a wooden barrel. A sample of this fluid proved to contain 84.6% water. This means that to every kilogram of beans of 15.9% water content 4.6 liters of water have to be added to obtain a sufficiently fluid milling product. To the 5.8 kilograms of soy-

Condiments Made with Aspergillus

TAOTJO and KETJAP are soy products fermented by another fungus, *Aspergillus Oryzae.* The first is eaten as a kind of paste, the second is used in a fluid form, and is familiar throughout much of the world under the simple name of soy sauce.

To make TAOTJO, boiled soybeans are mixed with roasted meal of wheat or glutinous rice. This mass is wrapped in hibiscus leaves, which commonly harbor the *Aspergillus* fungus. After two or three days the moldy mass is brought into brine and kept for several weeks. Palm sugar is added at intervals. Taotjo must be made in the dry season, because every day it has to be brought outside into sun and air for hours. This dish is eaten in the East with the "rijst-tafel." In Surinam it is not manufactured at all.

KETJAP, the well known soy sauce, is made all over East Asia and even here in Surinam. To manufacture ketjap the soybeans are boiled and after cooling are wrapped in hibiscus leaves, just as with taotjo, but without mixing in the roasted meal. After fermenting for two or three days the mass is brought into brine, as with taotjo. Every day for one to several months it is exposed to the sun At intervals a little palm sugar is added. Then the fluid is filtered and the residue cooked several times with fresh water to extract all the soluble parts. The fluid is then concentrated by slow boiling. Spices and other piquant materials are added, according to the *specialité de la maison.* These may include galangal, ginger, cloves, Jew's ear fungus, and dried and ground fish and chicken meat.

beans our Chinese therefore has to add as much as 26½ liters of water.

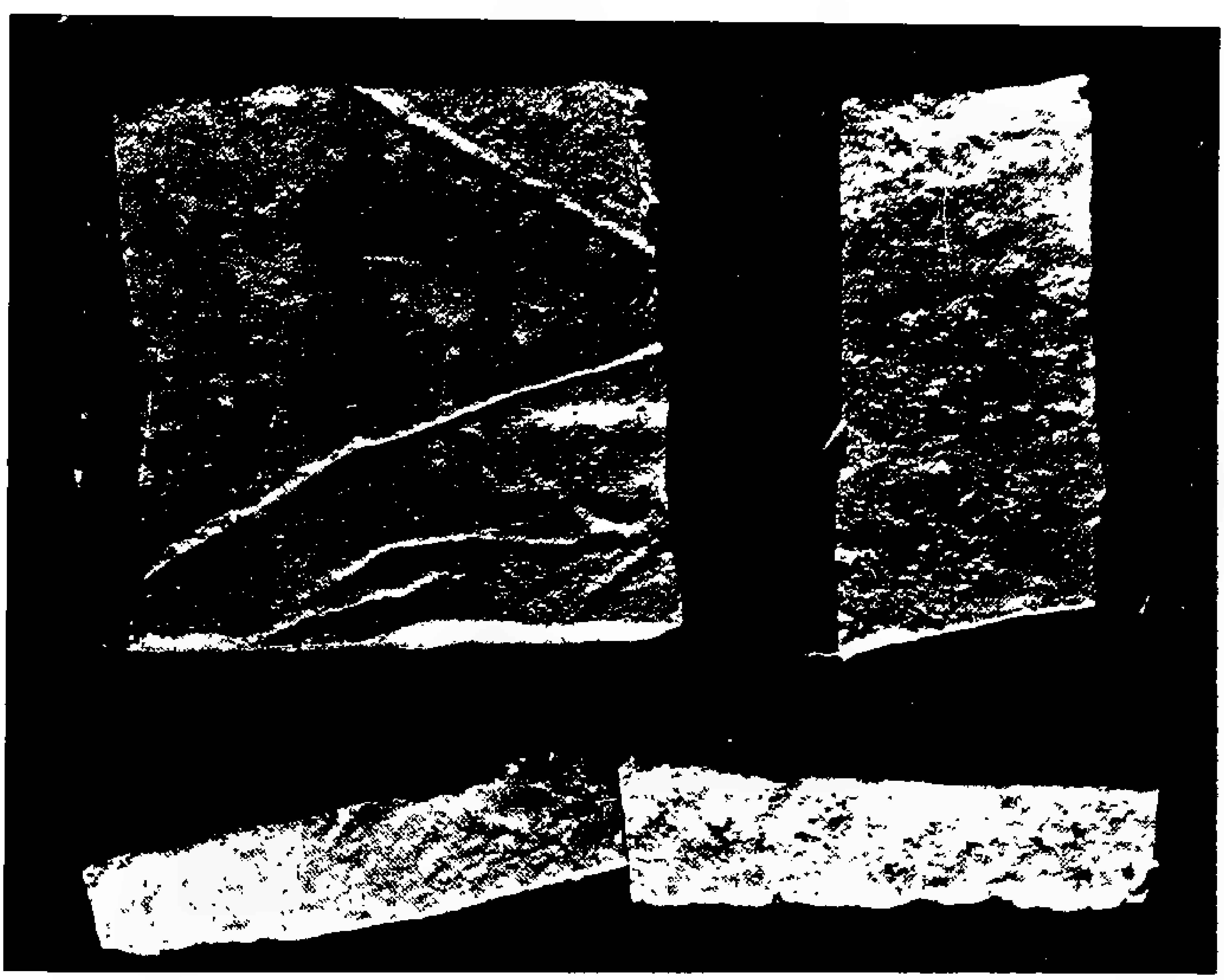
During the milling of the beans, water is boiled in a 50 liter pan. When milling is finished, the barrel is brought close to the pan. Then the hot water is ladled in the bag with bean residue, which is being moved constantly by pulling and stretching it to hasten filtration. After the pan is emptied and filtration slackens, the bag is placed on a grate above the barrel, the free part being twisted and closed tightly in this way. The bag is then pressed firmly to separate the milk as completely as possible from the residue.

There are now about 75 liters of milk in the barrel. Fifty liters are ladled back into the pan and 25 go in a pail placed next to the pan on the hearth. When the temperature of the milk reaches the boiling point, it is brought back to the barrel and successively the 25 liters of milk in the pail are poured into the pan to be heated. At least 45 liters of water of about 28°C are added now to the hot milk in the barrel. By now the 120 liters of milk may have a temperature of 65-70°C.

Then the starter, consisting of one liter of a 12% solution of salt and 15 cubic centimeters of 80% acetic acid, is added to the fluid, which is constantly stirred with a rod.

Almost immediately the white color changes into a greyish one and flocks of curd appear floating in the fluid. When the curd begins to settle a hand-basket with fine meshes is held in the whey and the clear fluid which filters into it, is ladled into pails and thrown away. When most of the whey is removed in this way, the watery curd is transferred to a cheesecloth lying crosswise over a loose wooden frame of 2 feet square and 12 centimeters high and placed on a square plank. Now on all sides the fluid drips away and our Chinese tries to hasten the filtration by drawing the corners of the cloth subsequently back over the cheese. Then the four corners of the cloth are placed over the curd and a plank just fitting in the frame is put on the curd and loaded with a pail containing 30 liters of water. To prevent the sticking of the plank to the cheesecloth a frame of very thin wooden laths is placed between them. When after ten minutes no further fluid drips out, the plank is removed again and the corners of the cheesecloth are carefully drawn, so that all the wrinkles disappear. Now plank and pail are replaced and remain on the curd for several hours.

The cheese is now about one inch high, and contains 84½% water. It is cut into 100 pieces, each 6 centimeters square. Those made in the early morning are sold after 6 o'clock in the morning as white soft curd. At the same time those of the afternoon of the previous day are sold as cakes, baked during the night in lard.



Pieces of fresh taohoo, four-fifths natural size.

Freshly baked taohoo, four-fifths natural size.

There are two kinds of waste products in the manufacture of taohoo, one the filter-residue and the other the whey. The first product may be fed to pigs as a concentrate; the second is useless and is thrown away.

In China, 50 grams of calcinated plaster of Paris is used to start the coagulation of the same quantity of soy milk. The whey from this may be used in agriculture as a thin liquid manure, whereas whey containing salt will be harmful for this purpose in the long run.

The table below shows the output of the different products resulting from the processing of 5.8 kilograms of soybeans into taohoo.

	Water content	*Dry Matter*		*Protein*		*Fat*	
	%	kg.	%	kg.	%	kg.	%
5.8 kg. soybeans	15.9	4.84	—	1.9	—	0.8	—
11.4 kg. taohoo	84.6	1.76	37.5	1.1	55	0.6	75
120 l. whey	99.13	1.04	22.2	0.3	15	0.02	—
10.2 kg. filter-residue	81.5	1.89	40.3	0.6	30	0.2	25
		4.69	100	2.0	100	0.8	100

More than half of the protein and ¾ of the fat present in soybeans go into the taohoo, whereas about 1/3 of the protein and ¼ of the fat are found in the press-residue. The whey contains only 1/7 of the protein and almost no fat at all. In the whey are found most of the soluble carbohydrates, such as galactan, pentosans, and others.

Taohoo is occasionally manufactured in the United States for the Chinese restaurant trade.

A list of references to the literature on soybean food products will appear at the end of the second and concluding article, to be published next month.

Robert Almer Harper

By A. B. Stout

THE DEATH of Robert Almer Harper on May 12, 1946, terminated a life of 84 years of which nearly 50 years were devoted to botany. After receiving the degree of Batchelor of Arts from Oberlin College in 1886 he was for two years a teacher of Greek and Latin at Gates College in Nebraska. Then he spent a part of the year of 1888-1889 in botanical study at Johns Hopkins University. For the next two years he was an instructor in science at Lake Forest Academy in Illinois. He received the degree of Master of Arts from Oberlin College in 1891. From 1891 until 1898 he was Professor of Botany and Geology at Lake Forest College. During this period he spent two years in botanical studies and research at the University of Bonn, Germany, where he studied under the celebrated botanist Eduard Strasburger and received the degree of Doctor of Philosophy in 1896. From 1896 until 1911 Dr. Harper was Professor of Botany and Head of the Department of Botany at the University of Wisconsin. In 1911 he became Torrey Professor of Botany and Head of the Department of Botany in Columbia University. In 1930, after 19 years of service, he retired from full duties at Columbia University but remained as Professor Emeritus. He continued in various relations both at Columbia University and at the New York Botanical Garden until 1938, when the family moved to Bedford, Virginia. Here he spent his remaining years with Mrs. Helen Sherman Harper, their son Robert, their daughter-in-law, and their grandson Robert LeRoy Harper on a former plantation of about 435 acres situated in an area of beautiful Piedmont scenery.

At Wisconsin University especially, and also at Columbia University, Professor Harper organized progressive and integrated courses in botany for the four years of academic study and for further postgraduate study. He himself presented the lectures of the introductory course. He gave personal attention to the advanced courses, especially to cytology, to the seminar which he conducted for all advanced and postgraduate students, and to the research by candidates for degrees.

ROBERT ALMER HARPER
1862-1946

Professor Harper was an inspiring teacher; his knowledge of botany was authoritative and extensive; his evaluations of subject matter and of research were critical and constructive. The numerous theses done under his supervision cover a wide range of subjects. This was a natural consequence of the diversity of his interests, the extent of his knowledge and his perception in assigning problems of interest to his students.

Early in his tenure at Wisconsin University, as probably also in his earlier teaching, Professor Harper organized field trips for his students and associates. These were events of pleasant comradeship as well as a means of stimulating an appreciation of plant life. My first acquaintance with Professor Harper was in this connection. It happened that from 1903 to 1907 I was a teacher of science in the High School at Baraboo, Wisconsin, which was near Devil's Lake. I sent plant specimens to Professor Harper for identification and soon the Devil's Lake area became a favorite spot for at least one field day each year. The diversity and richness of the flora in the wild mountainous terrain immediately surrounding this small post-glacial lake and within the survey of a single day are almost beyond belief. Professor Harper's delight and appreciation of the natural flora were contagious; his acquaintance with its members was inspiring. The survey included all types of plant life and many species as to identification, relationship, ecological status, and life history. Specimens, especially of the fungi, were taken for the herbarium or for study. After coming to Columbia University, Professor Harper's enthusiasm for field trips continued. To facilitate these he purchased a large roomy Panhard automobile in which numerous excursions were made to places of botanical interest along the seacoast and at some distance inland about New York City. After such a field day the laboratory with its various techniques became merely an important means for a better understanding of living plants in Nature's great experimental laboratory.

Professor Harper's personal researches were chiefly concerned with the cytology and morphology of the slime molds and of various fungi with special reference to sexuality and reproduction, and to the morphogenesis and organization of colonies of cells in certain of the algae. These studies greatly advanced the knowledge of cellular and nuclear behavior in the life cycle of the fungi. They exemplify careful examination by cytological methods, intensive and exhaustive study of a particular problem, and an analytical consideration of the observations. The illustrations of his papers on cytology are models of execution in pen and ink drawings.

In the period between 1911 and 1920 Professor Harper was keenly interested in the then rapidly expanding field of genetics. He devoted several summers to the study of the heredity of the intermediate or pseudo-starchy character that occurs especially in the hybrids obtained in crosses between sweet corn and flint, dent, flour and pop-corns. This research was started in the experimental breeding plots at the New York Botanical Garden and later continued on the farm which Professor and Mrs. Harper purchased in New Jersey. During this period genetics was the chief topic of discussion in the frequent conversations which the writer had with Professor Harper. The results and conclusions of this study were published in 1920.* This paper presents in a precise and concise manner his critical evaluation of Mendelian data and doctrines. Especially did he doubt the validity of the doctrine of unit factors and of the purity of germ cells for such factors especially after hybridization. He believed that every pair of contrasted characters will ultimately exhibit intermediates after intervarietal as well as after interspecific hybridization, as do the sugar and starchy types of endosperm in corn, and that long continued selection may be necessary to obtain relatively pure races of such intermediates. Professor Harper questioned the Mendelian conception that such variability is due to the recombination of modifying or multiple factors of fixed values, or to "mutations" in such factors. To him the recognizable elements of protoplasm are complex, labile, and interacting and are altered not by self-caused action but by interaction in the complex process of "synapsis, maturation and union of gametes."

Long Service to the Garden

It is appropriate that Professor Harper's long and valuable service to the New York Botanical Garden be surveyed for the records of this Journal. He was a Member of the Board of Managers from 1911 to 1942. He was Chairman of the Scientific Directors from February 1918 to April 1933, which is the date when this body was discontinued and its functions otherwise assigned. Thus Professor Harper was closely identified with many developments and activities responsible for the progress of the Botanical Garden. For many years he spent at least one day a week at the Garden, where he had an office. In 1945 his entire collection of approximately 15,000 separates and other literature pertaining to botany was given to the Library of the New York Botanical Garden, where it is known as the Robert A. Harper Reprint Collection. Professor Harper was chiefly responsible for the installation and use of equipment for sprays to combat insect pests and fungous diseases in the outdoor plantings, and for the addition of a plant pathologist to the staff. For more than 30 years he maintained close and sympathetic relationships with the administration of the Botanical Garden.

* Inheritance of sugar and starch characters in corn. R. A. Harper. Bull. Torrey Botanical Club **47**: 137-186. 1920.

Wood Displayed in Library Has Fluorescent Properties

THE fluorescent qualities attained by water which has come in contact with certain kinds of wood were demonstrated by a small exhibit in the Garden's library during the fall. A chalice made from the wood of *Pterocarpus indica* from the Philippines was filled with water. After several hours, when the water was poured into a beaker, a pale but definite fluorescence manifested itself. As the water evaporated over several days, the fluorescence became more pronounced.

Chalice from the Philippine wood known as "lignum nephriticum," which gives a fluorescent quality to water with which it has come in contact.

The demonstration was inspired by Clarence McK. Lewis, member of the Board of Managers, who read the article entitled "Lignum nephriticum—its history and an account of the remarkable fluorescence of its infusion" by W. E. Safford in the Annual Report of the Smithsonian Institution for 1915. Noting that one of the woods which bore the name of "lignum nephriticum" was possibly the kind called "red narra" in the Philippines ("vermilion wood" in the American trade), and knowing that the woodworking shops of the Philippine Railway Company at Iloilo on the Island of Panay had a supply of this wood (which is used for ties and also sometimes for flooring and furniture), he wrote to the Philippines to ask whether two chalices might be made for him out of narra lumber.

In due time two chalices arrived, apparently copied from a chalice in a local church, and one of these was brought to the New York Botanical Garden for testing.

Two Kinds of Nephritic Wood

Pterocarpus indica, which is a large tree belonging to the Leguminosae, is only one of two or more kinds of wood that have been renowned for their fluorescent properties. Another is a small tree or shrub native to Mexico—*Eysenhardtia polystachya,* also of the Legume family. Relatives of both these trees have been credited with similar powers, and it was not until Safford's paper was published that there seemed to be any certainty about the true source—or sources—of this marvelous wood. Dr. Safford opens his 28-page paper by saying:

"Lignum nephriticum is a remarkable wood which was celebrated throughout Europe in the sixteenth, seventeenth, and the early part of the eighteenth centuries, not only for its reputed medicinal virtues but on account of the strange color phenomena displayed by its infusion in spring water. Cups turned from it were deemed fit gift for emperors and princes. The water drunk from these cups, or from bowls in which a few chips were allowed to remain, was declared to work marvellous cures; and its beautiful opalescence and changes in sunlight and shadow were the subject of investigations by the most celebrated physicists of that period. Strange to say, scarcely a fragment of this wood is now to be found in museums or drug collections. Its very name has disappeared from modern pharmacographies and encyclopedias; and its botanical identity has remained doubtful until the present day. In the present paper I propose to show that this classic wood came from two distinct sources, from trees of distinct genera."

The Mexican species was the wood used by Robert Boyle in 1663 in his experiments on the fluorescence of light.

News from Abroad

The first correspondence received at the Garden from Camillo Schneider, German botanist and horticulturist, since before the war, reached New York Oct. 7. Written from Berlin Aug. 23, it tells of activities at San Souci, the famous castle of Frederick the Great in Potsdam, just outside Berlin. "Each week we are going to Sans Souci," Mr. Schneider writes, "where I have to deal with Russian professors of the Academy of Science at Moskau, which has established a department of botany at Sans Souci. The castles and gardens are still intact but the park is not well kept at present. The city of Potsdam has been entirely destroyed by bombs."

Mr. Schneider, who has done notable work in dendrology and who designed the plantings on a number of large estates in central Europe, was the Editor of *Gartenschönheit* for some years before the war. At the outbreak of the first world war he was in the United States, and remained here, working at the Arnold Arboretum until after peace was established. He also spent some time at Cornell University.

PICTURE PAMPHLET OF VEGETABLE GARDENING

HOME food production has not decreased in importance with the conclusion of the war. Gardeners who have been raising their own table crops during the last few years will without question find it advantageous to continue. Those who have not yet learned the art and fun of growing vegetables and who have a plot large enough for at least tomatoes and beans, will be ahead in the game of gardening for food if they start preparing their soil this fall.

For it is a well established fact among gardeners that the most successful gardens are begun in autumn. Although digging can still be done in early spring, November is an ideal time to make the ground ready for next year's sowing of seeds. It is beneficial to the soil to let it remain in a rough state over winter, to enable frost and air and decomposition to do their work

The first step in digging is to mark the limits of the first trench with a string pulled tightly between two stakes, then dig the soil out evenly to the entire depth of the spade. For convenience in finishing the job, the soil removed should be hauled to the far end of the garden.

This is the time to put in manure or other organic fertilizer, mixing it well into the bottom of the trench with a spading fork.

When the second trench is dug, the soil from it is thrown into the first trench. This process continues, always marking the lines of the trench carefully with stakes and string, until the end of the garden is reached. There the soil from the first trench will be ready to throw into the last A dose of lime spread over the top is beneficial.

In spring, artificial fertilizer may be added to the surface. A good raking then puts the soil in what the gardener calls "good tilth." It is then ready to receive the seeds and seedlings.

Illustrations of the preparation of the soil appear on the following page. On the two subsequent pages are shown methods of sowing seeds, setting out seedlings, and seeing the garden through the summer.

Some of these illustrations were used in the New York Botanical Garden's booklet "The Victory Gardens of 1942 and 1943," which is now out of print.

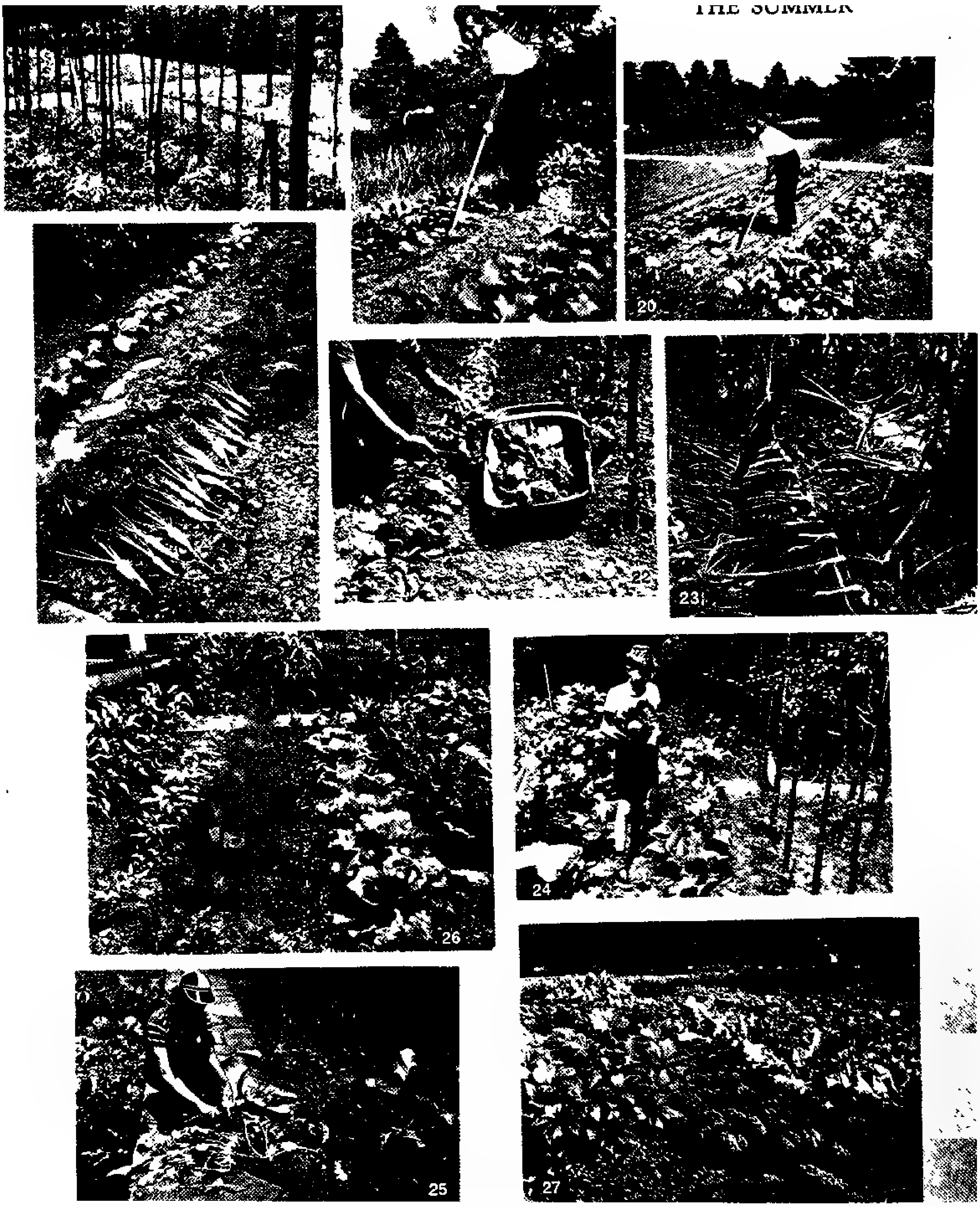
PREPARING THE SOIL FOR VEGETABLES

1. Marking the edge of the trench to be dug. 2. Throwing the soil from a second trench into the first. 3. Adding manure to the sub-soil. 4. Forking over the bottom of the trench. 5. Adding commercial fertilizer to the soil's surface in spring. 6. Raking the soil fine and smooth to make it ready for the seeds.

SOWING OF SEEDS AND PLANTING OF SEEDLINGS

7 & 8. Two methods of making furrows for seeds. The stake being pushed along the string at the left is V-notched to hold it in place. 9. Sowing seeds. 10, 11 & 12. Late March, sowing peas in a trench and covering them with soil, then protecting them from pests with chicken wire. 13, 14 & 15. Setting out cabbage seedlings in early June. 16 & 17. Planting young leeks in holes made with the top of an old spade handle.

THE SUMMER



SEEING THE GARDEN THROUGH THE SUMMER

18. Tall strong stakes for tomatoes. 19 & 20. Two tools for cultivating between rows of plants—a hoe and a 3-pronged cultivator. (Photographs by Ewing-Galloway). 21 & 22. Carrots and lettuce—two of the first crops. 23. Laying the tops of onions flat to induce ripening of bulbs. 24. Picking the first cabbage. 25. Harvesting kohlrabi while the size of a golf ball. 26 & 27. Some of the Garden's crops in midsummer.

Fastigiate Oak Reproduced from Seed

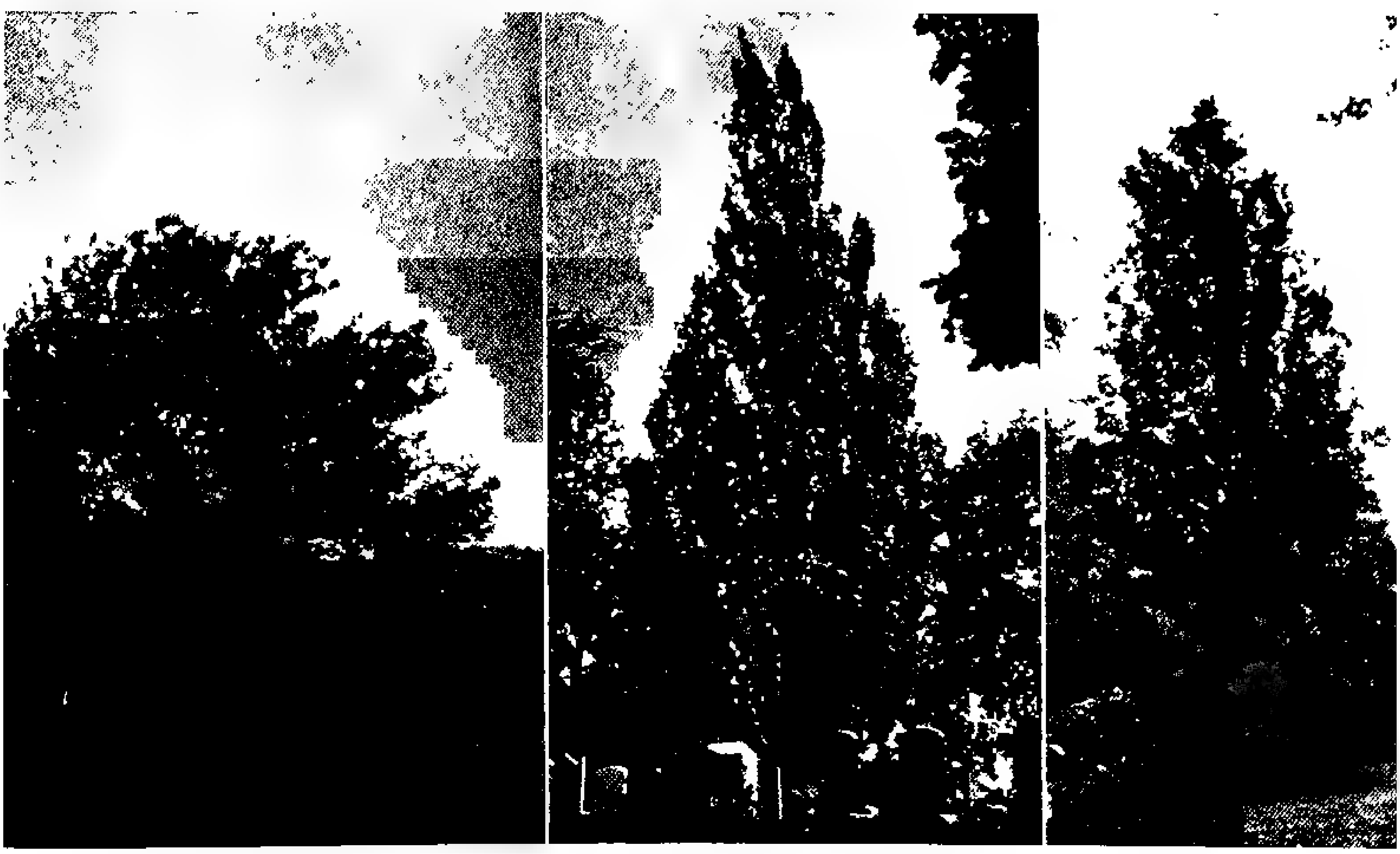
By J. G. Esson

MANY woody plants include within the limits of a single species a number of forms. One may have pendulous branches, another purple or variegated leaves, yet another may have stems that grow erect and close together; still another may have fruit of a different color from that of the recognized species.

None of these forms have been considered by the propagator as likely to come true from seed, and so vegetative propagation is usually resorted to.

A simple experiment with three acorns collected from a fine specimen of *Quercus Robur fastigiata,* that is 63 feet high and growing at Great Neck, Long Island, produced two ordinary English oaks, with spreading branches, while the third was a reproduction of the parent plant.

The acorns were collected in the fall of 1931 and planted immediately. The resulting fastigiate form is now 34 feet tall.



In the center is a fastigiate English oak in All Saints Church cemetery at Great Neck, Long Island, and at the left and right are two of its seedlings grown from acorns planted in 1931.

THE BESSA PAINTINGS

THE reproduction above is of crape-myrtle (*Lagerstroemia indica*). On the opposite page are shown *Gentiana acaulis*, *Chrysanthemum indicum* (under the name of *Anthemis artemisaefolia*), *Tibouchina holosericea* (under the name of *Rhexia*), and *Tulipa Gesneriana* var. "Henry IV."

These represent five of the 572 watercolor paintings on parchment made by Pancrace Bessa in the first quarter of the 19th century, for illustrating the first eight volumes of the French serial, the "Herbier Général de l'Amateur." One hundred of these were on

exhibit at the New York Botanical Garden for six weeks, beginning with the opening Members' Day program of the season, Oct. 6. They have been brought to the United States by Mrs. Flora de Campos-Porto Castaño Ferreira, daughter of Paulo Campos-Porto of Rio de Janeiro, the owner of the paintings and accompanying parchment text, and a cousin, Rodrigo Claudio de Campos-Goulart. The two Brazilians were among the guests at the Garden's program at which the exhibit was opened

Another selection from the group of paintings is to be shown during the A.A.A.S. meetings in Boston Dec. 26-30.

Three-Day Show and Program Staged With Eastern States Chrysanthemum Society

OUTDOOR displays of hardy chrysanthemums at the New York Botanical Garden were at their best for the second annual show and program presented Oct. 25-27 in co-operation with the Eastern States Chrysanthemum Society. Besides approximately 75 varieties in bloom in the borders adjacent to the conservatory, nearly 125 new varieties, received from growers in half a dozen northern states, were assembled for appraisal and test in a border between the conservatory and museum.

In the museum itself, the society staged a competitive exhibit in which there were entries in 48 classes for horticultural specimens and ten for artistic arrangements.

Duplicating its success of last year, the Garden Club of Mamaroneck won the Scott award, presented by Dr. Ernest L. Scott, the society's president, for the outstanding exhibit of the show. The display, placed on the right as one entered the building, consisted of a garden planting of chrysanthemums against a background of appropriate shrubbery. On the lawn in front grew a small clump of shaggy-mane mushrooms.

On the opposite side of the door was an effective display of chrysanthemums in many varieties with autumn foliage, exhibited by Mr. and Mrs. Marshall Field and arranged by George H. Gillies, their head gardener. There was also a collection of chrysanthemums from Totty's of Madison, N. J.

Other exhibits in the rotunda included two chrysanthemum borders arranged by Elsie A. Kiaz of Tenafly, N. J., and Marie J. Leary of Greenwich, Conn., and a group of potted plants from the Scotts' private greenhouse. At the far end of the corridor to the left, terminating the competitive exhibits, was a landscape plan set up by the organization that is developing the Blue Star Drive on Route 29 in New Jersey as a war memorial.

Three specimens of the chrysanthemum "Mrs. H. E. Kidder" brought the tricolor award in horticulture to Fred Shumaker, vice-president of the society.

Six flower arrangements were shown by invitation in shadow-boxes against the central pillars in the rotunda. Exhibitors were:

Mrs. George J. Hirsch, New Rochelle, N. Y., first prize and tricolor; Hans Christian Anderson Madison, Paramus, N. J., first prize; Mrs. Bernard E. Farley, Scarsdale, N. Y., and Mrs. William Rathbone, Mamaroneck, N. Y., second prizes; and Mrs. H. Herbert Johnson, Leonia, N. J., third prize. A non-competitive composition also was arranged by Mrs. Johnson.

The program for the opening day began with an address by S. L. Emsweller, Principal Horticulturist of the Department of Agriculture's Plant Industry Station at Beltsville, Md., on "Chrysanthemum Breeding." Part of his talk, it is planned, will be published in a later number of the Journal.

T. H. Everett then conducted a clinic on chrysanthemum culture and disease and pest control. With him on the platform, to help in answering questions from the audience, were Dr. Emsweller, Dr. B. O. Dodge, the Garden's Plant Pathologist; Stuart Longmuir, Head Gardener for Edward R. Steichen; Louis Pyenson, State Institute of Agriculture at Farmingdale; and F. F. Rockwell, Editor-in-Chief of *Home Garden* magazine.

A new chrysanthemum developed by V. R. de Petris of Grosse Pointe Farms, Mich., was then presented to Mary MacArthur, daughter of Helen Hayes and Charles MacArthur, by Dr. Scott and was christened in her honor.

To close the afternoon's program, the Garden served tea in the Members' Room to members of the two co-operating organizations.

On the Saturday and Sunday immediately following, the indoor displays were open to the public from 10 a.m. till 5 p.m. and the outdoor exhibits until dark. It is estimated that 18,000 persons visited the Garden during the three-day show.

"The Gift of Green"—Garden's New Film

MEMBERS of the New York Botanical Garden were invited to the first official showing of the Garden's new sound and color motion picture film, "The Gift of Green," in the fourth floor studio at the Museum of Modern Art Oct. 18. Four successive showings were given. Mrs. Antonie P. Voislawsky, a member of the Advisory Council, represented the Board of Managers in welcoming the audience and introducing the film. At the preview the day before, Dr. E. E. Naylor, who is in large part responsible for the script, explained the picture briefly to the assembled press.

"The Gift of Green" tells the story of photosynthesis—that is, how green plants function in the presence of light to manufacture, in their cells, sugars which are converted into other substances (even other sugars) and transported to other parts of the plant.

Produced by Robert Flaherty, under the immediate direction of his brother, David Flaherty, the film contains scenes made in California, Arizona, Florida, as well as at the New York Botanical Garden. The National Park Service and the Fairchild Tropical Garden co-operated. It includes pictures made through the microscope, to show the detailed structure of a plant; lapse-time photographs to show plants growing and flowers opening, provided through the courtesy of Allen K. White of Atlantic City (who showed his own films at the Garden in Sept. 1945). Fossils photographed at the American Museum of Natural History are included. Animated drawings show the chemical reactions that take place when sugar is made within a green cell. Dr. William J. Robbins served as technical adviser.

The Sugar Research Foundation, Inc., which has financed the making of this film for the Garden, has acquired 100 copies, and is making it available without cost to schools and other groups throughout the country through the catalog of the Modern Talking Picture Service. At the Garden, Dr. Naylor has charge of the film's distribution.

Notes, News, and Comment

Advisory Council. Eight women who have been active in the work of the Garden's Manhattan office during the past year were elected to the Advisory Council by the Board of Managers October 16. They are Mrs. James Cox Brady, Mrs. Sidney G. De Kay, Mrs. O'Donnell Iselin, and Mrs. Junius A. Richards of New York City, Mrs. Charles Burlingham of New York and Ridgefield, Conn., Mrs. Reginald Fincke of New York and Southampton, Long Island, Mrs. Grafton H. Pyne of New York and Bernardsville, N. J. and Mrs. Philip B. Weld of Hastings-on-Hudson, N. Y.

Library. Mrs. Elsie Phelon Phillips, who until recently worked as temporary gardener at the New York Botanical Garden and who received a certificate in the Two-Year Science Course for Gardeners last June, has been added to the library staff as assistant, commencing her work there November 1.

Board of Managers. A. Percy Saunders, retired professor of chemistry at Hamilton College, Clinton, N. Y., widely known as a breeder of peonies, resigned from the Board of Managers October 16. He was elected December 7, 1939, to succeed Raymond H. Torrey.

Hybrid Grapes. Dr. A. B. Stout spent a week in September at Geneva, N. Y, working with the Agricultural Experiment Station there on the new seedless grapes with which he has been concerned for many years. He reports 309 new seedless grapes developed. One which is now under test in commercial plantings is being christened the "Interlaken Seedless." Vines will be made available to growers as soon as possible through the New York State Co-operative Fruit Testing Association. A limited number will be distributed next year.

Lectures. Meeting at the Garden Oct. 21, the Advisory Council heard a repetition of the talk given by Dr. H. W. Rickett on Members' Day Oct. 2 for the opening of the exhibit of original 19th century paintings of flowers by Pancrace Bessa.

Dr. W. H. Camp addressed the fall conference of the Garden Club of New Jersey at Asbury Park, Oct. 23 on plant exploration. The ninth district of the Federated Garden Clubs of New York State, meeting at White Plains Oct. 28, was addressed by Elizabeth H. Hall on books for gardeners. The Women's Guild and Garden Club of Old Greenwich, Conn., heard Dr. Harold N. Moldenke speak on plants of the Bible Oct. 17. T. H. Everett was the speaker at the Horticultural Society of New York Oct. 16. His lecture, which was on house plants, was illustrated with kodachromes and living material. Dr. F. J. Seaver talked on fungi to the teachers of Julia Richman High School in New York Oct. 23.

Field Trips. During late summer and autumn Dr. H. N. Moldenke led numerous field trips for the Torrey Botanical Club and co-operating organizations. Among them were visits to Chimney Rock and Dock Watch Hollow in New Jersey and Mounts Riga, Everett, and Washington in the Berkshires of Connecticut and Massachusetts.

Visitors. Dr. Carl Epling of the University of California at Los Angeles, who is spending his sabbatical leave in the East, is working both at the New York Botanical Garden and at Columbia University.

Dr. Luigi Fenaroli, head of the Agricultural Experiment Station at Milan, Italy, spent the week of Oct. 7 at the Garden, beginning a study of maize in the United States. Mr. and Mrs. Brian O. Mulligan from Loking, England, were at the Garden Oct. 16 on their way to Seattle where Mr. Mulligan, formerly at the Royal Horticultural Society's Gardens at Wisley, England, is to become superintendent of the arboretum of the University of Washington.

Stanley J. Smith of Cornell worked at the Garden in early October on his Ph.D. thesis on the genus *Trillium*.

Elisabeth Keiper, Garden Editor of the Rochester (New York) *Times-Union* came to the Garden Oct. 19. She was in New York to receive the medal for horticultural activity presented by the New York State Federation of Garden Clubs at its annual meeting Oct. 21.

Among other visitors who have been at the Garden in recent weeks were Scott Haselton of Pasadena, editor of the *Cactus and Succulent Journal;* John F. Cornman of Cornell University, working on the genus *Juniperus;* Dr. Walker Ardes, Jr., an amateur mycologist of Philadelphia; Frank E. Egler of Norfolk, Conn.; Cynthia Westcott of Glen Ridge, N. J.; and Milton Hopkins of Roslyn, Long Island.

FM Broadcasts. Since the city's radio station, WNYC, began broadcasting all the proceedings of the United Nations conference, the New York Botanical Garden's bi-weekly program, scheduled for alternate Wednesdays at 5:45 p.m., has several times been delayed because of the long sessions of the conference. The program is now being transferred to the FM cycle of WNYC whenever the United Nations' conference is still on the air when the Garden's program is due.

Graduate Student. Monroe R. Birdsey of Middletown, Conn., is registered for work at the Garden in morphology and taxonomy under Dr. W. H. Camp, as a graduate student at Columbia University.

Another Agave. The summer of 1946 was the summer of century-plants. On Sept. 6 the third specimen in the New York Botanical Garden's Conservatory came into bloom for the first time. The two previous specimens of *Agave, A. neglecta* and *A. rupicola* (recorded in the Journal for August), had hardly died down when the flower-stalk began to appear on the third, *Agave filifera,* a plant which had been received from the New York City Department in 1902. A relatively small plant, with a globular rosette of sharply pointed leaves from which tough thread-like fibers uncurled at the edges, it produced a flower-stalk which grew with great rapidity to a height of nearly ten feet. When measured Aug. 20 it stood six feet above the base of the plant. Ten days later it was nine feet high, and a week later it began to bloom. Flowering proceeded upward on the stalk, a few rows opening each day. It was estimated that the stalk bore 1,500 individual flowers—inconspicuous in the mass, but each one attractive in itself, with petals of a lavender-rose color, and stamens, before they opened to expel their yellow pollen, of a slightly darker hue.

Meetings. Going to Philadelphia October 17, Dr. William J. Robbins attended the three-day meeting of the American Philosophical Society. Dr. B. O. Dodge followed him there for the gathering of the National Academy of Sciences October 20 to 23. On Sept. 27 to 30 Dr. Robbins also attended a growth conference at Princeton University.

NOTICES AND REVIEWS OF RECENT BOOKS

A Starter in Pelargonium Study

GERANIUMS. Pelargoniums for Windows and Gardens. Helen Van Pelt Wilson 248 pages, indexed, illustrated with watercolors and line drawings by Natalie Harlan Davis, also with photographs. M. Barrows & Co, New York, 1946. $2.75.

Miss Wilson writes well. Her books are a pleasure to read, not just because they give good descriptions of charming gardens, with knowledge of the needs of plants, but because there is a style about them in the telling. One enjoys the stories of the different flowers, their growth, their situations, their color, their fragrance.

In this new book, I am not conscious of this ease. Here one does not slip happily through the story of the geraniums, as we so firmly call them. The reason is evident. It is a tough story. Anyone planning it must often feel like a person trying to accomplish Ajax's task. The vast weight of the rock impedes.

It is easy to see why this is so. It is because of the pelargoniums' amiability. Where they grow profusely in their home in South Africa and where they tumble over every wall and rock on the Island of Saint Helena, they hybridize easily. This carries on when they are transplanted to northern abodes. They have been loved so long that their number is endless, and many, many of them have been given different names. And who can see them all and name them all correctly?

In writing this for a Botanical Garden Journal, one cannot quite dismiss the subject with a blessing. One must mention that the story is not complete. Even among this Botanical Garden's 260 pelargonium plants, there are many not included, not just among the species, which would be natural, but among the named horticultural varieties.

With it all, Miss Wilson has done a rewarding job. She knows it is a "starter" and urges further study. She has gone conscientiously to collections in the East and in the West and studied the ones she has seen. She gives many delightful suggestions of color combinations and numberless situations for sun and partial shade. She has an extremely good chapter on the growth of the plants in an amateur greenhouse. Outdoors under varying conditions, her hints for their culture are good. The colors are given according to the Horticultural Colour Chart of the Royal Horticultural Society, which is planned in accordance with Ridgway, the Répertoire de Couleurs, and Ostwald.

There are charming little color sketches and leaf shapes and a portfolio showing how the plants may be used. Many people will read her book with pleasure, identify their own plants, and forget that it is not and could not, according to present knowledge, be complete.

SARAH V. COOMBS.

History and Horticulture In a Gardening Town

OLD SALEM GARDENS. 71 pages, illustrated, indexed. Published by the Salem Garden Club, Salem, Mass. May, 1946. $1.10.

Here is a small booklet full of historical lore of early Salem gardens, their design and plant material. From the complete description of each garden, and of old Salem itself, one can mentally recreate a life in which much leisure was spent in the fine art of gardening by generations of owners of these beautiful old mansions in days and ways long since "gone with the wind."

The little booklet also contains much horticultural information, simply told, of plants which thrive in the vicinity, and should be an inspiration for all lovers of old gardens. For Americana fanciers it is full of nostalgia and charmingly illustrated with pencil drawings of plants and flowers.

This book is obtainable from Mrs. Henry R. Johnson, 376 Lafayette St., Salem, Mass.

MRS. GUTHRIE SHAW.

Rice Economy of the World

RICE IN THE WESTERN HEMISPHERE: Wartime Developments and Postwar Problems. V. D. Wickizer. 48 pages. War-Peace Pamphlets No. 7, Food Research Institute, Stanford University, California. June 1946. 50 cents

Rice, the staple grain of China and South Pacific Asia, and one of the five original grains planted by that first mythical Chinese Emperor, Shen-nung, assumed great importance during the recent world war. In fact, its role had so magnified that it occupied the serious attention of many governments and rulers, and has become the subject of much research and published discussion.

Of considerable interest in this connection is the pamphlet, "Rice in the Western Hemisphere" by V. D. Wickizer, published by the Food Research Institute of Stanford University. It has no dealings with the rice plant or with its cultivation; instead, it confines its discussions strictly to the rice economy of the world, especially of the Americas in relation to the war and to the problems of postwar adjustment.

The war was not over when this pamphlet was published, hence the discussion of postwar problems, western hemisphere trade prospects, the outlook for non-Asiatic production, and the timing of readjustments is more from the standpoint of what should be done than from a view of what had been done.

On the other hand, there is a satisfying amount of factual information and statistics employed in the study of actual wartime rice production and its flow from new sources. They serve also to clarify and explain the necessary adjustments demanded by stringent wartime economy in a country such as India as well as in non-Asiatic countries which in years past have been so dependent on the big three of rice production—Burma, Thailand and Indochina.

One comprehends the predicament of India which, while free of the actual devastation of physical warfare, is one of those countries desperately hit by the war and in need of contributions from surplus stocks built up in other parts of the world. Five per cent of its own needs of rice must be supplied from the outside. When this was cut off, the loss was sufficient to cause a famine.

It is equally interesting to note to what degree since 1938 Latin-America, particularly Brazil, Mexico and Ecuador, have been exporters of rice, and how since 1940 the six importing countries have been reduced to only one (Peru), and Chile since 1941 has become a consistent exporter.

The fact that the United States is the largest surplus-producing area in the western hemisphere may be surprising to many, but its significance dwindles when compared to the vast amounts of rice normally available from Monsoon Asia, and falls far short when it is considered that the recent (1944) crop of 70 million bushels (900,000 metric tons, cleaned basis) was only about three-fourths of the average crop produced on the Island of Formosa between 1935-36 and 1939-40, and that Formosa is rated as the smallest surplus-producing area in southeastern Asia.

WILLARD M. PORTERFIELD, JR.

Conservation Primer

THE LAND RENEWED. William R. Van Dersal & Edward H. Graham. 109 pages, illustrated. Oxford University Press, New York, 1946. $2.

"Top soil, the source of all our food, is on its way to the sea."

That is the ending of the chapter on Floods in "The Land Renewed," written by two of the best soil experts in this country. In simple language this book covers a very complicated subject with illustrations that are actual photographs admirably depicting the various practices now used by the intelligent farmer who is not only protecting his soil from that insidious thief, erosion, but actually making new soil and increasing his income at the same time. I like particularly the chapter on Field Borders because while protecting crops in the field, the planting of *Lespedeza bicolor* is beautiful in bloom in midsummer with deep lavender flowers. It also improves the soil and feeds quail and other native birds, and is equally valuable as a wind screen in the garden, growing like a four-foot hedge.

In the chapter on Democracy in Action, the method of establishing soil conservation farm districts is explained. The last two paragraphs give all Americans courage because the city people depend on the soil for food and wood as much as the country dwellers.

"This great movement to improve American land has been under way for less than ten years, but already it involves more than half the agricultural land of the United States. In another ten years possibly *all* farm and ranch land will be in districts, and *all* the people will be started on the important job of soil conservation." These are the encouraging words of the author, and the very last sentence of this remarkable little easy-to-read conservation primer says, "Freedom, like the soil, is most appreciated where it is endangered."

JANE B. FRANCKE.
Brookville, Long Island.

Flower Arrangement and Therapy

PLEASURES AND PROBLEMS IN FLOWER ARRANGEMENT. Emma Hodkinson Cyphers. 100 pages, illustrated, indexed. Second edition, 1944. $2.

This little booklet, subtitled "A reference work for flower arrangers," was presented to the library by Mrs. Clayton P. Stevens in appreciation of the courtesies which she and her club received at the time of the Garden's Fiftieth Anniversary. Proceeds from the sale of this booklet, which is obtainable at 114 Prospect St., Passaic, N. J., go to further the work in garden therapy carried on by the Garden Department of the Monday Afternoon Club.

THE NEW YORK BOTANICAL GARDEN

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station: use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to Bedford Park Boulevard.

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

An Illustrated Flora of the Northern United States and Canada, by Nathaniel Lord Britton and Addison Brown. Three volumes, giving descriptions and illustrations of 4,666 species. Second edition, reprinted. $13.50.

Flora of the Prairies and Plains of Central North America, by P. A. Rydberg. 969 pages and 601 figures. 1932. Price, $5.50 postpaid.

The Bahama Flora, by Nathaniel Lord Britton and Charles Frederick Millspaugh. 695 pages. Descriptions of the spermatophytes, pteridophytes, bryophytes, and thallophytes of the Bahamas, with keys, notes on explorations and collections, bibliography, and index. 1920. $6.25.

North American Cariceae, by Kenneth K. Mackenzie, containing 539 plates of *Carex* and related plants by Harry C. Creutzburg, with a description of each species. Indexed. 1940. Two volumes, 10¾ x 13½ inches; bound $17.50; unbound $15.50.

Keys to the North American Species of Carex by K. K. Mackenzie. From Vol. 19, Part 1, of *North American Flora.* $1.25.

Food and Drug Plants of the North American Indian. Two illustrated articles by Marion A. & G. L. Wittrock in the Journal for March 1942. 15 cents.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal, 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 15 cents.

The Flora of the Unicorn Tapestries by E. J. Alexander and Carol H. Woodward. 28 pages, illustrated with photographs and drawings; bound with paper. 1941. 25 cents.

Catalog of Hardy Trees and Shrubs. A list of the woody plants being grown outdoors at the New York Botanical Garden in 1942, in 127 pages with notes, a map, and 20 illustrations. 75 cents.

Succulent Plants of New and Old World Deserts by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. Second edition 1944. 50 cents.

Periodicals

Addisonia, annually, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Now in its twenty-second volume. Subscription price, $10 a volume (four years). Not offered in exchange. Free to members of the Garden.

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1.50 a year; single copies 15 cents. Free to members of the Garden. Now in its 47th volume.

Mycologia, bimonthly, illustrated in color and otherwise; devoted to fungi, including lichens, containing technical articles and news and notes of general interest. $7 a year; single copies $1.50 each. Now in its thirty-eighth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers published in co-operation with the American Society of Plant Taxonomists. Subscription price of volumes 1 through 5, $5 a volume ($4 to members of the Society). Now in its sixth volume. Price, $7.50 ($5 to members of the Society).

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 94 parts now issued. Not offered in exchange. Prices of the separate parts on request.

Contributions from The New York Botanical Garden. A series of technical papers reprinted from journals other than the above. 25 cents each, $5 a volume.

Memoirs of The New York Botanical Garden. A collection of scientific papers. Contents and prices on request.

JOURNAL

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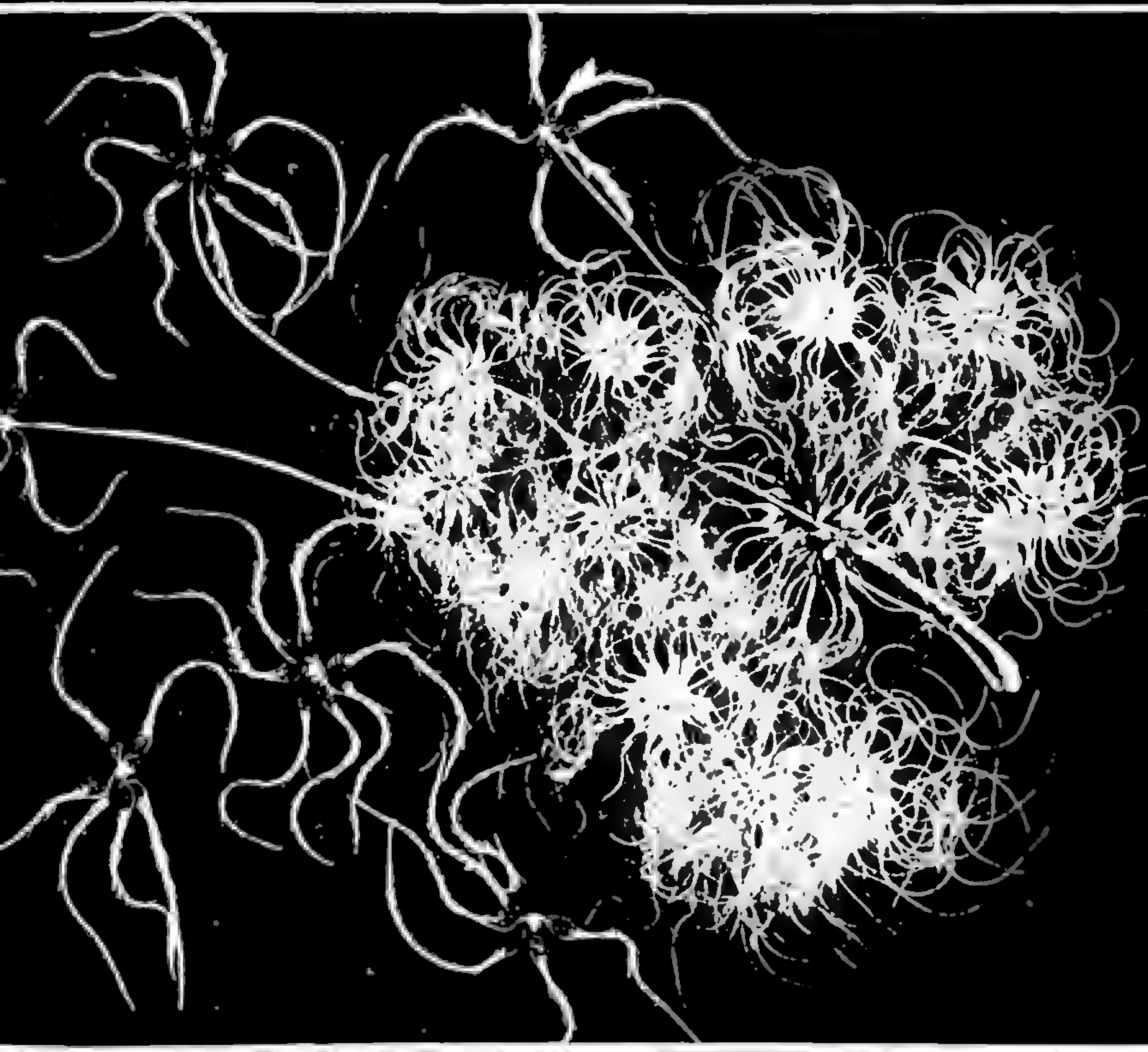

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CAROL H. WOODWARD, Editor

JANUARY EVENTS AT THE GARDEN

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Joseph W. Tansey, Instructor

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They will be answered by *E. E. Naylor*

Jan. 22—*Plant Tumors and Cancer in Animals*
Robert S. de Ropp

Saturday Afternoon Programs

3 p.m. in the lecture hall

Jan. 4—*Floral Emblems of the Nations and Our State Flowers*
Two kodachrome films with music by *Russell T. Pansie*

Jan. 11—*Gardens of Ancient Egypt*
H. W. Rickett

Jan. 18—*Landing and Living in the Tropics*
R. A. Howard

Jan. 25 *Gardens of the Sea*
I. G. C. Cooper

Members' Day Program

3:30 p.m. in the Members' Room

Jan. 8—*Orchids—Wild and Cultivated—in South America*
Rodney Wilcox Jones
President, Orchid Society of America

TABLE OF CONTENTS

December 1946

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# JOURNAL

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Foods from Fermented Soybeans . . .

As Prepared in the Netherlands Indies

II—Tempe, A Tropical Staple

By Gerold Stahel

Director, Agricultural Experiment Station,
Paramaribo, Surinam

DURING the war, soybeans were sent to New Guinea by the United States Government to feed the Europeans and Indonesians living there. For two years the people had had none of this to them important food. What the shippers did not realize, however, was that plain soybeans would be unpalatable to people of Indonesian eating habits. A specific fungus was needed to ferment the soybeans into TEMPE, a food that would be relished. Since the Papuans, the aboriginals of New Guinea, do not use soybeans in any form, all cultures of the fungus were lost when connections were broken with other Indonesian islands.

The author then was asked to send the tempe fungus from Surinam, where it was known to be in use by Javanese people living there. The pure cultures and quickly dried tempe cakes arrived in New Guinea by plane in a little more than a week. The people then were able to use the ample stores of American soybeans by making their familiar and well liked tempe cakes. The story is told on page 287. C.H.W.

IN the more tropical countries where soybeans are grown for human consumption, the principal food that is made from them is called TEMPE. Unknown in China and other cooler countries where soybeans form an important part of the diet, tempe is a food product characteristic of the Netherlands East Indies, and is also used in other places where natives

Packages of tempe, wrapped in the large leaves of monocotyledonous plants, being offered for sale in the Paramaribo market.

of this region have settled. It is in daily use by millions of people. Here in Surinam, most of the soybeans grown are consumed in this form. Tempe can be made only in a tropical country, because the fast-growing fungus (*Rhizopus Oryzac*) used for fermenting the boiled beans will function only in a tropical climate.

Our experiments to manufacture tempe in Paramaribo came as a direct result of an appeal for us to furnish cultures of the fungus to New Guinea. Tempe was probably manufactured there before the war, being made from soybeans imported from Java. But when imports stopped in 1942, tempe-making also had to be stopped. Inoculation of each new batch of tempe is customarily made from a piece of the previous batch. Therefore, when tempe-making ceased, the fungus essential to the product was lost.

In January 1945 I had a letter from Dr. Honig of the Economic, Financial and Shipping Mission of the Kingdom of the Netherlands in New York, asking me to send inoculation material of the tempe fungus as quickly as possible to New Guinea. There the Netherlands Indies Civil Administration (Nica) had acquired a fair quantity of soybeans from the United States, but there was no tempe fungus, so it was impossible for these people to use the beans for food. In little more than a week the pure fungus cultures and some dried tempe cakes arrived in New Guinea by plane from Paramaribo, and in April, Dr. Honig informed me, the Nica-kitchens all over the Netherlands Territory started with tempe making. Now this pleasant food is daily consumed in New Guinea, made from U. S. soybeans and the cultures of the Surinam *Rhizopus.*

Experimenting with Tempe

When I isolated the fungus for New Guinea I tried to make tempe myself, but having no success, I started further experiments.

In our first trials the boiled and peeled beans were washed for 24 hours in running water. The beans prepared in this way remained hard and horny after a second cooking, and after inoculation *Rhizopus* growth was insufficient or lacking, apparently because nearly all the carbohydrates had been washed out by this treatment.[1]

Native Method of Manufacture

After these preliminary and disappointing trials I visited the Javanese peasant woman Sinem near Lelydorp to study her method of tempe making. Every day she manufactures some 80 tempes for sale. To make them, she first boils about 6 pounds of the yellow soybeans one hour in about four times as much water. The beans swell to two and one-half times the original volume. After cooling they are brought into a basket

[1] Lockwood, Ward and May, as reported in reference (4) listed at the end of the article, have found that *Rhizopus Oryzae* breaks dextrose down to lactic acid. However, in soybeans, primarily at least, no dextrose is present. About 30% of the dry weight of the beans consists of carbohydrates in the form of galactan, pentosans, etc. Part of these are leached out during the preparation, but Boorsma (1) found 9.5% of carbohydrates still in beans when they were prepared for inoculation. One day after inoculation there was still 6.2% of carbohydrates, but after two days the vigorous fungus growth had reduced them to 0.3%. Since well made tempes taste slightly acid, lactic acid may be present too.

and trod by feet or—with smaller quantities—kneaded by hand to remove the seedcoats as completely as possible. Not more than *just enough* water to cover the beans is then added. They are now left to ferment for 24 hours. It is remarkable that after this time the fermenting beans do not smell putrid, but instead are slightly acid, not unlike sour milk. After a day, without the water being changed, the beans are boiled again to stop fermentation. Then, after removing the water, they are poured on a pandanus-mat to cool for three to four hours. The beans now are more soft and a little mealy, decidedly different from the hard beans leached in running water.

I asked Sinem: "Why do you leach and ferment the boiled beans for a day, and what is the reason you don't boil them for the second time immediately after the seedcoats are trodden away and washed out?"

Sinem answered: "By doing so, the tempes would taste bitter."

That explains why, in our own trials, the tempes made with unfermented beans showed a less vigorous fungus growth and had a less pleasant taste than those made with fermented beans. There was not a bitter, but an unpleasant, somewhat rancid taste.

Now a well made tempe cake is added to the heap of fermented beans, one tempe to every 5 pounds of beans. It is broken into several pieces and mixed with the heap. About 1½ or 2 hours later the pieces of the inoculating tempe are removed. After renewed mixing, the beans, which now contain about 60% water, are ready to be packed into leaves for ripening.[2]

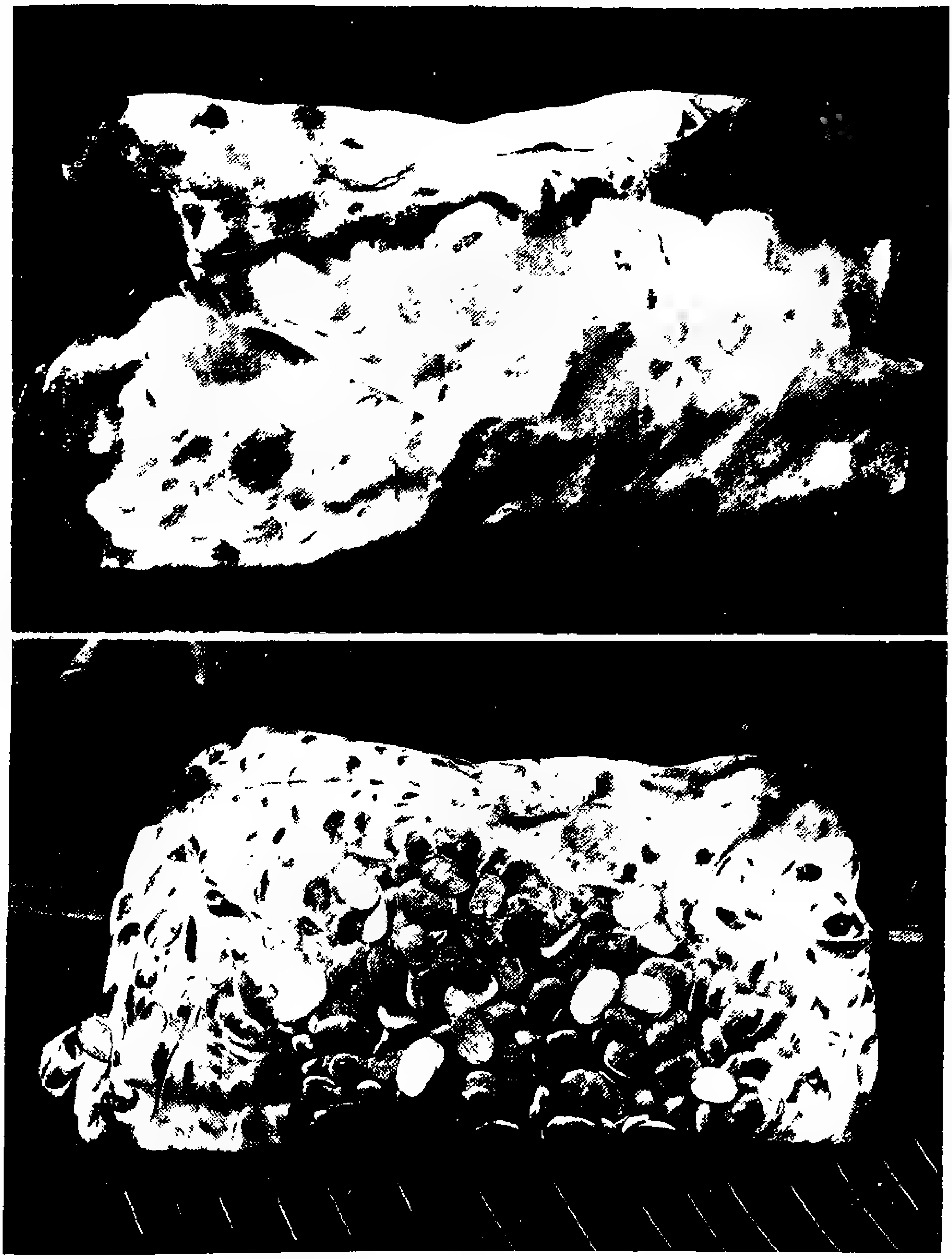
Packaging the Tempes

For this process, the inoculated beans are wrapped in big monocotyledonous leaves. In Surinam we use the leaves of Musaceae, such as *Musa* and *Heliconia,* and also of the Marantaceae, such as *Ischnosiphon,* which is the most convenient leaf for making tempe packages.

Thirty to forty grams of the soft, inoculated beans are put in the center

[2] I repeated this procedure with permanently excellent results. All boiling was done in a sterilizer, instead of an open fire. Instead of tempe it was easier for me to use young, pure cultures of the *Rhizopus* fungus. The beans are softer after a longer fermentation of 2 to 3 days or after being boiled for 2 or 3 hours. Soft tempes may also be obtained after steaming the beans for a short moment under pressure at 120°C. Still softer are the beans boiled during a half to one hour at 120-125°C. Tempes made with such beans are sometimes overgrown by yeasts and bacteria, which fully suppress *Rhizopus* growth, but when the *Rhizopus* growth is successful, such tempes are very palatable, at least to my own taste. The Javanese people, however, are accustomed to the more crisp tempes of a one-day fermentation and a half to one hour boiling.

If the leaves wherein the growing tempe is packed are pierced by an awl, or if they close insufficiently, or if mice or ants make a hole through them to reach the tempe, the places in direct contact with the air appear to be black and covered by *Rhizopus* sporangia. Only perfectly and closely packed tempes show the clear white fungus all over the cake.



Above: Tempe with a luxuriant growth of Rhizopus Oryzae, as it is sold on the Paramaribo market. Below: Tempe grown under conditions of insufficient oxygen supply, showing a horseshoe-like distribution of the fungus. Both pictures about four-fifths natural size.

of the leaves, generally two, sometimes three leaves, one on top of the other. This quantity of beans may be taken just by one grip. They are spread in a layer 1 to 1½ cm. thick over the leaf.

Now the left margins of the leaves are folded over the beans, then the right ones. The ends are folded too and the whole is tied with a rice stalk or with raffia. On the right as well as on the two small sides, some very slow ventilation is possible between the leaves, but on the left side the folded leaf permits no straight ventilation. For this reason, if tempes are made thick—for instance, with double the quantity of beans in the same package—they mold imperfectly. The oxygen present in the package and the small amount diffusing from outside between the leaves to the beans is not sufficient for normal fungus growth on the bigger quantity of beans. Therefore fungus growth appears in a horseshoe-like distribution, the center of the left side of the package, which is entirely closed, showing no fungus growth at all.

The same thing happened to the beans that were leached in running water and were short in carbohydrates, even when the normal quantity of beans was packed.

I tried different substitutes for the big leaves, such as parchment paper, cloth impregnated with paraffine, oilcloth, and tinfoil. In parchment paper the cakes dried out too rapidly and molding was very poor. With the other enveloping materials the beans had first to be wrapped in a thin white sterile paper. In these envelopes the tempes were never as well developed as in the control packages made from leaves. There was a remarkable and constant difference between the cakes wrapped in the two kinds of envelope. In the leaves no superfluous water was present between the leaves and the tempe. The inside surface of the leaf was only slightly wet. In the three other types of packages, the white paper and the envelope were covered by big drops of water, apparently guttation water.

Forty-eight hours after packing the inoculated beans, the cakes are covered with a clean, white, luxuriant fungus growth. A well made tempe shows beards of fungus threads on the three slightly ventilated margins of the cake. Here the fungus penetrates for some distance between the leaves. Sometimes these beards are black, because the higher oxygen content stimulates the formation of sporangia.

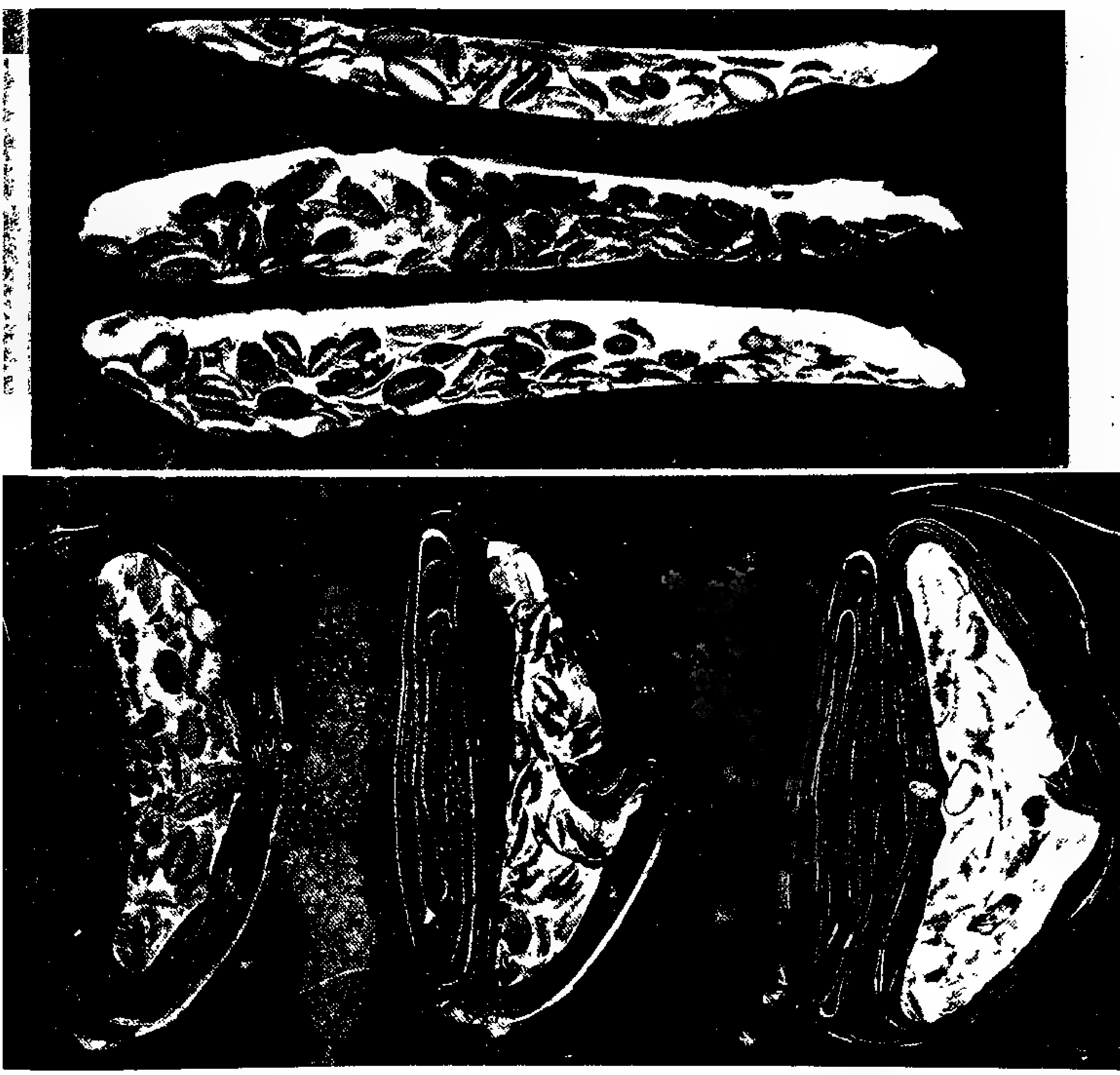
The tempe is now ready to be cut into strips and fried in coconut-oil or butter. It has a water content of 55 to 60%.

Rapid Deterioration

When the package is 2½ days old, the tempe begins to deteriorate. This is noticed first by a change in smell. Later ammonia vapors emanate in increasing amounts. Such tempes are poisonous. When the packages, however, are opened after 2 or 2½ days and the tempe has had the opportunity to dry slowly exposed to the air, the tempes may be eaten even two days later. Such full-grown ripe tempes remain clear white. No sporangia are formed as in unripe tempes, when exposed to the air.

If the cakes are successfully molded, about 40 hours after inoculation the packages feel warm and the temperature rises 4°C. above that of the surrounding air. If the packages are stacked one on the other, the temperature rises quickly as much as 10 or 12°C. Such tempes deteriorate much more quickly. Therefore, the Javanese women who manufactured tempes are very anxious to spread the packages from the very beginning as airily as possible. The packages have to be brought to the market in

Longitudinal and cross sections of tempes from the Paramaribo market, the lower ones wrapped in banana leaves.



baskets, but as soon as they arrive there, the baskets are emptied and the contents spread over the floor or over a table.

I studied the distribution of *Rhizopus* in a well made tempe. All interstices between the beans appeared to be filled tightly with fungus threads, forming a loose pseudoparenchyma. The fungus never penetrates into the tissue of the seed-lobes. It remains restricted to the spaces between the beans and to the surface of the tempe.

Quantities Measured

It may be interesting to have some knowledge about the output of tempe manufactured from a known quantity of soybeans. For this purpose all weights have to be reduced to dry weight.

The weight of the seedcoat is almost exactly 10% of that of the beans. During the initial boiling about 7% dry matter is leached out, mostly carbohydrates, but also coloring matter, waxes, etc. If these beans are leached for one day in running water and boiled again, there is a further loss of 19% of carbohydrates. If the beans, however, are fermented in a small quantity of water, only 11% of the carbohydrates are lost. It is undoubtedly this bigger loss in running water that caused the poor *Rhizopus* growth on the beans prepared in this way. As already mentioned in

Ten laboratory-made tempes, seven of which show the imprint of the midvein of the Ischnosiphon leaf used for making the packages, as shown at the right. (The ruler shows centimeter graduation.)

footnote 2, fermented and boiled beans, according to Boorsma, contain 9½% of carbohydrates at the moment of inoculation, a quantity which fully disappears after two days of molding, when the tempe is ready for consumption.

The matter leached out during one day of fermentation contains, besides the carbohydrates, only 5% of protein and 1/3% of the fat, which means 2% of the total protein content of the beans and still less of the fat. Tempe-making, therefore, is a more economical way of processing soybeans into food than, for instance, taohoo-making,[3] where 15% of the protein is lost with the whey.

As shown in the calculation below, the output of tempe results in a product 72% of the original weight of the dry soybeans.

7% dry matter lost with the first boiling
10% dry matter lost with the seedcoats
11% dry matter lost after one day of leaching and subsequent boiling.

28% total loss of dry matter

To check this, I prepared two lots of tempe, one with 600 grams and the other with 400 grams of beans. The first, which was boiled for a short time at 120°C, had an output of 71.2%; the second, one hour at 100°C, had an output of 72.3%. Apparently only a limited quantity of carbon dioxide is formed.

Large Tempes for Festive Occasions

There is still another method of tempe making. Instead of filling many packages with 30 to 40 grams of beans each, a big cake is made containing as much as 1 kilogram of beans. To do that, the bottom of a flat Javanese bamboo basket is covered with three layers of monocotyledonous leaves, on which the inoculated beans are spread in a layer 1 to 1½ cm. thick, forming a cake of about one foot diameter. The beans are covered again with three layers of leaves. Now two pans of different sizes are placed upside down on the leaves to press them down and prevent a too liberal ventilation. Such big tempes contain 25 to 30 times as much bean mixture as is present in one small package of tempe. There is less work in making the big tempes, but the small packages are easier to handle and to sell. When, however, for festivities considerable quantities of tempe are needed, the big tempes are more convenient.

Directions for Making Tempe

From the preceding we learn that the principal factors in tempe making are:

1. The fermenting and leaching of the boiled and peeled beans with a *small* amount of water for an entire day to extract most of the unpleasant-tasting material, but only a part of the carbohydrates.

[3] A description of the making of taohoo from soybeans was given in the Journal for November.

2. The tight wrapping of the inoculated beans in monocotyledonous leaves to ensure a limited ventilation for the proper growth of the fungus.

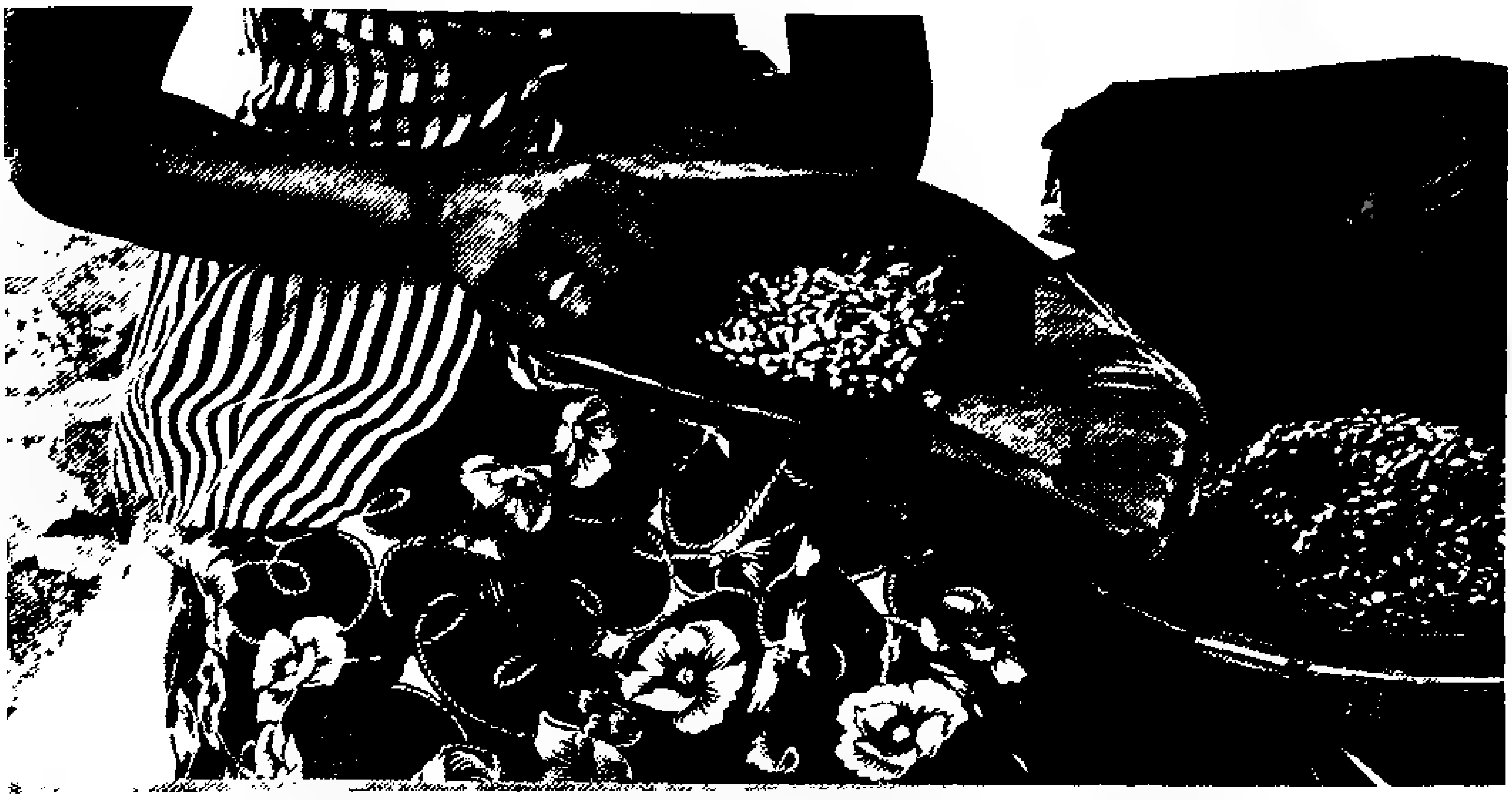
Ending this article it might be useful to give brief instructions on how to make tempe.

Dry, not soaked, soybeans are boiled in an even, sufficient quantity of water. After cooling and peeling, just enough fresh water is added to cover the beans. Then they are left to leach and ferment for one day.

After this time, fermentation is stopped by boiling the beans in the fermenting fluid for one hour. After the fluid is poured off, the beans are left to cool in a basket or on a table for 3 or 4 hours. They feel soft now and a little mealy and are ready for inoculation. Longer fermentation and longer boiling may make the beans softer.

After cooling, the beans are inoculated. A fresh or a dried tempe, or pure cultures of the fungus on soybeans in proportion of 1:80 or 1:100 may be added. The whole has to be mixed thoroughly.

A large tempe, one foot in diameter, cultured between Ischnosiphon leaves on a flat bamboo basket called a "tampa."



Making a tempe package with Ischnosiphon leaves.

About two hours later, the inoculating material is removed and the beans are mixed again to make them ready for packing. The amount of beans used per package is 30 to 40 grams. Two or three monocotyledonous leaves have to be wrapped carefully and tightly around the cake to allow only a limited ventilation for the enclosed beans.

From the very beginning the packages have to be spread as airily as possible to prevent an abnormal rise of temperature followed by a premature deterioration and poisoning of the tempe.

Exactly two days after packing, the tempe is ready and can not be kept more than half a day longer in good shape if enclosed in the package. Unpacked, however, and allowed to dry in full air, tempes do not deteriorate and become poisonous, and they may be eaten even two days after unpacking without danger.

After the second boiling of the beans, hands and implements to be used in contact with the beans have to be cleaned carefully.

With 100 grams of air-dried soybeans, four individual cakes of tempe totaling 152 grams (4 x 38) may be made. The dry matter is: 85 grams of beans and 61 grams (4 x 15¼ grams) of tempe.

Whereas taohoo may easily be manufactured in the United States, and is indeed produced there on a limited scale for the Chinese restaurants, tempe may be difficult to make outside of the tropics. The chief trouble is not so much a matter of temperature, as the lack of big monocotyledonous leaves, for which I was unable to find a suitable substitute. This is regrettable, indeed, because tempe is more palatable and tasty than taohoo.

For a list of references to the literature on food products made from soybeans, see the following page.

LITERATURE ON FOOD PRODUCTS MADE FROM SOYBEANS

1. Donath, W. F. De voedingswaarde der sojaboonen en enkele daaruit bereide specifiek Indische voedingsmiddelen. Landbouw, Vol. VII, 1932, Kedele-nummer. From here are cited the analyses of P. A. Boorsma.

2. Grove, E. W. Soybeans in the United States. Techn. Bull, No. 619, 1938, U. S. Dept. of Agric.

3. Heyne, K. De nuttige planten van Ned. Indie, Vol. II, Buitenzorg 1927.

4. Lockwood, L. B., Ward G. E., and May, O. E. Physiology of *Rhizopus Oryzae*. Journ. Agric. Research, Vol. 53, 1936, page 849.

5. Morse, W. J. and Carter, J. L. Improvement in Soybeans. U.S.D.A. Yearbook of Agriculture, 1937.

6. Stewart, C. L., Burlison, W. L., Norton, L. J. and Whalin, O. L. Soybeans and soybean products. Bull. 386, University of Illinois, 1932.

Tropical Rain Trees

By Edwin A. Menninger

SCATTERED through the tropics of every region in the world there are trees of various kinds which are known as "rain trees" because drops of moisture fall to the ground beneath them, sometimes almost like a shower. This phenomenon has fascinated many observers. A few writers have attributed the "rain" under these trees to a condensation of dew, but the majority of scientists who have studied the matter have proved that the "rain" is generally a liquid secreted by insects which are sometimes present in such enormous numbers that they actually produce a shower under the tree while the sun shines brightly all around.

One of the earliest records of the phenomenon was reported in 1889 in the Journal of the Linnean Society by the Rev. R. Baron in his "Flora of Madagascar" when he wrote:

> "*Leptolaena pauciflora* is a hard-wooded tree, from the trunk and branches of which, at certain seasons of the year, there is a ceaseless dropping of water, sufficient indeed to keep the ground quite damp. This is caused by a number of hemipterous insects crowding together in a slimy liquid. May this afford an explanation of the similar well-known phenomenon exhibited by the Tamai-capsi,* or Rain Tree, of the eastern Peruvian Andes?"

Undoubtedly the best known "rain tree" of the tropics is *Pithecolobium* (*Pithecellobium*)† *saman* H. F. Macmillan's "Tropical Planting and Gardening," page 98, says of it:

> "The small pinnate leaves, which form a canopy of shade in the daytime, close up at night; therefore during a period of drought a patch of green grass may be seen beneath, while the surrounding ground is parched and brown. This led to the supposition that the tree mysteriously produced rain at night; and hence the name Rain-tree."

* Efforts to identify this tree have been unavailing.

† More recently designated as *Samanea*.

Paul C. Standley in "Flora of the Panama Canal Zone," page 196, says:

> "The leaflets are said to fold together during cloudy weather, hence the name raintree."

Referring to this passage, Dr. David Fairchild writes:

> "I have noticed they fold here (Florida) at night. I think the idea of the tree raining is erroneous. The nearest I ever came to seeing a tree rain was in Orotana. The dark volcanic strand there was planted to Tamarind trees (*Tamarindus indica*) and in the evenings their twigs—pendent branches—were always dripping a salty water. It was the condensed fog from the sea."

M. C. Cooke, in "Freaks and Marvels of Plant Life or Curiosities of Vegetation," page 15, mentions "rain" falling from *P saman*, and adds: "A glance upwards showed a multitude of cicadas, sucking the juices of the tender young branches and leaves, and squirting forth slender streams of limpid fluid." J. C. Willis, in "Dictionary of the Flowering Plants and Ferns," page 517, refers to *P. saman* as "the rain tree, so called because of a legend that it was always raining under its branches. The ejections of juice by the Cicadas are responsible for this."

Harold N. Moldenke, Associate Curator at the New York Botanical Garden, notes that Willis, under *Acer*, (page 11 in the fifth edition, 221 in the third) points out that the leaves commonly exhibit varnish-like smears of sticky honeydew, the excretions of aphids which live on the leaves, and continues:

> "The insect bores holes into the tissues, sucks their juices, and ejects a drop of honey-dew on an average once in half-an-hour. In passing under a tree infested with aphids one may sometimes feel the drops falling like a fine rain."

Otto Degener, Collaborator in Hawaiian Botany at the New York Botanical Garden, asks:

> "Have you not occasionally felt droplets of moisture on your face when walking under a tree? I have. I then traced it to the honeydew of aphids."

"A Rain Tree in Bolivia" is the subject of a short note in "Tropical Woods" for 1926 by Dr. H. H. Rusby, then Dean of the College of Pharmacy of the City of New York and an honorary staff member of the Botanical Garden. He wrote:

> "One of the strangest phenomena observed by the members of the Mulford Exploration party of 1921 was that of a rather copious rainfall from the branches of a tree at mid-day in perfectly clear weather and in brilliant sunshine. The tree stood on a dry bank, in an open place by the side of the road, and with few other trees about it. The rainfall was continuous and steady, and its pattering was like that of a mild shower on one of our summer days. It was sufficient to wet one's clothing in a few moments, if standing beneath the tree. The size of the tree was about that of a large wild-cherry tree. There being no convenient way of climbing it, it was felled, when the cause of the shower was found to be a profusion of caterpillars' nests, of all sizes up to a foot or more in length, which occupied the forks of the branches and branchlets. They closely resembled the nests of our common tent caterpillar, except that they were surcharged with water, in which abundant larvae led an aquatic existence. The water was evidently drawn from the bark of the tree where covered by nests. No openings in the bark could be detected with the naked eye, and the party had no time for an investigation

of the mechanism of the procedure. The tree was in flower-bud at the time, and the specimens secured prove it to be a hitherto undescribed species of *Vouacapoua* (family Fabaceae)."*

Macmillan, in the index to "Tropical Planting and Gardening," without supporting reference refers to the genus *Orcodaphne* as the "rain tree" of the Canary Islands. In this connection, G. E. Maul, director of the Museu Municipal do Funchal, in Madeira, writes:

"The genus *Oreodaphne* belongs to the *Lauraceae* and the species *foetens* is peculiar to Madeira as well as the Canary Islands. The name *Ocotea* seems to have taken the place of *Oreodaphne* in all the more modern books. As to why it might be called rain tree, I cannot give any satisfactory answer. I have never heard *Ocotea foetens* called anything but Til in Madeira, where it is the vernacular name. 'Rain tree' as a name for it is quite new to me."

With reference to the same species, John Hutchinson writes in "A Botanist in Southern Africa," page 6 (1946):

"So vital, indeed, is the vegetation to the water supply that there is an interesting story about a celebrated rain tree on the island of Hierro, the most western of the Canaries. Although the Canary Archipelago was probably known to the earliest voyagers, the Phoenicians and the Carthaginians, many hundreds of years before the Christian era, we known for certain that it was visited by Roman navigators during the reign of Juba II, King of Mauritania, about 25 B.C. The Romans regarded the islands as being the western boundary of the world, and Pliny has given us Juba's account of them, in which he mentions a tree from which water was obtained. The particular tree of Hierro is supposed to have been *Oreodaphne foetens* Nees, one of the Laurel family, Lauraceae. It grew in a hollow on a hill, and whilst in the heat of the day it drooped, in the night time it condensed enough water from the clouds to supply the whole island. Beneath this precious tree a stone well was built to conserve the water. The Spanish name for it was *El Garve*. So famous was this tree at the beginning of the seventeenth century that pictures of it were used as frontispieces in contemporaneous herbals."

Hutchinson reproduces two of these: one from Bauhin and Cherler's "Historia Plantarum Generalis" (1619) and one from Duret's "Histoire Admirable" (1605).

Audas, in "Native Trees of Australia," page 212, writing of *Glochidion ferdinandi* of the Euphorbiaceae, records the common names "rivulet tree, rain or weeping tree, the last because of the curious effect of insect associations: a species of 'frog-hopper' live on the sap of the softer parts of the tree and are attacked by ants in search of moisture, causing a dropping of fluid from the tree."

C. T. White, Government Botanist at the Botanical Garden at Brisbane, writes in this connection:

"The name 'Rain Tree' is given to *Glochidion ferdinandi* on account of the moisture exuded by the larvae of frog-hoppers or spittle insects. It appears that the larvae of these insects suck the sap of the tree and excrete it in the form of froth. After losing some of its included gases the froth falls from the tree as a clear liquid. If a file of the Kew Bulletin is avail-

* This species was later described by Dr. Rusby as *Lonchocarpus pluvialis* in the Memoirs of the New York Botanical Garden, Volume 7.

able to you, you will find a reference to this by Mr. Francis in the issue for No. 3 of 1931, page 156."

But perhaps all of the showers do not come from insects after all. Britton & Wilson, in "Scientific Survey of Porto Rico and the Virgin Islands," volume 6, page 178, record the common name of "rain tree" for *Brunfelsia americana* but offer no explanation. In this connection, Edward P. Hume, Horticulturist of the United States Department of Agriculture's Experiment Station at Mayaguez, writes:

"On the origin of the common name 'Rain Tree' for *Brunfelsia americana,* I can find no authoritative answer as to the reason of this name. The following has been suggested: (1) That the corolla tube hangs down in a pendulant manner either during or just prior to rains, (2) that the fragrance is more pronounced during or just prior to rain, and (3) that the plant is so prolific in flower that when the flowers fall it appears like a shower, as the term 'aguacero' can also be translated 'shower' and this name is most commonly used by the natives of the hills for this particular plant."

Most of the showers from tropical rain trees, however, are caused by insects—hemipterous species, aphids, cicadas, or frog-hoppers—as is evidenced by reports on species of *Leptolaena, Pithecolobium, Acer* (not necessarily tropical), and *Glochidion.*

NOTICES AND REVIEWS OF RECENT BOOKS

Farm Management Theories

UNEASY MONEY. Edward H. Faulkner, 114 pages, University of Oklahoma Press, Norman, 1946. $1.50.

This work by the author of "Plowman's Folly" is addressed to the larger field of economics. Mr. Faulkner's thesis is that if the United States is to compete in the post-war world markets, "drastic reductions in the selling prices" of American goods are necessary. He proposes to initiate this general reduction in prices by lowering the cost of farm products through more efficient farming methods. He believes that with lower food costs, we can have lower wages, and with lower wages, lower prices of manufactured articles, all without affecting the standard of living.

This reviewer does not believe that there is much likelihood of a general decline in the price structure. The size of the national debt, unbalanced Federal budgets and our money, credit, and interest rate policies lead one to believe that we shall be lucky indeed to keep prices from rising. The chief interest of this book, however, lies not in the author's ideas on economics but in his suggestions on how farming as a business can be made more efficient and more profitable to the farmer.

His first recommendation is that farmers should adopt better methods of handling the soil, substituting for contour plowing the mixing of organic matter in the surface of the soil. The author has modified somewhat his views of the iniquity of the plow as set forth in "Plowman's Folly," but insists that greatly increased yields of wheat and corn may be obtained by surface tillage, without the use of chemical fertilizers. He also suggests a re-appraisal of current notions on the usual corn-wheat-hay rotation, which he believes is responsible for much of the over-production of wheat and corn. He recommends that hay should be grown near the barn to cut labor costs and that animal manures should be used solely on the meadows and pastures. Wheat and corn should have their own fields, fertility of which is to be maintained by the use of green manures disked into the soil. For corn, he advocates using rye and vetch; for wheat, soybeans, buckwheat, lespedeza, and even young corn. With better pastures, he intimates that prime beef might again be marketed direct from the pasture, eliminating the expense of corn feeding.

Farmers are urged to become acquainted with recent development in chemurgy and its effect on the demand for farm products, such as soybeans, flax, and sweet potatoes. He suggests that these crops be grown on part of the acreage formerly occupied by wheat and corn, the income from which can be used to offset that lost through lowered prices of other farm products.

Mr. Faulkner's views on farm management are persuasive and should have a wide audience.

GOVE B. HARRINGTON
Katonah, N. Y

"By Their Fruits . . ."

FRUIT KEY TO NORTHEASTERN TREES. William M Harlow. 50 pages, illustrated. Published by the author [234 Kensington Pl., Syracuse, N. Y.] 1946. 50 cents.

Although primarily designed for beginning students of dendrology, this booklet will be of great assistance to others seeking to identify the more common species of trees in the Northeastern States solely by their fruits. Certain of the more complex genera, such as the willows, apples, hawthorns, and a few others, are not keyed to species for -as the author points out - their identification often is a problem for the specialist; furthermore, in these genera the specific characters usually are to be found in characters other than those of the fruit alone. It is a handy booklet and fills a definite niche in this group of publications.

W. H. CAMP.

International Review

ADVANCES IN ENZYMOLOGY, Vol. 6, Edited by F. F. Nord, 563 pages. Interscience Publishers, New York, 1946, $6.50.

Volume six of the "Advances" contains eleven excellent reviews of as many aspects of biochemistry, by authors who have contributed to the subjects they have reviewed. The international character of the series has been maintained despite the difficulties caused by war by two contributors from England and one from Russia. The topics discussed are:

The Bacterial Amino Acid Decarboxylases by Ernest F. Gale
Enzyme Problems in Relation to Chemotherapy, "Adaptation", Mutations, Resistance, and Immunity, by M. G. Sevag
Biological Antagonisms between Structurally Related Compounds by D. W. Woolley
Adenosinetriphosphatase Properties of Myosin by V. A. Engelhardt
States of Altered Metabolism in Diseases of Muscle by Charles L. Hoagland
Acetyl Phosphate by Fritz Lipmann
Microbial Assimilations by C E. Clifton
Chemical Changes in the Harvested Tobacco Leaf by Walter G. Frankenburg
The Actions of the Amylases by R. H. Hopkins
The Amylases of Wheat and Their Significance in Milling and Baking Technology by W. F. Geddes
Tocopherol Interrelationships by K. C. D. Hickman and P. L. Harris

F. W. KAVANAGH.

From the Pacific Northwest

CHRYSANTHEMUMS, How We Grow Them Out-of-Doors. By members of the Portland (Ore.) Chrysanthemum Society. 97 pages, illustrated. Published by the Society, 2905 N. E. 38th Ave., Portland 13, Ore. 1946. $1.50.

With one eye on winning blue ribbons at the fall shows, a dozen members of the Portland (Ore.) Chrysanthemum Society have pooled their experiences in growing show quality flowers, within the covers of this book. It is obvious from the beginning, however, that these local experts ignore, for the most part, the common hardy sorts found in eastern gardens, and grow, instead, the large-flowered varieties principally of greenhouse origin, which thrive outdoors in the mild Pacific Northwest climate.

How to produce these big blooms is covered step by step in the first four articles and although individual methods vary, there is considerable duplication here. Cultural practices are meticulous, particularly in the matter of selecting the bud which will yield a prize flower, and how this is done is fully explained and illustrated.

Growing plants in pots in the garden for final bloom indoors has more eastern application than some of the other articles, and in six pages the methods and advantages of this system are fully covered.

Peculiarly, only in J. G. Bacher's article on Small Varieties is there any discussion of chrysanthemum varieties, and his list contains many kinds that are popular in the East.

The only technical article is one on disease control by Drs. Frank McWhorter and A. W. Dimock; another writer covers pest control.

PAUL F. FRESE,
Editor, Flower Grower.

Building and Equipping Greenhouses

GREENHOUSES, Their Construction and Equipment. W. J. Wright. 269 pages, illustrated. Orange Judd, New York, 1946. $2.50.

Were this book found lying on a table in the waiting room of a doctor's office, and it happened to be opened at random by someone awaiting the pleasure of the M.D., it would not be immediately put down. For were the heel-cooler gardener or not, the book would tempt him to look it through and to read the captions of some of its illustrations and perhaps a line or two here and there of its text. For its paper is of good quality, its format is pleasing, the illustrations are many and clear, and the type, as this reviewer's old eyes can testify, is excellent. Although as an amateur he has operated a greenhouse for a long while, he was refreshed by reading it.

The book describes the construction of greenhouses from foundation to finial. Its opening chapter, entitled "A General Survey" gives the *raison d'être* of the greenhouse, describes the various types, (including coldframes and hotbeds) and sketches its history and evolution. Following this is a chapter explaining in detail what the author terms "sash beds" that is, coldframes, hotbeds and similar structures. This chapter is followed by two on the greenhouse proper which discuss location, arrangement, size, pitch and style of roof. Structural Material, Framework and Methods of Erection, Glazing and Painting, Ventilation and Ventilating Machinery, Beds, Benches and Walks, are treated in five subsequent chapters, and the next four deal with the methods and machinery for heating greenhouses. Chapters on Water Supply and Irrigation, Concrete Construction, Plans and Estimates complete the volume.

The book could be studied with profit by anyone, professional or amateur, who contemplates the acquisition of a greenhouse, or who already maintains one. While it is concise, it is, at the same time, complete and up to date, as its references to electric heating and automatic control of ventilation indicate.

It is to be regretted that a book which may often be used for reference has not a more complete index, one instance of this being that it appears to contain no reference to ventilation. However, the Table of Contents goes into considerable detail, which makes criticism of the index a minor matter.

JOHN H. MYERS,
White Plains, N. Y.

The Lore of the British Sylva

TREES IN BRITAIN. L. J. F. Brimble. 352 pages, illustrated, indexed. Macmillan, London, 1946. $4.50.

As a companion and supplement to his "Flowers in Britain," Mr. Brimble presents a volume on the sparse native and diverse exotic British sylva. Like the earlier work it opens with a general review of the plant kingdom and the principles of classification; and the succeeding chapters deal with the woody plants according to their families. The notices of individual species include short running descriptions, notes on origin and distribution, economic uses and folklore. The book is generously illustrated with seven colored plates, text-figures of exceptional excellence by the author, and a number of tree portraits by Archdeacon Lonsdale Ragg. The latter have been described as a marriage of Science and Art, but industry and a blunt pencil seem to have been more directly implicated.

"Trees in Britain" is designed for the use of botanist and amateur alike; but it can be recommended seriously only to the latter class. There is an excellent book on the trees of Britain by the Rev. Johns (often quoted by Brimble), and Macmillan would have done better to reissue this if, as I suspect, it is out of print.

RUPERT C. BARNEBY,
Wappingers Falls, N. Y.

Research in Holland

MODERN DEVELOPMENT OF CHEMOTHERAPY. E. Havinga, H. W. Julius, H. Veldstra & K. C. Winkler. 175 pages. Elsevier, New York and Amsterdam, 1946. $3.50.

This is number four of Monographs on the Progress of Research in Holland During the War, of which 25 have been published. There are monographs on a wide variety of botanical, zoological, physical, chemical, and technological topics. The volume under review is concerned primarily with the chemistry and pharmacology of sulfa-drugs and of the antibiotic substance expansine (patulin). This book is a small indication of the success of the Dutch in conducting research under adverse conditions existing in an invaded country. Part of the work was seriously hampered by the lack of gas and electricity.

F. W. KAVANAGH.

Review of American Farm History

FARMS AND FARMERS. The Story of American Agriculture. William H. Clark. 346 pages, illustrated, indexed. L. C. Page & Co., Boston, 1945. $3.75.

This is an easily read rehash of the advances and recessions of American agriculture from the time the first land was wrested from Indians and forests until the soil had been depleted to the point at which chemistry and plant and animal breeding are barely able to maintain productivity. Many of the things said here have been said more effectively before, but they can not be said too often.

VIRGENE KAVANAGH.

Foundation for Beginners

FACTS ABOUT FLOWER ARRANGEMENT. Winifred Teele. 51 pages, illustrated. Published by the author. [Mrs. Arthur P. Teele, 100 Walnut Place, Brookline 46, Mass.] 1946. $1.

This booklet offers a wide range of ideas on the principles and mechanics of flower arrangements. Written in simple, easy style, it provides an excellent foundation for beginners. The illustrations show what can be done with ordinary plant material—the bizarre not being necessary to win prizes.

MRS. HARRY A. JENNISON.

Essays on Biochemistry

CURRENTS IN BIOCHEMICAL RESEARCH. David E. Green, editor. 486 pages. Interscience Publishers, Inc., New York, 1946. $5.

These thirty-one short essays on various aspects of biochemical research are by authors who have made substantial contributions to the topics they discuss. The book opens with "The Gene and Biochemistry" by G. W. Beadle and closes with "Organization and Support of Science in the United States" by L. C. Dunn. One interested in biochemistry will find nearly every chapter worth careful reading.

F. W. KAVANAGH.

Text Book in a New Edition

ELEMENTARY BACTERIOLOGY Joseph E. and Ethelyn O. Greaves. 613 pages, illustrated, indexed. W. B. Saunders Co., Philadelphia and London. Fifth edition. 1946. $4.

Although this book contains much worth-while information, it is poorly written and contains some misinformation. As examples of this, the authors, in speaking of bacterial dissociations, state that the fourth type of dissociation is "the M (mucoid) in which the cells of the stype are non-capsulated." This is wrong, as it is the capsulated stype of bacteria that forms a mucoid colony. Also, they state that "apparently penicillin can be administered without sensitizing the subject," and that "some organisms may become penicillin-resistant but such organisms generally decrease in virulence." In the light of most recent investigations on this subject, it would appear that these statements are of doubtful validity.

Some of the inaccuracies of expression are "the great advancements made in viruses," the collection of "floating particles of air," and the "American Society of Bacteriologists."

The general caliber of this book is such that it can scarcely be recommended for a school text.

MARY STEBBINS.

Technical Papers

Freshwater Algae. Max E. Britton presents in "A Catalog of Illinois Algae" a check list containing 962 species in 178 genera. This 177-page book published in 1944 by Northwestern University, Evanston, Ill., at $3, is of use to all those doing research on the algae of the Middle West.

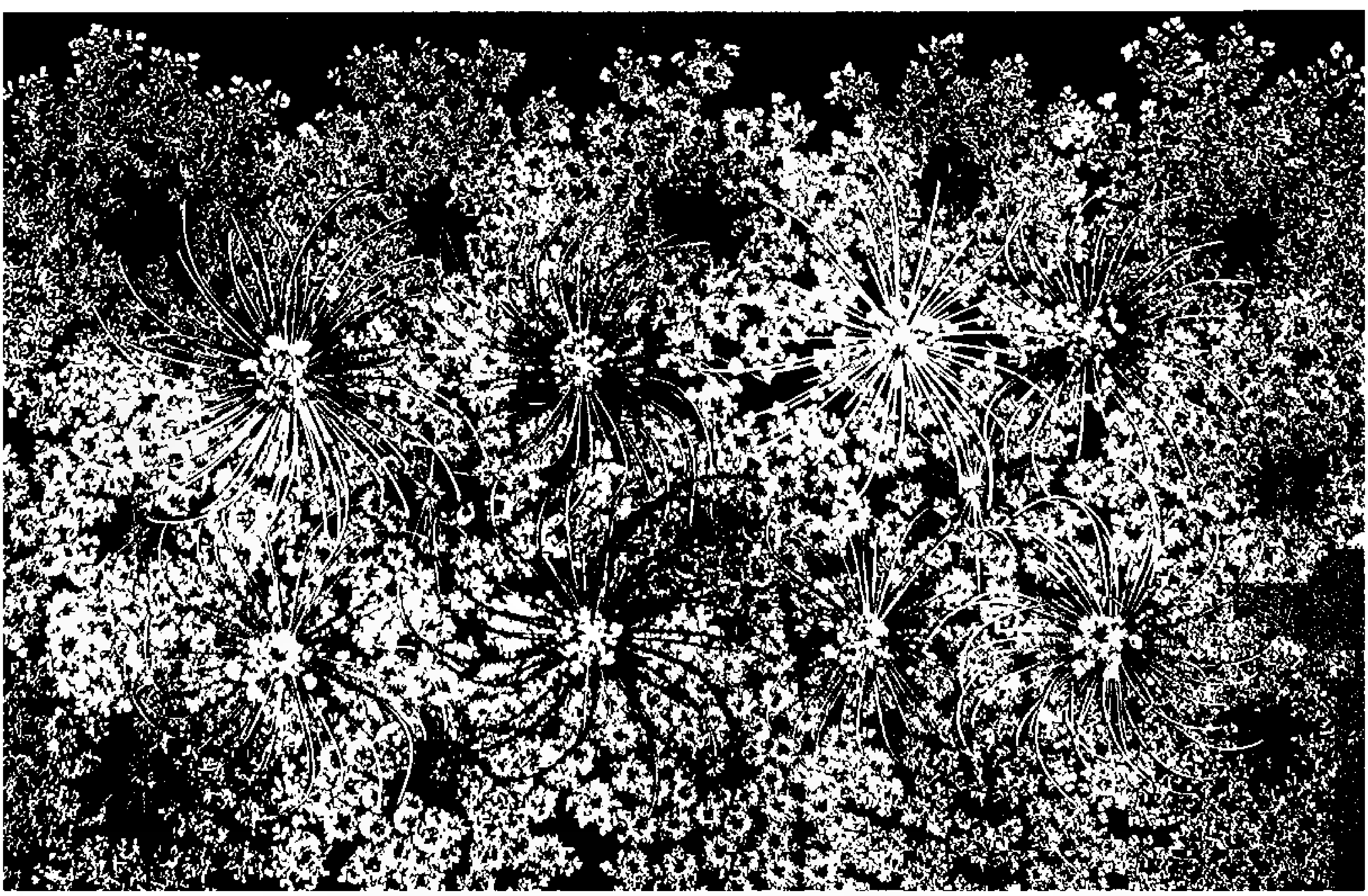
Delphinium Species. Joseph Ewan, who is now at the Bureau of Plant Industry, Beltsville, is the author of "A Synopsis of the North American Species of *Delphinium*" published last year by the Library of the University of Colorado. He treats 79 native species besides three naturalized ones: *D. Ajacis*, *D. orientale*, and *D. Consolida*, and precedes the descriptions of species with regional keys. His reports on livestock poisoning by certain delphiniums are an important contribution to the studies of this genus.

Dried Plants Used in Pictorial Compositions Now on Exhibit in Museum Building

TWO hundred pictorial compositions made entirely of dried plant material are on exhibit at the New York Botanical Garden, and will remain on view in the Museum Building through Dec. 31.

The originator of these unique designs and pictures is Mrs. Grace Knox Macfarlane, who has developed the art during the past five years out of a lifelong habit of observing the beauty of plants, particularly around her farm at Salem Center, N. Y., along the roadside, and in nearby fields, and of bringing home and pressing specimens which appealed to her fancy. The result of her starting to mount them to bring out their attractiveness is a collection of hundreds of pictures, ranging from lacy valentines to realistic scenes. One of her most effective scenes shows a family of swans—aggressive father, solicitous mother, and a flock of little ones—all made from immature milkweed pods, swimming on a lake whose shore is bordered with sturdy evergreens made of yarrow leaves. Grasses, weeds, and sections of fruits and vegetables, as well as garden flowers and the more familiar wild flowers, have been used. All are mounted on colored paper which brings out effectively the natural tones of the dried plants.

Mrs. Macfarlane was the guest of the New York Botanical Garden for the opening of her exhibition on Saturday, Nov. 23. Here is the story of her work, as she tells it herself.



Rabbit-foot clover, against a background of soft yellow, has inflorescences of lamb's-quarters curling around the edges of the mat. Swirled heads of Panicum, a common grass, form the design at the right. On the opposite page is a tray made entirely of the flowers of Queen Anne's lace.

"Danbury, Connecticut, was my birthplace. I married and went to New York City to live. About thirty years ago, we came to Salem Center, a small village in northern Westchester. Here I was able to satisfy my liking for wild flowers and for gardening. As a child I had always been fond of color and design, but I never had the opportunity to take any lessons in art or painting.

"About five years ago, however, I started my collection of pictures. I was taking two collie pups, that early spring, down to the fields for their daily exercise. The spring green was just beginning to show, and I gathered whatever took my fancy. I was quite impressed by the beauty, and thought what a pity such loveliness should last only a short time. Then the thought came, 'Why not press some?' I did, and every day I continued bringing in and pressing other plants and blossoms until I had collected quite a variety. Finally, one day I began grouping some of the pressed flowers on colored papers. I glued them; and, because they were very fragile, put them into frames for protection. Of course, I never intended to make so many, but always a few more pretty ones carried me along.

"My first idea was not to make arrangements but to show the different parts of the flower and stages of development in the plant. Finally, almost without realizing it, I began making designs.

"Most of the material I have found on the hills or near the brook in the vicinity of my home. Perhaps one of the greatest pleasures has come from discovering many of the wild flowers that I never realized grew around here and also in learning about the many different kinds of each.

"For equipment, I use folded newspapers, and for weights, as many heavy books as I can find, plus several old-fashioned flatirons. I handle the material with pins while I am arranging and glueing it.

"One of the most interesting parts is

selecting the mounts, since some backgrounds seem to bring out color in the material, while others deaden it. The actual arrangement is almost like a jigsaw puzzle, since I am obliged to use the form which the material has taken while drying, and nothing can be erased or twisted to make it fit into the design.

"All in all, it is fascinating but time-consuming; however, the hours simply fly while I am working."

Mrs. Macfarlane was 70 when she started this hobby, and she is looking ahead to creating many more compositions out of the plants she has already dried and those she will gather on her walks next year.

Against black paper, the white leaf rosette and flowers of Antennaria are combined with flowers of the pearly everlasting which grows wild.

Swans of immature mildweed pods swim in a lake which is bordered by evergreen trees made of the finely cut leaves of yarrow.

* * *

The above article and accompanying illustrations (including the Clematis composition on the cover) are published with the aid of the Stokes fund for the preservation of the native flora.

Notes, News, and Comment

Sound Projector. For showing its new motion picture film, "The Gift of Green," and other sound films, the New York Botanical Garden has acquired a 16 millimeter sound projector. The new machine has been presented by the Sugar Research Foundation, producer of "The Gift of Green" under the Garden's sponsorship.

Conference. Professor G. Ledyard Stebbins of the University of California was the Garden's conference speaker November 13, with the subject of "The Production of Polyploid Species of Grasses for California Livestock Ranges."

Radio. Mrs. John L. Kuser, Jr., is representing the New York Botanical Garden on the Modern Farmer hour on WNBC December 17 between 6 and 7 a.m. She is being interviewed on how the public can use and enjoy the Botanical Garden. Carol H. Woodward spoke on the Garden's tree and shrub collection on the same hour on October 29.

Lectures. Dr. W. H. Camp addressed the Academy of Sciences of Philadelphia Nov. 25 on "Distribution Patterns and the Problems of Dispersal in Seed Plants."

The Greenwich Garden Club heard a talk by Otto Degener Nov. 19 on his explorations in Fiji. Elizabeth C. Hall talked before the Rusticus Garden Club of Katonah Nov. 19 on books for gardeners. Dr. H. N. Moldenke lectured on plants of the Bible for the South Orange Garden Club Nov. 13.

Williamsburg Program. During the last two weeks of January and concluding February 1, a flower and garden symposium and exhibition will take place at Colonial Williamsburg, Virginia. The program which begins January 20 will be repeated the following week, with talks on 18th century gardens of the region and flower arrangements, and the restoration and care of these gardens today.

Douglas Fir. News of "the largest Douglas fir tree ever felled by man" has come to the New York Botanical Garden through a letter from Herschell H. Bradford of Salem, Oregon. The trunk of the tree, which was felled in the forests southwest of Mt. Ranier, measures 12 feet 9 inches in diameter. The tree was 586 years old.

Visitor. Major Albert Pam of England, noted authority on the Amaryllidaceae, brought the Garden seeds of some rare plants on a visit Nov. 14 and spent some time in the greenhouses selecting plants to take back with him to England.

Begonia Society. A New York suburban branch of the American Begonia Society was organized Nov. 24. The president is Mr. Louis J. Kuester, a member of the Garden. Alice L. Dustan of *House Beautiful* magazine, another Garden member, was named representative to the board of the parent society.

Return from Africa

Leonard J. Brass returned Nov. 11 from the Vernay Nyasaland expedition in Africa, on which he has been collecting plants for the Garden for the past six months. A cocktail party honoring members of the expedition was given Nov. 25 at the home of Mrs. Byron Foy in New York. Brief talks were given by Dr. William J. Robbins, Dr. Harold E. Anthony of the American Museum of Natural History, who was also on the Vernay expedition, and by Mr. Brass himself. Mr. Vernay returned with Dr. Anthony several weeks earlier, and had already left the city.

Benefit Exhibit

Paintings by Winslow Homer will be shown in an exhibition for the benefit of the New York Botanical Garden at the Wildenstein Galleries, 19 East 64th St., New York, for a month, from Feb. 19 to Mar. 21. The show is being planned by the Garden's Manhattan office, and is to be manned by a corps of volunteers.

INDEX TO VOLUME 47
1946

Asterisks indicate illustrations. The letter "R" before a page number refers to the Annual Report, which is separately paged and which was issued as Section Two of the Journal for October. Books reviewed are alphabetized by the authors' names at the end of the index.

A

B

O

P

Q

R

S

T

BOOK REVIEWS

To reach the Botanical Garden, take the Independent Subway to Bedford Park Boulevard station; use the Bedford Park Boulevard exit and walk east. Or take the Third Avenue Elevated to the Botanical Garden or the 200th Street station, the New York Central to the Botanical Garden station, or the Webster Avenue surface car to

Third Avenue Elevated to the Botanical Garde

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

The New York Botanical Garden was incorporated by a special act of the Legislature of the State of New York in 1891. The Act of Incorporation provides, among other things, for a self-perpetuating body of incorporators, who meet annually to elect members of the Board of Managers. They also elect new members of their own body, the present roster of which is given below.

The Advisory Council consists of 12 or more women who are elected by the Board. By custom, they are also elected to the Corporation. Officers are: Mrs. Robert H. Fife, Chairman; Mrs. Elon Huntington Hooker, First Vice-Chairman; Mrs. William A. Lockwood, Second Vice-Chairman; Mrs. Nelson B. Williams, Recording Secretary; Mrs. Townsend Scudder, Corresponding Secretary; and Mrs. F. Leonard Kellogg, Treasurer.

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George Arents, Jr.
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Prof. William J. Bonisteel
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George M. Moffett
H. de la Montagne
Col. Robert H. Montgomery
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Barrington Moore
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Ogden Mills Reid
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Dr. William J. Robbins
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Nathan Straus
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Joseph R. Swan
Mrs. Joseph R. Swan
Prof. Sam F. Trelease
Arthur S. Vernay
Mrs. Antonie P. Voislawsky
Manfred Wahl
Allen Wardwell
Sidney J. Weinberg
Nelson M. Wells
Alain C. White
Mrs. Nelson B. Williams
Mrs. Percy H. Williams
John C. Wister
Richardson Wright

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