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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

FOR ALL GARDENERS

THE prospect that the supply of canned fruits and vegetables for civilians will be still further reduced in the coming year means that city, suburban, and country people alike will need to take their victory gardening very seriously this spring.

As in years past, the New York Botanical Garden stands ready to assist individuals by answering questions on problems in gardening either in person or by mail or telephone. In addition, organized instruction is being offered as part of the institution's Educational Program. A six weeks' course in *Vegetable Gardening* starts Feb. 21, in ample time for directions to be followed for this year's planting. For those who have the daytime hours free, a *Three-Day Short Course in Vegetable Gardening* takes place March 27-29. Later, for those who want to learn the fundamentals that can be applied to any type of gardening, there will be a *Three-Day Short Course in Practical Gardening* April 24-26; and for those who want to know the best ways of keeping their plants healthy, a *Two-Day Short Course in Disease and Pest Control* June 6 and 7.

Meanwhile, two new courses are being presented—courses for which there has long been a demand: *Botany for Beginners*, commencing April 10, designed for gardeners craving a background of knowledge about the plants they grow, and *Plant Propagation*, beginning Feb. 26, with three Saturday afternoons of classroom work, followed by two short terms of practice in spring and fall in the greenhouse and outdoors.

Students in the *Two-Year Course in Practical Gardening*, will enroll in April for their term of work in Outdoor Gardening Practice, and in early May the class in Garden Construction, which is now part of the new one-year course in *Home Landscaping*, will begin.

As fruits begin to assume a place of importance along with vegetables, the two free lectures on fruit culture being given jointly by the New York Times and the New York Botanical Garden downtown the evenings of Feb. 24 and March 2 will be of special value to the home gardener this year.

In all of these classes the aim is to have useful information dispensed by instructors who are practical men rather than theorists. The classroom studies and practice periods can profitably be augmented at the New York Botanical Garden by observations in the demonstration vegetable garden and other plantings, by reference to the Garden's own publications on fruit and vegetable growing, and by the use of the library, where there is an abundance of literature on every type of gardening.

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The Sugar Beet in Europe and America

*By Eubanks Carsner**

ANDREAS SIGISMUND MARGGRAF, Director of the Physical Division of the Prussian Royal Academy of Science, laid the foundation for the great beet-sugar industry in 1747 when he published his epochal discovery that:

> ". . . sugar, this sweet salt, can be made out of our plants as well as out of the sugar cane."

Marggraf, a chemist, was interested in scientific knowledge and not in commercial exploitation of his findings. Franz Carl Achard, student and successor of Marggraf, was led by the achievement of his illustrious master to study and persistently develop good cultural practices for beets and manufacturing methods and finally to found at Cunern near Steinau in Silesia in 1802 the first commercial beet-sugar factory. Funds for the enterprise were granted by Friederich Wilhelm III of Prussia. It was during Achard's time that the terms "sugar beet" and "beet sugar" were introduced. Baron von Koppy, an ardent and energetic follower of Achard, in 1805 established a beet-sugar factory at Krayn near Strehlen, also in Silesia. The beet-sugar industry in Russia was also started in these first years of the 19th century.

Von Koppy, on the basis of Achard's and his own experience with sugar-beet growing and beet-sugar manufacturing, wrote in 1810:

> "There is no crop which has such a strong influence on the improvement of farm management, on the productivity of the soil, on the succeeding grain crop; no other manufacturing compares with beet-sugar production in its wholesome influence on numerous domestic industries and on the welfare of the nation."

Many European and American agriculturists, as well as informed industrialists, have held and hold the same opinion.

*Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.

Napoleon and Vilmorin

In France early development of the beet-sugar industry drew heavily on the pioneering experience in Germany. Napoleon became interested because of the difficulty of getting sugar from the West Indies. By his vigorous support the beet-sugar industry developed rapidly and extensively in France. But his defeat at Waterloo in 1815 followed by the lifting of the European blockade permitted resumption on an extensive scale of importation of cane sugar. Slave labor in the tropics made competition difficult and the French industry declined.

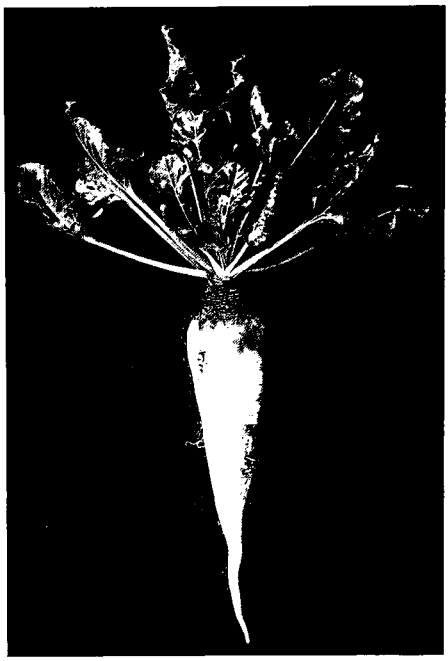
Revival and stabilization of the European beet-sugar industry was largely due to the efforts and writings of Count Chaptal. The outstanding agricultural contribution of this period to the beet-sugar industry was the beginning of sugar-beet breeding by the Vilmorin method. Philippe André de Vilmorin did selection work, probably in the latter part of the 18th century, but his son Louis de Vilmorin, through works published around the middle of the 19th century, founded the method of breeding still used generally in Europe for the production of commercial varieties.

Beginnings in the New World

American interest in sugar beets and beet sugar stemmed from France. James Ronaldson, first president of the Franklin Institute of Philadelphia (1824-1841) and also president of the Beet Sugar Society of Philadelphia, joined with several friends in financing a trip to France in 1836 by James Pedder for the purpose of investigating and reporting on beet growing and sugar manufacturing. Edward Church and David Lee Child at about the same time formed the Beet Sugar Company of Northampton, Mass. Both organizations imported sugar-beet seed and distributed it among farmers. Their efforts, including two important publications, are historically noteworthy even though these did not lead immediately to the establishment of the beet-sugar industry on this continent.

Western Pioneering

The Mormons fleeing across the plains and taking refuge in Utah contributed a picturesque even though disappointing episode to American beet-sugar history. "Sugar House," the designation of a ward in Salt Lake City, gets its name from the fact that there the Mormon Church, taking over an enterprise started by the Deseret Manufacturing Company, built the first beet-sugar factory in the West, the second in the United States. President Brigham Young had instructed Apostle John Taylor, then a missionary in France, to buy a complete outfit of machinery for making beet sugar. The machinery was bought in Liverpool, shipped by boat to New Orleans and up the Mississippi and Missouri rivers to Fort Leavenworth, Kansas, and then by an ox train of fifty-two teams across



The sugar beet, a white form of Beta vulgaris, used for the past two centuries as a source of sugar.

the plains to Utah. The factory was put in operation in 1853 and made syrup but apparently there was no one there who knew how to make sugar.

E. H. Dyer built the first successful beet-sugar factory in America at Alvarado, California. The factory was first built there in 1870 and 250 tons of sugar were produced that year. It continued to operate with slowly increasing production for the next three years but operations were discontinued after 1873 and the machinery was sold. Dyer equipped the factory again, enlarged it, and resumed operations there in 1879. That year should be regarded as the time when the first successful beet-sugar factory in America was started. The ownership has changed several times. The Holly Sugar Corporation, the present operator, has completely rebuilt and enlarged the factory.

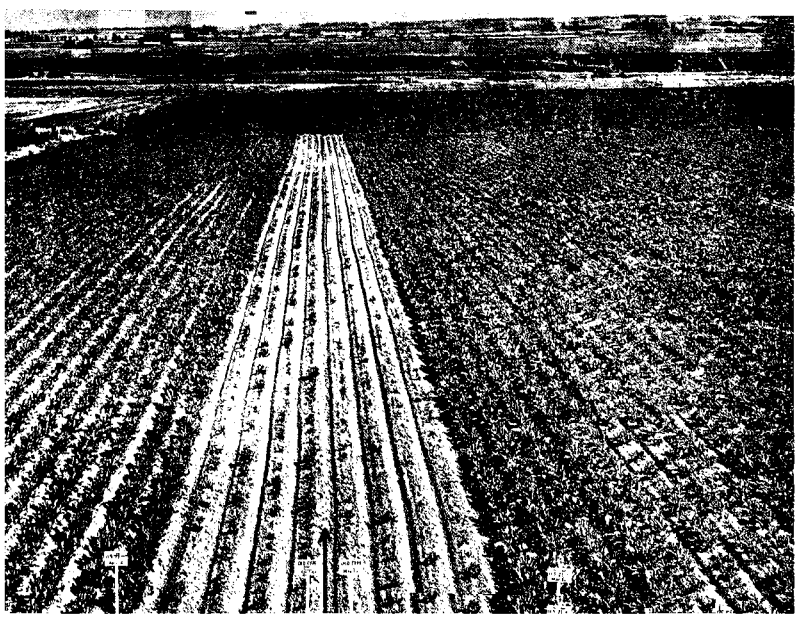
The next successful beet-sugar factory was built at Watsonville, California, in 1888, by the Western Beet Sugar Company, predecessor of the Spreckels Sugar Company. Soon after that the industry began to expand steadily. From Ohio and Michigan westward there are now eighty beet-sugar factories in nineteen states.

Curly-Top Menace

Curly top has been the dominant factor in recent important contributions to the advance of the American beet-sugar industry. This virus disease earlier caused more loss and later resulted in greater gains for the industry than any other single factor. Beginning in 1898, devastating curly-top epidemics at frequent intervals swept through some of the factory districts in California, Utah, Colorado, Idaho, Oregon, and Washington. There were 21,389 acres planted to beets in the Twin Falls, Idaho, area in 1934 and 18,635 acres (88%) were abandoned mainly because of curly top. The yield from the relatively small acreage harvested averaged only 4.88 tons

CURLY-TOP RESISTANCE BREEDING FIELD NEAR TWIN FALLS, IDAHO

Left of the arrow, is a four-row strip of "Old Type" (European variety) and adjacent to it are four rows of "Improved U.S. 22" and other resistant varieties, planted April 11. Right of the arrow is a four-row strip of "Old Type" and adjacent to it are four rows of "Improved U.S. 22" and others planted May 1. Photographed August 6, 1941.



per acre. The destructiveness of this 1934 epidemic is indicated by the fact that in the preceding season, a light curly-top year, 25,612 acres were harvested with an average yield of 13.78 tons per acre. Factories costing in the aggregate millions of dollars were abandoned. Fine farming areas gave up trying to grow sugar beets, losing an important cash crop and one greatly needed for the best diversified farming. The industry west of the Rockies was in dire straits when relief came.

Comeback of the Industry

Plant breeding and related investigations have resulted in a degree of curly-top control so effective that this disease is no longer a limiting factor in the areas where it occurs. Beet-sugar factories have been rebuilt in districts previously abandoned. The first curly-top-resistant variety released for grower use, called "U. S. 1," was only moderately resistant. However, nineteen separate field tests of this variety in one factory district in 1931 showed an average increase in yield of 4.7 tons per acre over European varieties, and consequent use of "U. S. 1" encouraged growers and sugar companies both to produce while better varieties were being bred. The progress thus far made in breeding for increased curly-top resistance is indicated by the following tabulated data from a test in 1941. Purposely late planting and artificial measures to increase the severity of the curly-top exposure made the disease conditions very severe.

Variety	*Tons per Acre*
Old Type (European)	0.00[1]
U. S. 1	6.31
U. S. 33	8.40
U. S. 12	11.25
U. S. 22	14.32
Improved U. S. 22	16.61

With such a high level of curly-top resistance as has been attained, more emphasis can be put on combining it with other valuable characters. Resistance to other diseases, higher sugar content, and adaptation to peculiar regional conditions and to evolving mechanical operations are some of the characters that ought to be combined with high curly-top resistance.

American Seed Production

Sugar-beet seed-growing, a new industry in America, was established as a result of the need for multiplying American varieties resistant to curly top. Europe supplied nearly all the sugar-beet seed used in the United States up to a decade ago. Now enough seed is produced here to meet all domestic and Canadian requirements and have some for export. Varieties better adapted to various American conditions have been developed and are multiplied in the seed-growing districts. These include some varieties

[1] No marketable beets produced.

resistant to *Cercospora* leaf spot, a disease serious in areas where curly top does not occur. Establishment of sugar-beet-seed growing, an outcome of curly-top control by breeding resistant varieties, has completed the integration of the American beet-sugar industry.

The foundation for the method of sugar-beet-seed growing generally used in America was laid some years before curly-top-resistant varieties became available and led to extensive employment of the method. Instead of the European method of growing the beets in one season, digging and storing the plants over winter and transplanting them in the spring, a much less laborious practice is involved in the American method. The seed is planted in late summer or early fall, the plants allowed to stand over winter in place, usually without thinning, and the seed harvested the following summer. The method permits mechanized procedures that eliminate much of the hand labor involved in the transplanting method. Average yields are higher, too, in the better adapted areas.

The sugar-beet-seed industry in this country is still young and much remains to be done before it is thoroughly stabilized. Agronomic and physiological investigations have markedly improved cultural practices and guided the selection of climatically suitable areas. By such means the factors influencing thermal induction of flowering are largely subject to control and are now much better understood than they were when sugar-beet-seed growing in this country was first started.

Segmenting the Seed-ball

Mechanization of sugar-beet growing operations has received a great deal of investigation in the last few years and encouraging progress has been made, especially in the development of harvesting machinery. Rediscovery of the possibility of using mechanically cracked or "segmented" seed has been an outstanding recent development. The beet-seed ball is a multiple fruit and consequently the resulting seedlings are often so closely spaced as to make thinning laborious and expensive. Breaking the seed balls up into pieces containing a reduced number of seed makes possible elimination of some of the thinning effort. Mechanical problems involved in the satisfactory cracking of the seed balls and the distribution of the segmented seed in planting are being extensively studied. Mechanically cracked seed was introduced from Germany many years ago but did not prove generally acceptable. The difficulties encountered then were largely the same as those troublesome now. The degree of satisfaction obtained with segmented seed in the past season seems likely to lead to such improvements in cracking and planting as to insure permanent adoption of its use.

Russia has led the world in beet-sugar production, with Germany second and the United States third. Approximately one-third of the world supply of sugar comes from sugar beets. The wholesale value of the sugar pro-

SUGAR-BEET SEED FIELD IN ROGUE RIVER VALLEY NEAR MEDFORD, OREGON

An example of the overwintering-in-the-field method of seed growing. Planted early September, 1941. Photographed June 26, 1942.

duced from beets in the United States in 1941, the last year for which statistics have been published, was approximately $145,000,000. A long advance has been made in a little less than two hundred years since Marggraf reported the results of his research.

PERCY WILSON

SUCCUMBING to an illness of many years' duration, Percy Wilson died the night of Feb. 6. He had been a member of the staff of the New York Botanical Garden since 1899, and was active in his work until five years ago, when he was retired from his post of Associate Curator. During his early years he worked in close association with Dr. N. L. Britton, and through his explorations with him he became an authority on the flora of the West Indies. An appreciation of Mr. Wilson by Dr. H. A. Gleason will appear in a forthcoming number of this Journal.

Hunting Cinchona in the Peruvian Andes

By Walter H. Hodge*

Photographs by the author

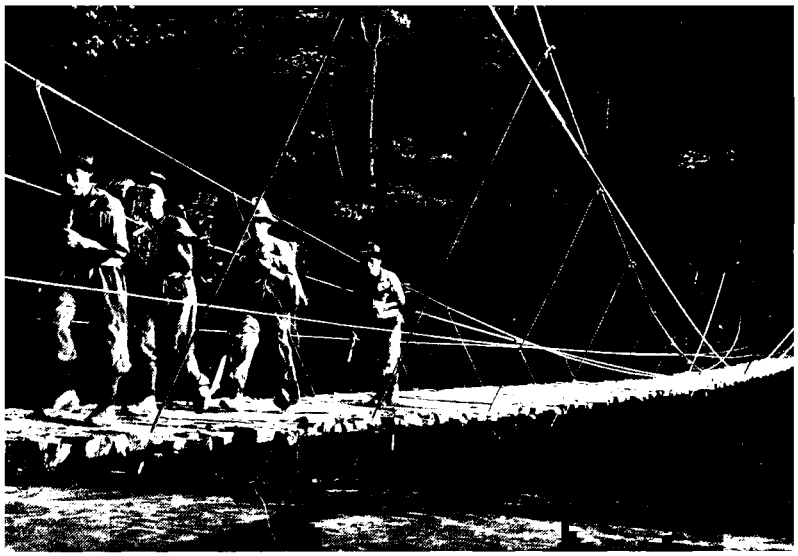
FEW war essentials have as high a priority rating as cinchona bark. Ever since the fall of Java, formerly the source of 95 percent of this strategic product, the United States has been on the spot as regards her stock of this sole source of quinine—the oldest and best of the anti-malarials. Without quinine, battles in the tropics can easily be lost, for malaria is an ally of the enemy. Java will be retaken, however, and by Americans using American quinine. For after all, cinchona bark, like hevea rubber, is a pure-blooded American which became expatriated only at man's interference.

The bark of the cinchona tree is one of this hemisphere's most important contributions to the world's drugs. Andean aborigines had probably long known and used the dry bark as a febrifuge and soon after the coming of the conquistadores cinchona became known to European civilization. First mention of the curative properties of quinine was made in 1628 by a Spanish friar in a manuscript only recently unearthed in the Vatican library. From that time to the present, montane forests from Ecuador to Bolivia have been ransacked for their supplies of this precious bark.

The Province of Loja in southern Ecuador first achieved fame as an important source of cinchona, and up to the year 1750 it was the headquarters for the industry. By the middle of the last century, however, exploiters realized that the wild stands in the Andes would never be able to supply the increasing world demand for quinine. Interested persons employed botanists who were sent secretly into the richest of the Andean cinchona regions to collect quantities of the tiny winged seeds. Seedlings raised from these eventually found their way to India and to the Dutch East Indies, where with tender care, scientific selection, and the aid of a bountiful and cheap labor supply, there grew into being the great plantation cinchona industry. In Java there were produced strains of the genus (for instance, the famous *Ledgeriana* stock) with bark that far surpassed, in the percentage of cinchona alkaloids contained, all barks ever found in the Andean home forests. Little wonder then that in recent years Java has provided the world with practically all of her quinine, and little wonder that quinine prices have been rigidly controlled by a single Dutch monopoly.

After Japan's island conquests in the south Pacific, climaxed by the capture of Java, the United States Government immediately shifted into high on the road to cinchona bark procurement. Under the direction of the

* Dr. Hodge, on leave from the Department of Botany of Massachusetts State College, is engaged in cinchona procurement in Peru for the United States Government, Office of Economic Warfare.



Cascarilleros bringing in loads of freshly stripped bark from Oroya on the Inambari River, with a cinchona forest in the background.

Office of Economic Warfare a study was made of the old South American industry and plans were drawn up to make this region an immediate, safe, and independent source of bark. Survey parties, each composed of a botanist and forester, were recruited. They have been searching the cinchona areas, scattered from Colombia to Bolivia, for over a year, seeking out the old stands and finding many a new one. The urgent need for quinine has permitted the exploitation of species long considered of little value because of the relatively low percentage of alkaloids contained in their bark. These "ugly ducklings" are abundant in the forests and until that time when our new Latin American plantations have attained an exploitable age, these low grade species will serve as good pinch hitters for plantation-grown cinchona.

Peru holds in her mountain fastnesses the very heart of the cinchona belt. No other Andean country possesses as many species of this variable genus, and today when the need for this bark is so great, Peru is proving to be one of our most important sources. In Peru cinchona is to be found in the highest mountain forests which cover the eastern slopes of the Andean ranges. Commercial species can be found growing from the upper limits of tree growth at about 10,000 feet down to the beginnings of Amazonian forest at the 2,000-foot level. The belt occupied by species of cinchona is a region of unbelievable beauty unmatched by any forested

zone in this hemisphere. This area is the fountainhead of many an Amazonian river—the Tambopata and Inambari, the Madre de Dios and Apurimac; the Beni, Marañon, and Huallaga. Born in the snowfields that top most of the eastern ranges, hundreds of turbulent tributaries of these parent rivers fall through breathtaking gorges and ravines which so dissect the eastern slopes as to make this rugged area almost impassable. Yet from this land of "perpendicular plateaus" must come all of Peru's cinchona bark.

It is no easy job to reach the eastern forested slopes, which constitute the upper margin of what the Peruvians call LA MONTAÑA* (forest land). Approaching from the west two other phytogeographic sections of the country must be passed—LA COSTA, or dry Pacific coastland with its deserts and lomas, the latter supporting a peculiar periodic herbaceous vegetation depending principally on the atmospheric moisture of seasonal fogs; and LA SIERRA, comprising the bulk of the high mountain tableland, the old Inca homeland, with its cold deserts, dry valleys, grassy steppes which support the flocks of llamas, alpacas, and sheep, its heathlike formations, and the curious cushion-forming plants of the higher altitudes. Automobile roads of the coast and sierra are numerous but as they approach the border of the montaña most of them peter out, being replaced by mule trails or tenuous foot trails which now hug begonia- or calceolaria-clad cliff walls or which now descend precipitously, finally threading their way through the forested montaña. Parties surveying for cinchona in such terrain have walked over 200 "vertical" miles in a two-weeks' period, and under these conditions good hiking shoes seldom last for more than a month!

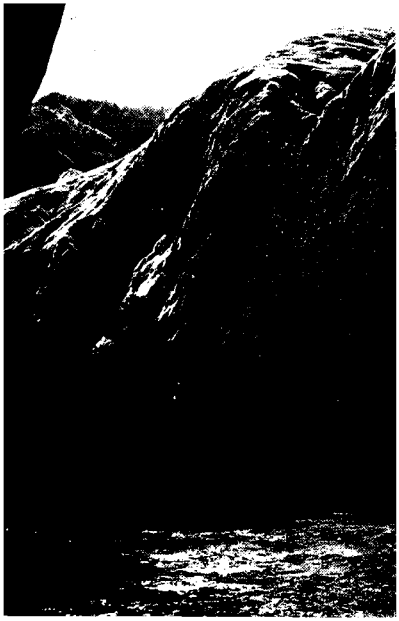
SOME OF THE PLANTS THAT ARE FOUND BY CINCHONA HUNTERS IN SOUTH AMERICA

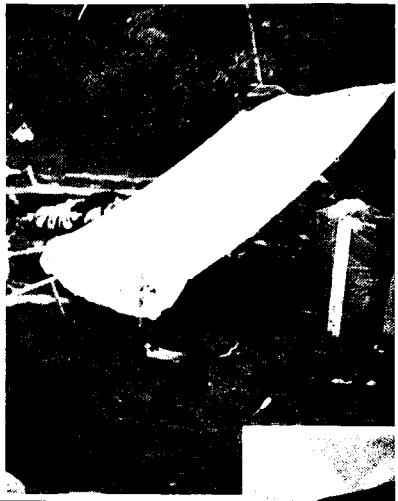
(Photographs on the opposite page)

UPPER LEFT: *Sprout shoots of a form of Cinchona micrantha called "huanuco" in northern Peru. Bark of this species is comparatively rich in alkaloids.* RIGHT: *Leaves of "monopol," another form of C. micrantha. The tips of a pair of stipules show at the bottom of the picture.* CENTER: *Flowers, capsules, and leaves of a "false cinchona" (Ladenbergia). The bark of this genus is the most frequent adulterant of true cinchona barks.* LOWER LEFT: *Inhabiting middle elevations is a large-leafed Cinchona pubescens. Its bark is usually of very low quality. The author is examining a seedling growing in the Cosñipata Valley.* RIGHT: *A flowering branch of a northern Peruvian form of Cinchona officinalis called "loja." This has been commercially exploited in South America longer than any other form of Cinchona.*

* In other Spanish-speaking countries generally called EL MONTE.

WITH THE U. S. GOVERNMENT
QUININE HUNTERS IN PERU

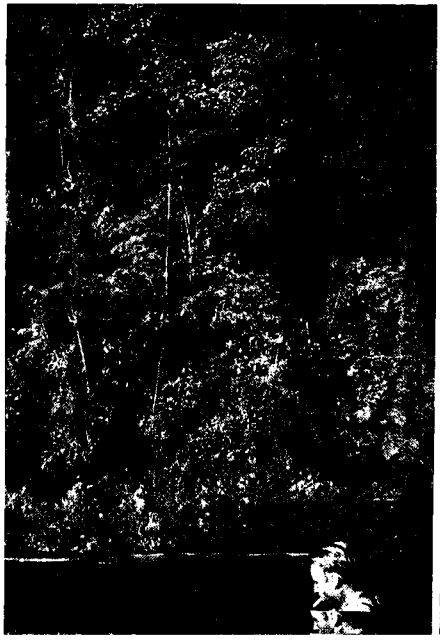




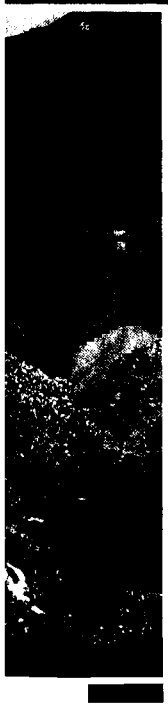
Beginnings of cinchona forests in the precipitous Sandia valley in southeastern Peru.

Poor grades of cinchona occur at the highest elevations, in a shrub-type forest like this in the Sandia valley (center, below).

Cinchona rainforest bordering the Huari-Huari river, vicinity of Oroya. "Monopol" (Cinchona micrantha) is the most important species here. ➔



Photographs by Walter H. Hodge



The rocky trail that leads to the cinchona forests in the Tambopata and Huari-Huari valleys in southern Peru.

Overnight camp of cinchona hunters on the Huari-Huari River (center, above).

← *Rain-forest in the Cosñipata valley. Leaves of Cinchona pubescens can be seen on the left as well as palms and tree ferns characteristic of this forest.*

Forests containing cinchona trees may vary considerably in general aspect. At higher elevations the forest tends to be low and thicket-like, and since moist blankets of clouds often settle for long periods at these elevations, the branches of the trees are generally festooned with pendent mosses, delicate hepatics, filmy ferns, bromeliads and tiny orchids. Plumose bamboo-like CHUSQUEAS often form impenetrable thickets. In addition to the mossy forest one also finds the more familiar mountain rainforest with its scattering of graceful tree ferns and palms. This forest is of moderate height, and covers most of the montaña of middle elevations. It is in the mountain rainforest, with its climate tempered somewhat by the elevation and subject often to over 200 inches of rain, that the greatest quantity of available cinchona species are to be found.

The genus *Cinchona* is a botanical headache. In Peru only three species have commercial importance, but these three—*Cinchona officinalis, C. pubescens,* and *C. micrantha*—have a great variety of leaf forms, making their classification difficult. Of the trio named, *Cinchona officinalis* has the greatest economic importance because certain of its forms possess bark very rich in alkaloids. Most if not all of the important plantation strains developed in the Dutch East Indies have originated from stock of this species collected in southern Peru and neighboring Bolivia. And today in Peru the forms of *Cinchona officinalis* are still the prizes of the CASCARILLERO, or cinchona hunter.

Bark increases in value in proportion to the percentage of crystallizable alkaloids contained, so one finds the best price paid for the form of *C. officinalis* called CALISAYA, found principally in Peru, in the valley of the Tambopata river but extending into the forests of nearby Bolivia. Unfortunately wild calisaya has been exploited for generations and only small quantities of the bark now find their way into the markets. Another form of *C. officinalis* called LOJA (having taken its name from a province in southern Ecuador) is also much sought after in the mountains of Cajamarca, a state of northern Peru, but this form is less valuable than calisaya although it claims fame as the first bark used in medicine. Curiously enough there are forms of *C. officinalis* containing practically no cinchona alkaloids. This is even more striking in forms of *C. pubescens* which in one locality may possess merchantable bark and in another locality, where growing conditions appear to be identical, it may possess totally worthless bark. Such anomalies still remain unexplained.

Species of *Cinchona* have a definite altitudinal distribution. One has to be a gymnast in order to clamber about in QUEBRADAS with precipitous walls where *C. officinalis* delights in growing. Seldom is this tree found below 6,000 feet and from this elevation it ascends with the mossy forests to that point where they begin to peter out at 10,000 feet. Growing in difficult sites at such elevations *C. officinalis* is generally a small tree. Forms

SOME BARK TYPES OF NORTHERN PERU

Left to right, by pieces: "Loja" (C. officinalis); "amarilla"—2 pieces (C. pubescens); "huanuco"—4 pieces (C. micrantha); "colorada"—2 pieces (C. pubescens).

of *C. pubescens,* called AMARILLA, sometimes penetrate the range of *C. officinalis;* but generally speaking *C. pubescens,* which is usually unimportant commercially, is a species of middle elevations forming its heaviest stands between 4,000 and 6,000 feet. Growing in the lower elevations is *Cinchona micrantha,* generally known in northern and central Peru as HUANUCO and in southern Peru occurring in another form called MONOPOL. Monopol can be found anywhere from 4,000 feet down to 2,000 feet. Because it often grows in sheltered river valleys where soils are deeper and wind action is less, it generally is the largest of the commercial cinchonas, the trunk sometimes reaching a diameter of two feet. Though possessing a low grade bark its large size makes it very important, and in the present procurement program in Peru, monopol is proving to be the principal source of cinchona bark.

Bark harvesters apply the general term CASCARILLA to all the species of true cinchonas and "false cinchonas" (*Ladenbergia* species), but modifying names, such as CASCARILLA CALISAYA, CASCARILLA AMARILLA, etc., are appended to such forms as are very well known. As might be expected,

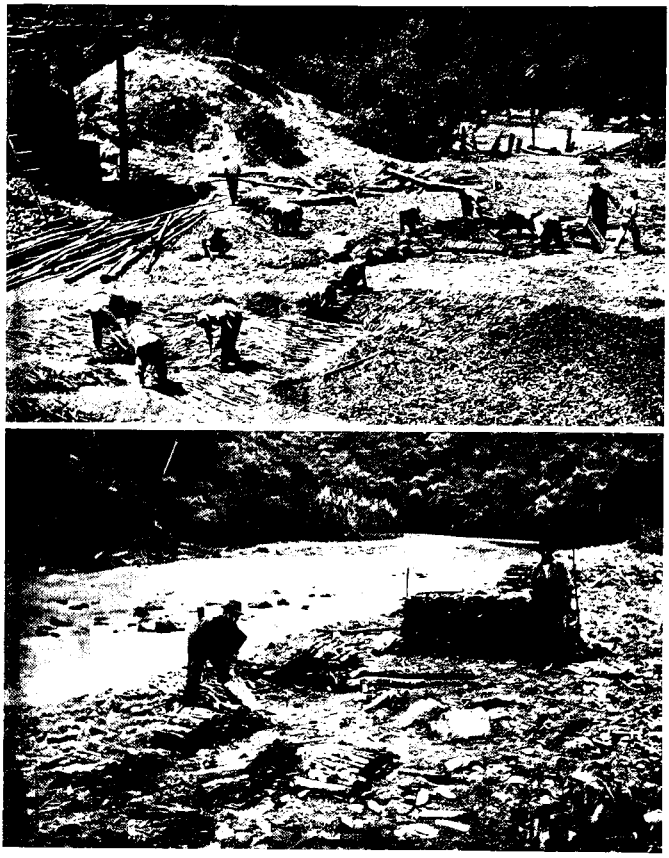
these modifying names are most frequent in those regions where cinchona bark has been harvested for the longest period. The men who actually cut bark in the forests also take their name from the word CASCARILLA, and are called CASCARILLEROS.

Peruvian cascarilleros are usually pure-blooded sierra Indians—lineal descendants of the Incaic race—who for some reason or other have quit their ancestral ALTIPLANO home and are now living on the uppermost fringe of the montaña. Many of them have small CHACRAS—tiny forest farms—where they may grow corn, bananas, coffee, YUCA (*Manihot*), PAPAS JAPONESES (*Colocasia*), or COCA (*Erythroxylon Coca*). At home and afield they are sure to have a stimulating wad of their favorite "chew," dried coca leaves, in their mouths and a bountiful supply in a colorfully woven little bag slung at their belts. In order to get a little extra spending money they may harvest a few QUINTALES of cinchona bark from the neighboring forests. Because of the urgency of drying the bark quickly, this work usually falls in the dry season—roughly from May to December.

Cascarilleros have to know their forests for there are no rules on searching out cinchona trees. The saying is: "Cinchona is where you find it."

TWO CINCHONA TYPES—A WORTHLESS AND A USEFUL ONE—FROM SOUTHERN PERU

LEFT: *C. officinalis grows at the highest elevations. This is a valueless, shrubby, narrow-leaved form.* RIGHT: *Photographing flowering branches of "monopol" (C. micrantha).*



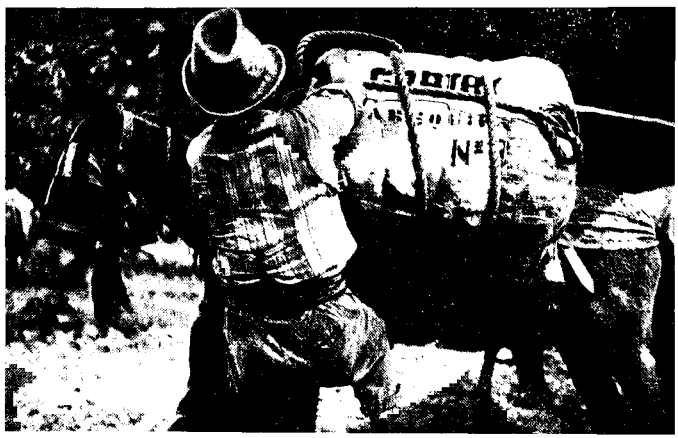
DRYING MONOPOL BARK FOR QUININE PRODUCTION

ABOVE: *Spreading it in the sun at Oroya on the Inambari. Under the frame (left) is an oven for artificial drying during rainy weather.* BELOW: *Working on the bank of the Sandia River.*

Usually, when a tree is seen it will be found to be a member of a small group of the same species, forming what the natives call a MANCHA. Several manchas may occur close together but just as often they may be a mile or more distant. This spotty distribution makes difficult the scientific estimates of the volume of bark available in a given cinchona district.

The universal tool of the cascarillero is the MACHETE with which he fells smaller trees not requiring an axe, and with which he peels the bark, cutting it off in strips of such a length as can be easily packed. The bark of the trunk, the bark of larger branches, and the bark of large roots—all is valuable. Cinchona bark varies in thickness and in external markings depending upon the age and upon the species. Some barks peel easily; others cling tightly. All possess an exceedingly bitter-tasting inner surface which is yellowish-white when first peeled. The color turns in a few minutes to a rusty hue which lightens somewhat after the bark is thoroughly dried. Cinchona alkaloids are very sensitive to light and the color changes in barks are probably the result of this sensitivity; in general, barks rich in alkaloids change more rapidly and to a deeper color than do barks poor in alkaloids.

Cascarilleros work in small groups. One man may fell the trees, another trim the branches, while still another may strip the bark. Women and children often aid in the easier task of bark peeling. They may also help carry the fresh bark to an open area, often a river bank, where it is spread



Loading a mule with cinchona bark ready for shipment.

for the sun and air to dry it. The drying process is a critical one for, unless it is rapid and thorough, alkaloids are lost. Rapid drying is difficult in a rainy tropical region, and for this reason drying by artificial heat in ovens has been introduced in the more important cascarilla districts.

Once dry, Peruvian cinchona bark is ready for that chemical processing which will extract the valuable alkaloids. This is accomplished in the United States. Long before that can take place the bark must be moved by the crudest of transportation facilities—first by human back, by mules, or by burros, often over almost impassable trails, to the upper edge of the montaña: then by trucks which carry it over the rugged Andean backbone on the roughest of roads to the nearest railheads; at collection depots it is analyzed, sorted, and baled for export, and then one day, after a long ocean trip, the bark finally arrives at a North American port. Only then does its journey approach completion.

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.)

Meals From Woods and Fields

EDIBLE WILD PLANTS OF EASTERN NORTH AMERICA. M. L. Fernald & Alfred C. Kinsey. 452 pages, illustrated; bibliography, index. Idlewild Press, Cornwall-on-Hudson, N. Y. 1943. $3.

If you have been reading this Journal for several years, you may recall an article[1] in which cattail spikes were said to make an excellent vegetable. So with an attitude perhaps of skepticism you pick up the Fernald-Kinsey book to see what these two botanical gourmets have to say.

But to open a book like this at random is a dangerous habit if you are looking for a particular subject. First you read that the young leaves of skunk cabbage really can be eaten if they are boiled in several waters with a pinch of baking soda. (I tried them once, insufficiently cooked and without the soda, and found that they tasted like French endive with a strong garlic dressing *plus* a fiery prickle that burned the inside of my mouth.) The golden-club (on the same page) has evidently given its Indian name of "tuckahoe" to a town in Westchester County. Both the seeds and the tuberous roots, when properly prepared, can be used for making bread. But this is a troublesome family to deal with unless one is seriously in need of food—or has a strong desire to experiment. The calcium oxalate crystals which inhabit the tissues of aroids make eating unpleasant unless they are disintegrated by drying, baking, or boiling.

Daylilies offer a much more palatable and accessible food, found along nearly any country roadside as well as in most gardens.

> "The fully grown buds or the freshly expanded flowers of *Hemerocallis fulva* immersed in a batter of beaten egg, milk, flour, and seasoning and browned like fritters in oil or butter are a delicious and quickly prepared vegetable. . . . The fleshy tuber-like roots, borne in clusters like dahlia-roots, boiled in salted water, taste like a blend of sweet corn and salsify."

The authors also quote from this Journal[2] on the use of daylily flowers by the Chinese in soups.

[1] Hopkins, Milton. Wild Plants Used in Cookery. March 1942.

[2] Stout, A. B. Gum-Jum or Gum-Tsoy: A Food from the Flowers of Daylilies. May 1933.

Dock leaves, you will find on another page, make an excellent potherb. (I will vouch for that, and will add that they are equally good in batter, like daylily flowers.) But few appreciate them, because of prejudice, and a neat little paragraph is quoted from Culpepper to prove the point.

Spicebush? It has always been tempting —and with good reason. The young twigs and leaves can be used for an aromatic tea, and the dried berries have been used as a substitute for allspice.

Two plants (and possibly many more) will provide a coffee-substitute, if they happen to grow in your region—the Kentucky coffee-tree and the wild senna; yes (turning the page), and the seeds of broom as well, though they are not recommended. But there is an inviting recipe quoted from Evelyn on the pickling of flower-buds of broom. That is something to know, since broom has begun to run wild over some of the sandy areas of the East.

Lamb's-quarters will furnish an acceptable flour for bread or muffins, as well as leaves for the potherb with which many are familiar, and the senior author tells an entertaining story of how his dinner guests first refused, and then finally relished the blackfish muffins he had made of ground lamb's-quarter seeds.

Leaves and dried flowers of one of the goldenrods (*Solidago odora*) can provide a tea substitute in time of need. Reading a few lines further, we find that the candied roots of elecampane have long had a use which, the authors say, "sounds like a substitute for bicarbonate of soda."

But what was the plant that we started to look up? It was cattails. So, turning back—and turning too far—we find that the tempting-looking berries of the common wild baneberry of the woods, also of the China-tree, are poisonous to eat. An extensive section is devoted to poisonous plants that might easily be mistaken for edible species. All are illustrated.

Finally, by looking in the index, we find three pages on cattails and how the different parts of the plant may be used for food.

Mushrooms, seaweeds, and lichens are treated at the end of the book, with emphatic warnings given against the poisonous fungi. Recipes for the edible species are offered, but this is the weakest part of the book. The recipes sound too much alike, and the information given about the beefsteak mushroom (*Fistulina hepatica*) does not conform to the observations of at least one well known mycologist, who has stated in this Journal[3] that in America it is known only on stumps of chestnuts.

Many of the thousand plants in the book have been actually tried by one or the other writer. If not, an authority is quoted for their use as food, and the reader is left to make his own decision as to whether or not he would like it.

The only thing I have personally tried —and enjoyed—which is not mentioned in the book is the winter stage of the exudation on red-cedar trees caused by the fungus *Gymnosporangium*. I seized it as possible relief after the skunk-cabbage episode, and found it had a resinous nut-like flavor and texture which made it eminently palatable. I can, however, only assume its safety on the basis of feeling no ill effects after munching half a dozen. And they did relieve the burning from the skunk-cabbage leaves.

CAROL H. WOODWARD.

The Rubber Problem

TREES AND TEST TUBES. Charles Morrow Wilson. 352 pages, bibliography, illustrations, index. Henry Holt & Co., New York, 1943. $3.

Despite its comprehensive title, this is a book about rubber—and rubber only, both natural and synthetic. It will be of signal value to the layman who wants to acquire a background for this much discussed subject; for the scientist it is not adequate.

The author, who has traveled extensively through rubber-growing countries, presents his knowledge clearly and entertainingly. The first part of the book is devoted to the various latex-producing plants, their cultivation, and the methods employed to extract the precious juices. At some length he discusses the social and economic status of plantation labor, and rightly concludes that no industry can nowadays be economically stable in which one set of indispensable workers earns from four to fifteen cents a day while another set, equally indispensable, gets a dollar and more per hour. The

[3] Thomas, William S. The Beefsteak Mushroom. September 1937.

history of the leading eastern rubber companies, their political intrigues, commercial machinations and price fixings, to the detriment of the public and the benefit of absentee directors, is set forth and makes sorry reading.

Our own folly in neglecting the possibilities for the exploitation of *Hevea* in its original habitat, South America, is historically well developed. (Henry Ford is the great exception, but he has not been entirely successful.)

Instead of being pioneers in that field, our capitalists have preferred to put all their eggs into the Sumatran-Malayan basket. How thoroughly those eggs were scrambled is now sad history.

In his discussion of synthetics (or elastometers), the author presents in non-technical language the various methods of production, just now so widely and confusedly taken up by the public press. He tells us in terms of dollars, cents, and tonnage just what we can expect during the next few years; and he concludes that here, too, we are being sold down river. After comparing the "plant" cost of $200 per ton per year for rubber obtained from commercial waste-product alcohol with the cost of "from 700 to 1,000" per ton for that made from petroleum, the author sadly concludes (page 131, italics mine):

"It is noteworthy that the Rubber Reserve Corporation and the Co-ordinator of Rubber for the War Production Board *have chosen to regard rubber made from grain* or other vegetable alcohols as an *untried experiment and rubber from petroleum an accredited success*—a view not only unsupported but *flatly contradicted by the facts*. It is also noteworthy that the placid continuation of an exclusive rubber-from-petroleum experimentation would succeed in giving *unchallengeable control of the synthetic rubber industry* to fewer than twenty corporations, including *seven major petroleum companies and four rubber companies*, namely, Goodyear, Firestone, United States Rubber, and Goodrich, which in effect are assigned the immensely strategic mission of fabricating butadiene into rubber." We can see where that leads to.

The third part of the book deals with statistics, percentages of rubber used in all sorts of war material, the scrap and conservation problems, how to save your tires, and the like. Incidentally, the author is more pessimistic than events—so far—have warranted. He predicted that by the end of 1943 most privately owned tires would have been taken over by the government. But never mind, it may yet come to that.

ADRIAN VAN MUFFLING.

BROADCAST

BEGONIAS, if given proper moisture, light, and temperature, can be grown successfully in a sunroom even when they have to be left untended for ten days at a time, according to S. P. Miller, who spoke on the Garden's radio program Jan. 28. Mr. Miller has about 200 begonia plants of nearly 150 species and varieties in his own 12 by 24-foot sunroom in Scarsdale, New York, and he has solved the problem of keeping them growing in spite of the fuel shortage and the fact that he is often away on business trips. Some quotations from his radio talk are given here.

Managing the Plants When Away

"I experimented until I found a way of holding a small amount of moisture around the plants for a ten-day period. Once I tried ordinary wooden plant boxes, thinking that their self-insulating quality would keep the roots properly moist, but they were not successful. Finally, I had 15 wooden trays built, 3½ to 4 feet square and 6 inches deep, lined with builder's felt and roofing pitch to make them watertight, and I filled them to the top with builder's sand. I plunge my begonia pots deep in the sand, and keep the sand moist but not wet by dousing it with water from the top. It will stay moist for a week or ten days."

Temperature in the Sunroom

"Most of my plants grow successfully all winter long in a temperature as low as 40 degrees. A radiator mildly warm prevents freezing. Even though many of these plants have come from tropical regions, this temperature does not seem to be too cold for them. *B. imperialis*, for example, is a tropical begonia which

grows well under these conditions. If you accustom begonia plants gradually to a lowered temperature, then keep them constantly where it is fairly cold, they will usually adjust themselves. While they grow more slowly and bloom less than in a warmer room, they certainly do better than if the temperature varies widely and irregularly. At least, that is my experience. My problem has been to keep my begonias growing with a minimum of care in the winter and this is the way I have solved it. If there had not been a fuel shortage, I probably would never have learned how well most begonias tolerate low temperatures."

Cultural Requirements

"The majority of my plants can be treated alike. They take an acid soil, rich in humus, but light and rather porous, and, except for the desert types, an abundance of moisture at intervals. Almost all resent drafts and sudden changes of temperature. Only a few like direct sun; the beefsteak begonia (*B. Feastii*), is one and another is *B. Templinii,* a begonia that almost anyone can grow under ordinary household conditions. (I have a four-foot specimen of it myself.) A half-dozen others, besides my semperflorens varieties, live on the sunny side of the room. These are easy to manage, but some of the begonias do present different problems. *B. Feastii,* for example, likes a heavier soil, containing more clay. The desert varieties, such as *B. venosa* from Brazil and *B. incana* from Mexico, insist upon less water than the others and also require a much lighter soil. They are also difficult to propagate."

Starting Begonias from Cuttings

"I use a goldfish aquarium, 14x24x14 inches high, fitted with a tight glass lid and located in the sunniest spot in the room. On the bottom is an inch of crushed rock, then 1 inch of sphagnum to support the sand, and a top layer of 3 inches of builder's sand. The 8 to 9 inches of air space is sufficient until the new plants are ready to be potted. If the sand is properly moistened and the lid tight, the cuttings need practically no attention. To keep molds from developing and injuring the plants, I put a few mothballs in a small tray. Rex begonias, also the beefsteak begonia and imperialis, are propagated by inserting a triangular piece of the leaf upright in the sand. Rex may also be propagated by laying a leaf flat down on the sand. Most of the others require stem cuttings, a piece of a branch with a leaf (or part of a leaf) attached being inserted in the sand. I often make the hole for the stem with the blunt end of a pencil, then press the sand firmly against the base of the cutting, perhaps an inch or an inch and a half deep in the sand.

"For propagating in summer I use a deep flat filled with builder's sand and plunged in the ground in a moist sheltered spot with plenty of north light."

Care of the Plants in Summer

"Most of my plants go outdoors in the summertime; some in the shade on the porch. I tried several spots in my garden and finally put them north of a quince tree, using a lath shelter for full protection against direct sun. I plunged the pots in the soil, which was a heavy clay, and they all perked up immediately. I hosed them well every night that I was home, and they liked it. Even the difficult ones came through the summer successfully. Most of them lost their leaves when they were brought indoors in the fall, but they all grew out again. Except for my few semperflorens varieties, I never cut my begonias back in the fall. I just let them keep on growing."

* * *

Mr. Miller confesses having two ideas in mind as he increases his collection: to obtain as great a variety as possible in shape of plants, texture, form and coloring of leaves, and appearance of flowers, and to obtain as many different geographical types as possible. He has prepared a list of what he considers his outstanding varieties in these categories. For three cents to cover postage (two cents in Manhattan and the Bronx), the New York Botanical Garden will mail a copy of Mr. Miller's list to those requesting it.

Notes, News, and Comment

Members' Day. Sketches and photographs made by Dr. H. W. Rickett while he was in Mexico last summer for the Committee for Inter-American Artistic and Intellectual Relations were shown during the Members' Day program at which he was the speaker Feb. 2. Mexican plants, particularly succulents and begonias, were among the specimens brought from the greenhouses for exhibit. Many orchids were included in the afternoon's horticultural display. In his talk, Dr. Rickett told of the areas of Mexico that were still virtually unexplored botanically, areas, he said, that should yield many species of plants of horticultural value.

A member of the Garden, Mrs. John C. Stilwell of Mt. Vernon, brought for exhibit a fern that she had kept growing luxuriantly for several years in a pot provided with a wick which draws chemically infused water toward the roots.

Each member who attended the program of Feb. 2 was presented with a small potted geranium propagated from the Garden's large collection of *Pelargonium* varieties.

The speaker for Members' Day on March 1 will be Rutherford Platt, who will show some new kodachromes of seedpods which he has made during the fall and winter.

Portraits of Botanists. For the opening of an exhibit at the Grolier Club in New York, showing portraits of botanists and of plants which have been named for them, Dr. William J. Robbins was invited to give the principal address on Dec. 14. The exhibit, entitled "Great Names and Subjects in the History of Botany and Horticulture," was arranged through the co-operation of the Garden Club of America. A large number of the portraits of the plants concerned, as well as some of the men, were provided by the New York Botanical Garden. Most of the portraits of the botanists and horticulturists came from the private collection of Mrs. Roy Arthur Hunt of Pittsburgh.

In Dr. Robbins' address, which was published in the February Bulletin of the Garden Club of America, he revealed some little known details from the lives of the Tradescants, John Evelyn, Gaspard Bauhin, Philip Miller, John Fothergill, Sir John Hill, John Stuart (Earl of Bute), James Edward Smith, François André Michaux, and others.

Fruit Culture. Tickets for the two lectures on the culture of fruits in the home garden, to be presented at the conclusion of the four lectures on vegetable gardening being given on Thursdays in the New York Times Hall, will be issued free upon application to Dorothy Jenkins, Garden Editor, New York Times, 229 West 43rd St., New York 18. Arthur King will speak Feb. 24 on tree fruits and Edwin Beckett the following week on bush fruits and berries. Both lectures will be given at 8:00 p.m. The New York Botanical Garden is co-operating with the New York Times in offering this free course of lectures on gardening. A discussion period follows each talk.

Addisonia. Circulars are being mailed announcing that the twenty-one completed volumes of *Addisonia*, dating from 1916, are being offered for sale by the New York Botanical Garden for $75. The established price is $10 a volume, each volume consisting of four numbers with a total of 32 colored plates accompanied by descriptions of plants of unusual interest. *Addisonia* is the only publication of its kind in America.

A.A.A.S. Dr. William J. Robbins has been elected a member of the Council of the American Association for the Advancement of Science. Chosen at the same time was Dr. George B. Pegram, Professor of Physics and Dean of the Graduate School at Columbia University.

Visitors. Marcel Raymond of the Montreal Botanical Garden is spending a month in New York to study means of identification for plants under cultivation and methods of publicity at the New York Botanical Garden.

Dr. William J. Bonisteel, home for a brief visit during the holidays, stopped at the Garden just before Christmas. He expected to return immediately to his work in the production of drug plants in tropical America.

Dr. F. R. Fosberg, who is in charge of the search for cinchona in Colombia, spent Jan. 11 at the Garden.

Other midwinter visitors have been Frans Verdoorn, Waltham, Mass.; L. J. Brass, American Museum of Natural History; H. K. Svenson, Brooklyn Botanic Garden; Mrs. Antoinette Miele Wilkinson, Cornell; Helen Mittlachen, Wheaton College; and John Caulfield, of Bowdoin.

Grenville L. Winthrop. Word has just been received at the Garden of the death in January 1943 of Grenville L. Winthrop of New York City. In point of years of continuous support, Mr. Winthrop was one of the oldest members of the New York Botanical Garden, his annual membership having begun in 1895.

Caroline L. Iselin. A member of the New York Botanical Garden since 1924, Mrs. John H. (Caroline L.) Iselin died Oct. 2. She was a resident of Riverdale in New York City.

Groups. Twenty-eight students from the College of New Rochelle, under Prof. J. Carolyn Ferris, visited the Main Conservatories Jan. 15. Ten students from Adelphi College, Garden City, made a similar trip a month earlier.

Lectures. Dr. Roberta Ma spoke on "Flowers and Gardens of China" before the Little Gardens Club of Greenwich Village Jan. 3. G. L. Wittrock addressed the Plainfield Garden Club Jan. 12 on "Food Plants of the American Indian." Dr. H. W. Rickett spoke at the Arboretum of the Barnes Foundation at Merion, Pa., Dec. 7 on "Gardens of Ancient Egypt."

Conference. Arthur Cronquist was the speaker at the monthly conference of the scientific staff and registered students of the Garden Jan. 21, his subject being "Taxonomy of the Genus *Erigeron*."

Succulent Booklet. A new edition of "Succulent Plants of New and Old World Deserts" by E. J. Alexander is appearing this month. The first edition of 1,500 copies, published in June 1942, has been exhausted for several months, and the demand for this 64-page, illustrated booklet has continued steadily. Based on a series of articles published in the Journal, the booklet treats 350 species and varieties of cacti, other New World succulent plants, and Old World succulents, including the stone and windowed plants of South Africa. One hundred are illustrated, and directions for culture are given.

Vice-Chairman. The Board of Directors of the Horticultural Society of New York unanimously elected Dr. William J. Robbins Vice-chairman for the year at a meeting Jan. 12. He was also appointed to the Executive Committee. The Chairman of the Board is Richardson Wright, who is a member of the Corporation of the New York Botanical Garden. The President of the society is Henry F. du Pont, a member of the Garden's Board of Managers, and the Treasurer is Frederick T. Bonham, an annual member of the Garden.

Torrey Club. Dr. Fred J. Seaver was elected First Vice-president of the Torrey Botanical Club at the annual meeting and banquet Jan. 4. Others named from the Garden's staff are Dr. H. W. Rickett, who continues as Editor; Mrs. Lazella Schwarten as Bibliographer; Dr. B. O. Dodge, delegate to the New York Academy of Sciences; Dr. H. A. Gleason, representative on the Board of the Botanical Garden; and Dr. J. H. Barnhart, one of two representatives on the Council of the American Association for the Advancement of Science. Dr. William J. Robbins, retiring President, was chosen on the program committee. The new President is Dr. Michael Levine of Montefiore Hospital.

Resigned. Alletta Rauch (Mrs. Louis Fredericks), who had worked at the Garden ever since she finished business school in 1927, resigned her position last month in favor of home life. During her nearly 17 years at the institution, she served as secretary to the late Drs. M. A. Howe and P. A. Rydberg, to Dr. A. C. Smith until he left in 1940, and up to Jan. 15 of this year for Drs. A. B. Stout, B. O. Dodge, and H. W. Rickett.

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To reach the Botanical Garden, take the Independent Subway to Bedford Park Blvd. station; use the Bedford Park Blvd. exit and walk east. Or take the Third Avenue Elevated to the Bronx Park or the 200th St. station, or the New York Central to the Botanical Garden station.

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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LITERATURE CITED

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