JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD

EDITOR

VOLUME 44

1943

Published monthly by the New York Botanical Garden
BRONX PARK, NEW YORK 58, N. Y.

COVER ILLUSTRATIONS

1943

EDITORIALS

1943

* See page 239 (October 1943) for probable identification of this plant.

JOURNAL

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THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 517

JANUARY
1 9 4 3

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CAROL H. WOODWARD, Editor

HERITAGE

IT is conceded readily that mass production of war goods that require wood and steel, rubber and plastics, rope and new synthetic products is making heavy demands on the engineers and chemists. What is not realized is that back of much of their work lies the wisdom and toil of botanists.

The war found this country short-handed on many supplies, even for a year of normal production. Where could such former imports as balsa wood, rubber, and sisal hemp be found? How, moreover, was quinine—a winner of battles when available to save men's lives—to be obtained again under wartime conditions? And what could be done about many other drug plants of which the supplies in this country were dangerously low?

Dr. William J. Bonisteel, a special scientific investigator at the Botanical Garden and member of the Corporation, has been sent to the American tropics to direct the production of new supplies of our most needed drugs. Ralph Pinkus, our Arboretum Foreman, is in Guatemala with Dr. John Shuman, a former Botanical Garden student, raising cinchona trees for future quinine. Charles Gilly and two former gardeners, Robert Simpson and Donald Dodds, are in Mexico working on the investigation and production of drug plants. Dr. W. H. Camp is in Haiti supervising the growing of a number of important crops for industrial uses. Frank Mackaness, a former student gardener, is working on cryptostegia for rubber production, also in Haiti. John H. Pierce is now on his way to South America to hunt and study plants of economic importance. And men from many other institutions call frequently on the Botanical Garden for special information on plants they are seeking before they leave for their wartime botanical jobs.

That the New York Botanical Garden today has men, materials, and information with which to serve these critical needs is because of the foresight of those who fostered, supported and carried on the scientific work of the Garden on a broad and enduring base in days of peace. The contribution in trained men and accumulated knowledge and materials now being made to the war is a heritage claimed from the past thirty, forty, even fifty years of effort at the New York Botanical Garden.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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VOL. 44 | JANUARY 1943 | NO. 517

*Mexican Paper-Making Plants**

By Victor W. von Hagen

PAPERMAKING among the tribes of middle America is as old as the civilization of these early peoples. More than a thousand years before the caravels of Columbus made their landfall among the islands of the Lesser Antilles, thereby ending the isolation of the Americas, paper was in general use among the Maya, the dominant tribe on the Yucatan peninsula. The manufacture of this paper, which the people called HUUN, kept pace with Mayan intellectual development until, with the achievement of hieroglyphic writing, it evolved into book form. By the time of the League of Mayapan (800-1200 A.D.) the Mayas had produced a folded book of 75 pages, known as the Dresden Codex, for it had been preserved in the City of Dresden.

This Codex was not an isolated achievement. The Mayas had many books—libraries, in fact—if the Spanish chroniclers may be trusted.

"Among the Maya," writes Bishop Diego de Landa, "we found a *great number of books* written with their characters and because they contained nothing but superstitions and falsehoods about the devil, we burned them all . . . "

But it was the Aztec, as the "heir" of the Maya, who developed papermaking from a craft into an industry. Villages in Central Mexico, particularly in Morelos, were given over to the manufacture of paper, called AMATL by the Aztec, and these papermaking villages—Tepoztlan, Amatlán, Amacoztitla, Itzamatitlan—not only are still extant, but the stone beaters

* This ethnobotanical article is an excerpt from Victor W. von Hagen's manuscript, *The Aztec and Maya Papermakers,* now in final preparation for publication. It is the first work of its kind to deal exhaustively with the origins and uses of Aztec and Maya paper. Manuscript copies of the work are in Mexico and England where simultaneous publication is expected. The limited American edition (250 copies) will have eight original samples of paper in each volume; in the trade edition of about 1,000 copies, the paper samples will be photographed.

which were the instruments of paper manufacture are still the most ubiquitous archaeological remains in their environs.

Under the Aztecs much of middle America was forced into some form of economic synthesis. Trade was extended; so were the levies of tribute. There was an incessant demand for paper, for it was needed to keep track of the villages and peoples tributary to Tenochtitlan and to record the tribute paid by them. Made into rolls thirty feet in length, paper was also used by the Aztecs as by the scribes of ancient Thoth, to record the accretions of conquests. Paper took on too, as among the Chinese, a religious and ceremonial character. Folded into the form of a book resembling closely a modern railroad timetable, it was often made into a sacred almanac, called a TONALAMATL; libraries of such documents were housed in the large Aztec community of Texcoco. Thus a relatively vast supply of paper was required, and we cannot be surprised to find that in the Codex Mendoza, one of the most famed of the tribute charts of Moctezuma II, there is an item which reads:

> "Twenty-four thousand bundles of paper are to be brought yearly to the storehouses of the ruler of Tenochtitlan."

Twenty-four thousand bundles! The word "bundle" is used here to correspond with the Aztec numeral PILLI, a form of the word *twenty* used in counting paper and other flat objects in quantity. It suggests then that 480,000 sheets of paper (and sometimes these sheets were thirty feet long) were paid annually to the Aztec capital by the tribes in tribute to it.

Of what then was all this enormous amount of paper made? "From a tree," wrote Francisco Hernandez in 1570, "from a tree they call the AMAQUAHUITL . . . a large tree with leaves like a fig and with white flowers and fruits arranged in clusters. It thrives in the Tepoztlan mountains where . paper is made from it." This statement comes from the great ethno-botanist whose five-year work in the Americas took place between 1570 and 1575*. Hernandez was deeply concerned with the botany of the Aztecs and the use to which they put each plant within their ken that grew in the great terra incognita of Mexico.

Tepoztlan, a little village in Morelos, was one of the papermaking villages and it was there that Francisco Hernandez saw the people at their work. "Many workmen," he wrote, "are employed at this craft . . . To fashion the paper they cut the larger branches from the tree, soften them in water . . . and on the following day it [the fiber] is thoroughly beaten with a stone beater. It is thus rendered pliable. After this it is next cut into strips which are easily joined together by beating the bark again with a smoother stone . . . Finally this is fashioned into sheets two doldrans (18 inches) long and one and one-half doldrans (13½ inches) wide. It is something like our own paper, except that their paper is whiter and

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* See my article: "Francisco Hernandez—Conquistador of Science," Frontiers Magazine, Philadelphia Academy of Science publication, February 1940.

PAPER-MAKING PROCESSES IN MEXICO

Above: An Otomi woman of San Pablito fashioning paper from the fibers of the "xalamatl." The stone which she holds is used for beating and felting the paper strips together (Photograph by Hans Lenz). Right: An Aztec woman of Chicóntepec making russet paper from the bull's-horn acacia.

thicker . . . The tree is called AMAQUAHUITL . . ." And, good botanist that he was, Francisco Hernandez left us an excellent figure of the tree, which he had already said "had leaves like a fig." So exact is it, that Dr. Paul Standley, the eminent authority of the Flora of the Americas, has had no difficulty in identifying Hernandez' "paper-tree" as *Ficus petiolaris.*

With this as a botanical clue, the writer began ten years ago, during an expedition to Mexico, to search out the trees from which Mexican paper was made. The evidence for a solution of this involved cultural puzzle had been obscured for over three hundred years by the early assertion by unobserving FRAILES (monks) that the Aztecs had made their paper from

The "tecomaxochiamatl" (Ficus involuta) was an important paper-tree among the ancient Aztecs. Still in use today by the Aztec Indians of Chicóntepec, Vera Cruz, it yields a russet-colored sheet of relatively coarse quality. The leaves of this species are shown at the right. (Photographs by Bodil Christensen).

the "leaves of the maguey." Precisely how and in what manner the large succulent leaf of the century-plant could be beaten with a heavy stone beater and formed into smooth sheets of paper was never explained or experimented upon: "Mexican paper was made from maguey" became an archaeological axiom.

Botanico-chemical investigations of the fibers of the paper that made up the ancient Maya and Aztec codices failed to disclose maguey fibers. On the contrary, the tell-tale mark of the *Ficus* lay under the microscope. In the soft fibers, inextricably laced, collapsed hollow tubes were observed—tubes through which passed (when the plant lived) the abundant milk-white sap for which the members of the Moraceae are noted. That ended, for this investigator, the maguey theory. I turned to the *Ficus* trees and, with the help of Dr. Standley, who had written so completely about the *Ficus* species of Mexico, I worked out over a period of years a distribution chart of the genus with altitudes marked and synonyms of the different species given in Aztec and Spanish.

The genus *Ficus,* to which the wild figs belong, contains more than 700 species, fifty of which occur in Mexico and Central America. The genus is divided into five to eight divisions, or subgenera, according to characters furnished by the "fruits"—that is, the receptacles. These structures supply the distinguishing character of the genus, separating it at once from all the other members of the family Moraceae, and likewise from all other plants

Aerial roots of the "cilamatl" (Ficus padifolia), one of the trees which the Aztecs employed for making paper. By using the larger of these vine-like supports of the tree, the Indians avoided cutting off the branches. (Photograph by Bodil Christensen).

of the earth. Although fig-trees often constitute a substantial percentage of tropical forests in any part of the world, and the trees attain great size, they are among the least useful of all the trees of the world—except for this one great exception which has affected the culture of the people in many regions. *Ficus* and its allies, including the mulberry (*Morus*), have furnished primitive peoples nearly everywhere—Chinese, Polynesians, Africans, Mayas, Toltecs and Aztecs—with the fibers from which paper, in one form or another, has been fashioned.

The index made shows the distribution of these plants according to the states and regions of Mexico. Species of *Ficus* have been found growing throughout all the diverse regions of the Mexican soil, from the hot moist *tierra caliente* through the temperate zones to the *tierra fria* at a height as great as 2,600 meters. Special attention has been given in this index to the species of *Ficus* growing in and about the ancient villages where paper was made in pre-Columbian times. While it might be said that all the native species of *Ficus* could serve for the purpose of papermaking, from botanical evidence and from numerous suggestions given by the Spanish chroniclers, it has been deducted by the writer that the following species of *Ficus* were used in ancient Mexican papermaking: *Ficus petiolaris, F. padifolia, F. cotinifolia*, and *F. involuta*. These trees are abundant and moreover they all bore in Aztec etymology the word AMATL in such complex constructions as TEPEAMATL (the amatl-that-grows-on-mountains); AMAQUAHUITL (the paper-yielding-amatl); AMACOZTIC (the tree-of-the-yellow-paper). Now the connection becomes evident.

Early in Aztec history, the word for paper, (AMATL) became associated with *tree*. Now the ancient Aztecs were apparently excellent botanists, and the plant kingdom, as they conceived it, was divided into two great natural orders—the woody plants, which carried the term "quauh," and the herbaceous, "xiuh." Families of plants were formed, based on the special characteristic of some type member, just as in our own botanical system. AMAQUAHUITL, the "paper tree," was, for example, the type-specimen of this family, and every variation of this genus had the term AMA or AMAT in some form in the word, as in the names given above: thus TEPEAMATL (from TEPE, meaning mountain) indicated precisely the habit of *Ficus petiolaris*, and this is the Latin name for the plant known to the Aztecs as TEPEAMATL.

Recently came a remarkable denouement: It was discovered that tribes still living in the modern states of Hidalgo, Puebla and Vera Cruz were fashioning paper by the same primitive method as did their ancestors, the Aztecs. It had been known as early as 1890 that certain Otomis in the Indian villages of San Gregorio and Xalapa, in Hidalgo, made paper; but the ethnologists were not provided with the technical means of associating the fibers used with the plants from which they came.

So, early in 1942, with Miss Bodil Christensen of Mexico as my most

The leaves of the nettle, "teotzitzicaxtl" (Urera baccifera). From the woody stems of this tree paper is made in thin smooth sheets. (Photograph by Bodil Christensen).

able collaborator, an *expedicionilla* was conducted to an isolated Aztec village in Chicóntepec, Vera Cruz, close to the border of the State of Hidalgo. Still living their ancient ways, the Indians there are immersed in milpa-culture—small-scale farming—in a little valley of 1,800 feet altitude. Among their palm-thatched houses they also carry on their age-old traditions as papermakers.

The men go to the forest, peel the bark from the trees, and bring it home to the women, whose technique of manufacture is precisely that which Francisco Hernandez described as used among the papermakers of Tepoztlan 350 years ago. The bark is peeled from the trees, rolled in a bundle and soaked in water *cuando esta tierna la luna*—when the moon is young—then boiled in ashes so as to help break down the fiber. After being washed again the outer bark is removed and the fibrous inner bark is cut into strips; then, by means of a stone or a corn cob (first fired to make it hard), the strips are beaten on a long board until the fibers are felted together to form a homogeneous piece of paper. The sheets approximate 50 x 22 centimeters, and the paper is used for the purposes of black magic. Pieces are cut into little doll-like figures and sold in packages of eight.

Miss Christensen was careful to collect, in each instance, the leaves, flowers, and bark of each specific plant in question and these were identified by Dr. Paul Standley of the Field Museum. All the plants used, with the exception of one unique instance, belong to the Fig, or Mulberry family, Moraceae. In the Chicóntepec village, the Indians use the intertwining aerial roots of the CILAMATL (*Ficus padifolia*) which yields a yellowish-white mottled paper. Another fig, *Ficus involuta,* called TECOMAXOCHIAMATL, produces a russet-colored paper. A nettle (*Urera baccifera*), called TEOTZITZICAXTL, which grows into relatively large woody trees, yields a soft white paper very much like the product made from the CILAMATL. It too belongs to the Moraceae.

The one paper-producing plant not in this family is the bull's-horn acacia. Called HUITZMAMAXALLI, it has been identified as *Acacia cornigera.* The paper made from the bark of this acacia is, as might be expected, coarse, woody, and obviously only a substitute for the fibers of members of the Moraceae. Paper is called by these modern Aztecs CUAHAMATL.

So we see that not only have our deductions proved correct as to the type of plants used by the ancient Aztec papermakers, but that the technique itself has not changed through the centuries in this Aztec village, the single instance available for study today. Papermaking is also widespread among the Otomi Indians of the Mesquital Valley in Hidalgo, but the method is kept secret. However, here again we find the use of *Ficus padifolia* under the name of XALAMATL LIMON (Otomi: MUXI-CONI) and of another species, *F. Goldmanii,* which yields a paper russet in color. Nettles are used by the Otomi natives also—the same species, *Urera baccifera,* and the Otomis likewise use the fibers of the mulberry-tree, called in Spanish MORAL. The mulberries are widespread throughout Mexico and their use may be considered to have been very general for papermaking purposes among the Aztecs. Francisco Hernandez collected and figured mulberries (*Morus* species) by their Aztec name of TLACOAMATL.

One fact that stands out in this ethnobotanical investigation is the preservation throughout the centuries of the word AMATL in one or more of its contracted forms for the principal papermaking plants in the Moraceae. This etymology is also used among the Otomis, whose principal papermaking plant is called the XALAMATL (the sand-amatl). Down the course of centuries through conquest, monarchy, republican and modern Mexico, these linguistics have been preserved.

It is worthy of remark that throughout the tropical and semi-tropical world, wherever man has fashioned paper or made bark-cloth, whether this was made for writing or for clothing purposes, or even for the rites of black magic, some member of the Moraceae has been the selected plant. Moreover, in each instance of bark-cloth fabrication, all primitive cultures have used the beater, which in fundamental structure does not vary from culture to culture.

Left: The bull's-horn acacia, from the bark of which a coarsely-fibered russet-colored paper is manufactured. Both paper and tree are known as "huitzmamaxalli," and the tree has been identified from sterile specimens as Acacia cornigera.

*Right: Muñecos (dolls) cut from fiber paper are used in black magic rites among the Otomis and Aztecs. This is an ancient custom which now, despite 400 years of Christianization, still flourishes in these communities. (Photographs by Bodil Christen-
sen).*

In the identification of the species from which Mexican paper was made, along with the synchronization of taxonomy with native words, we can see the importance of ethnobotany. By the means of these investigations (in which the sciences were brought together) we have been able to explain a great cultural puzzle: Who were the papermakers? How did they make their paper? Of what did they make their paper and what did their paper mean to their civilization?

Thus one more hiatus in the cultural history of the Aztec has been closed through the agency of ethnobotany.

Winter Lectures at the Garden

The series of ten winter lectures given on Saturdays at 3 p.m.. beginning Jan. 9, includes three speakers who have never before appeared at the New York Botanical Garden, and one, Mrs. Mortimer J. Fox, who has not appeared on a Saturday program. Mrs. Fox's lecture on herb gardening will be modeled on the talk she gave at the Garden last April during the Herb Conference. The three new speakers are Mrs. R. A. Wetzel of Mt. Vernon, an amateur photographer of rare ability; Mr. Rodney Wilcox Jones, who raises orchids in his own private greenhouses at New Rochelle, and Mr. George S. Haight, who will accompany the new natural-color motion picture of Westchester County's parks and parkways. Dr. E. E. Naylor, a new member of the Botanical Garden's staff, will give the same talk which brought a record crowd to the lecture hall two years ago when he appeared on the program as a visiting botanist. The complete schedule of lectures follows.

Jan. 9 ***Ornamental Fruits and Berries in the Winter Garden***
Howard R. Sebold, Columbia University

Jan. 16 ***Pre-War Rambles in Northwestern Greece***
Prof. and Mrs. Clarence H. Young

Jan. 23 ***Dye Plants of the American Indians***
G. L. Wittrock, Custodian of Herbarium, N.Y.B.G.

Jan. 30 ***Orchids for the Amateur***
Rodney Wilcox Jones, President of American Orchid Society

Feb. 6 ***Growing Your Own Vegetables***
T. H. Everett, Horticulturist, N.Y.B.G.

Feb. 13 ***Westchester's Parks and Parkways***
A Motion Picture in Color
George S. Haight, Supt. Westchester County Park System

Feb. 20 ***Getting New Plants From Cuttings***
E. E. Naylor, Technical Assistant, N.Y.B.G.

Feb. 27 ***Thirst-Quenchers for the Duration***
Ralph H. Cheney, Long Island University and Brooklyn Botanic Garden

Mar. 6 ***Plant Life Through Changing Seasons***
Recorded in Kodachrome *Ruth N. Wetzel*

Mar. 13 ***Herb-Growing in the Home Garden*** *Helen M. Fox*

Rubber From A Hardy Tree

By E. E. Naylor

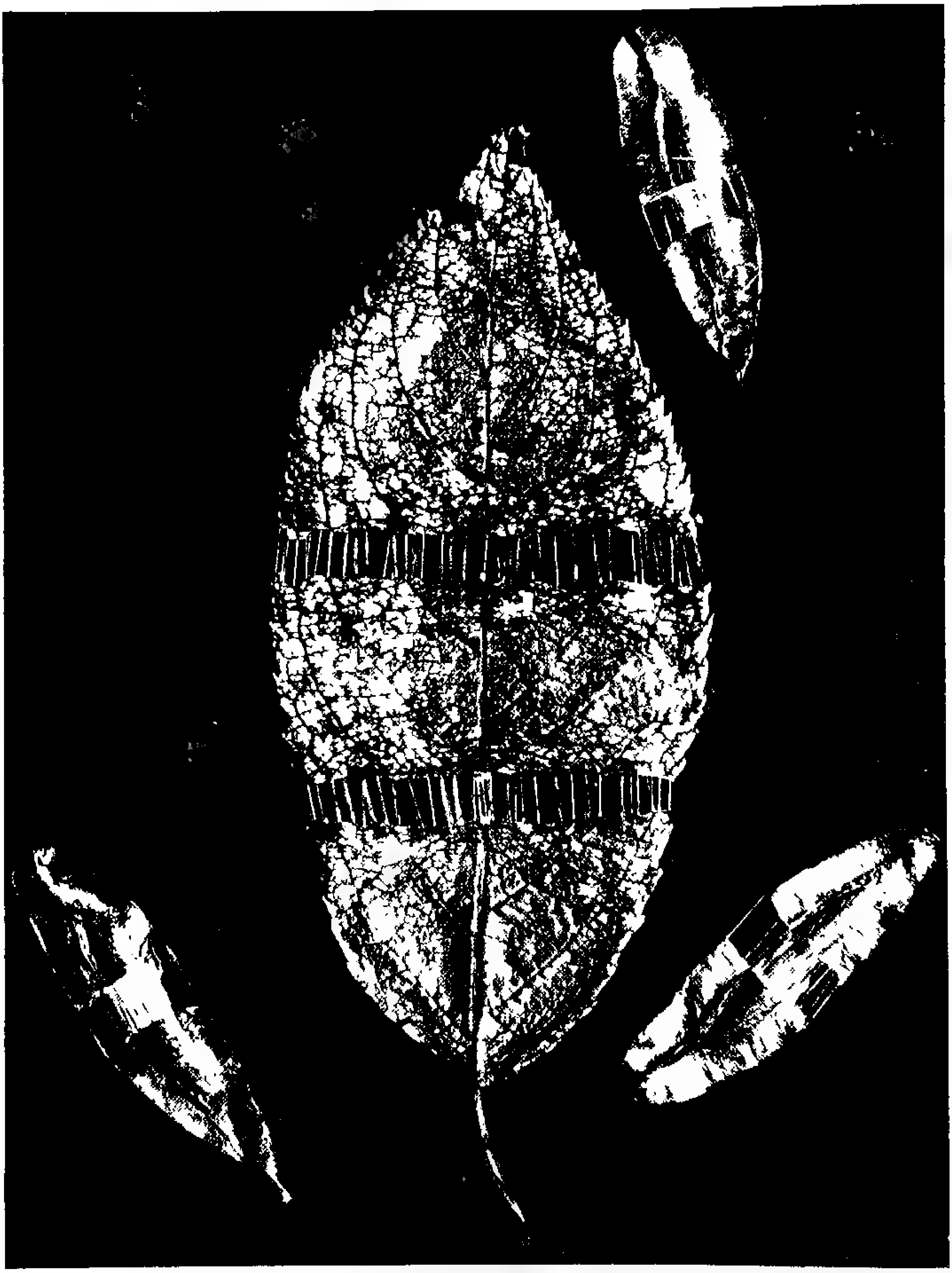
THE verdict still stands against possible exploitation of the ornamental *Eucommia ulmoides,* which has been designated as "the only hardy rubber tree," because its 3% of rubber content is considered too insignificant for commercial extraction. Still, a fairly abundant supply of elastic substance exists in nearly all parts of the plant. If a piece of the bark, a fruit, or a leaf is broken and pulled apart, numerous fine strands with a silvery luster appear, and they will stretch about a centimeter before they snap in two. In the leaf these threads always appear from the broken ends of the veins, for they are definitely associated with the branching vascular system. The wood, or xylem, and the embryo inside the dry fruit are the only parts of the plant free of this material.

The yield is about 3% of the dry bark weight and slightly over 2% of the dry leaf weight. Reports from the Royal Botanic Gardens at Kew in 1921 stated that the quality of the rubber contained was excellent but that the yield was considered too low to make eucommia one of the important rubber-producing plants.

The elastic constituent exists in a dry, solid condition in the living plant. This peculiarity is shared with *Parthenium argentatum,* source of guayule rubber, and with *Chrysothamnus graveolens,* the rabbit-brush of the Southwest, another plant which has been considered as an emergency rubber-producer. Because of this, the elastic threads can be observed in the dry bark of the tree or in the old dead leaves picked off the ground during midwinter.

A chloroform extract made from the ground leaves has a dull brown color with slight metallic reflections. When it is poured into boiling water, a soft black material is deposited on the surface. Rolled into a ball while hot, this substance is quite elastic, but it tends to harden as it cools, apparently losing most of its elastic properties. It is free from stickiness. When ignited it produces a heavy black smoke and the characteristic odor of burning rubber.

It is evident from the dry condition of the rubber that it can not be obtained by any tapping process. Extraction from ground portions of the plant with chemical reagents is the only method thus far described. Obtaining rubber from such a tree as eucommia would, therefore, necessitate some method of annual pruning or of stripping off portions of the bark, unless the trees themselves were to be sacrificed. It has been said that the leaves, with only 2%, would probably not supply sufficient quantities of rubber to be of commercial usefulness, yet, if the tree were to be exploited, the annual crop of leaves might in the end prove to be the most practical method for obtaining rubber.



A leaf and several fruits of Eucommia ulmoides, showing the elastic fibers which exist in most parts of this hardy ornamental tree from China. (Photograph by Fleda Griffith).

The carrier cells in *Eucommia* differ considerably from those in such plants as *Hevea* or *Manihot*. In these true latex-bearing plants the system constitutes one complicated network arising from the branching and anastomosing of cells originally present in the embryo. When the system is broken at any point, as by tapping, the contents flow out for a time. The thin-walled cells bearing the solid rubber in eucommia do not branch or unite, nor are they present in the embryo. They originate from parenchyma of the vascular system and elongate rapidly as the elements of the vascular system differentiate. At maturity each cell is extremely elongated and uniformly filled with this homogeneous elastic substance. In a leaf which has been made almost transparent with bleaching reagents, these groups of rod-like cells are very conspicuous as they follow the branching veins. The rubber is also present throughout the leaf in small globular masses generally distributed within the parenchyma of the mesophyll without any reference to the veins.

Eucommia can be easily grown from seed. Apparently there is no dormant period, for seeds gathered here at the Garden germinated within three to five days after they were removed from the dry fruit and placed on moist blotting paper. According to the Royal Botanic Gardens' report, the seedlings grow well on a variety of average-quality soils. A group of Kew seedlings reached a height of 15 feet after 10 years. The tree may be propagated by cuttings taken in midsummer from the current year's growth and rooted after a few weeks in moist sand. Plants grown from cuttings need pruning and training for the first few years to prevent them from becoming bushy and spreading. Layering is also a possible means of propagation.

Though still rare in cultivation, the tree appears to be perfectly hardy in this vicinity, and will grow as far north as the Arnold Arboretum in Massachusetts. Two healthy specimens have been growing since 1912 on the grounds of the New York Botanical Garden, and at the present time they are about 25 feet high.

A native of China, where it is called TU CHUNG, *Eucommia ulmoides* is similar to our common elm in appearance and habit of growth. The Chinese hold it in high esteem as a drug and general tonic, although its actual therapeutic value is doubtful. Experiments with the bark have resulted in the extraction of only 0.038% of alkaloids. In the mountainous regions of central and western China the tree is cultivated in small plantations and the bark is sent to large cities for local use or for export.

Taxonomically, this tree occupies a somewhat isolated position. It is the only member of the genus *Eucommia* (established by Oliver in 1890), and *Eucommia* is the only genus in the family Eucommiaceae. It is rather closely related to the witch-hazel, though in appearance, as its specific name indicates, it somewhat resembles the elm.

Cold Kills Greenhouse Plants After Fire Which Damages Propagating House

FIRE which broke out in the heating plant of the propagating houses around 4 a.m. on December 17 destroyed the service building at the entrance to this range of greenhouses and resulted in the loss of most of the plants in the range, mainly by freezing. The monetary loss has been estimated to be around $50,000 for the reconstruction of the heating system and the damaged part of the building and for replacement of the plants. Some of the exotic specimens can probably not be replaced until after the war. Indoor and outdoor displays will be affected during the coming year but by suitable adjustments it is expected that the Garden will continue to maintain exhibits of beauty and interest.

Except for the loss of several hundred winter-flowering begonias, the Christmas display in the Main Conservatories showed little effect of the disaster, for the poinsettias and other plants were saved, and much of the material to be used for the Nativity scene was already growing in Range 1.

The fire on this extremely cold morning first became evident with the appearance of smoke from beneath the floor boards. William Hawkes, night furnace-man, immediately telephoned the fire department. Dr. William J. Robbins, who was also called, and T. H. Everett drove immediately to the Garden, but by the time they arrived the heating plant was

ATTEMPTING TO SALVAGE PLANTS FROM THE COLD AFTER THE FIRE

Above: An effort was made to save one or more specimens of each plant that could not be easily replaced. Azaleas and other shrubby ornamental plants are shown here, with one jasmine in standard form. Below: Poinsettias being wrapped for transportation to Range 1, where they comprised an important part of the Christmas display, which opened a few days later. (All photographs by Dan Israel, used by courtesy of the New York Herald Tribune).

gutted and many panes of glass were broken in the adjacent houses of the range.

Already on the scene, in response to the nightman's call, were A. J. Corbett, A. C. Pfander, and Joseph Tansey, Greenhouse Foreman. The first job to be done was to determine which plants had greatest value because they could not be easily replaced, then to save some specimens of every kind in this group that could be salvaged. Nevertheless, the loss represented probably more than half of the different kinds of plants in the greenhouse, and amounted to more than 80 percent of the actual numbers of plants growing there.

This greenhouse range was the one used for the propagating and growing on of specimens to be used for display in Range 1, also for part of the summer's outdoor displays, as well as for the maintenance of material of scientific interest and of use in the instruction of classes. Material from the greenhouse formerly known as Range 2 and from the old propagating house, both on the east side of the grounds, had been moved into this "new prop" only last fall, upon completion of extensive installations and modifications by the W.P.A. supplemented by the Garden's forces. The greenhouse was formerly occupied by the Park Department of the City of New York, and was acquired by the Garden in 1940 as part of the agreement made between the City and Garden relative to an exchange of land.

About half of the space in the greenhouse, at the time of the fire, was occupied with material of permanent character, specimens of which were to be transported to Range 1 and outdoors during their blooming season. There were a great many plants from Australia, for example—acacias and pittosporums among them—all of which were lost. Jacobinias, which were counted on for brilliant bloom in the Main Conservatories later in the winter, also succumbed to the results of the fire. Specimens of cryptostegia, being used for experiments on rubber, as well as a number of plants being cultivated because of their pharmacological importance at the present time, were also lost. Many large azaleas planned for spring display in Range 1 were destroyed. Cyclamens, cinerarias, snapdragons, stocks, and narcissi, all of which were counted on to hold important places in the indoor garden arrangements of the coming months, had to be abandoned and were killed by the cold. Of stock material, from which new plants can be propagated, at least one or two specimens of each were saved so far as possible.

The Garden's large collection of hybrid amaryllis (*Hippeastrum* varieties) and related species, including the rare blue amaryllis from Brazil (*H. procerum*) were saved, along with several hundred calanthe orchids, by laying the pots on their sides in tiers and covering them with salt hay and burlap. About 4,000 plants from the Garden's large collection of orchids were loaded into wheelbarrows, covered with mats, and moved to the root-cellar, which was kept above 32 degrees Fahrenheit with the aid of kerosene stoves brought for the purpose.

Every gardener who could be spared was called into service at the scene of the fire, and the success in saving plants was due to their well organized

For Replacement of Plants

NOT only is time required for the replacement of plants that were lost as a result of the greenhouse fire December 17, but an expenditure of money, as well, must be made in building up again the collections that had been assembled and cultivated over many years. The Garden does not have reserve funds with which to meet such disasters, but it does have friends, as evidenced by the numerous telephone calls and notes of sympathy which followed the fire. Significant among the messages received was one from Mrs. Elon Huntington Hooker, member of the Board of Managers and former Chairman of the Advisory Council, for it carried with it a check for five hundred dollars to aid in the purchase of plants for replacement. A gift like this is a heartening beginning in the task ahead—the task of replenishing stock of the valuable plants that have been lost.

efforts. Mrs. Lucien B. Taylor of Boston, who was at the Garden doing volunteer work in the greenhouses, offered her services too and aided the regular gardeners greatly in their work of rescuing the plants. Poinsettias and some other plants were individually wrapped and carried to Range 1 as soon as the outside temperature was high enough to permit of safe transportation in a truck. Specimens of *Primula kewensis* were saved, also 40 or 50 plants of *Begonia socotrana*. The primula, a yellow-flowered sterile hybrid, is believed to be the only stock in this country representing the true cross. The variety originated at Kew Gardens in England when *P verticillata* from Arabia accidentally crossed with *P. floribunda* from the Himalayas. *Begonia socotrana* is valued because it is the species from which the floriferous winter-blooming begonias have all been derived. This parent species, which comes from the island of Socotra in the Indian Ocean, is little known in cultivation and it might not easily be replaced. New stock of most of the hybrids, however, can be obtained perhaps in time for display in another year.

Plants which could not be saved were taken from their pots at once to avoid the bursting of the pots from the freezing of their soil, and the labels were collected from all of them for record. Houses which could be kept closed—where no glass was broken—were kept above freezing by fires built in empty oil drums. As rapidly as possible, salvageable material was moved to Range 1, where space was made for it.

Part of the loss in the fire included many records as well as considerable equipment.

Plans are already drawn for reconstruction of the damaged part of the greenhouse with a minimum use of critical materials, and it is hoped that the houses will again be in running condition by next fall.

Marshall A. Howe Fellowship Established For Research in Cryptogamic Herbarium

TO perpetuate the memory and work of Dr. Marshall A. Howe, for 35 years a member of the staff of the New York Botanical Garden and for the last two years of his life its Director, a summer fellowship has been established in his name through a gift of Mrs. Elon Huntington Hooker. This initial contribution to the Marshall A. Howe Fellowship fund will allow one scientist to work for the summer of 1943 at the Botanical Garden, and Dr. Margaret H. Fulford, Assistant Professor of Botany at the University of Cincinnati, has been appointed as the first recipient of the fellowship. Dr. Fulford has already spent several summers and periods of leave, including much of the time on her Guggenheim fellowship last year, working in the Garden's Cryptogamic Herbarium, so her familiarity with the collection here will give her work a special value.

Future summers of work in this department will depend upon additional contributions to the fund which Mrs. Hooker has established.

"It is hoped that friends of the Garden will make it possible to continue this fellowship annually," Dr. William J. Robbins said in commenting on the gift.

"There is a three-fold purpose in establishing this fellowship," he explained. "First, there is the desire to memorialize the scholarly and sympathetic, charming, and friendly personality of Dr. Marshall A. Howe; second, to make it possible to continue work on the collections of lower plants on which he himself did so much, both in assembling and studying them; and third, to extend our knowledge of these groups of plants and familiarize others with them."

Dr. Howe's chief personal interest was the algae, but he was also concerned with all the lower forms of plant life as represented in the Cryptogamic Herbarium at the Garden.

Dr. Harper Resigns From Board

AFTER serving on the Board of Managers of the New York Botanical Garden for more than thirty years, Dr. Robert A. Harper, Professor Emeritus of Botany at Columbia University, resigned from the Board in November. Dr. Charles W. Ballard, Dean of the College of Pharmacy at Columbia, has been appointed to succeed him.

Dr. Harper was first made a Scientific Director of the Garden in July 1911, and when this body was abolished in 1933, he was appointed to represent Columbia University on the Board. During the past few years, since his retirement from Columbia, he has made his home at Bedford, Va. He reaches his 81st birthday anniversary Jan. 21.

The Board of Managers passed the following resolution as a tribute to him at the December meeting.

Resolved, that the Board of Managers of The New York Botanical Garden in accepting the resignation of Dr. Robert A. Harper express their sincere regret at the severance of this happy relation which has existed for over thirty years.

Resolved further, that they formally include in the record of their proceedings this testimony to the deep appreciation they have for the years of valuable service which Dr. Harper has rendered this institution and to the sense of great loss which they feel personally and officially at his departure.

They wish, furthermore, to express the hope that good health will permit him many more years of usefulness to the community and to assure him of their continuing good wishes

Miss Wheeler Retires

CONCLUDING 31 years of work at the New York Botanical Garden, Miss Margaret Wheeler was retired January 1. She had directed the mounting of all the specimens of flowering plants and ferns over a period in which nearly a million sheets were added to the herbarium. Of these she personally handled approximately half.

For many years Miss Wheeler worked entirely alone. It was only during the period when the Federal Work Projects Administration and its predecessors furnished help for the New York Botanical Garden that she had a crew of workers to assist in the mounting of specimens. There were 35 women placed under her supervision at first, in 1930, and every, one of them had to be trained for the job. In the past three or four years, until the W.P.A. departed in April 1942, there were 17 or 18 workers regularly, some of whom had been on the project since the beginning.

Miss Wheeler's successor is Miss Mary Ashley, who had worked under her direction for four years.

Plants from all over the world have gone through Miss Wheeler's hands—thousands of Asiatic specimens brought to the Garden by Dr. E. D. Merrill; the collections of Hawaiian and more lately of Fijian specimens from Otto Degener; the Killip & Smith collections from northern South America; examples of economic plants from the tropics throughout the world, representing the work of B. A. Krukoff; plants from India brought here by Dr. R. R. Stewart; only a few from Africa and the Arctic and Antarctic zones, but many from all parts of North America; and sometimes a collection that was made many years ago.

The mounting of plants for herbarium reference consists of far more work than is suspected by a casual glance at specimens.

When the plants are first received they are tied in bundles of newspapers and each specimen has a crude field label attached to it. To kill the insects, insect eggs, and fungi that the plants may harbor, they must each be dipped in a solution of bichloride of mercury and alcohol, then thoroughly dried for two days. Then each specimen is neatly glued to a standard-size herbarium sheet—16½ by 11½ inches—and is further held in place by strips of gummed linen. Seedpods and other bulky structures are in addition sewed down, while seeds or other loose parts are often enclosed in a small envelope which is glued to the sheet.

Meanwhile labels are typed to correspond with the field labels that are found with the original specimens, and these are matched up and pasted to the lower right-hand corner of the sheet.

But even this is not all the job that Miss Wheeler has had to handle, for the constant use of the material in the herbarium necessitates frequent repairs, and these she has always done herself. The neatly mounted specimens in the herbarium are a tribute to her years at the Garden.

Miss Wheeler is a sister of Mrs. Percy Wilson and of the late Mrs. John K. Small. In December a dinner was given in her honor by the other women who are working for the New York Botanical Garden.

Lessons in Vegetable Culture Offered by Botanical Garden

VEGETABLE gardens wherever it is practical to have them will play an important part in meeting the critical food situation in the United States during the months to come. The more carefully these gardens are planned and prepared, the more abundant will be their crops. Raising successful vegetables, gardeners are learning, is not a mere matter of sowing a packet of seed in lightly raked soil and then waiting for the plants to mature, but it involves selection of the best kind of seed (or of healthy young plants to set out), deep digging and fertilizing of the soil, raking and tamping, sowing, watering, then constant care until the crop is ripe. It even involves the proper time and method of harvesting each crop in order to get the best value from the vegetables.

All these points are conscientiously taught in the New York Botanical Garden's spring course in Vegetable Gardening, which will begin on Monday evening, Feb. 15, and will meet for two hours that night and also on March 1, 8, 15, 22 and 29. The two instructors will be James B. Jack and Arthur King, who taught a large class a year ago in the same subject and who also took part in the Victory Course in Vegetable Gardening given last year by the Garden in co-operation with the New York Times.

Later in the season, March 29, 30, and 31, the New York Botanical Garden will offer a Three-Day Short Course in Vegetable Gardening.

Notes, News, and Comment

To South America. John H. Pierce was scheduled to leave New York January 12 on a wartime assignment in South America for the Pan-American Products Corporation. He is to collect and make a survey of certain critical plant products that are needed in war production.

Colombia, Venezuela, and Brazil are expected to provide the field for his tropical research.

Another to Haiti. Frank G. Mackaness, who was an exchange student gardener from Kew for a year in 1937-38 and who has since been head of the Garden School at Dillard University, New Orleans, has gone to Haiti as Assistant Divisional Manager of Cryptostegia Activities for SHADA. His work there will be allied to the work that Dr. W. H. Camp is superintending for the same organization.

New Printing. The three volumes of Britton & Brown's "An Illustrated Flora of the Northern United States and Canada" will be reissued during the current year in a new printing of 700 copies to meet the steady demand for this standard work.

Returned. Dr. John H. Barnhart, Bibliographer Emeritus, has returned to his desk at the Garden after spending the summer at his home at Southampton, Long Island.

Conference. Dr. Frances E. Wynne spoke on the moss genus *Drepanocladus* in North America at the monthly conference of the staff and registered students of the Garden Dec. 9, and Dr. H. A. Gleason reported on his recent work on the flora of North America.

Research. Dorothy Longacre, who is a candidate for a Doctor of Philosophy degree at Columbia University, is working on the nutrition of the Dermatophytes—the fungi that cause human disease—in the laboratory of Dr. William J. Robbins at the Garden. Miss Longacre was formerly an assistant in the laboratory of Dr. William J. Bonisteel at Fordham University.

Movie. G. L. Wittrock showed the Garden's motion picture Dec. 8 to the Chicago Academy of Sciences.

Members' Day. YANGONA (called KAWA or KAVA in some of the islands of the Pacific and known as AVA in Hawaii) was served to members and their guests at the Members' Day program January 6, when Otto Degener spoke on "Collecting Plants in the Fiji Islands." The drink, which is made of the ground root of *Piper methysticum*, is in common use in Fiji and on other islands. It was mixed in a ceremonial wooden bowl from Fiji and, in traditional fashion, was dipped with a coconut shell. The Members' Room was ornamented with tapa cloths, made from the beaten inner bark of trees, and other native objects which Mr. Degener brought with him on coming to New York. There were also plants from the greenhouses on display, and the Advisory Council served tea and maté after the lecture.

Among the guests were Mrs. Ann Archbold of Washington, D. C., who sponsored the expedition on which Mr. Degener went to Fiji; Mrs. Adrian Archbold, her daughter-in-law; and Mr. and Mrs. J. R. Ashley of Scarsdale, world travelers, who also were familiar with the region of which Mr. Degener spoke.

Dr. A. B. Stout gave "Some Simple Facts About Plant Breeding" at the December Members' Day program. The next talk will be presented by Dr. H. W. Rickett, Feb. 3. With the title of "'A' Stands for Allium" he will explain the significance of botanical names for garden plants and will tell some stories of their origins.

Frederick D. Chester. When he came to the New York Botanical Garden in 1935 to work on a special project concerning the Dutch elm disease, Frederick D. Chester was already 74 years of age. A few years later he returned to the Mimex Company, Long Island City, where he previously had been head chemist, and resumed investigations there on rubber, resins, and allied products. He died at his home in the Bronx the evening of January 1, 81 years old.

Dr. Chester had begun his professional career as instructor in geology and botany at the University of Delaware (then Delaware College) after his graduation from Cornell in 1882. He eventually became bacteriologist and mycologist for the Agricultural Experiment Station there and later Director of the State Bacteriological Laboratory. Meanwhile, he had obtained a Master's degree from Cornell, and later the University of Delaware awarded him an honorary Doctor of Science degree.

In his earlier years he wrote extensively on geology and botany, and at the beginning of the century he prepared the first American textbook on determinative bacteriology. Later, Bergey's Manual replaced his in the field; then in 1939, at the time of the International Mycological Congress in New York, Dr. Chester revised the section on the Bacteriaceae in Bergey, bringing that once-modern work again up to date.

For about 20 years he worked in graphite, carbon products, and other phases of industrial chemistry and geology, then went to the Mimex Company in 1922.

He was a charter member and former vice-president of the Society of American Bacteriologists; also a member of the American Chemical Society, American Society for Testing Materials, Franklin Institute of Philadelphia, Society for the Promotion of Agricultural Science, and a fellow of the American Association for the Advancement of Science.

Current Literature At a Glance*

Stamps. Forty-three kinds of trees which have been depicted on more than 400 different postage stamps of countries in every hemisphere are shown in a gift book of the Barclay Madison Corporation and Piling Associates, Inc., New York City, prepared by William D. Cox. Much of the work of identifying the trees and preparing descriptions of them was done in the New York Botanical Garden's library and herbarium.

Stamps showing plants which furnish useful products for world commerce are illustrated in the December 1941 number of *The Chicago Naturalist,* published by the Chicago Academy of Sciences.

Kings Canyon. The dramatic story of the creation of Kings Canyon National Park in March 1940, after 59 years of campaigning, is told by Robert Sterling Yard in *The Living Wilderness*, issued in December by the Wilderness Society. Mr. Yard himself has been an ardent campaigner since 1915, following in the steps of Stephen T. Mather, who carried on the torch for John Muir, discoverer of the area and the first advocate of its preservation. The new park lies directly north of Sequoia National Park in California, and, from its photographs, is a region of breathtaking grandeur.

Bulletin. The *School Nature League Bulletin* is being published this year by the National Audubon Society.

Synthetics. Experiments being conducted by the United States Department of Agriculture on synthetic organic compounds for insecticides are described in a reprint from the April number of *Industrial and Engineering Chemistry*. Among the 25 compounds listed by L. E. Smith, one of the most promising is Phenothiazine, which, it is predicted, may replace lead arsenate. It is already available in large quantities, and it has been proved particularly effective against the larva of the codling moth. It has also been used successfully against the tent caterpillar, Mexican bean beetle, grapeberry moth, European corn borer, and mosquito larva.

Bermuda Fungi. In *Science* for Nov. 20 Dr. E. J. Seaver describes his finding in Bermuda of a subterranean puffball that is new to science; also of two cup-fungi with a unique record of distribution on parts of continents far removed from the islands.

Textiles and Dyes. A complete set of the *Ciba Review*, a periodical concerned with textile dyes, published in Switzerland, has recently been received in the library. Beautifully illustrated with halftones, many of which represent famous works of art, others the life and craftsmanship of races in remote parts of the world in ancient days as well as the present, these magazines contain an abundance of material on plants that are used for textiles and for dyes.

Vegetative Keys. To facilitate identification of plants when they are not in flower, John B. Moyle has prepared a Field Key to the Common Non-woody Flowering Plants and Ferns of Minnesota based mainly upon vegetative characters. First issued in 1938, the book has just appeared in its fourth revised edition. Minnesota plants are treated further in a Key to the Woody Flora of Itasca Park by Murray F. Buell and Robert I. Cain. Both books are published by Burgess in Minneapolis.

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

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.)

Beauties in Plant Life Portrayed By an Appreciative Layman

THIS GREEN WORLD. Rutherford Platt. 222 pages, illustrated with photographs by the author, indexed. Dodd, Mead & Co., New York. 1942. $3.75.

Louis Agassiz, the famous American naturalist of the middle nineteenth century, once said "Study nature, not books," and his words have since become famous as the formula for really enjoying the great outdoors. None of his pupils could have been more astute in following his precept than the author of "This Green World," for throughout the book there is a delightful betrayal of that close observation and appreciation of hidden beauties which can be the source of so much pleasure. Rutherford Platt, the author, is a business man, and one of the few among them who has discovered that pleasure. In his book he tells of his discoveries, not as a ranting sentimentalist bubbling with teleological interpretations, but rather as a layman who has read the books and then gone to see for himself. Nothing of what he has seen is new; it was always there; but he has seen it and enjoyed it, and therein lies the value of his volume to those who would but follow his precept.

His book is divided into three parts. In the first, devoted to trees, he tells of their root systems and their internal structures which contribute to giving them what he calls the "world's greatest waterworks." Green leaves and their marvelous role in converting water and carbon dioxide into food for the trees themselves, as well as for man and other animals, logically fills a chapter, and the section terminates with chapters on leaf arrangement, autumn colors, and the generally overlooked beauties of winter buds.

Many other aspects of tree life might have been discussed but the book was not intended—nor should it be expected—to serve as a text. It fulfills a far more valuable purpose in showing that a layman can fully appreciate the principles taught in ponderous texts and then add to them an appreciation of their spiritual and esthetic values so pathetically absent from the more professional works.

The second part considers mainly flowers, and the author briefly reviews the seasonal succession of blossoms and then carries the pageant of color through the year as it is revealed by lichens, fungi, and fruits of seed plants. The phenomenon of photoperiodism has occupied the author's mind for an entire chapter, and rightly so, for perhaps no other discovery in the biology of plants during the past twenty years combines such simplicity of doctrine with such revolution in concept. Previously, it was believed that flowers appear at particular seasons solely because of responses of the plants to temperature and water and other nutrient factors; but now we know that such blossoming in many plants is controlled with remarkable precision by the number of hours of daily sunlight to which they are exposed, some requiring short days, others long days, and still others not showing such photoperiodic response at all.

The marvels and intricacies of pollen and pollination occupy the next four chapters, and through them all the author has never found it necessary to depart from accuracy or to indulge in imagination in rendering very readable accounts of these fascinating phases of the world about us. A brief review of important plant families, as represented by flowers of fields and woods, concludes this second part.

In the third part we find illustrated keys enabling identification of common trees, only as to their genera, and the book ends with an annotated list of books recommended for reading.

Outstanding among the admirable features of this volume are the photographic reproductions, some of which are in color. The author is truly an artist and those who have been fortunate enough to have seen projections of his colored slides will appreciate them more than any words can convey.

E. H. FULLING.

An Agricultural Cause of War

SOIL EXHAUSTION AND THE CIVIL WAR. William Chandler Bagley, Jr. 101 pages, indexed. American Council on Public Affairs, Washington, D. C. 1942. $2.

The author tries to establish a relationship between the soil-exhausting influence of one-crop farming under conditions of slavery and the Civil War. Cotton and tobacco farming gave larger profits than other crops. They were raised through the use of slave labor. Single-crop farming coupled with the use of unskilled, uninterested labor and unscientific farm methods led to soil exhaustion. Soil exhaustion necessitated moving on to new soil if that system of agriculture was to continue. Expansion met the confining intentions of several acts of Federal legislation aimed at the territorial limitation of slavery. Soil exhaustion thus stimulated an internal pressure in the South which finally exploded in the Civil War.

The foregoing is the thesis of this small volume as this reviewer reads it. The book itself is preponderantly a collection of quoted passages. It reads like a scrapbook, and one puts it aside with a wish that the pertinent data and ideas from the imposing bibliography had been synthesized into a smoothly built hypothesis. The hypothesis is there and one could read the book very rapidly by omitting the quoted passages.

JOHN A. SMALL,
N. J. College for Women.

Weedless Acres

WEED CONTROL. A Textbook and Manual. Wilfred W. Robbins, Alden S. Crafts, and Richard N. Raynor. 643 pages, illustrated, indexed; chapter bibliographies and appendices. McGraw-Hill Book Co., New York. 1942. $5.

This is an excellent piece of work by three botanists of the Agricultural Experiment Station at the University of California, the sort of book which professors of agriculture will prescribe for study and which they will want for their own shelves.

The volume does not concern the identification and description of weeds. The effort is rather to bring together the information which the practical man needs in solving his own problems of weed control. Besides the farmers, orchardists, and horticulturists to whom the book will be useful, the officials who keep golf courses in order, those who are responsible for keeping roadsides, parks, and railway rights-of-way free of weeds, and those who must keep irrigation ditches open will find valuable suggestions here.

The latest work on the control of weeds by chemical methods has been incorporated, with recommended formulae and directions for use. Our chief crops are taken up one by one and their special weed problems discussed. Then the most successful methods of treatment for our worst weeds are given, from poison ivy and Canada thistle to quack grass and wild morning glory.

This is the sort of book that ought to be in the hands of every intelligent grower of plants, but I fear that its price will materially limit its use.

R. R. STEWART.

Monograph and Horticultural Guide

CEANOTHUS. Maunsell Van Rensselaer & Howard E. McMinn, with chapters by Alfred J. Stewart and Herbert L. Mason. 308 pages, illustrated, indexed. Santa Barbara Botanic Garden, Santa Barbara, Cal. 1942.

The work is in two parts. Part I, Ceanothus for Gardens, Parks and Roadsides by Van Rensselaer, gives a descriptive account of the natural stand of the species and the horticultural history and use in the landscape of the various species and varieties of the genus. Many of those listed are not available from nurserymen. The sites of notable collections are given. A separate chapter on Propagation and Culture by Alfred J. Stewart details the problems of seed germination and other matters.

None of the species and varieties, outside of our two eastern natives, is dependably hardy north of Washington, D. C., but many of the varieties of European origin appear to have a place in southern gardens. The descriptions are entrancing, and if hardier varieties could be developed, they would find a ready place in the gardens of the northeastern section of our country.

Part II is A Systematic Study of the Genus *Ceanothus* by Howard E. McMinn, with a chapter on The Distributional History and Fossil Record by Herbert L. Mason.

The systematic study is the first attempt at complete revision since 1897. Included are 55 species, 25 varieties, 11 named natural hybrids and several minor variations.

All the species of *Ceanothus* are confined to the continent of North America. Four species occur east of the Mississippi River, 6 in the Rocky Mountain-Great Basin area, and the great majority along the Pacific Coast, from British Columbia to Lower California. Excellent maps of natural distribution, charts showing probable relationships of species and natural hybrids, and clear drawings showing taxonomic differences of the chief species are included.

The section on "Distributional History and Fossil Record of Ceanothus" by Herbert L. Mason discusses in a general way plant migrations and then specifically this genus.

C. H. Connors,
New Jersey State College of Agriculture.

Nutrients For Plants In Review and Application

THEORY AND PRACTICE IN THE USE OF FERTILIZERS. Firman E. Bear. 360 pages, indexed, illustrated. John Wiley & Sons, Inc., New York, 1942. $3.50.

Most research workers start on a problem by studying all that has been done before in their chosen field. To such persons, doing research in some phase of plant nutrition, this book would be a time-saver.

The text is a compilation of most of the theories, ideas, viewpoints, arguments, differences of opinion, and practices relative to plant nutrients "that have been developed by the many workers in this field since the time of Liebig and of Lawes and Gilbert of Rothamsted fame."

The first half of the book is devoted to this complete and exhaustive rehearsal.

Following this are chapters on nitrogen, phosphoric acid, and potash fertilizers and their combinations, also on other phases of fertilizer practice. At the end of each chapter will be found a list of selected references which totals more than 250.

The chapters on The Soil Reaction and on Organic Matter seem inadequate to this reviewer, and the list of references following these chapters is incomplete.

The final chapter is on the subject of trace elements in the soil.

F. C. Hersman,
State Institute of Agriculture, Farmingdale, N. Y.

Model in Fern Guides

FERNS AND FERN ALLIES OF LOUISIANA. Clair A. Brown & Donovan S. Correll. 186 pages, illustrated, indexed. Louisiana State University Press, Baton Rouge, 1942. $3.

We must congratulate Drs. Brown and Correll for a thoroughgoing and complete work upon the fern world of Louisiana. Not only have all actual records for the state been checked and listed, but considerable exploration has been done so as to make the listing as complete as possible.

The map showing the geological formations of Louisiana, the complete bibliography, and the glossary are definite contributions to a work of this sort.

The illustrations are particularly good and clear, and the printing style a happy choice to make for ease of reading.

This is the kind of botanical publication that is all too rarely done, and which would be a blessing to all fern-students were one like it produced for every state.

E. J. Alexander.

A Point of View on Plant Classification

PHYLOGENETIC AND CYTOLOGICAL STUDIES IN THE RANUNCULACEAE. (From Transactions of the American Philosophical Society.) Walton C. Gregory. Pages 443 to 521, illustrated. The American Philosophical Society, Philadelphia. 1941. $3.

Gregory presents a very extensive review of existing cytological knowledge of a single family. He shows that, while chromosome numbers and types are not by themselves conclusive in classifying plants, the same must be said of the traditional characters of the taxonomist, and that progress can be made only by careful correlation of all available kinds of evidence.

H. W. Rickett.

To reach the Botanical Garden, take the Eighth Avenue Subway to Bedford Park Blvd., the Third Avenue Elevated to the Bronx Park station, or the New York Central to the Botanical Garden station; or drive up the Grand Concourse then east on Mosholu Pkwy., or, coming from Westchester, turn west at the end of Bronx River Pkwy.

MEMBERSHIP IN THE GARDEN

Established as a privately endowed institution, aided partially by City appropriations, The New York Botanical Garden is dependent for its progress largely upon benefactions and memberships. Through these means, though young as botanical gardens go, it has become the third largest institution of its kind, its library, herbarium, and horticultural collections ranking among the finest and most complete in any country.

Membership in The New York Botanical Garden, therefore, means promotion of scientific research in botany and the advancement of horticultural interests. Scientifically, the Garden is able to serve as a clearing-house of information for students and botanists all over the world; horticulturally, it often serves as a link between the plant explorer or breeder and the gardening public.

Through memberships and benefactions, provision is made at the Botanical Garden for the training of young scientists and student gardeners; hundreds of new books are added annually to the library, which is open daily to the public for research and reading; free exhibits are maintained in the museum, the greenhouses, and gardens, and lectures, courses, and free information in botany and gardening are given to the public.

Each individual member of the Garden receives:

(1) A copy of the Journal every month.

(2) A copy of Addisonia once a year, each number illustrated with eight colored plates of unusual plants, accompanied by descriptions.

(3) A share of surplus plant material of interesting or new varieties whenever it is distributed.

(4) Announcements of special floral displays, programs, lectures, and other events at the Garden.

(5) Credit to the amount of the membership fee paid, toward courses of study offered by the Garden.

(6) The privilege of borrowing lantern slides from the Garden's collection.

(7) Use of the Members' Room in the Museum Building.

A limited number of garden clubs are accepted as Affiliates. The privileges of affiliation are one lecture a year by a member of the staff, a share in the distribution of plants when they are available, a subscription to the Journal and to Addisonia, and announcements of special activities at the Botanical Garden. In addition, any member of an affiliated club may receive for the current year of membership a reduction of $5 in the fees paid for instruction. (This does not apply to the course for professional gardeners.) An Affiliate Garden Club may borrow lantern slides from the Garden's extensive collection, such loan being subject to the regulations for the use of lantern slides by individual members. Likewise, an affiliate club may engage without fee the Members' Room at the Garden for its meetings.

The classes of membership are as follows:

Annual Member	annual fee	$ 10
Sustaining Member	annual fee	25
Garden Club Affiliation	annual fee for club	25
Fellowship Member	annual fee	100
Member for Life	single contribution	250
Fellow for Life	single contribution	1,000
Patron	single contribution	5,000
Benefactor	single contribution	25,000

Fellowships or scholarships for practical student-training in horticulture or for botanical research may be established by bequest or other benefaction either in perpetuity or for a definite period.

Contributions to the Garden may be deducted from taxable incomes. The following is a legally approved form of bequest:

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

Conditional bequests may be made with income payable to 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, N. Y.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

OL. 44
O. 518

FEBRUARY
1 9 4 3

PAGES
25-48

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

NATIVE PLANTS FOR AMERICAN GARDENS

IN the Annual Report which was presented to the Corporation of the New York Botanical Garden last month, Dr. William J. Robbins expressed the hope that someday in the future "someone will see the opportunities at hand to develop native American plants for horticultural use, and support such a project generously enough to make it worthy of its objective."

No plants have been more neglected in the American garden than those that appear in the natural landscape of the continent. In the Great Basin of the West abound colorful perennials, attractive shrubs, and innumerable rock plants of arresting charm, yet scarcely a plant of all this array has found its way into a garden. In every part of the country, in fact, there are annuals, perennials, shrubs, and trees that could be enjoyed far outside their native habitats if the secret of their culture could be learned in a well managed test garden.

The Europeans have long appreciated American plants, and many of them they have improved. It was the astute English gardeners who collected seed of our native American asters, raised them, hybridized them, made selections of the best strains, and eventually sent them back to America under the new name of "Michaelmas daisies." This is the sort of long-term work that ought to be done in a well endowed experimental garden where our choicer wildlings can be hybridized, selected, displayed, and distributed, as well as merely cultivated. The aster border at the New York Botanical Garden, where more than 60 varieties are shown every autumn, is evidence of what can be accomplished in developing native American plants for American gardens. The recent book by William R. Van Dersal, "Ornamental American Shrubs," should be an inspiration for anyone aiming to have the finest of woody plant material on his grounds.

American plants are by nature adapted to American gardens. To introduce them successfully here, a large test garden is needed—one where intelligent selection and care and breeding of the plants will result in bringing the finest of them into American horticultural use.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 FEBRUARY 1943 No. 518

Fiber Plants of the North American Aborigines

The Story of What the Prehistoric Indian Employed For Textiles, Ropes, Fish Nets and Lines, Bags, Burden Straps, and Sandals

By A. C. Whitford

LONG before the white man came to North America, the native Indian had taught himself the art of weaving. Besides making cloth of the native cotton which grew in Mexico and elsewhere, and which was apparently one of the earliest articles of trade, he manufactured fine textiles from the fibers of milkweeds and nettles; he walked on sandals and carried his burdens in straps made from the heavier fibers of yucca; and he wove blankets from the pliant stems of Spanish moss throughout the region where it grew. If fish nets, ropes, and cordage are included, it will be found that the aboriginal Indians of North America utilized at least 55 different species of plants for their fibers. Thousands of examples of their craftsmanship are now reposing in the white man's museums throughout the country. They have been found in caves, in mounds, and in other sites where the Indians are known to have sojourned long ago. The fibers they used have been identified largely by microscopic comparison with living or dried specimens of plants.

Dr. Whitford, who is a fiber technologist, has been growing and studying textile fibers both as hobby and profession for 20 years. In his pursuit of fiber plants used by the North American aborigines, he has examined early Indian artifacts and other objects from practically every museum in the United States and he has closely followed the excavations of Indian mounds and recent discoveries in caves and other dwelling sites of the aborigines. Botany, chemistry, microscopy, and ethnology are called upon in his attempts to identify the plant fibers used by the North American Indians. In his present capacity as fiber technologist for the Manawul Corporation of Boston, Dr. Whitford is combining his profession with his avocation.

Generally, the Indians of a particular region used only the plants that grew wild in that vicinity, and they apparently learned to make the most of every kind of plant, from grasses to trees, that bore any sort of fiber. Occasionally, however, exotic fibers are found, representing plants sometimes from hundreds of miles away. Weaving was important enough to make the raw materials it required a leading article of trade.

In no case observed has there been found a mixture of animal with vegetable fibers in a cord or a rope, although in feather and fur cloths the core of the material was often some vegetable fiber made into a cord around which or into which the animal materials were fastened. This is especially noticeable in the attractive feather blankets of the West and the fur materials found in Spiro Mound of Texas.

Plant materials used for weaving by the Indians fall into two distinct classes: *structural fibers* and *bast fibers,* depending upon their place in the plant's anatomy. *Structural fibers* are those which provide the veins or fibrovascular bundles of the leaves or stems, and they occur almost exclusively in the monocotyledons—plants of the Lily and Grass and related families. *Bast fibers,* which exist in the dicotyledons and the Gymnosperms, or cone-bearing trees, are those fibers which occupy the layer between the epidermis, or bark, of the plant and the inner stele, or woody portion.

Structural Fibers

The structural fibers are usually too coarse and stiff for finer work unless considerable preparation is done; but, on the other hand, they are so strong that they have been abundantly used. The palmetto, *Sabal palmetto,* for example, was not only used by the southern Indians in whose territory it grew, but also by the Iroquois Indians of New York, who acquired it as an article of trade. In an Iroquois burden strap in the American Museum of Natural History, the stiff, strong cords are made from palmetto fiber, then covered with soft cotton, also imported. In the same museum there are found three bags made by the Winnebagos with stiff palmetto fibers in the handles. Further south the fiber was universally used in the construction of all classes of materials from ropes to baskets.

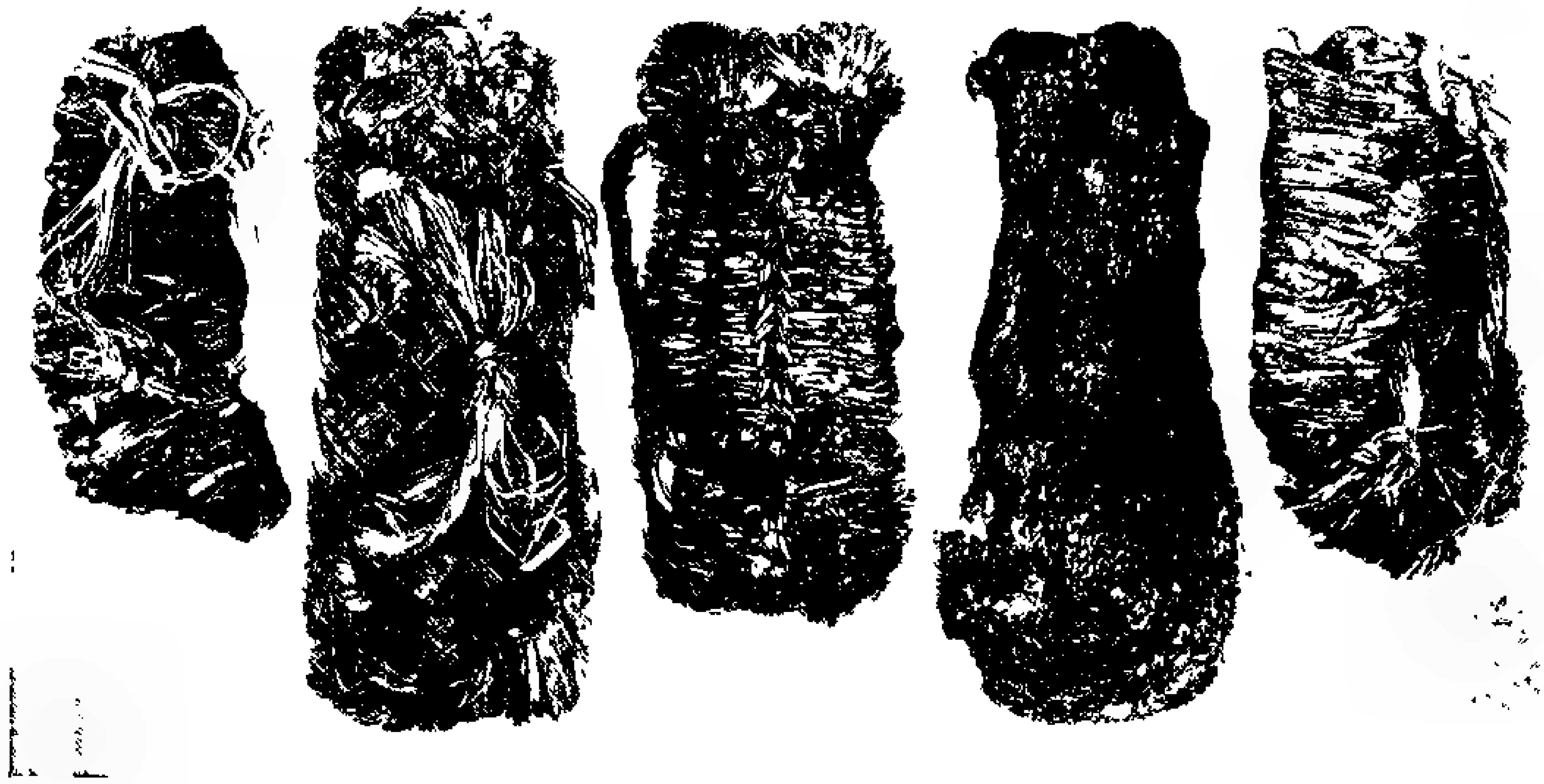
For blankets in the southern regions, the natives gathered the abundant Spanish moss from the trees, stripped off the small bract-like leaves, and wove the entire plant into a comfortable covering. A finished specimen is shown in the Museum of the American Indian, Heye Foundation, in New York.

Of all the North American plants containing structural fibers that were usable, probably the yuccas were most important. They were used wherever found, in all section and by all peoples.

The versatility of yucca fiber is great. It is found both as warp and weft of common cloth, and used in open woven cloth with cotton. Some early tribes mixed it with cotton cloth to make a new cloth. It was found in bags, both twined and woven, and in head bands, aprons, G-strings and mats. Tump lines were composed of yucca fiber, as well as nets and fine cords, both one- and three-ply; likewise both braided and twisted rope. Sandals have most commonly been made from it throughout the whole prehistoric Indian period even down to the present time. Sandal pads of yucca also have been found. In fact, it appears to have been used for every purpose in which a fiber was demanded. The only regions where its occurrence in materials has not been noted is where it does not even grow within a reasonable trading distance.

Except for *Yucca glauca* and *Yucca baccata,* the species are very limited in their distribution, and generally the distribution determined the kind that was used by the inhabitants of a particular region. The people of the Arkansas Bluff culture, for example, used *Yucca arkansana.* Further north, however, the Mound Builders are found to have used at least two plants which they obtained through trade with tribes to the south. *Yucca filamentosa* appears in a cord, and a closely related plant, *Nolina georgiana,* is seen in moccasins, both of which are in the Ohio State Historical and Archaeological Museum. These stronger fibers were mixed with the weaker native ones of the Mound Builders, such as eryngo, *Eryngium yuccacfolium,* identified with the nolina in sandals.

This same blending of materials has often been noticed in a study of the material from Spiro Mound.



Five sandals in different types of weaving, all made from yucca leaves by prehistoric Indians; found in Ceremonial Cave, Winchester Mountains, Arizona. The middle sandal is made from Yucca elata, the other four from Y. baccata. (Photograph from the Museum of the Amerind Foundation, Dragoon, Arizona.)

Ropes, cords, fish lines, threads, and other articles fashioned from plant fibers, probably by the Basketmakers, and found in Ceremonial Cave in the Winchester Mountains in Arizona. The letter "a" indicates animal fiber combined with Yucca baccata; "b" indicates articles made entirely of Yucca baccata; "c" shows the cotton articles; "d" a mixture of Yucca baccata with Y. elata; and "e" Yucca elata alone. (Photograph from the Museum of the Amerind Foundation, Dragoon, Arizona.)

At the Wupatki National Monument in Arizona, *Yucca Baileyi,* the dominant species of the region, has been most frequently found in woven goods, although *Y. elata* and *Y. baccata* were also used there, as well as *Nolina microcarpa.*

Dasylirion Wheeleri, another desert relative of the yucca, has been observed combined with the commoner yuccas, also with *Y. Schottei* and *Y. mohavensis* in articles from the Montezuma National Monument in western Arizona. It is safe to conclude that none of the species of *Yucca* or the closely related *Nolina* or *Dasylirion* was overlooked in the search for fibrous materials.

Grasses are the next most widely used monocotyledonous group, particularly east of the Mississippi River or where the yucca was not native. Sweet grass, *Hierochloë odorata,* was frequently woven in for decoration and to give a pleasant odor to the article. The Mound Builders gathered the big blue-stem grass of their region, *Andropogon furcatus,* to blend with other fibers or to make into a cord, either the leaf itself simply twisted or the main fibers taken. In many sections the canebrake, *Arundinaria tecta,* was the source of raw material for ropes and moccasins. The Oregon

Prehistoric Indians made cloth of *Muhlenbergia pungens*. Among the monocotyledons closely related to the grasses were several rushes, species of *Scirpus* and *Juncus*, used along with cattails (*Typha*) to make mats and coarse objects.

The most striking development yet to come to notice in the use of fibers in North America is the use of grass by the Aleuts as found on Kagamil Island by Dr. Alexis Hrdlicka, whose shortly forthcoming paper will describe these exceptional fabrics in detail. These peoples made some of the most striking textiles and yet the only vegetable fibers they had to use were rye grass, *Elymus mollis*, and the roots of Sitka spruce, *Picea sitchensis*. In the manufacture of their fabrics and mats they used all parts of the grass—roots, stems, and leaves. These were worked in various manners, with some roots of spruce and very occasionally whalebone for decoration. They worked out their designs and patterns with precision and consummate skill. Their work, which is especially remarkable when the paucity of material is realized, is one of the world's textile wonders.

Wherever agaves were found they were used in the making of cords and nets, especially *Agave utahensis*, the most widely distributed and abundant, but also *A. Parryi* and *A. Palmeri*.

One other structural fiber must not be overlooked and that is eryngo, *Eryngium yuccaefolium*, one of the few parallel-veined dicotyledons found in the United States. It was much used and evidently highly prized in the region of its growth for it has been encountered 55 times in materials from the caves and rock shelters of Arkansas, Kentucky, Tennessee and Ohio. It was utilized for cordage, in the manufacture of bags, braided work, cloth, and sandals. This wide use seems to be due to its abundance, its tensile strength, and the fact that it required very little preparation.

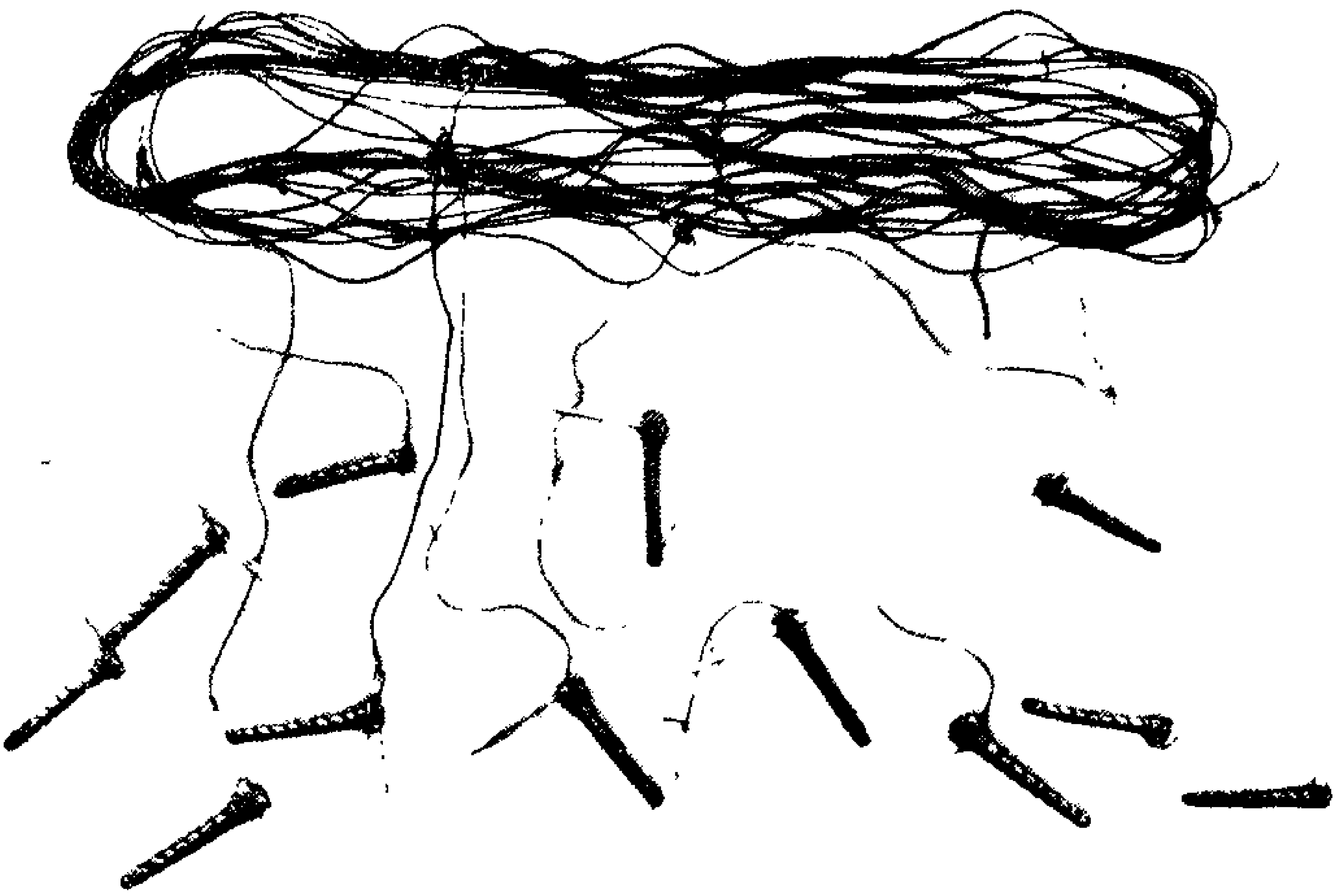
To date there have been found some 25 species of plants from which structural fibers were derived by the aborigines of this continent. This is a rather imposing list when it is remembered how crude the manner was in which they were obtained and utilized.

Bast Fibers

While there are no bast fibers among the monocotyledons, several examples are to be found among the Gymnosperms, and many bast fibers were derived by the aboriginal Indians from the dicotyledonous annuals and herbaceous perennials, besides a few from shrubs and trees.

Milkweed, especially *Asclepias syriaca*, was used wherever it grew for the manufacture of fine materials such as fish nets and fine cords and fabrics, also wampum belts and burden straps.* Further south and west

* In the Peabody Museum there are samples of fine cloth made from the fiber of the common milkweed, and in the American Museum of Natural History there is a fish net of milkweed made by the Matchapunga Indians.



Nettles have been used throughout the country by the Indians for the fiber they contain. These fish lines made from Urtica Brewerii by pre-Columbian Indians were found in Lovelock Cave, Pershing County, Nevada. (Photograph from Museum of the American Indian, Heye Foundation.)

this species became replaced by *A. incarnata, A. tuberosa,* and *A. pulchra.* The Cave Dwellers of Arkansas used the upland milkweed, or butterfly-weed, *Asclepias tuberosa,* and the Ohio Mound Builders made cloth from it. The swamp milkweeds, *Asclepias pulchra* and *A. incarnata,* were also used, sometimes for making rope ** as well as fine cords and threads. In the Rocky Mountain states these species are replaced by the whorled milkweed, *Asclepias galioides,* and the Mexican milkweed, *Asclepias mexicana.* These are found in all cultures and in all localities yet examined, their utilization ranging from fabrics and thin matting to cords, string, and netting. Milkweed was commonly used because it required very little preparation to secure fine threads, breaking down easily either artificially or by simply leaving it out to weather.

Nettles, throughout their distribution, provided fibers for textiles. In the East the slender nettle, *Urtica gracilis,* and the stinging nettle, *Laportea canadensis,* were the most common ones, although the stingless nettle, *Boehmeria cylindrica,* was also used. Like the milkweeds, their fibers have been found in nets, cords and fabrics and, being easily handled, they also

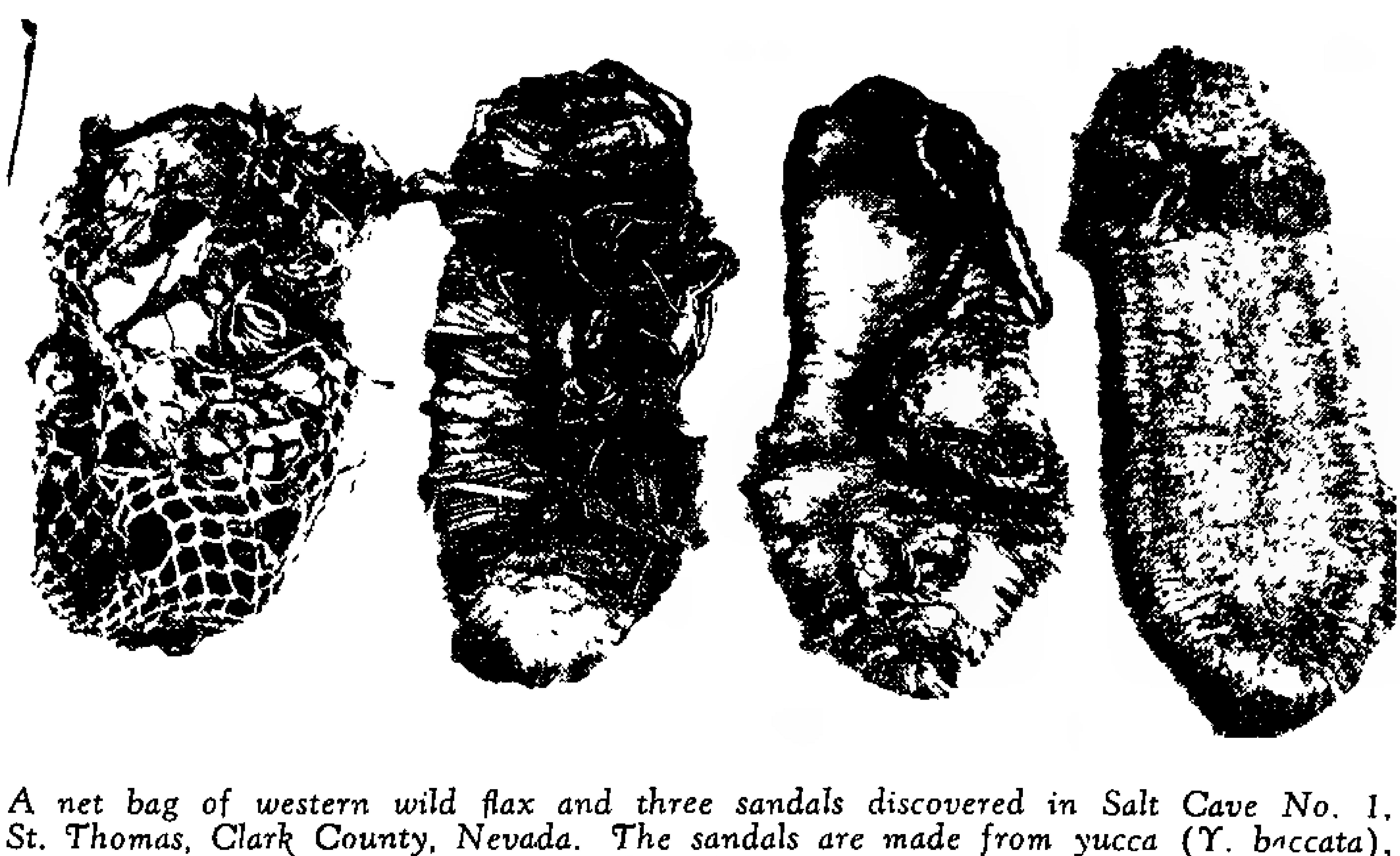
** In the University of Kentucky Museum, also in the Ohio State Historical and Archaeological Museum, are ropes made from the swamp milkweed.

were much prized for fine work. In the Western States these species were replaced by the ones common there, *Urtica Brewerii* and *Urtica Lyallii.* The finest fabrics made by the primitive peoples of this continent were woven either from the milkweeds or the nettles.

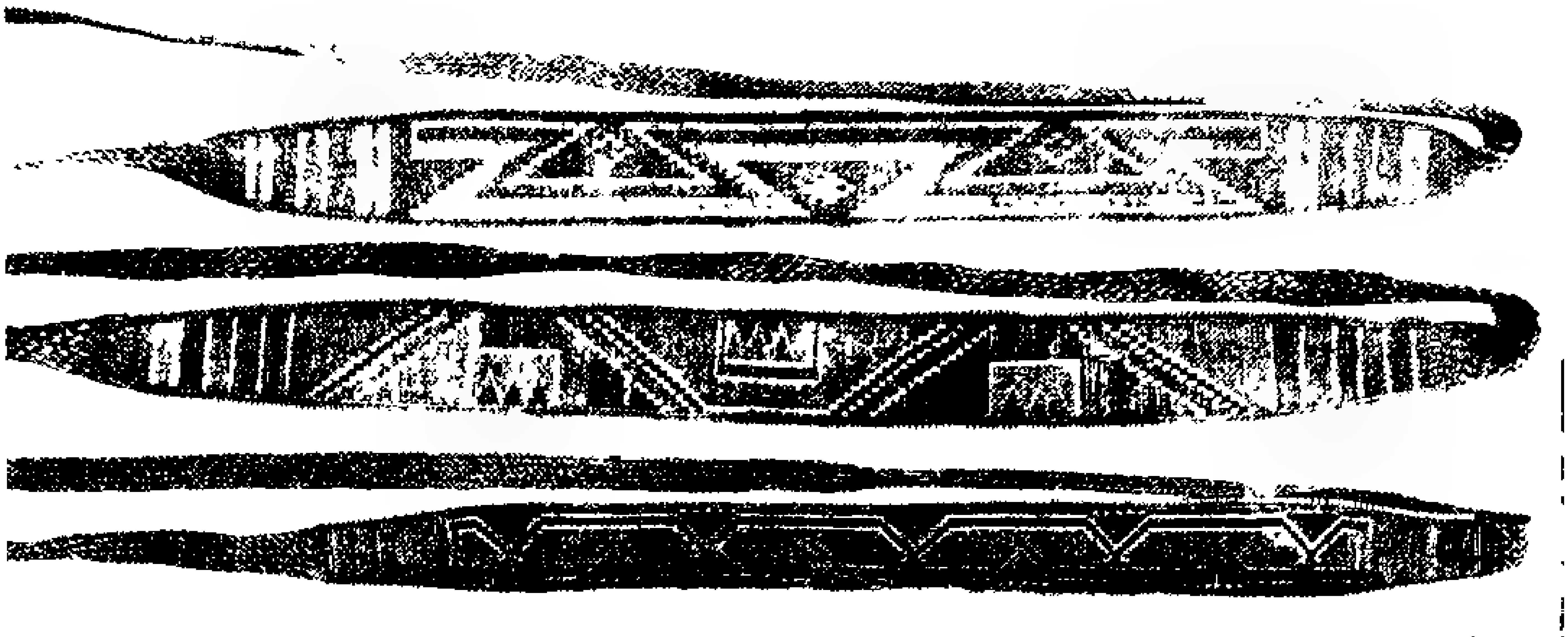
Another family of plants which was occasionally utilized was the Dogbane, or Apocynaceae, which contains the Indian hemp, *Apocynum cannabinum,* and *A. androsaemifolium*, or dogbane. Although these have been given credit for being the chief bast fibers used by the aborigines, they were, as a matter of fact, used less than either the milkweeds or the nettles. In some 1,500 specimens of prehistoric materials collected from all parts of the United States and in many museums of the country there have been found 106 specimens containing milkweeds, 130 containing nettles, and only 14 containing the Indian hemp and dogbane.

One other herbaceous plant has often been observed in western material, and that is the perennial wild flax, *Linum Lewisii.* The long, tough, slender fibers were used for the manufacture of the delicate cords and strings of bird nets and other articles where both strength and fineness were required. It has been found used by peoples from Alaska to Mexico and from the Pacific to the Mississippi River—or throughout its entire distribution.

The utilization of shrubs as a source of bast fibers seems to have been confined to the region west of the Mississippi, for in an investigation none was found in any material from eastern United States. Sagebrush, *Artemisia tridentata,* was one of the plants most frequently used by the aborigines of the Northwest. As it appears in a piece of cloth at the



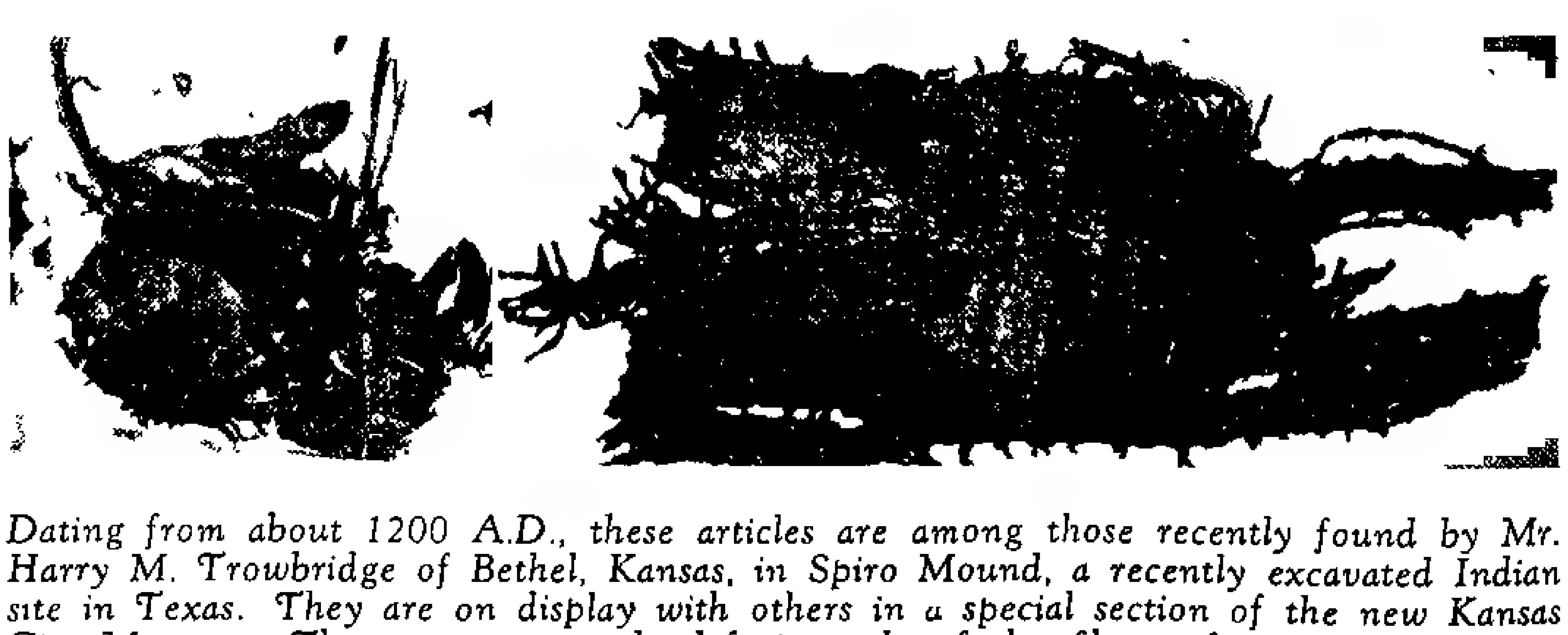
A net bag of western wild flax and three sandals discovered in Salt Cave No. 1, St. Thomas, Clark County, Nevada. The sandals are made from yucca (Y. baccata), nettle (Urtica Brewerii), and milkweed (Asclepias galioides). (Photograph from Museum of American Indian, Heye Foundation.)



Elaborate burden straps have been made by the Indians of every era in North America. These three, made probably in the 17th century, are from the Mohawk tribe. The upper one is of basswood fiber, the other two are of black walnut. (Photograph from the Museum of the American Indian, Heye Foundation.)

University of Michigan, the bark was evidently peeled off and then the stems were boiled with ashes to break them down into their finer fibers. In the Museum of the American Indian, Heye Foundation, there are several pieces of sagebrush rope and cord from caves in Idaho, while in the United States National Museum there are sandals and bag cords made from sagebrush.

Another commonly used western shrub was the cliff-rose, *Cowania Stansburiana*, especially by the natives of the region around the Wupatki National Monument. In collections of the Museum of Northern Arizona it was found in six specimens, chiefly mats and coarse cords because of the harshness of the bast. In the same museum is a single specimen of cord made from one of the sumacs, *Rhus trilobata.* One of the south-



*Dating from about 1200 A.D., these articles are among those recently found by Mr. Harry M. Trowbridge of Bethel, Kansas, in Spiro Mound, a recently excavated Indian site in Texas. They are on display with others in a special section of the new Kansas City Museum. The ornament at the left is made of the fibers of pawpaw (*Asimina triloba*), the two upright strands being of *Nolina georgiana*. At the right is a piece of canebrake cloth woven from fibers of *Arundinaria tecta*.*

Basswood fiber occurs in this Potawatomi bag from Wisconsin. At the left is part of an Indian fish net made from milkweed fiber. (Photographs by American Museum of Natural History, where these objects are on display.)

western blueberries, *Vaccinium oreophilum,* was used for cordage by the primitive cave-dwellers of Nevada, usually as strips twisted together, but occasionally broken down into finer material.

While herbaceous plants and shrubs were important for their fibers, trees were not overlooked by the primitive peoples of America. Perhaps the most commonly used bast of all was taken from a tree, the basswood ("bass-" from "bast"), or linden, *Tilia americana.* This linden bast was utilized for all classes of objects from coarse rope to fine cloth, sometimes simply as twisted strips, other times broken down by boiling in ashes and pounding to break it up into its fine component parts. In the Milwaukee Museum there is a Menominee bag of linden bast in the form of a very fine spun yarn. The waxes and gums have all been removed and the fibers laid parallel as though having been combed. In Massachusetts in the Peabody Museum there is a piece of twilled cloth made by the protohistoric Indians of that region. Many other museums have coarser cords and ropes made from this material. Encountered 52 times in the objects examined from east of the Mississippi, it proved to be the most commonly used fiber in that region. Other trees which are known to have provided fibers for the eastern aborigines are the common elm, *Ulmus americana,* and the slippery elm, *U. fulva;* the black willow, *Salix nigra;* leatherwood, *Dirca palustris;* paper birch, *Betula papyrifera;* black walnut, *Juglans nigra,* and finally the pawpaw, *Asimina triloba.* All these were handled much like the linden bast, for the construction of mats, bags, cords, rope and cloth.

Three species of Gymnosperms have been encountered, but by far the most common is the papery bast from the red-cedar, *Juniperus.* Where strength and fineness were not required, this material proved itself practical for many purposes. It also appeared occasionally as a decoration. In one example of the materials taken from Winchester Cave in Arizona by Mr. W. S. Fulton, one of the spruces, *Picea Parryana,* was found woven in apparently to furnish a kind of incense. A single specimen of larch, *Larix laricina,* was found in material submitted by the Museum of the Southwest.

One other fiber plant remains to be mentioned and that is cotton, which was used from the earliest times, so far as known. It appears to have been either a native *Gossypium* or a species brought up from Mexico. The early Basketmakers used it in the manufacture of fabrics and fine cords. In fact, wherever it was available either through culture or trade, it was employed by the aborigines.

* * *

The above survey does not pretend to be complete or final but simply attempts to illustrate the types and numbers of different plants used by the prehistoric inhabitants of North America in their search for textile materials. In addition to the 25 structural fibers used, there were some thirty-odd species of dicotyledonous plants used for their bast, or a total of not less than 55 species of plants known to have been utilized by these primitive peoples. It is to be hoped that investigations may continue so that the full extent of the supply may be known and the ability of the early inhabitants to make the most of the natural resources surrounding them can be more fully appreciated.

WHAT DOES REFORESTATION ACCOMPLISH?

REFORESTATION amounts to more than the mere planting of trees; more than raising a wood crop. It relates to improving the value of the land. It serves (1) to hold sandy soil in place; (2) to control flood waters; (3) to provide a natural refuge for wild life; (4) to protect inhabited areas against snow and wind; and (5) to restore the productivity of barren soil by building up a humus layer. And with these useful services of growing trees come the beauties of the forest and the opportunities the forest offers for healthful recreation.

From a recent lecture at the Garden by
E. W. LITTLEFIELD *of the State Department of Conservation*

The Story of Wild Rice

By Helen M. Fox

"In the golden-hued Wazu-pe-wee—the moon when the wild rice is gathered,
When the leaves on the tall sugar-tree are as red as the breast of the robin,
And the red-oaks that border the lea are aflame with the fire of the sunset,
From the wide-waving fields of wild-rice, from the meadows of
Psin-ta-wak-pa-dan,
Where the geese and the mallards rejoice, and grow fat on the bountiful harvest,
Came the hunters with saddles of moose and the flesh of the bear and the bison,
And the women in birchen canoes well laden with rice from the meadows."
Gordon, Legends of the Northwest, pp. 58, 59.

This quotation in a Longfellow-like meter is from the material published in the 19th Annual Report of the U. S. Bureau of American Ethnology, "The Wild Rice Gatherers of the Upper Lakes" by Albert Ernest Jenks.

Wild rice (*Zizania aquatica*) grows in brackish waters of rivers, in countless lakes and ponds from the Atlantic to the Rocky Mountains, and from the Great Lakes to the Gulf of Mexico. The Menominee Indians who lived along the boundary lands in Wisconsin and Michigan took their name from MANOMIN, the Indian word for rice. The Objibwas and Dakotas were important tribes in the rice area and for centuries were engaged in a continual struggle for the rice fields. Almost every bend or turn of the Chippewa and Red Cedar rivers was the scene of an Indian battle, and both of the streams bore Indian names synonymous with the words "Wild Rice River."

The gathering of the grain by the Indians is curious. Before it ripens the women go out in their canoes and with curved sticks pull the grain toward them and tie it in a crook shape with string made of the inner bark of basswood. They do this to prevent the birds from eating it and to make a pathway so they can harvest it with their canoes. Harvesting occurs in the exact moment before the grain is ripe enough to fall into the water by the stirring of a breeze or the alighting of a bird. The stalks are so close together that a paddle cannot be used, so the canoe is punted, or moved forward by a pole, by one of two women. The other has a curved stick with which she pulls the stalks down over the side of the canoe, then with a similar stick in her other hand she hits the head of the grain, knocking the seeds into the canoe. After one side of the canoe is filled the laborers exchange implements and harvester becomes boatman. The grain, not being entirely ripe, which is necessary to separate the husk from the kernel, is dried either in the sun or over a slow fire. Canoes, winnowing trays, and mococks (for carrying grain) are all made of birch bark.

Even the wild rice of the market today is largely gathered by Indians. It is a graceful plant rising sometimes to 12 feet above the water. The full panicles of yellow-green flowers become purplish when the grain is ripe. In food value wild rice is reputed to be more nourishing than oats, barley, wheat, rice, or maize.

A Greenhouse Mushroom

By F. J. Seaver

DURING the month of September, 1942, the writer observed a mushroom growing in large clumps on a pile of leaf-mold in one corner of the Main Conservatories of the New York Botanical Garden, a new growth appearing every few days for several weeks. It was at once recognized as a *Lepiota,* the genus which includes the beautiful parasol mushroom. The identity of the species, however, was somewhat in question. After consultation with other mycologists it was determined as *Lepiota americana,* a strictly American species, described by Dr. C. H. Peck, one of our pioneer mycologists.

The cap of the fungus is white above with a brownish center and delicate brown scales, which are characteristic of the genus. The gills are creamy white and the spores white. The stems are slender and the entire plant seems to be a rather delicate form of this species. One of the outstanding characteristics is the fact that when scratched or bruised the fungus turns red or reddish-brown. When sprayed drops of water become reddish so that the fungus appears to sweat drops of blood. On drying the cap turns from white to rosy red.

Most of the species of this genus are edible, with one outstanding exception—*Lepiota Morgani,* also described by Peck. This mushroom has been referred to in a recent number of *Mycologia* as an unwholesome fungus, with the following notes:

"About two pounds of an agaric were gathered in the lawn and were eaten by four adults. Four hours after the meal symptoms were noted and were severe for two hours with traces for 24 hours. Symptoms consisted of nausea, cramps, and diarrhea. Two of the persons (women) who ate the mushrooms were severely affected; one man was mildly affected, and the one man not affected."

This illustrates the difficulty of determining by any general rule which fungi are poisonous and which are edible. In this case the two fungi belong to the same genus, one being poisonous and the other harmless. The plants shown in the illustration accompanying this article were photographed and afterwards eaten with no bad results. When the mushroom is cooked it turns red or reddish, and like the parasol fungus is one of the forms which is regarded as delicious eating. It has been used several times by us.

Lepiota americana, an excellent edible mushroom, found growing last fall in the Main Conservatories at the New York Botanical Garden. (Photographs by Fleda Griffith.)

New Sources of Vitamin C

With Recipes for Utilizing Rose Hips, Green Walnuts, Persimmon Leaves, Parsley, and Other Products

By Virgene Kavanagh

CITRUS fruits, until recently, have been considered one of the best available sources of vitamin C. But since oranges, lemons, limes, grapefruit, and tangerines, never plentiful, have become increasingly scarce in Europe, efforts have been made there to locate new kinds of food to provide this important anti-scorbutic factor and to discover new ways of preserving the vitamin C that is present in ordinary foods.

News of the resultant discoveries by Russian and British scientists deserves attention in America even though we still have adequate supplies of the citrus fruits in our markets.

The fleshy red fruits of roses, known as rose "hips," have been found to contain so large a percentage of vitamin C that a generous serving (a heaping dessert-spoonful) of rose-hip marmalade made, for example, from *Rosa rugosa,* will provide at least as much vitamin C as a four-ounce glass of orange juice. And there are other roses even richer in this vitamin.

In Russia it was found by two scientists, Bukin and Zubkova, that two species of roses grown there (*R. cinnamomea* and *R. acicularis*) contained from 5 to 10 times as much vitamin C as did *R. rugosa* in tests made in England. They derived as much as 4750 milligrams* of vitamin C for every 100 grams* of raw pulp, or 14.5 percent of the weight of the dry pulp. It was found, however, that the region in which the roses grew greatly affected their vitamin content. In the south, for example, the amount was not more than 2.2 percent, and roses growing in the mountains contained more vitamin than those in the lowlands at the same latitude.

It was the work of these Russians, published in 1937, that inspired Drs. M. Pyke and R. Melville in England to study the vitamin content of roses growing there. While they found none of the species native to England containing as much vitamin C as the majority of the Russian-grown roses, they did find the roses native to Scotland and northern England far superior to those in the southern part of the island. Also, many foreign roses growing in English soil proved to be better sources of vitamin C than the native species, though only one of these, *R. Fedtschenkoana,* from Turkestan could compare with the best of the Russian roses. *R. cin-*

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*One milligram (mg.) is 1/1000 of a gram (g.); 28 grams make one ounce; 100 grams make 0.22 pound.

namomea and *R. acicularis* did not produce the outstanding amounts of vitamin C in England that they did in northern Russia.

The roses tested in England are listed below in groups according to their vitamin content.

Between 2000 and 5000 mg. per 100 g. fresh pulp
Rosa Fedtschenkoana, R. elymaitica

Between 1500 and 2000 mg. per 100 g. fresh pulp
R. macrophylla, R. nutkana, R. Moyesii

Between 1000 and 1500 mg. per 100 g. fresh pulp
R. Sweginzowii, R. therebinthinacea, R. mollis,[E] *R. Sherardi,*[E] *R. cinnamomea, R. pomifera, R. caudata, R. manca, R. pisocarpa, R. coriifolia,*[E] *R. rubrifolia, R. Afzeliana*[E]

Between 500 and 1000 mg. per 100 g. fresh pulp
R. rugosa, R. calocarpa, R. salaevensis, R. acicularis var. *Engelmannii, R. virginiana, R. rubiginosa,*[E] *R. tomentosa,*[E] *R. baicalensis, R. dumetorum,*[E] *R. canina,*[E] *R. altaica*

Between 100 and 500 mg. per 100 g. fresh pulp
R. agrestis,[E] *R. obtusifolia,*[E] *R. micrantha,*[E] *R. spinosissima,*[E] *R. Helenae, R. stylosa*[E]

Between 75 and 100 mg. per 100 g. fresh pulp
R. arvensis[E]

For comparison, here are the amounts of vitamin C per 100 grams in some of our recommended common foods:

Lemons 56 milligrams	Oranges 54 milligrams
Grapefruit 39 milligrams	Strawberries 34 milligrams
Cabbage 35 milligrams	Tomatoes 22 milligrams
Lettuce 14 milligrams	Peaches 9 milligrams

Apples 7 milligrams

In Germany rose hips have been used for many years in the preparation of a type of jam. The recipe is as follows:

Rose Hip Jam

Remove the seeds from very ripe rose hips, sprinkle the flesh with fresh water to which may be added a very small glass of wine, and let them stand in a cool place for three to four days, stirring occasionally. Run them through a fine sieve. Heat together 500 grams (2½ cups) of pulp and 400 grams (a scant 2 cups) of sugar, stirring until thick.

Uncooked jam is made by stirring equal weights of pulp and sugar together for an hour.

These jams have not been analyzed for vitamin C. They probably have lost much of it during the sieving and stirring processes. The marmalade recipe given later is more likely to preserve the vitamin than is this jam.

Whole green walnuts have been found to be excellent sources of vitamin C. The English walnut, *Juglans regia,* contains about 1500 milligrams

[E] Roses native to England

per 100 grams when the kernel is soft and before the shell is formed.* The black walnut, *Juglans nigra,* contains about half as much vitamin C. Of the other whole nuts tested in England, two varieties of *Carya ovata,* the shellbark hickory, had about 500 milligrams per 100 grams; and *C. glabra,* the pignut, produced almost as much. Even *Carya alba,* the mockernut, with 70 milligrams, has a higher percentage than oranges, although it is easier to get one's daily ration with a large glass of orange juice than with a portion of prepared green nuts. The vitamin C in walnuts is not well preserved in the candies made in Russia or in the ordinary methods of pickling in England, but most of it was saved in the unshelled green nuts prepared by the methods of more than two hundred years ago, which follow:

Green Pickled Walnuts

Peel as thinly as possible, soak 24 hours in a 15 percent salt solution, remove, pack in spiced vinegar (without cloves), and let stand three months before using.

White Pickled Walnuts

Peel more deeply than for green walnuts, soak 12 hours in a 15 percent salt solution, simmer for 5 minutes in a fresh 15 percent salt solution, remove, pack in spiced vinegar (without cloves), and let stand for three months.

Walnut Marmalade

230 grams (½ lb.) unripe nuts sliced into 560 milliliters (1 pint, generous) boiling water and boiled until tender (about 40 min.). Add 340 grams (1½ cups) sugar, and boil until set (about 20 min.).

Walnut and Black Currant Jam

453 grams (1 lb.) unripe sliced walnuts, 112 grams (¼ lb. or ⅔ cup) black currants, and 560 grams (2½) cups sugar. Bring to a boil and cook gently until tender.

Walnut and Green Tomato Chutney

680 grams (1½ lb.) sliced unripe walnuts, 453 grams (1 lb.) green tomatoes, 225 grams (½ lb.) shallots, 225 grams (½ lb.) raisins, 5 grams (1/5 oz.) mustard seed, 15 grams (½ oz. or 1 tablespoon) salt, 25 milliliters (2 tablespoons or less) saccharine solution; cook all together until tender.

Rose hips could be substituted for the black currants in the jam or used in place of all or part of the walnuts in the marmalade. It is believed that a small portion of the vitamin C is also preserved in this recipe for walnut liqueur, which has been used for many generations by a Swiss family. In other recipes, the cloves that are often used, also the exposure to the sun that is recommended, would both destroy the vitamin C.

Walnut Liqueur

1½ lbs. of green walnuts, ¾ gal. of whiskey, 1½ lbs. of brown sugar. Put the walnuts into a gallon bottle, pour whiskey over them to fill bottle completely, and stand the bottle in a cool dark place.

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* Gergelzhiu in Russia and Pyke, Melville, and Sarson in England have all obtained this figure for *J. regia,* as have Hennig & Ohske in Germany.

After three months take out the nuts and discard them. Put the brown sugar into boiling water and cook over a slow fire until the liquid has the consistency of heavy syrup. Cool and add this to the whiskey. Leave standing for about four weeks before using.

Parsley is a better source of vitamin C than most of our other vegetables. In 1935 several investigators found that it contained 150 to 250 milligrams of "C" per 100 grams of fresh weight. Since it was a bulky food usually used as a seasoning, its vitamin value was not considered important. However, only last year Morgan in England found that an ounce of parsley supplied the daily vitamin requirement; an ounce is two handfuls of parsley. Chopping the dry plant with a sharp knife caused about 20 percent loss in vitamin but still left more than the average dose. Few persons would wish to take their entire ration of vitamin C by eating two handfuls of parsley a day; still, it is easy to include much larger quantities of parsley in the diet in salads and in sandwiches than is ordinarily done. Parsley may also be used as a base for a beverage.

Suggestions for Parsley in Sandwiches

Sprinkle on meat.

Chop finely and add to meat pastes.

Add to cream cheese, cottage cheese, or American cheese mixed with mayonnaise.

Add to soybean paste which has been mixed with salad dressing or with vinegar and salt.

Spread bread with parsley and chive butter.

Parsley Drink

Press one ounce of leaves into a jug or pot, pour ½ pint of boiling water over them, and allow this to stand for two minutes. Strain through a piece of cloth into which the leaves can be dumped, and squeeze out all the liquid possible; then chill. If the slight parsley flavor seems unpleasant, one of the synthetic lemon or orange drinks may be used for flavoring. This decoction contains from 40 to 60 milligrams of vitamin C; the average daily dose for good health seems to be between 50 and 75 milligrams; and less than 35 milligrams may permit symptoms of scurvy to develop.

Recently two American workers, C. G. Vinson of Missouri and F. B. Cross of Oklahoma, have discovered that persimmon leaves used for a tea "give exceptionally high values in content of vitamin C."* They recommend fresh leaves, either from wild or cultivated trees, saying that they contain about 10 times the amount of the vitamin found in dried leaves. The tea was made in the orthodox way, they said. For those who need a recipe for tea, here is theirs:

Persimmon Tea

Steep the finely divided leaves in a cheese-cloth bag or ball for five minutes in water that has just been brought to a boil. Add a little sugar if desired before drinking.

The flavor of the tea is similar to sassafras tea, and in color and general appearance it is much like a light-colored tea from tea leaves, the scientists report.

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* Science, Nov. 6, 1942, pp. 430-431.

The presence of vitamin C in raw food does not necessarily mean that it will be present when the food is prepared for the table. Cooking often destroys or soaks out much of it (hence the desirability of using the water in which vegetables are boiled), and grating also destroys the vitamin by exposing the injured cells to the air. Dr. Pyke set up an experiment last year to discover how to prepare raw vegetables to save as much vitamin C as possible. Savoy cabbage and rutabagas were the vegetables tested as they are both good sources. A head of cabbage or a rutabaga was cut into four parts. One quarter was grated, one shredded with a suet shredder,† one cut with a sharp steel knife, and the fourth analyzed immediately to see how much "C" was present. The grated cabbage lost 35 percent, the shredded 10 percent, and the knife-cut none of its vitamin within five minutes; and no more was lost by standing in the laboratory for three hours. The rutabaga lost more vitamin than the cabbage when it was grated or shredded with the shredder and continued to lose it for the full three hours. The part cut with a sharp knife lost almost no vitamin C.

The method of preparation is almost as important as the choice of foods in providing the daily requirement of at least 50 milligrams of vitamin C to protect the body against symptoms of scurvy.

Brittonia Becomes Official Organ For Plant Taxonomists

BEGINNING with Volume 5, which will start in 1943, *Brittonia* will become the official organ for the American Society of Plant Taxonomists through an agreement reached last month between the Council of the Society and the New York Botanical Garden, which has been publishing this botanical periodical since 1931. The editorial policies of the publication henceforth will be determined by a board of four members, three to be appointed by the Council of the American Society of Plant Taxonomists and a managing editor to be appointed by the New York Botanical Garden. Each volume is to consist of approximately 500 pages, much as in the past, to appear as material is received and as funds are available, not more than one volume to be issued in any calendar year.

The agreement hinges upon a minimum of 100 subscribers among the members of the Society at an initial rate of $4 a volume.

During most of the early years of *Brittonia*, Dr. A. C. Smith, Associate Curator, now Curator of the Herbarium at the Arnold Arboretum, served as editor. Since the beginning of Volume 4, in 1941, the magazine has been handled by Dr. H. W. Rickett, who will continue as managing editor.

The members of the Board appointed by the Society are Drs. S. F. Blake of the U. S. Department of Agriculture in Washington, D. C.; C. A. Weatherby of the Gray Herbarium at Harvard; and E. E. Sherff of Chicago Teachers' College.

† The next to coarsest cutter on a 4-sided metal grater.

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.)

Precepts for Flower Show Exhibitors and Judges

A HANDBOOK OF FLOWER SHOW JUDGING. Sarah V. Coombs. 90 pages and color chart; indexed. National Council of State Garden Clubs, Inc., New York. 1942. $1.

Advice of equal value to exhibitor and judge will be found in the new Handbook of Flower Show Judging, for the procedure of putting on a flower show has been given quite as much attention as the judging of the entries. The book, which has been prepared by a committee of which Mrs. Jerome W. Coombs is chairman (Mrs. William Crocker and Mrs. Margaret Scruggs Carruth being the other members), deserves a place in the library of all who are interested in flower shows.

In the introduction, the authors stress the fact that the popularity of the Judges' Courses, started in New York in 1930, necessitated the setting of a standard for the use of the schools which have since been started all over the country. The committee appointed by the National Federation of State Garden Clubs has done its work nobly. To one who has both exhibited and judged, it is gratifying to note the courage of the writers in tackling the knotty points that arise at flower shows and offering solutions that really solve. It is heartening to a professional to find the authors stressing the necessity of horticultural classes at all shows, and warning that where these are neglected a steady deteriorating of the club responsible may be noted.

The Judging Committee has its duties outlined at length, even to suggestions about refreshments. I have yet to meet a judge at an amateur show who had any complaint on this score, with the exception perhaps that he was being pleasantly killed by kindness. The judges have a chapter to themselves headed "The Judging and the Judges." Here no punches are pulled and the paragraph on Courage makes enjoyable reading. Decidedly the authors lacked not this commodity. In addition, there is a chapter on "Hints for the Judges," in which the duties of a judge are clearly defined. This is followed by "Hints for Securing a Well Balanced Show." The advice given here not to award a prize for the largest bloom in the show seemed a little misplaced under the heading of Freaks.

The five important points of a flower arrangement are covered and undesirable practices are listed.

A three-page list of books for required or suggested reading is given to the prospective student in a Judges' Course, and the handbook closes with a copy of the Fischer New England Gladiolus Society Color Chart.

The authors stress the fact that this book has been compiled primarily for the amateur. It has gone much further than that. They are to be congratulated on covering their field so thoroughly. The professional gardener may learn much, but could add little of additional value to this book.

George H. Gillies,
Head Gardener, Marshall Field Estate.

Instructor's Problem

BASIC HORTICULTURE. Victor R. Gardner. 441 pages, illustrations, glossary, index. The Macmillan Co., New York, 1942. $3.75.

Basic Horticulture is intended to be a textbook for beginning courses in horticulture, taken prior to much training in science. It would be useful also for gardeners who seek a generalized treatment of fundamental processes.

It draws illustrations from the whole field—pomology, vegetable growing, ornamental horticulture. There are discussions of classification of plants, plant structure and plant growth; temperature, moisture, light, nutrient relations; flower and fruit formation, propagation, pests and their control, etc. On the whole, the treatment is very sound.

Unfortunately, there are a few generalized statements that are capable of misinterpretation. *Vaccinium corymbosum* is listed as a bog plant, and *Hosta plantaginea* as a scaly bulb. Most soils of granitic origin, the book implies, tend to be basic or neutral. Some statements are made that are not in agreement with present knowledge, as that the optimum temperature for the carnation is 55°F. night and 72°F. day, instead of the generally accepted 48° and 60°F. respectively; and for the rose, 70° and 90°F. instead of the accepted 60° and 70°F., respectively. *Euonymus* is curiously spelled with an *o* in place of the *y*. Terminology is sometimes confused, as in "bulbet" and "bulbel" (which should be *bulbil*), and "graftage" and "grafting" in propagation. The use of botanical names is not always exact. *Delphinium ajacis* is called a perennial. Often a class common name is used, as phlox, and a specific botanical name is given to it, as *Phlox subulata*, as though that were the only species known. Figure 47 is mislabeled; it is *Paradisea liliastrum*, not *Tolmiea Menziesii*. In the main, however, the many illustrations are excellent and well chosen.

Basic Horticulture should be a usable book, on the whole, provided the instructor in the course gives elucidations where necessary.

C. H. Connors,
N. J. State College of Agriculture.

Chapter on Photosynthesis

SCIENCE IN PROGRESS. George A. Baitsell, editor. Third series. 322 pages, illustrated, indexed. Yale University Press, 1942. $3.

A collection of 12 learned articles by eminent authorities on particular topics in astronomy, physics, chemistry and biology; not a general review of progress in either science as a whole or in any of its branches. The only biological article, entitled Some Fundamental Aspects of Photosynthesis, considers the questions of why organic matter is not formed on the earth without photosynthesis; why organic matter, once produced through photosynthesis, is stable enough to make life possible at the low temperatures now prevailing on earth; why the organic matter of our bodies does not immediately react with oxygen to form carbon dioxide and water; and why light energy alone is especially suited to reverse the process of burning in producing organic matter and oxygen by the combination of carbon dioxide and water.

E. H. Fulling,
Editor, The Botanical Review

Symposium on Vitamins

THE BIOLOGICAL ACTION OF THE VITAMINS. A Symposium. E. A. Evans, Jr. 227 pages, illustrated. University of Chicago Press, Chicago, 1942. $3.

Fifteen authors, each an authority, have contributed to this most interestingly written volume in which vitamin B_1, riboflavin, pellagra and nicotinic acid, pyridoxine, pantothenic acid, biotin, choline and vitamin K are discussed. While the clinician, dietician and investigator will find the book of most value, the layman also will discover chapters which are most absorbing and illuminating.

W. J. Robbins.

Enzymatic Actions Reviewed

ADVANCES IN ENZYMOLOGY. Vol. II. Edited by F. F. Nord & C. H. Werkman. 374 pages, indexed. Interscience Publishers, Inc., New York. 1941. $5.50.

This book consists of 12 parts written by 15 authors reviewing 881 articles. Therefore, it is a useful book of references for the study of enzymes and enzymatic actions in connection with bacteria, fungi, green plants and animals. For instance, the part on Vitamin K, its Chemistry and Physiology, covers all that is known today on this subject, giving a bird's-eye view of the entire field.

Roberta Ma.

Plants and Animals

GENERAL BIOLOGY FOR COLLEGES. Gairdner B. Moment. 661 pages, indexed, illustrated. D. Appleton-Century Co., New York. 1942. $4.

A workmanlike if not inspiring classbook of biology. The treatment of plant life is unusually adequate and in the main competent. The illustrations are a compilation, those of plants not always wisely chosen.

H. W. Rickett.

Discovery for Young People

BASIC SCIENCE EDUCATION SERIES. Paper-covered books, illustrated in color, mostly of 36 pages each. Row, Peterson & Co., Evanston, Ill. 1941-2. 28c each.

A criticism often made of scientists is that those who are most competent in their fields are often the least able to write interestingly—or even intelligibly—for the public. And if the professional writer essays to "popularize" science he usually succeeds only in betraying his own inadequacy. Children particularly are faced with a horrible passage between the Scylla known as "textbooks"—lifeless, hackneyed, never to be read for fun—and the Charybdis of sentimental twaddle—pictured by a Disney.

The "Basic Science Education" series and its companions are (for all their formidable title) a welcome discovery in the dreary prospect. A hundred or more titles have been published, each a small paper-bound volume clearly printed and copiously illustrated in color and black-and-white. It is true that the language here and there verges inevitably on the didactic; but in general the text is skillfully and pleasantly written for its readers—children of 4th to 7th grades. Each book treats of one topic; some that are concerned with plants are: *Trees; The Garden and its Friends; Our American Forests; Flowers, Fruits, Seeds; Seeds and Seed Travels; Man's Use of Plants and Animals.* Another that is in the Botanical Garden's library is *The Earth's Changing Surface.*

The accuracy of these miniature treatises is something to marvel at. The illustrations are copious, well chosen, — and beautiful. The color-reproduction is remarkable. *Trees* and *Birds* are a bit disappointing in this respect, but the book on *Flowers* surpasses well known works costing many times 28 cents. Publisher and author are to be congratulated.

H. W. Rickett.

Terms Used in Chemistry

CHEMICAL DICTIONARY. Compiled by F. H. Campbell. 85 pages. Chemical Publishing Co., Brooklyn, 1942. $2.50.

The 1,200 terms defined are followed by a valency table. This is a book of convenient size for ready reference.

Current Literature At a Glance*

Rope Fibers. The snake-plant, or bowstring hemp (*Sansevieria*), that grows uncomplainingly in the dim dry living-rooms of apartments, is one of the available plants suggested as a substitute for manila hemp, now that our normal supplies of materials for making rope and burlap are cut off by the war. Okra—not the vegetable, but the plant on which it grows—is another, and the French cockle-burr or Caesar-weed of Florida (*Urena lobata*), a third. According to Dr. A. C. Whitford, who writes of them in *Textile Research* (Oct. 1942) these plants are among the most practical substitutes because stock is available, they can be easily grown in this country, and their fibers are known to be of good quality.

Ramie (*Boehmeria nivea*) is another fiber of which Dr. Whitford recently has written. Satisfactory cloth simulating linen, wool, and other materials, he says, is being made from ramie combined with fixed percentages of other fibers.

Plastic from Nutshells. How walnut shells are used to make a plastic compound for dies needed in the aviation industry is told in the January number of *Forest and Outdoors,* a Canadian publication.

Liliaceae. The American Lily Yearbook, published by the American Horticultural Society, consists of 119 pages of information on species, clones and varieties, details of culture, diseases and pests, and personal experiences with lilies. It also contains an insert by A. B. Stout on Nomenclature of Lilies, reprinted from the *National Horticultural Magazine,* July 1942.

Daffodils, Chiefly Abroad. The Daffodil Year Book of 1942 is appearing as a joint issue of the Royal and the American Horticultural Societies. The opening article describes the R. H. S. Show in London in April 1941, which took place amid enemy aircraft attacks that damaged the hall but miraculously did not

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

harm the exhibit. The only American daffodil show reported in this 96-page year book is the one at Pasadena, but pages are devoted to the exhibits in Tasmania, New Zealand, Australia, and at Lymington in England.

One writer describes his efficient and economical method of using pharmacist's capsules for pollinating narcissi.

"Daffodils—An Inspiration" by C. G. Hayes is the personal story of a bedridden gardener whose greatest joy is provided by his daffodils, the culture of which he supervises from his window, and by the friends he has made through his interest in this flower.

Palm Pests. A valuable tabulated list of the insect pests of tree palms in Florida is given in the January number of the *Arborist's News*. The control measure for each is listed.

Physiology. Abstracts of the papers that were to have been given at the meeting of the American Society of Plant Physiologists in New York in December are contained in a mimeographed bulletin which was received about the time that all of the meetings of the A.A.A.S. were called off. The 31 topics include experiments with electric currents on onion roots, tetraploid cabbage, crop response to soil nutrition, growth substances on crop plants, vegetative propagation of hemlock and sugar maple, and the influence of magnetic fields on seed germination.

Alaskan History. The Laboratory of Tree-ring Research has issued its first bulletin as a joint publication of the Universities of Arizona and Alaska. J. J. Giddings, Jr., summarizes the results of three years of research in dendrochronology in Alaska in which logs from ancient dwellings, wooden artifacts, driftwood, buried wood of the frozen silt deposits, timberline tree-trunks, and other specimens have been used to develop a 300-year record of silt deposition and an even longer record of climate and anthropological data.

Hedera. The cultivated ivies is the subject of L. H. Bailey in a recent number of his *Gentes Herbarum*. He describes four species of *Hedera* and more than 30 valid varieties, listing many times that number of invalid names.

Essential Oils. A world-wide view of the essential oil industry—a glimpse of its history and future and a record of the sources and uses of every essential oil that is known—is presented in a reprint from *The American Perfumer and Essential Oil Review*. The tabulated list, which has been prepared by Dr. Ernest S. Guenther, Chief Research Chemist for Fritzsche Brothers, New York, contains a wealth of information. Dr. Guenther was one of the speakers at the New York Botanical Garden's Herb Conference last spring, at which he showed two motion pictures on essential oils.

The list alone occupies ten quarto pages. The name of each oil is given, then the botanical source, the geographical origin —both where the plant is native and where it is cultivated—then its application. Nearly 30% of the oils are official in the twelfth edition of the United States Pharmacopoeia. Others, besides their use in medicine, are employed as flavoring agents in foods, confections, beverages, perfumes, sprays, tobaccos, toiletries, and even paints and polishes.

The same information is given for the five important balsams—Copaiba, Peru, Tolu, and American and Asiatic Styrax. These reports are followed by a table arranged geographically, and this explains at a glance why we are short of certain products. England, one learns, produces only one essential oil, and that is oil of peppermint. Southern France has been the world's most prolific producer, with an output of oils of lavender, sweet marjoram, clary, carrot seed, celery seed, hyssop, parsley, estragon (tarragon), cypress, sweet basil, myrtle, lavandin, labdanum, and savory; three separate oils from *Citrus bigaradia;* besides a great variety of floral oils, such as jasmine, rose, orange blossom, violet, and three, known as cassie and mimosa, which are derived from species of *Acacia*.

Morocco, another inaccessible place today, so far as trade is concerned, ranks second. From there we formerly obtained essential oils from pennyroyal, thyme, labdanum, origanum, myrtle, rue, bitter almond, and cumin seed.

A hopeful note appears in the last line of the booklet, where Chile is mentioned. It says: "A start has been made to produce aromatic herbs and to distill their oils."

Notes, News, and Comment

Annual Meeting. All officers were re-elected at the annual meeting of the Corporation and the Board of Managers of the New York Botanical Garden, which took place in the office of President Joseph R. Swan, 14 Wall St., Jan 26. Dr. William J. Robbins read the annual report of the Garden's activities and Mrs. Robert H. Fife reported as Chairman of the Advisory Council. A new Horticultural Committee was established by vote of the Board, with Henry F. du Pont as chairman with power to add to the Committee. William F. Barrett was named as a new member of the Scientific Committee. Mrs. Joseph R. Swan was elected both to the Corporation and the Advisory Council. Other new members of the Corporation are Dr. Charles W. Ballard, William F. Barrett, Rev. Robert I. Gannon, and Mrs. Robert H. Montgomery.

Visiting Curator. Dr. Bassett Maguire, Professor of Botany and Curator of the Herbarium at the State Agricultural College at Logan, Utah, arrived at the New York Botanical Garden last month to spend a year as Visiting Curator. He will work on the flora of Utah and will also make revisionary studies of the Caryophyllaceae for *North American Flora.*

Island Specimens. A group of 54 herbarium specimens of plants collected on the Great Barrier Reef of Australia, on Viti Levu in the Fiji Islands, at New Caledonia, and on Guadalcanal in the Solomons has been presented to the New York Botanical Garden by the American Museum of Natural History. With them are specimens preserved in formalin and color sketches of the majority of them. They were collected as models to be used in designing some of the Museum's new exhibits showing scenes in the far Pacific.

Gary N. Calkins. Professor Emeritus of Protozoology at Columbia University, Dr. Gary N. Calkins died at his home in Scarsdale Jan. 4. He had been a member of the Corporation of the New York Botanical Garden for the past ten years. Dr. Calkins was widely known as a writer, teacher, and lecturer in the field of what he called the "smallest living things." He was Director of the American University Union in Paris for a year in the 1920's, and for many years was president of the Men's Faculty Club at Columbia. From 1919 to 1921 he was President of the Society for Experimental Biology and Medicine.

Students. Four students from Mt. Holyoke College, South Hadley, Mass., visited the Garden with their instructor, Dr. Mary H. Wilde, on Jan. 5, especially to study ecological groups of plants in the Main Conservatories.

Conference. The results of a two-summers' floristic survey of a newly established reserve of 4,000 acres near Litchfield, Conn., were given by John D. Dwyer at the conference of the staff and registered students of the Garden Jan. 13. A group from Fordham University attended. Dr. Dwyer, who received his Ph.D. degree from Fordham, doing research at the New York Botanical Garden, in 1941, is now teaching at Union University in Albany.

Army. Howard Swift, who has been with the Burpee Company of Philadelphia since leaving the New York Botanical Garden a year ago, was inducted into the U. S. Army at Camp Dodge, Iowa, last month. Only a few months before, he had been sent in a managerial capacity to Burpee's growing field at Clinton, Iowa.

Four student gardeners have left in the past two months to join the Armed Forces. They are Peter Smirk, Julian Finkenstein, Francis De Vos, and Henry Elbaum.

Foreman. Louis Politi, who came to the Botanical Garden as a student gardener in February 1942, on Dec. 1 was appointed Arboretum Foreman to succeed Ralph Pinkus, who is now in Guatemala.

New Position. Walter Wollny, who has had charge of the culture of the succulent plants in Range 1 during the past few years, became assistant manager of the Goldfarb seed store in New York on Feb. 1. He had worked at the Garden for nearly 12 years and was a member of the first graduating class in the Science Course for Professional Gardeners, which was organized at the Garden shortly after he came here. During his first years at the Garden he was employed in Range 2, then was transferred to the Main Conservatories, where he developed a wide acquaintance among the public.

Women Gardeners. Four women have recently joined the gardening staff at the Botanical Garden to replace some of the men who have left for Army service. The first to come was Mrs. Dorothy Malby, a graduate of Ambler School of Horticulture, who began work Dec. 1. Late in January, Miss Ellen Alspaugh, Miss Bride McSweeney, and Mrs. Emma Ahles began working. Mrs. Ahles worked formerly in the orchid collection, but neither of the others has had previous experience in gardening. Mrs. Victor D'Asaro who, as Angelina Perez, previously worked at the Garden, returned late in the year to the accessioning department to take the place of Mrs. Elsa Stevenson who resigned to take a defense job. Miss Anne Seaman, who has been at the Garden since 1941, is now the only other woman on the gardening staff.

Visitors. Dr. William E. Martin of the University of Arizona spent several days at the Garden in January studying tropical plants in the library, herbarium, and conservatories, preparatory to an expedition to Peru. Dr. & Mrs. F. W. Kavanagh from the University of Rochester spent a week at the Botanical Garden last month, partly for the purpose of conferring with Dr. William J. Robbins on recent work in vitamin research. Among other recent visitors have been Dr. E. D. Merrill of the Arnold Arboretum; Dr. Cynthia Westcott, Glen Ridge, N. J.; Dr. Robert Bloch, Yale University; and Dr. Robert M. Tryon, Jr., of the Gray Herbarium.

Torrey Club. Dr. H. W. Rickett addressed the Torrey Botanical Club at the Garden Jan. 20 on "The Genus *Cornus* of North America."

Artists. Miss Mary Easton, who has formerly been at the American Museum of Natural History, began work last month as an artist at the Botanical Garden. Walter D. Graham, who made drawings for Dr. B. O. Dodge for several years, has also been engaged, to commence on Feb. 1. Both will work on drawings of the wild plants of northern North America.

All-America Selections. Winners of silver medals in the All-America Selection trials of annuals during the past summer include a double-flowered petunia of the "Rosy Morn" class, called ***America,*** and an orange-colored, double, "French Harmony" type of marigold named ***Sunkist.*** Another petunia, named ***Igloo,*** a floriferous creamy-white variety, won the bronze medal and a third, called ***English Violet,*** was awarded first honorable mention. Other recommended new varieties which were tried out during the summer of 1942 are a tall red-flowered cosmos, ***Dazzler,*** and two new kinds of China asters, ***Navy Blue,*** and a light-colored mixture called ***Victory Giants Mixed.*** The asters, however, are not resistant to the aster wilt disease, hence can be of only limited culture. For the second time, one of the trial grounds for the All-America Selections was at the New York Botanical Garden, in a bed along the path between the Museum Building and Range 1.

The four new vegetable varieties which were awarded bronze medals in the year's trials for All-America Selections are cucumber ***Marketer,*** pole snap bean ***Potomac,*** yellow tomato ***Jubilee,*** and sweet pepper ***Early Pimento.*** Honorable mention was awarded to ***Cangreen*** bush lima bean. ***Mary Margaret McBride*** and ***Grand Duchess Charlotte*** are the two new roses which won awards this year.

Blind Gardeners. Sage and thyme are being cultivated and packaged by a group of thirty blind women, members of the Blind Players Club, on an acre of ground at Suffern, N. Y. Their first crop was put on sale at Christmas time under the auspices of the New York State Commission for the Blind.

Lobelias. The first number of *North American Flora* to be issued for more than a year appeared on January 5 as Part I, Volume 32A. Containing 134 pages, it deals with the Lobelia subfamily of the Campanulaceae. Fifteen genera are treated, one of which, *Pseudonemacladus,* is a new name proposed by the author, Rogers McVaugh, and another a new genus, *Legenere,* named in honor of E. L. Green, by way of an anagram.

To reach the Botanical Garden, take the Eighth Avenue Subway to Bedford Park Blvd., the Third Avenue Elevated to the Bronx Park station, or the New York Central to the Botanical Garden station; or drive up the Grand Concourse then east on Mosholu Pkwy., or, coming from Westchester, turn west at the end of Bronx River Pkwy.

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.

Plants of the Vicinity of New York, by H. A. Gleason. 284 pages, illustrated. A handbook especially compiled for the beginner in plant identification. 1935. $1.65.

Flora of Bermuda, by Nathaniel Lord Britton and others. 585 pages with 494 figures, covering algae, fungi, mosses, ferns, flowering plants. 1918. $3.50

A Text-Book of General Lichenology, by Albert Schneider. 230 pages. 76 plates. 1897. $2.50.

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.

Plants of the Holy Scriptures by Eleanor King, illustrated, and accompanied by a list of Plants of the Bible with quotations, in the March 1941 Journal. 15 cents.

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.

Hardy Ferns and Their Culture. Edited by Carol H. Woodward. 40 pages, illustrated; bound in paper. 1940 25 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.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal. 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 25 cents.

An Herbal. First published by Richard Banckes in London. 1525. Edited and transcribed into modern English with an introduction by Sanford V. Larkey, M.D., and Thomas Pyles. 200 pages, including facsimile of original. Prepared by Scholars' Facsimiles and Reprints. 1941. Price to members of the Garden, $2.50; to others, $3.50.

Succulent Plants of New and Old World Deserts by E. J. Alexander. 64 pages, indexed. 350 species treated, 100 illustrated. Bound in paper. 1942. 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-first 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 a year; single copies 15 cents. Free to members of the Garden. Now in its 43rd 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 $1.25 each. Now in its thirty-fourth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers. Subscription price, $5 a volume. Now in its fourth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 90 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

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 519

MARCH
1943

PAGES
49-76

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

VEGETABLE GROWING FOR VICTORY

CONTINUING a program instituted nearly two years ago in anticipation of food shortages, the New York Botanical Garden is greatly increasing its effort this spring in helping home gardeners to learn to grow vegetables properly. It is in the educational aspects of vegetable growing that the Botanical Garden is especially able to play its part in this essential phase of war work.

The success last year of the Demonstration Vegetable Garden, the report of which is published here and also in booklet form (at ten cents a copy) through the aid of the Advisory Council, has warranted the continued maintenance of the demonstration area in 1943.

The evening classes in Vegetable Gardening given last spring at the Garden, also the Three-Day Short Course in the same subject, are being repeated. The series of free lectures presented downtown in co-operation with the New York Times attracted around a thousand persons both last year and this.

A booklet on the home culture of vegetables and fruits, published a year ago by the Garden, was followed in the Journal by appraisals of the year's outstanding books on vegetable gardening. Frequent lectures by members of the staff and the answering of innumerable questions have comprised no small part of the Garden's work in giving the public reliable information on a subject of major importance today.

The newest educational approach for the Garden is over the radio, in a series of four consecutive Monday evening broadcasts, 6 to 6:15, over station WNYC, beginning March 22. One of the biggest projects of all is the six weeks' program of instruction in vegetable gardening being given by R. H. Macy & Co., starting March 29, arranged for the store entirely by the New York Botanical Garden.

Equally far-reaching projects are in the making, ready to be announced probably within the month.

A successful Victory Garden campaign, such as the Botanical Garden has inaugurated, involves not only the actual raising of crops, to show what can be done and how, but also the stimulation and direction of interest in growing vegetables and the provision of sound instruction for the participants. The Botanical Garden is exerting every energy to carry out this part of its wartime responsibility.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

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THE NEW YORK BOTANICAL GARDEN

VOL. 44 | MARCH 1943 | NO. 519

The Victory Gardens of 1942 and '43

A Report and Prospectus of the Demonstration Plot Maintained at the New York Botanical Garden

With Plans and Suggestions for Home Growers

By T. H. Everett

THIS is the story of one small Victory Garden, a Victory Garden that was planted at the New York Botanical Garden in 1942 to demonstrate what could be accomplished on a small plot of ground. This garden attracted much favorable attention from visitors, and numerous requests were received for plans and for information concerning its upkeep.

Records were kept throughout the season of most of the significant factors except the amount of labor used; a careful estimate places this at not less than 25 hours per month from May to September inclusive. The double-digging of the ground which was done the previous November occupied two men for 32 hours each. All the work was done with hand implements—a spade, fork, rake, garden line, trowel, dibber, draw hoe, scuffle hoe, wheelbarrow, sprayer, duster, hose, sprinkler and a watering can.

Because the garden was small and because hand tools were employed exclusively it was possible to follow an intensive system of cultivation and thus to secure a maximum amount of produce from our ground. Rows were planted as closely together as the growth of the various crops would permit. At maturity the plants in adjacent rows touched each other. No extra space had to be left to accommodate mechanical or horse-drawn implements.

Seeds, fertilizers, and other supplies were furnished gratis by Stumpp & Walter Company of 132-138 Church Street, New York, N. Y.

The produce from the garden was given to Fordham Hospital.

The publication of this report is made possible by a special appropriation received from the Advisory Council of the New York Botanical Garden. Included in it are explanations and suggestions which may be applied by the home gardener who is developing a plot for vegetable culture.

The Site

The site chosen for the V-Garden was previously occupied by a small model flower garden which consisted of lawns, flower borders and some shrubbery, the whole enclosed by a low picket fence upon which rambler roses were trained. It thus duplicated in its essentials the conditions presented by many home gardens. The surface was level and unshaded by trees or buildings. The area enclosed by the picket fence measured 52 by 38 ft. but as shrubs and a rose arch occupied one end of this area, the space available for the V-Garden was 47 by 38 ft.

Because our garden was well within the boundary fence of the New York Botanical Garden we did not suffer from theft or vandalism. These may, however, be real anxieties to the person whose V-Garden is in an exposed position, and careful thought should be given to the matter of suitable protection.

The Layout

The design of a vegetable garden should not be elaborate; rather it should be planned functionally with simplicity as the keynote. Complicated path systems and involved planting arrangements add greatly to the work of maintenance and often result in a reduction in the amount of the crops obtained from the area.

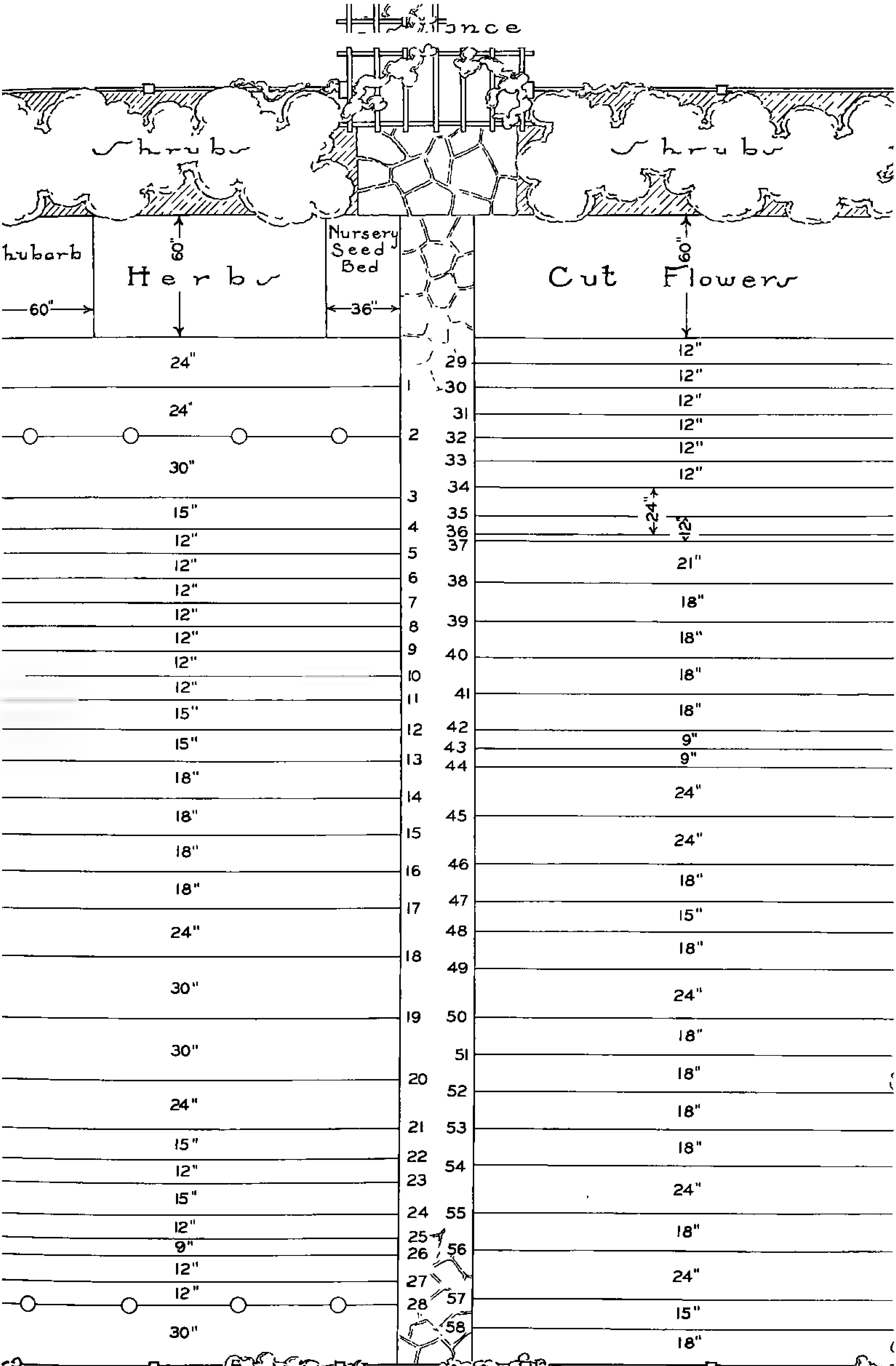
In our V-Garden a path running north and south divided the area into halves. The rows ran at right angles to this path. (While it is generally agreed that some slight advantage is gained from running vegetable rows north and south, because the light then falls on both sides of the rows evenly, this advantage is so slight that if circumstances make it more advisable to have the rows running in some other direction there should be no hesitation in doing so.)

To maintain a constant succession of tender vegetables, an adequate water supply is necessary. True, the 1942 season was unusual in that the rainfall was so evenly distributed that artificial watering was seldom needed; however, provision for supplying water was considered when our V-Garden was laid out and a single faucet, to which a hose and sprinkler could be coupled, was available.

The Planting Plan

Without a planting plan a garden is a haphazard undertaking. There is a very real danger of planting too much during the early part of the season, of not providing for proper groupings, successions, and rotations, and consequently of having too much produce during part of the season and not enough at other times.

The plan used in our 1942 V-Garden was developed during the winter. By spring, we knew exactly where each crop was to go and had this marked clearly on paper. It was not the perfect plan (few first-year plans are), but it was a good plan and it served its purpose well. With minor



THE PLAN FOR THE 1942 DEMONSTRATION VEGETABLE GARDEN

Figures down the center indicate the numbers of the rows. Each row is 17 feet long. *See pages 64, 65, 66.*

THE PLAN FOR THE 1942 DEMONS

Broccoli, leeks, carrots, beets, beans, and cabbages are growing in orderly succession as the result of the careful planning of the vegetable garden at the New York Botanical Garden. (This and all the other photographs except the one on page 70 are by Fleda Griffith.)

changes, based on the experiences of 1942, and other changes dictated by the needs for crop rotations, the same plan will be used for the 1943 V-Garden.

In making the plan, the following points were carefully considered:

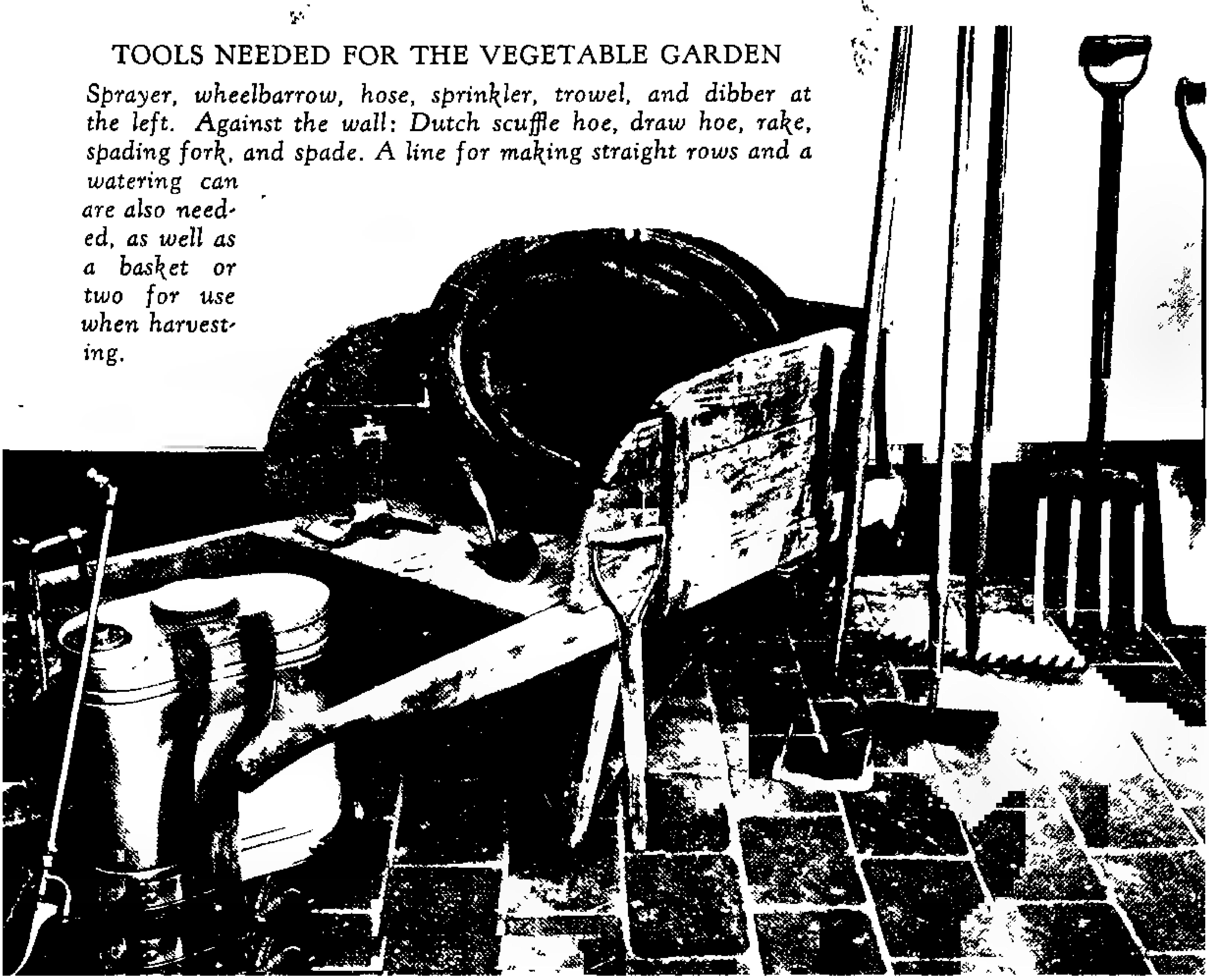
1. *What crops to grow?* As the produce was to be given to a hospital rather than to be used exclusively for a private family, personal likes and dislikes were not significant. It was early decided to leave out certain crops that are beyond the skill of the average amateur in this vicinity. For this reason cauliflower, Brussels sprouts and celery were not included. One sowing of early peas was made with the full knowledge that this would be an uncertain crop. Peas are doubtfully worth while in a small garden in the region of New York. The same is true of cucumbers and melons. It was not thought worth while to attempt potatoes because of the small size of the garden. For this reason also asparagus was omitted. We debated whether or not to include sweet corn. A favorable decision resulted not from the belief that sweet corn was a paying crop in such a small garden, but because we believed that almost every home gardener would desire to plant *just a few hills* no matter how small his plot.

2. ***Where to locate the individual crops?*** In the placing of individual crops we did not have to consider crop rotations, as this was a first-year garden and vegetables had not been grown on the ground the previous season.

It was considered highly desirable to keep in one area the few crops that would occupy the ground for more than one season, such as rhubarb, mint and chives. (If it had been a larger garden and asparagus had been included, this also would have been set in the same area.) Those crops that occupy the ground practically through the entire season, such as pole beans, corn, tomatoes, eggplants, peppers, New Zealand spinach, parsnips, Swiss chard and leeks, were also placed together, while the remainder of the garden was given over to more quickly developed vegetables that are harvested early and are followed by other crops.

The Soil

The soil was of reasonable depth; it consisted of about a foot of heavy topsoil overlying a cold, stiff, gray clay. Natural drainage was satisfactory (it is quite useless to attempt to grow vegetables in a waterlogged soil). We knew that soils such as ours are potentially good, but their fertility depends very largely upon sympathetic management. Every effort must be made to bring them into that fine crumbly condition that



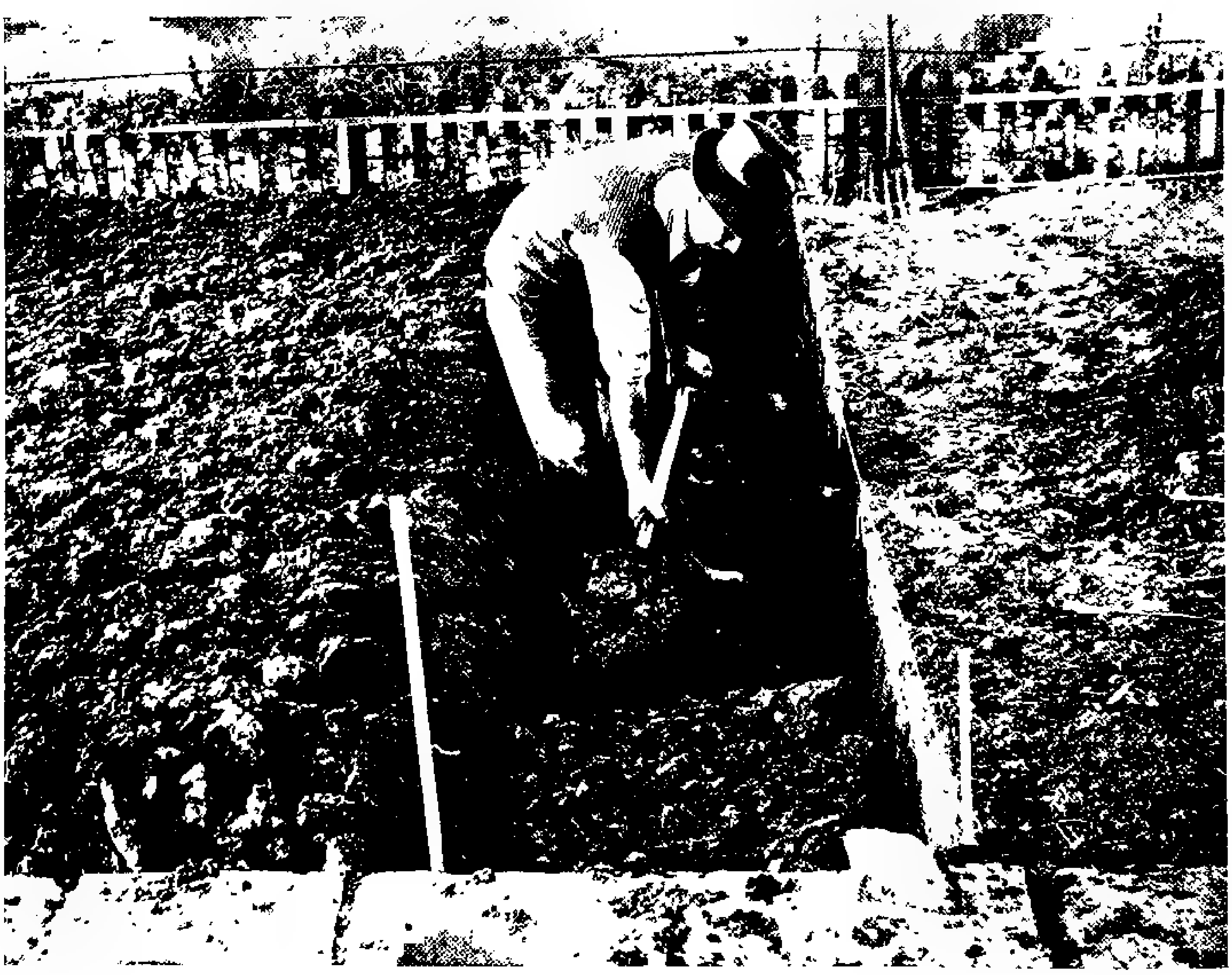
TOOLS NEEDED FOR THE VEGETABLE GARDEN

Sprayer, wheelbarrow, hose, sprinkler, trowel, and dibber at the left. Against the wall: Dutch scuffle hoe, draw hoe, rake, spading fork, and spade. A line for making straight rows and a watering can are also needed, as well as a basket or two for use when harvesting.

gardeners call good "tilth." In this the winter frosts and snows are of great help, therefore it is wise to spade the soil over in the fall to expose new portions. This was done in our V-Garden. In November the entire area was double-dug. That is to say, the soil was loosened and improved by the addition of manure and compost to a depth of 24 inches.

Double-Digging

The procedure for double-digging is simple. Across one end of the garden, a trench (or ditch) was excavated, the trench measuring 2½ feet in width and 1 foot in depth. The soil taken out was deposited at the opposite end of the garden. Next, a liberal quantity of compost was thrown into the bottom of the trench and with a spading fork was mixed with the subsoil to a depth of 10 or 12 inches. Large stones that were encountered were removed. Next the strip of soil adjacent to the trench, 2½ feet wide and 1 foot deep, was turned over with a spade onto the newly loosened bottom soil of the first trench. Good cow-manure in quantity equivalent to a 3- or 4-inch layer spread over the whole surface was mixed



DOUBLE-DIGGING TO IMPROVE SOIL FOR THE VEGETABLE GARDEN

Note the straight line for the trench, the perpendicular walls; and the method of forking over the bottom of the trench, adding to it a quantity of compost.

in with it. The bottom of the new trench that was in this way opened up was treated in exactly the same manner as that of the first trench, and then a third strip of topsoil was turned over onto the top of it. This process was repeated until the end of the garden was reached, when the soil taken from the first trench was used to fill in the last. Care was taken to see that the surface was left level *but rough* so that the full benefit of the frosts and winds and snows of winter could act upon the newly turned soil.

Had it not been possible to spare the labor needed for double-digging we would then have single-dug the area in the *fall.* (Single-digging means turning the soil over to a depth of from 10 inches to a foot and is ordinarily sufficient for a garden that is going to be operated only for a year or two. If permanent operation of a vegetable garden is considered, then it is advisable to *double-dig* at least a part of it each fall because double-digging gradually improves the depth and fertility of the topsoil. While double-digging is desirable it must be admitted that good crops are often grown on land that is single-dug year after year. If spading must be delayed until the spring, double-digging is too time-consuming to be feasible; it is essentially a fall task, to be done from the first frost until the ground freezes hard, which is usually after Christmas.)

Spring Preparation

Following fall spading but little work is needed in spring to make the ground ready for planting. A shallow forking over, the addition of such fertilizers as are needed and perhaps some lime, and the raking level of the seed beds constitute spring preparation.

We applied to our V-Garden 150 lbs. of ground limestone in mid-March. (Periodic dressings of lime are necessary on most vegetable soils, particularly if they are clayey. If in doubt a soil test is advisable). The lime was merely stirred into the top 2 or 3 inches of soil. We also applied 65 lbs. of a complete fertilizer (5-10-5), half of this being mixed with the soil a week or so before planting and the other used later as side dressings between the growing crops. (When applying lime do not bring it into contact with manure or other fertilizer. It is all right to apply the lime after the manure is buried or to apply fertilizer to ground that has been rained on since liming.)

First Plantings

Planting of the V-Garden began just as soon as the ground was fit to work in the spring. (It is extremely important to take advantage of every opportunity that the spring weather affords, for it is a sad mistake to attempt planting or seed sowing if the ground is not in the right condition—friable, crumbly and easy to work without sticking to either shoes or tools.)

Most vegetable seeds are best sown in drills. ➔

← *Peas are sown in a trench 4 inches deep and 9 inches wide.*

In 1942 our first opportunity to plant came just after the 20th of March—two or three drying days with sunshine and wind had dried the surface so that the soil crumbled easily before the fork and rake. We immediately got busy planting our rhubarb, mint, chives, peas and onion sets. The next opportunity for seed sowing outdoors came on March 27 and 28 when we sowed onion seeds, beets, carrots, turnips, kohlrabi, spinach and radishes. This was followed by a sowing of lettuce on April 7. In early May many other items were sown and planted and successional plantings followed as indicated on the chart.

March 20 was the sowing date selected for most of the seeds that were sown in the greenhouse to provide plants to set in the garden later. On that day we sowed tomatoes, eggplants, peppers, early cabbage and broccoli. Celeriac was sown in the greenhouse May 15. (It is a common mistake of beginners to sow such plants too early. This is to be avoided. The person with a small garden and without adequate facilities for raising plants indoors is well advised to purchase ready grown plants from a reliable local dealer.) Our plants were grown on without receiving any checks to their growth and were carefully hardened off before being set in the V-Garden.

Plants of broccoli and cabbage needed for later planting, as well as plants of leeks and kale, were raised by sowing seeds quite thickly in short drills in the nursery bed near the herb section of the V-Garden. Drills a foot or two long provided ample quantities of these plants for our needs.

THE CROPS

Beans, Bush Limas

The seeds were set individually *with the eyes down* about 2 inches apart in drills 1½ inches deep. When the plants were 8 inches or so tall, soil from between the rows was drawn up to the base of the stems with a hoe. Care was taken to sow only when the ground was dry and warm. The wet 1942 season was unfavorable to this crop.

Beans, Pole Limas

Four hills were planted. Before the hills were made, stout ten-foot poles were sunk into the ground to a depth of nearly 3 feet. Soil was then hilled up about each pole to form a low mound about two feet in diameter. Eight or ten seeds, *eyes down,* were set in a circle around each pole and were covered with about ½ inch of soil. When the beans began to climb they were thinned out to four to each pole.

Beans, Snap

The planting and after-care of these were the same as for bush limas, except that no special attempt was made to set the seeds with the eyes down.

Beets

Each beet "seed" is really a group of seeds which produces several plants. Accordingly, we sowed them rather thinly in drills about 1 inch deep. When the plants were well above ground they were thinned out to a distance of about 1 inch apart. (The plants removed may be cooked and eaten as spinach.) A later thinning provided young beets for the table.

Broccoli

As only a few plants were set out, a trowel was used for planting. This tool is preferred to a dibber even though planting with the latter is much faster and so is advantageous where large numbers of plants have to be handled. The plants were spaced 18 inches apart in the rows and were set fairly deeply into the soil. Later, soil was pulled up to the bases of their stems with a hoe and the plants were staked. (While not absolutely necessary, staking is often a wise practice where only a few plants are grown.) Broccoli is an excellent crop for the small garden because after the terminal head is cut off (5 or 6 inches long) side growths develop which in turn are used and then other shoots develop and so a continuous supply of the vegetable is provided.

Carrots

Carrot seeds are small and so were sown in rather shallower drills than the beets. They were also sown somewhat more thickly because each is a single seed. At the first thinning they were spaced ½ inch apart. The second thinning provided usable small carrots.

Cabbage

Cabbages were planted in the same manner as broccoli. They were not staked, of course, and when the heads were harvested the stumps were dug out as they do not produce continuously.

Chinese Cabbage

The seed was sown thinly in shallow drills and when the young plants had developed three or four true leaves they were thinned out so that they stood 15 inches apart. When they started to form solid heads the leaves were drawn together and tied at the top so that the center of each head was blanched. (This is an excellent salad vegetable for the home garden. It needs plenty of water to encourage fast growth.) Our sowing date proved a little too early; a sowing made sometime between the middle and the end of July would have been better.

Celeriac

Plants were set out with the trowel about 8 inches apart. Care was taken to provide plenty of water throughout the growing season.

Cucumbers

The hills for cucumbers were prepared by forking over the surface soil and then placing three or four good forksful of manure in a mound where each hill was to be. The manure was covered with a 3- or 4-inch layer of soil and was lightly flattened down. Eight or ten seeds were then pushed into each hill so that they formed a small circle near its top. The seeds were covered about 1 inch deep.

SOME OF THE CROPS IN THE V-GARDEN DURING THE SUMMER

Corn, lima beans, Florence fennel, celeriac, cabbage, and rhubarb Swiss chard are shown.

When the young plants began to crowd each other all except 4 were removed. In view of the amount of space required and the uncertainty of this crop in many gardens (because of diseases and pests), cucumbers are probably best omitted from the very small garden.

Eggplants

Plants from 4-inch pots were set out with the trowel 18 inches apart in the row. This proved to be a little close; 21 inches or even 2 feet between the plants would have been better. Great care was taken not to disturb the balls of roots at planting time.

Endive

Seed was sown thinly in a shallow drill and the plants were thinned out to 9 or 10 inches apart. When the hearts were showing the leaves were pulled upwards and tied together at the top to effect blanching. (In a home garden it is best to tie up only a few at a time, for if they remain tied too long before using they are apt to rot.)

Fennel

This crop we sowed somewhat too early with the result that the plants tended to run to seed. A mid-July sowing date would have been better. The seed was sown in a shallow drill, the young plants thinned out to 10 or 12 inches apart. When the bases of the stems began to swell to bulb-like proportions, earth was hilled up about them to effect blanching.

Kale

Plants were set out in the same way as broccoli plants with 18 inches allowed between the plants in the rows. Two rows proved too much for the space available and when the plants were half grown one of these was removed. Cultural care was the same as for broccoli. (Kale is a first-rate late vegetable for the small garden. It should not be used until it has been touched by fall frosts.)

Kohlrabi

Drills about an inch deep were drawn for this crop and the seeds were scattered so that they averaged about 1 inch apart. The seedlings were thinned out to about 4 inches apart. (The roots are ready for eating when they are 2 or 3 inches in diameter.)

Leeks

In planting the leeks we first made a drill about 3 inches deep. Along the bottom of this we punched holes with a dibber 6 inches apart and 4 or 5 inches deep. A leek plant was then dropped into each hole, so that only the tips of its leaves stood above the surface of the ground. The holes were then filled up with water; the soil, however, was not pressed against the plants nor were the holes filled with soil. Later in the season when the leeks had made considerable growth the soil was pulled in the trench and was hilled up a little against the plants to develop a good length of blanched stem. Our leeks were rather small at the time of planting although they made up well later. It would probably be advisable to have sown them a month earlier.

Lettuce

The seeds of ***May King*** and ***Big Boston*** were sown in drills about 1 inch deep. Every 7 inches along the drills little groups of 3 or 4 seeds were dropped. When the plants developed they were thinned to one in each group. Both crops were excellent. The seeds of ***Black Seeded Simpson*** were scattered thinly (about 2 inches between seeds) along the entire drill. The young plants that were thinned out were usable, but the later ones failed during the hot weather.

Onions

The onion *sets* were planted 2 inches apart by merely pushing them into the

LEEKS ARE AN EXCELLENT CROP FOR THE HOME GARDEN

Left: Method of planting young leeks with a dibber. Right: Part of the harvested crop.

Laying the onion leaves flat with the back of a rake to induce the ripening of the bulbs.

soil surface. The *seeds* were sown at an average distance of about ½ inch apart. Radish seeds were mixed with the onion seeds in such quantity that one fell about every 6 inches or so along the drills. The radishes came through the soil long before the slower germinating onions and marked the rows so that we could cultivate between them early. The thinnings from both the sets and the seedlings were used as scallions. We thinned out so that the plants stood about 4 inches apart. This was a little too much; the crop would have been larger if we had allowed but 3 inches. When the leaves started to turn yellow and flop over, the tops were bent down flat to the ground with the back of a rake; the crop was then left for about two weeks, at the end of which time most of the foliage had withered. The bulbs were then pulled up and laid out in a single layer in flats and exposed to sunshine for several days until they had thoroughly ripened off and were ready for storing.

Parsnips

Our parsnips were sown in the manner employed by growers of exhibition vegetables. With the aid of a crowbar, holes were bored to a depth of 2½ feet every nine inches along the row. Each hole was packed with a prepared soil mixture and on the top four or five seeds were sown and shallowly covered with soil. The young plants were thinned so that only the strongest one remained at each station. A good crop of excellent and shapely parsnips resulted. (Good parsnips can be obtained by sowing them like beets in drills and thinning them out to 6 inches apart. The roots develop their best flavor after fall frosts.)

Peas

The peas were sown in a flat-bottomed trench about 4 inches deep and 9 inches wide. They were spaced about two inches apart and were covered with 1 inch of soil. The variety was supposed to be the 1½-foot-tall ***"Laxton's Progress"*** but our plants grew fully 6 feet high and obviously were not what they were supposed to be. Brushwood stakes were used and additional brushwood had to be provided as the plants lengthened. The crop was poor, possibly in part because of the variety.

Peppers

The pepper plants were planted out of 3-inch pots at a distance of 18 inches apart.

Radishes

These were sown somewhat thickly in shallow drills and were gradually thinned out as they attained usable size. As is usual, the early and late sowings produced the best quality of radishes.

Rhubarb

Three strong roots were planted with their crowns just below the soil level. The distance between the roots was about 3 feet. As this was the first year after planting we did not pick heavily and we ceased picking fairly early in the season.

Rutabagas

The seed was sown in drills about 1 inch deep and the young plants were thinned out so that they stood 8 inches apart. The sowing date proved a little late. The crop would have been heavier if it had been sown a month earlier.

Spinach

The spring crop was excellent but both

Part of the crop of 57½ pounds of onions harvested from the Botanical Garden's V-Garden in 1942.

fall sowings failed. Seed was sown like kohlrabi and the seedlings thinned out so that they stood about 4 inches apart.

Spinach, New Zealand

This was sown very thinly in a drill and thinned out to 18 inches apart. It provided good picking throughout the entire summer. (It is a good crop for dryish soils.)

Squash

The two hills of squash were planted in the same manner as the cucumbers. They were quite satisfactory.

Swiss Chard

Sown in the same way as beets, the Swiss chard was thinned out to 6 inches apart. The plants provided useful greens over a long period.

Tomatoes

The tomatoes were set out of 4-inch pots with a distance of 2 feet between the plants. They were set rather deeply in the ground because tomatoes produce new roots from the stems. Each plant was tied to an individual stake (the stakes were placed in position before the plants were set). Only the central stem of each plant was permitted to develop; all side growths (the little shoots that develop in the angles formed between the leaves and the main stem) were pinched out when they were quite small, as also were the occasional leafy growths that develop from the trusses of fruits. When the plants were 5 feet high the top of the main stem was pinched out and no other growth was allowed to develop. (This method of growing tomatoes assures the maximum quantity of high quality fruits being produced.)

Turnips

Turnips were grown in the same manner as kohlrabi. The plants were used when comparatively small and before they became tough and bitter.

Miscellaneous Crop

In addition to the crops listed above, the garden produced quantities of mint, sage, thyme, parsley, chives and a few flowers for cutting.

Summer Care

On the average, our V-Garden received some attention three or four times a week throughout the summer. On occasions a man spent two or three hours there in a single day—on other days, an hour or less sufficed. Young growing crops needed thinning out to give them additional room for development. Once a week, and as soon after each rain or artificial watering as possible (that is, when the ground surface had dried sufficiently not to be sticky), the entire garden was cultivated—the surface soil being thoroughly stirred with a Dutch scuffle hoe to a depth of about 1 inch. This operation destroyed developing weeds, admitted air to the roots, and promoted healthy growth.

The 1942 season was uniformly moist and only on rare occasions was artificial watering necessary. When water was applied care was taken that the soil was thoroughly saturated to a depth of 8 or 9 inches.

After the crops were half grown and while they were still developing vigorously, they were given additional food either by applying side dressings of commercial fertilizer or by giving them dilute liquid manure. The fertilizer was scattered thinly between the rows two or three inches from the plants themselves at a time when the soil was reasonably moist; it was then scratched in with a cultivator and watered if rain did not fall shortly

Good solid heads of cabbage resulted from careful cultural practices.

afterwards. The liquid manure was made by tying a bushel of fresh cow manure in a burlap bag and steeping it for a week in a large barrel of water. The resulting liquid was diluted to half its strength and was poured freely along the rows of plants.

Other tasks that needed attention through the summer were the pruning of tomatoes and the harvesting of produce—these are referred to under the notes on special crops.

Diseases and Pests

Like all gardens, our V-Garden was visited by some diseases and pests. Because good cultural practices were followed and because early control measures were applied, these for the most part did not seriously interfere with the productivity of the crop.

The beans were attacked by Mexican bean beetles. Rotenone dust checked these. The onions suffered slightly from the attacks of thrips and were sprayed with soap suds to which Blackleaf 40 was added at the rate of 1 teaspoonful to each gallon. The same treatment proved effective for thrips on the tomatoes. Rotenone dust was only partly effective in checking the corn borer and we lost several ears as a result of its depredations. Wilt affected the cucumbers (this could possibly have been prevented by spraying with Bordeaux mixture). A few cabbage worms appeared on the cabbage and broccoli; these were controlled by hand picking.

CHART OF 1942 V-GARDEN PLAN

Row No.	Variety	Seeds Sown	Plants Set Out	First† Picking	Last† Picking	Amoun Har-vested
1	**Kohlrabi**—Early White Vienna	Mar. 27		June 9	June 25	18 l
2	**Summer Squash**—Straight-neck (½ row)	June 3		July 29	Sept. 16	22 fru
	Cucumbers—Longfellow (½ row)	June 3		Aug. 12	Aug. 27	7 fru
3	**Spinach**—Emerald Standing	Mar. 28			May 29	15 l
4-5-6	**Onion**—Southport White Globe	Mar. 27			Aug. 8	22 l
	Endive—Full-hearted	Aug. 1 (in nurs.)*	Aug. 20		Oct. 28	23 hea
7-8	**Onion (sets)**—Yellow Ebenezer		Mar. 23	May 29	July 17	24½ l
	Beets—Detroit Dark Red	July 17		Sept. 23	Nov. 6	43¼ l
9	**Onion (sets)**—Yellow Ebenezer		Mar. 23	May 29	July 17	11 l
	Carrots—Selected Danvers	July 17			Nov. 4	17 l
10-11	**Leeks**—American Flag	May 11 (in nurs.)	June 9	Oct. 27	Nov. 10	30½ ll
12-13	**New Zealand Spinach**	May 13		July 19	Sept. 8	74 ll
14	**Parsnips**—Improved Hollow Crown	May 2		Oct. 20	Nov. 4	41½ ll
15-16	**Kale**—Dwarf Green Curled Scotch	June 3 (in nurs.)	July 1		Nov. 10	48 ll
17	**Peppers**—Ruby King	Mar. 20 (indoors)	May 19	July 17	Oct. 8	231 fru
18	**Eggplant**—New York Improved	Mar. 20 (indoors)	May 19	July 29	Oct. 8	35 fru
19-20	**Tomatoes**—Marglobe	Mar. 20 (indoors)	May 19	July 29	Nov. 10	104 ll
21	**Lettuce**—May King	Apr. 7			June 9	30 hea
22	**Corn**—Golden Cross Bantam	June 9		Aug. 19	Aug. 27	42 ea
23	**Endive**—Full-hearted	Aug. 1 (in nurs.)	Aug. 28		Oct. 28	23 hea
24	**Radishes**—Early Scarlet Globe	Aug. 28		Sept. 23	Oct. 28	107 roo
25	**Corn**—Golden Cross Bantam	May 11		July 29	Aug. 5	62 ea
26	**Rutabagas**—Purple-top White Globe	Aug. 6			Oct. 28	13½ ll
27	**Radishes**—Early Scarlet Globe	Aug. 6			Sept. 8	130 roo
28	**Pole Lima Beans**—Early Leviathan	June 3		Aug. 27	Sept. 23	13 ll
29	**Snap Beans**—Stringless Green Pod	Aug. 22			Oct. 15	1½ ll

† Because we were picking for a hospital, where quantity was important, the harvesti season for each crop was shorter than it would have been in a home garden.

* Reference to sowing in the nursery in each instance means the small nursery bed in t V-Garden itself.

Row No.	Variety	Seeds Sown	Plants Set Out	First Picking	Last Picking	Amount Harvested
30	**Carrots**—Selected Danvers	Mar. 28		June 25	July 1	21 lbs.
	Chinese Cabbage—Pe-Tsai	July 1			Sept. 16	12 heads
31	**Beets**—Crosby's Egyptian	Mar. 28		June 25	July 1	23 lbs.
	Endive—Full-hearted	July 1			Sept. 23	10 heads
32	**Turnips**—Early White Milan	Mar. 28			May 29	36 lbs.
	Radishes—Early Scarlet Globe	June 4			July 1	76 roots
	Kohlrabi—Early White Vienna	Aug. 6			Oct. 28	17 lbs.
33	**Beets**—Crosby's Egyptian	May 11			July 10	10 lbs.
	Beets—Crosby's Egyptian	July 10		Sept. 23	Nov. 4	11 lbs. with tops
34	**Carrots**—Selected Danvers	May 11		July 29	Aug. 5	12 lbs.
	Beets—Crosby's Egyptian	Aug. 6		Oct. 28	Nov. 4	19½ lbs. with tops
35	**Beets**—Crosby's Egyptian	July 10		Sept. 23	Nov. 4	14 lbs. with tops
36	**Cabbage**—Golden Acre	Mar. 20 (indoors)	May 2	July 1	July 10	34 lbs.
37	**Carrots**—Selected Danvers	July 10			Nov. 4	12½ lbs.
38	**Broccoli**—Italian Market	Mar. 20 (indoors)	May 2	June 11	Aug. 5	22 lbs.
39	**Snap Beans**—Bountiful	May 11		June 25	July 10	9½ lbs.
	Snap Beans—Bountiful	July 25		Sept. 8	Sept. 23	8¾ lbs.
40	**Snap Beans**—Golden Wax	May 19		July 10	July 17	12 lbs.
	Snap Beans—Stringless Green Pod	July 25		Sept. 16	Sept. 23	7¼ lbs.
41	**Snap Beans**—Golden Wax	May 19		July 10	July 17	9 lbs.
	Snap Beans—Brittle Wax	July 25		Sept. 16	Sept. 23	4½ lbs.
42	**Bush Lima Beans**—Henderson's Bush	May 13		July 30	Aug. 5	3 lbs.
	Spinach—Long Standing Savoy	Aug. 6				Crop failed
43	**Lettuce**—Big Boston	Aug. 12 (in nurs.)	Aug. 28		Oct. 28	35 heads
44	**Bush Lima Beans**—Henderson's Bush	June 9		Aug. 12	Aug. 27	7 lbs.
	Spinach—Long Standing Savoy	Aug. 28				Crop failed
45	**Cabbage**—Succession	May 11 (in nurs.)	June 9		Aug. 12	61 lbs.
	Snap Beans—Bountiful	Aug. 12		Oct. 8	Oct. 15	5½ lbs.
46	**Snap Beans**—Bountiful	June 16		July 30	Aug. 18	7 lbs.
47	**Beets**—Crosby's Egyptian	June 23		Aug. 27	Sept. 8	22¼ lbs. with tops
	Radishes—Early Scarlet Globe	Sept. 8			Oct. 28	48 roots
48	**Carrots**—Selected Danvers	June 23		Sept. 23	Nov. 4	10¾ lbs.
49	**Leeks**—American Flag	May 11 (in nurs.)	June 9		Nov. 10	14 lbs.

Row No.	Variety	Seeds Sown	Plants Set Out	First Picking	Last Picking	Amount Harvested
50	**Broccoli**—Italian Market	June 3 (in nurs.)	July 1	Aug. 27	Nov. 10	22 lb:
51	**Kohlrabi**—Early White Vienna	June 9		Aug. 5	Aug. 20	18 lb·
	Radishes—Early Scarlet Globe	Aug. 21			Oct. 28	72 root
52	**Rhubarb Swiss Chard**	May 5		June 25	Nov. 10	61¼ lb·
53	**Cabbage**—Danish Ball Head	June 3 (in nurs.)	July 1		Sept. 8	42½ lb:
54	**Celeriac**—Large Smooth	May 15 (indoors)	July 1		Nov. 10	36 lb:
55	**Florence Fennel**	May 13			Sept. 23	17 stalk
56	**Lettuce**—Black-seeded Simpson	May 29 (in nurs.)	June 29			Crop faile
	Bush Lima Beans—Fordhook	July 16				Crop faile
57	**Peas**—Laxton's Progress	Mar. 23		June 8	July 1	7 lb·
	Corn—Golden Cross Bantam	July 1		Sept. 8	Sept. 16	41 ear
58	**Radishes**—Early Scarlet Globe	Mar. 28			May 1	150 root
	Lettuce—Black-seeded Simpson	May 1				Crop faile

CHART OF 1943 V-GARDEN PLAN

Row No.	Variety
1	**Peas**—Telephone followed by ½ row **Cabbage**—Mountain Rock Red, ½ row **Savoy Cabbage**—American Drumhead
2	**Lettuce**—May King followed by **Cabbage** (late)—Danish Ballhead
3	**Peas**—Little Marvel followed by **Broccoli** (late)—Italian Market
4	**Spinach**—Emerald Standing followed by **Kale**—Dwarf Green Curled Scotch
5	**New Zealand Spinach** (½ row) **Squash**—Straight-neck (½ row for 2 hills)
5A	**Lettuce** (early)—Mignonette
6	**Celeriac**—Large Smooth
7 & 8	**Leeks**—Large American Flag
9, 10, 10A & 10B	**Onions** (seed)—Southport White Globe followed by 1 row **Lettuce** (late)—Big Boston, and 3 rows **Spinach** (late)—Emerald Standing
11	**Perpetual Spinach**—½ row, and ½ row **Rhubarb Swiss Chard**
12	**Broccoli** (early)—Italian Market followed by **Endive**—Full-hearted
13	**Cabbage** (early)—Golden Acre followed by **Snap Beans** (fifth sowing)—Bountiful

THE PLAN FOR THE 1943 DEMONSTRATION VICTORY GARDEN

THE 1943 V-Garden is arranged according to a plan that provides for crop rotation on a three-year schedule. The area (excepting that devoted to the permanent rhubarb, herbs, and nursery seed bed) is divided into 3 equal sections.

Section A *(Rows 1 to 17 inclusive)* is planted with the leafy brassicas (cabbage, kale, and broccoli) and other crops that appreciate deeply worked and heavily manured soil. Preparation of this section consists of double-digging in the fall with the incorporation of liberal quantities of farm manure or compost with the undersoil and of liberal quantities of farm manure with the top layer. In the spring, a dressing of ground limestone (15 lbs. to 100 sq. ft.) is given.

Section B *(Rows 31 to 55 inclusive)* is devoted to root crops that do not require freshly manured ground but that thrive best in soil heavily manured for a previous crop. Preparation of this section consists of single-digging in the fall and the application of commercial fertilizer in the spring before planting. As these crops especially need potash, a spring dressing of unleached wood ashes is worked into the soil with the commercial fertilizer.

Section C *(Rows 18 to 30 inclusive)* is given over to beans, tomatoes, eggplants and peppers, all of which are planted late. Preparation consists of single-digging with a moderate application of farm manure in the fall, followed by a dressing of superphosphate of lime (or of a commercial fertilizer rich in phosphates) in the spring. It will be noted that the two latest sowings of beans are made in Section A. This is done so that a second crop can be taken from the ground occupied by onions in the beginning of the season.

In following this rotation:

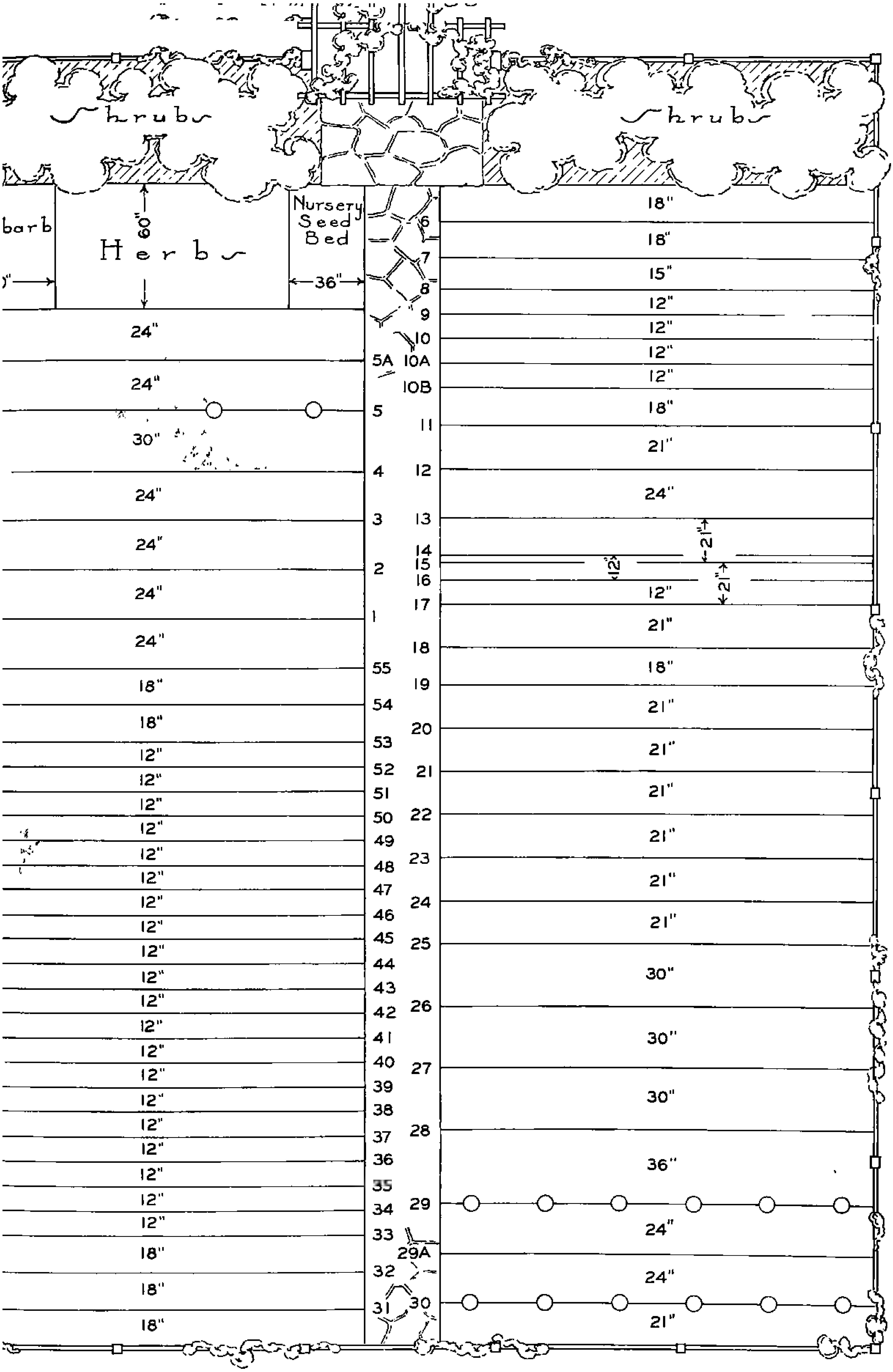
Section A occupies the ground devoted the previous year to Section C.
Section B occupies the ground devoted the previous year to Section A.
Section C occupies the ground devoted the previous year to Section B.

Our 1943 V-Garden provides for more winter storage crops (onions, carrots, beets, parsnips, salsify, rutabaga, etc.) than did the 1942 plan. It also allows for more tomatoes. Corn has been eliminated because it is not considered a profitable crop in a small garden. Peas are included because the space they occupy is not needed by other crops until the peas have been removed.

As in 1942, the plan is designed to meet the needs of the home garden. A greater total weight of crops could be obtained from the same area by increasing the amounts of early radishes, lettuce, turnips, etc., but it is thought that the amounts indicated will meet the needs of most families.

T. H. EVERETT.

14	**Onion** (sets)—Yellow Ebenezer
15	**Snap Beans** (fifth sowing)—Bountiful
16	**Onion** (sets)—Yellow Ebenezer
17	**Onion** (sets)—Yellow Ebenezer followed by **Snap Beans** (fourth sowing)—Golden Wax
18	**Snap Beans** (fourth sowing)—Golden Wax
19 & 20	**Snap Beans** (third sowing)—Stringless Greenpod
21 & 22	**Snap Beans** (second sowing)—Tendergreen
23 & 24	**Snap Beans** (first sowing)—Bountiful Row 23 followed by **Chinese Cabbage**—Pe-Tsai
25	**Eggplant**—New York Improved—½ row, **Peppers**—Ruby King—½ row
26	**Tomatoes**—John Baer
27	**Tomatoes**—Marglobe
28	**Tomatoes**—Rutgers
29	**Pole Lima Beans**—Sunnybrook
29A	**Lettuce**—Black-seeded Simpson
30	**Pole Lima Beans**—King of the Garden
31	**Salsify**—Mammoth Sandwich Island
32 & 33	**Parsnips**—Improved Hollow Crown
34	**Turnips** (second sowing)—Early White Milan followed by **Kohlrabi** (late sowing)—Early White Vienna
35	**Beets** (second sowing)—Detroit Dark Red followed by **Kohlrabi** (late sowing)—Early White Vienna
36	**Kohlrabi** (second sowing) followed by **Turnips** (late sowing)—Early White Milan
37	**Carrots** (second sowing)—Oxheart followed by **Turnips** (late sowing)—Early White Milan
38	**Carrots** (third sowing)—Chantenay
39	**Beets** (third sowing)—Detroit Dark Red
40	**Radishes** (early)—French Breakfast (sown 10 days apart in 2 half rows) followed by **Beets** (fourth sowing)—Detroit Dark Red
41	**Radishes** (early)—French Breakfast (sown 10 days apart in 2 half rows) followed by **Carrots** (fourth sowing)—Chantenay
42	**Carrots** (first sowing)—Oxheart followed by **Beets** (main-crop)—Detroit Dark Red
43	**Beets** (first sowing)—Detroit Dark Red followed by **Beets** (main-crop)—Detroit Dark Red
44	**Kohlrabi** (first sowing)—Early Purple Vienna followed by **Beets** (main-crop)—Detroit Dark Red
45	**Turnips** (first sowing)—Purple-top Milan followed by **Beets** (main-crop)—Detroit Dark Red
46 & 47	**Beets** (main-crop)—Detroit Dark Red
48, 49, 50, 51, 52, 53	**Carrots** (main-crop)—Selected Danvers
54 & 55	**Rutabagas**—Long Island Improved



THE PLAN FOR THE 1943 DEMONSTRATION VEGETABLE GARDEN

Figures down the center refer to row numbers. Each row is 17 feet long.
...ach row, see pages 66 and 68.

At least once a week the vegetable garden must be cultivated to keep down weeds, admit air to the soil, conserve soil moisture, and, as a result, promote vigorous growth of the crops. A scuffle hoe, a cultivator, or a hoe like the one above may be used for the purpose. (Photograph by Ewing Galloway.)

"Do's" And "Don't's" For Your Victory Vegetable Garden

Some Practical Pointers for Beginning Gardeners In the Region of New York City

The Location

Don't attempt a Victory Garden:

1. *In a shaded area.* Your garden must have at least 6 hours of sunshine every bright day.
2. *On a steep slope.* The ground must be level—or at most only slightly sloping.
3. *On wet swampy ground.* Vegetables need well drained soil.
4. *On soil that is too poor.* You should have 8 inches of good topsoil. No worth-while garden will grow on land filled with debris or stripped of its topsoil.
5. *Where you can't get water* for watering in dry weather.
6. *Where crops will be destroyed by thieves or vandals.*

***Do get advice** from an experienced gardener in your neighborhood* on the location of your garden and the suitability of its soil before you spend money for seed, fertilizer, and labor. (Also see the suggestion at the end.)

The Size

Don't attempt more than you can handle.

A garden 30 x 60 or 40 x 50 feet takes not less than 30 hours of work per month during the entire growing season.

Arrangement

Don't try to start a garden without a definite plan.

Do map your garden first on paper.

Find out the proper distances to allow between rows and plants and mark these accurately on your plan. Keep together plants with a long season of growth (parsnips, onions, tomatoes, eggplants, peppers, Swiss chard, New Zealand spinach). Plant early crops in one section and follow these (radishes, carrots, turnips, beets, kohlrabi, lettuce) with later sowings or plantings when the first crop is removed.

Preparing The Ground

Don't neglect your soil. Its condition may make or ruin your crop.

***Do spade or plow** as early in the spring as possible.* (Better yet is to have dug the ground deeply in the fall and left it in a rough condition over winter.)

If you can get some partially rotted manure (or dry manure of any kind) or some compost, leafmold, or commercial humus, spread it 3 or 4 inches thick on the surface of your soil, then dig it in *deeply*. If manure is not available, use the special Victory Garden Fertilizer sold this year by dealers in garden supplies, and mix it well with the top layer of soil at a rate of 3 or 4 pounds per 100 square feet. Do this a week or more before planting.

If you use lime (which will be beneficial on most soils near New York City), *do not let it come in contact with manure or other fertilizer* that is on top of the ground. It should be applied before fertilizing or after the fertilizer has been worked deeply into the soil. Use 10 pounds per 100 square feet, and cultivate it into the top 3 or 4 inches of soil.

What Vegetables To Grow

Don't try to plant too many different kinds.

Do select crops that are easy for a beginner. Most satisfactory ones are tomatoes, broccoli, cabbage, kale, New Zealand spinach, Swiss chard, beets, carrots, radishes, string beans, leaf lettuce, onions (from sets) and leeks. (Choose other crops to suit your taste.)

Avoid cauliflower, Brussels sprouts, celery, peas. (Only experienced gardeners should grow these.)

Think twice about corn, potatoes and squash in the small garden. (They take up too much room.)

Tools

Do buy all your implements from a reliable dealer. You will need: Spade, spading fork, hoe, rake, cultivator, hose, sprinkler, garden line, trowel, a basket or two, and a sprayer or duster.

Don't let your tools get rusty. Always clean them before you put them away.

Planting

Don't plant your seeds too deeply. One-half inch is enough for carrots and other small seeds; 2 inches for large seeds like beans. Except for corn and pole beans, sow seeds in drills spaced 12 to 24 inches apart for different crops (tomatoes require more space). Never sow seed when the soil is so wet that it sticks to your tools. If it is dry, water the drills well *before* sowing. Scatter the seeds thinly and evenly in the drills, then cover drills with soil.

Do get directions for specific vegetable crops from one of the many reliable books or booklets on gardening.

Summer Care

Don't think that planting seeds is all there is to gardening. You must be prepared to work nearly every day in your vegetable garden.

Do stir the upper inch of soil with a hoe or cultivator regularly. This will keep down weeds, admit air to the roots, conserve moisture in the soil, and promote healthy growth.

Don't sprinkle the garden every evening. If it is dry, water it *thoroughly* so that the moisture penetrates 8 or 9 inches, then give it no more water for a week.

Do watch constantly for signs of diseases and pests. Remember that conscientious care of your garden will discourage them, but be prepared to cope with a few. Learn to observe the first evidence of attack and find out the cause of it at once. If your gardening book does not tell you, send a specimen without delay to your State Agricultural Experiment Station (there is one at Ithaca, N. Y.) or to the New York Botanical Garden, Bronx Park, New York City. Apply immediately the control measures recommended.

A Suggestion

Do learn to use your Public Libraries, State Experiment Stations, and Botanical Gardens for advice on the culture of plants. They are equipped to help you and are organized for that purpose.

Spring Lectures at the Garden

THE motion picture taken by Dr. Ernest Guenther, Chief Research Chemist for Fritzsche Bros., Inc., New York City, showing methods of obtaining essential oils from plants in various parts of the western hemisphere, opens the spring series of free Saturday afternoon lectures at the New York Botanical Garden March 20 at 3 p.m. The two reels were shown at the Garden during the Herb Conference last April and excited much favorable comment then. Charles Schneider of the staff of Fritzsche Bros. is appearing with the film as commentator.

The complete schedule of lectures for the spring months is given here.

Mar. 20 ***Production of Essential Oils in the Western Hemisphere***
A natural-color motion picture by Fritzsche Bros., Inc.

Mar. 27 ***Cacti and Other Desert Plants***
E. J. Alexander, Assistant Curator, N.Y.B.G.

Apr. 3 ***Color Photography in the Garden***
Paul Rittenhouse, Amateur Photographer

Apr. 10 ***Plant Hunting in Kashmir***
Ralph R. Stewart, Acting Curator, N.Y.B.G.

Apr. 17 ***Wild Flowers of the Great Basin***
Bassett Maguire, Visiting Curator, N.Y.B.G.

Apr. 24 ***Exploring in British Guiana***
William Hassler's motion picture record of the Terry-Holden Expedition
Robert P. Snedigar, Member of the Expedition

May 1 ***The Cruise of the "Cheng Ho" to the Fiji Islands***
Otto Degener, Collaborator, N.Y.B.G.

May 8 ***Chinese Vegetables for America***
Culture and Preparation for the Table
Roberta Ma, Research Assistant, N.Y.B.G.

May 15 ***Plants Essential to Our Wartime Needs***
G. L. Wittrock, Custodian of Herbarium, N.Y.B.G.

May 22 ***Successful Plants in City Gardens***
Harriet K. Morse, City Gardens Club

Current Literature At a Glance*

Blueberries. An abstract of the paper on cytology of *Vaccinium* species prepared by George M. Darrow of the U. S. Horticultural Station at Beltsville, Md., and W. H. Camp, in collaboration with two other Beltsville men, to be published in the *American Journal of Botany,* appears in Vol. 41 of the *Proceedings of the American Society for Horticultural Science,* issued in February.

Economic Possibilities. *Tropical Woods* for December contains two articles from men recently at the Botanical Garden.

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

Charles L. Gilly, who has just left for Mexico, writes on "Two New Species of Caryocaraceae from Northern South America" and John H. Pierce on "The American Species of *Daubentonia*." A member of the Leguminosae, the genus *Daubentonia* offers possibilities as a substitute for coffee. Members of the Caryocaraceae are chicle-producing plants.

For Studying Nature. Research areas which have been established in national parks and monuments—that is, areas which are remote enough from roads and campsites to be unaffected by the human life which uses the parks—are described by S. Charles Kendeigh in a reprint from *Ecology* (April 1942). Location and description of 28 such areas in nine of the national parks are given. In a reprint from an earlier number of *Ecology*, V. E. Shelford lists reserves in all of North America that may serve as nature sanctuaries.

Notes, News, and Comment

Gardening Lectures. A capacity house of 500 each afternoon and evening attended the series of four lectures on Victory Vegetable Gardening recently given by the New York Times and the New York Botanical Garden in cooperation. Beginning January 20, the course opened with J. H. Beale, Superintendent of the Boyce Thompson Arboretum, speaking on "Planning The Victory Garden." The following week Thomas Little, Superintendent for Col. Robert H. Montgomery, Cos Cob, Conn., spoke on "Planting The Victory Garden." On February 3, T. H. Everett, Horticulturist at the New York Botanical Garden addressed the audience on "Keeping Victory Crops Growing."

The closing lecture on February 10 was given by Dr. Cynthia Westcott, author of "The Plant Doctor," on "Controlling Victory Garden Pests." Dr. B. O. Dodge, Plant Pathologist at the New York Botanical Garden, was also on the platform to assist in answering the many questions from the audience.

Botanists Wanted. The United States Civil Service Commission is seeking a number of botanists and horticulturists to work on the production of rubber and oil-producing crops and other tropical plants. The majority of the openings are outside of continental United States, principally in Central and South American countries. The positions pay from $2600 to $8000 a year.

New Orleans. The natural-color motion picture of the New York Botanical Garden was shown twice last month in New Orleans with Mr. J. A. Schuurman, formerly Consul General of the Netherlands in New York City and a member of the Garden, as commentator. Mr. Schuurman is now in his country's diplomatic service in New Orleans. The first showing took place February 19 before the Orleans Club; the second before the New Orleans Garden Society, which had dedicated its meeting to the Botanical Garden in New York.

Victory Gardens. Dr. William J. Robbins presided at a meeting for the discussion of Victory Gardens in New York City held in the Aldermanic Council Room, City Hall, February 17. Dr. L. H. MacDaniels, Head of the Department of Floriculture, Cornell University, who is Victory Garden Coordinator for Greater New York, opened the program with an address on "Why Victory Gardens Are Needed." Montague Free, Horticulturist, Brooklyn Botanic Garden, discussed the question, "Are Victory Gardens Practical in Greater New York?" Mayor F. H. La Guardia spoke on "Victory Gardens in New York City" and George Burkhardt, Nassau County Victory Garden Coordinator, talked on "The Organization of Victory Gardens in the Community." The program was closed with an address by Mrs. Vernon Lamson, Victory Garden Chairman for the Civilian Defense Volunteer Organization.

Garden Club of America Exhibit. Fifty of the flower prints shown during February in the special exhibit of the Garden Club of America were furnished by the New York Botanical Garden, as were also three portraits of André Michaux.

The exhibition showed engravings of the portraits of seventy-nine botanists for whom plants have been named—such as John Tradescant (*Tradescantia*), Daniel Carl Solander (*Solandra*), John Gerard (*Gerardia*) Peter Collinson (*Collinsonia*), Sir Joseph Banks (*Banksia* and *Rosa Banksiae*) and Clusius (*Tulipa Clusiana*).

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The majority of the books and autographed letters as well as the portraits came from the collection of Mrs. Roy Arthur Hunt of Pittsburgh.

Executive. Dr. William J. Robbins has been elected Vice-president of the American Association for the Advancement of Science for the section on botanical sciences for 1943. The Council of the Association cast the ballot by mail. He has also been elected as the thirty-seventh President of the Botanical Society of America. The new vice-president is Dr. George S. Avery, Jr. Dr. Robbins has appointed Dr. P. W. Zimmerman of the Boyce Thompson Institute and Dr. F. D. Kern of Pennsylvania State College to represent the Society on the Council of the A. A. A. S. for the 1943-44 term.

Class. Dr. B. O. Dodge is lecturing on Wednesdays of each week to a class of nine graduate students from Columbia University and the New York Botanical Garden. The subject is "Genetics of the Fungi."

Officer. Dr. Thomas Laskaris, who worked at the Garden for two years on a fellowship supported by the Delphinium Society of America and the Garden Club of America, has been commissioned a Second Lieutenant in the United States Army Medical Corps and is soon to report for his duties in Washington. For the past year he has been working on investigations of crown-gall organisms at Rockefeller Institute for Medical Research, Princeton, N. J.

Student Gardener. Howard Mayer, who has been a student gardener at the New York Botanical Garden for nearly two years, is leaving March 15 to become assistant foreman at Woodlawn Cemetery. He will graduate from the Garden's two-year Science Course for Professional Gardeners this spring.

Radio. Advice to victory gardeners in New York City was given on Nancy Booth Craig's morning program over WJZ on February 10 by T. H. Everett.

Boston. On February 10 Dr. R. R. Stewart gave an illustrated talk on the plants of Kashmir before the Massachusetts Horticultural Society in Boston. He spent three days working with Dr. E. D. Merrill at the Gray Herbarium and the Arnold Arboretum.

Visitors. Dr. Cyrus L. Lundell, Curator of Herbarium, University of Michigan, was a Garden visitor February 17. Dr. H. K. Svenson of the Brooklyn Botanic Garden spent two days at the Garden in early February.

Art. The annual exhibition of the Bronx Artists' Guild will be held in the Museum Building at the New York Botanical Garden from March 28 to April 25 inclusive.

Conference. Dr. C. Leonard Huskins, Professor of Genetics at McGill University, Montreal, addressed the monthly conference of the staff and registered students of the Garden February 10, speaking on "Mutations and Polyploids in Cereals."

Army. Earle L. Dugan, an employee of the New York Botanical Garden since 1928, was inducted into the United States Army at Fort Dix late in February from where he was sent to take training in an armored tank division at Camp Campbell, Kentucky, on the Tennessee border.

Mr. Dugan came to the Garden originally as a telephone operator. In 1939 he was given charge of the stock room and mailing and continued in that work until his departure.

Guatemala. Mr. B. A. Krukoff returned the last of February from a three weeks' trip, during which he inspected the cinchona plantation in Guatemala where Dr. John Shuman is working as geneticist, and Mr. Ralph Pinkus as propagator.

Westward. Margaret McKenny, a member of the Garden and author of a number of books on gardening and nature study, has been granted a leave of absence from her post as Executive Secretary of the City Gardens Club to go to the West Coast where she will serve as Radio Nature Commentator for the Washington State Progress Commission. Miss McKenny lectured on one of the Botanical Garden's Saturday afternoon programs in 1941, showing her own kodachrome slides of wild flowers of the Rockies and Cascades.

Recent Deaths

Max Schling. The life of one of New York's best known florists and seedsmen came to an end on Feb. 22 with the death of Max Schling. He had been a member of the New York Botanical Garden for nearly 20 years, and during that time was an ardent supporter of all that the Garden stood for in the highest ideals in horticulture and in the education of gardeners. From the beginning he was interested in the training courses established for the student gardeners, and was the speaker at the graduating exercises in 1940. He also addressed the Rose Conference here in June 1939, delighting his large audience with his elaborate flower arrangements made with roses as their base. Only last year, though his health had already begun to fail, he conducted an afternoon course in flower arrangement in the Members' Room as part of the New York Botanical Garden's Educational Program.

Mr. Schling was born near Vienna March 1, 1874, and came to this country in 1899 after laying out a large botanical park for an Austrian count. Previously, he had created a park for a health spa near Vienna and had also been foreman of the Botanical Gardens in Vienna. When he arrived here he was on his way to Brazil, but never went further than New York. He set himself up in business here in 1901 and in 1914 opened the seed store which stills bears his name at 618 Madison Avenue. Later, he also opened a flower shop as well where he became widely known for his arrangements for corsages and for home decorations.

Always a believer in the education of gardeners, he established a fund at Cornell for the aid of indigent students of horticulture and also sponsored the introduction of vocational training for florists in New York City high schools.

Max Schling is survived by his wife, Mrs. Louise Schling, by a daughter, Mrs. P. O. L. Austin, Jr., and by his son, Max, Jr., who is also a member of the New York Botanical Garden.

Mrs. Addison Brown. The widow of Judge Addison Brown, one of the original incorporators of the New York Botanical Garden, died Feb. 22 at the home of her daughter in California. She was 81 years old. Burial was in New York City March 2.

It was her husband who was co-author with Dr. N. L. Britton of "An Illustrated Flora of the Northern United States and Canada," and also the man for whom the Garden's illustrated publication *Addisonia* was named. He was a Scientific Director of the Garden from 1894 through 1904, a member of the Board of Managers from 1905 to 1913, and President of the Garden from 1910 to 1913, when he died. Mrs. Brown was a life member of the Garden.

Howard Atwood Kelly. Shortly before his 85th birthday in February, Dr. Howard Atwood Kelly, an amateur mycologist and author of "Some American Medical Botanists" (1914), died at his home in Maryland. He had been consulting gynecologist at Johns Hopkins Hospital since his retirement from active work there in 1919. Throughout his life his major interest outside of his medical practice had been in botany, and he had amassed what is believed to be the largest private mycological library in the country. It is now at the University of Michigan. From 1924 to 1940 Dr. Kelly was a member of the New York Botanical Garden, and he used to make visits here to consult with members of the staff. He was also a member of the Mycological Society of America and of many honorary and learned societies both in this country and abroad. A brief biography and portrait will be published in an early number of *Mycologia.*

William C. Sturgis. One of the country's authorities on the Myxomycetes, William C. Sturgis died last month at the age of 80, at his home at Annisquam, Mass. Dr. Sturgis's years of professional life were devoted to the diseases of field crops and forest trees, and until 1914 he was Dean of the School of Forestry at Colorado College. Meanwhile, he was constantly collecting and studying the Myxomycetes. His collection of 3,200 specimens, which the Garden acquired from him in 1938, is rich in type material and in rare species and varieties. With it are his own notes and drawings and his correspondence with other students of the group over a period of 40 years.

THE NEW YORK BOT

To reach the Botanical Garden, take the Eighth Avenue Subway to Bedford Park Blvd., the Third Avenue Elevated to the Bronx Park station, or the New York Central to the Botanical Garden station; or drive up the Grand Concourse then east on Mosholu Pkwy., or, coming from Westchester, turn west at the end of Bronx River Pkwy.

to the Botanical Garden station; or drive up the

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.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

Vol. 44
No. 520

APRIL
1943

Pages
77-100

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

Carol H. Woodward, Editor

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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THE NEW YORK BOTANICAL GARDEN

VOL. 44 APRIL 1943 No. 520

Gardening In The City

Illustrated With Photographs By F. W. Raetz

Harriet K. Morse

BY the costly process of trial and error, the city gardener eventually learns what plants will adapt themselves to urban living. But sometimes his patience and enthusiasm begin to wane. For without painstaking care, the casualties may be enormous, until it is learned which are the easy doers in town.

After years of experimenting with the various types of green things a New Yorker might grow, the City Gardens Club has boiled down its findings to a small selected group of plants which seem—in New York at least—to pass the test of endurance. The list which is published here is the result of this survey. Questionnaires had been sent to hundreds of city gardeners for their opinions on plant material in metropolitan areas. The replies were gratifying and the notes and comments interesting. Someone wrote: "In my garden near Washington Square, we have fun with radishes. They grow easily and swiftly (though better ones may be

Mrs. Morse, who is Horticultural Chairman for the City Gardens Club of New York, is the author of two recent books published by Scribner "Garden Easily" (1942) and "Gardening in the Shade" (1939).

had of any grocer)." Another scrawled across her sheet: "Certain things do remarkably well in our garden—caterpillars!"

The biggest city success, according to the poll, was good old *Ailanthus*, the tree of heaven. But where will this not grow? In sun or shade it thrives in anybody's back yard, and everyone knows it well. The pistillate plant is the one to get because the male, or staminate one, exudes a disagreeable odor when in flower. Among shrubs, highest score fell to privet. Clipped or free-growing, one sees it everywhere and its endurance is proverbial.

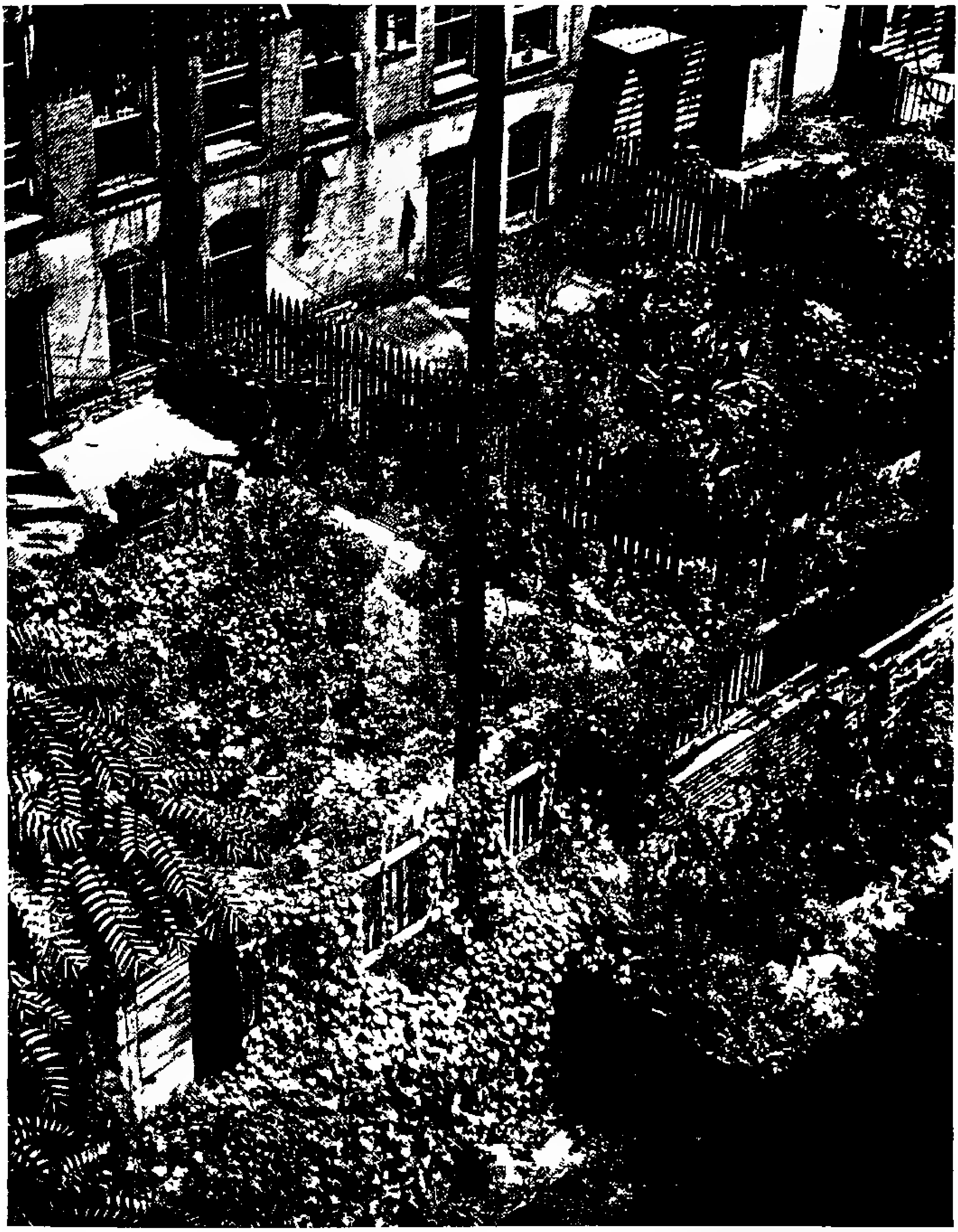
For sunny spots *Sedum spectabile* was considered the most enduring perennial. For the shade, Christmas fern received a high quota of praise. The best annuals for sun were found to be "French" marigolds, petunias and morning glories. In the shade few annuals if any will do well, though *Impatiens Sultanii*, which is treated as an annual, grows well in the city and does not require continuous sun.

Vines are important in the city garden. They take up but little ground space and they drape pleasantly over unsightly fences. Silver lace-vine (also called fleece-vine)—*Polygonum Aubertii*—is an enthusiastic traveler. Its filmy white flowers will festoon the garden wall from early summer to frost. Yet some criticize this vine as too rampant. A latticed fence, decorative in itself, is useful for such a vine as this, and for wisteria and wild grape, which climb by means of twining stems and tendrils. Lacking the lattice, it is easy to pin up these non-clinging vines by means of wall tacks especially made for the purpose. By far the sturdiest clinging vine and the fastest growing is Boston ivy (*Parthenocissus tricuspidata*).

Regarding trees in a small city garden, the thornless honey-locust is highly recommended. Its slender habit and its fine lacy foliage allow light to filter into the garden. This plant, *Gleditsia triacanthos inermis*, should not be confused with the true locust, *Robinia*. The ginkgo is another fascinating tree which accustoms itself easily to the rigors of city life. Its somewhat erratic structure adds to its charm. Unfortunately flowering dogwoods are not usually successful for long, but certain other small trees are—the carmine crab in particular. Many species of hawthorn are beautiful and easy.

For both summer and winter effect many broad-leaved evergreens do remarkably well in the city in sun or shade, notably Japanese holly and Japanese andromeda. Needle-leaved evergreens are not so long enduring, but of these, Japanese yews are the most reliable. Unless one has a bright airy garden one must not expect a profusion of bloom from most of the shrubs, either evergreen or deciduous.

Success with plants everywhere, especially in the city, depends, we must remind ourselves, on many factors. The soil, drainage, feeding all have their influence. Insects and diseases must be controlled, and systematic hosing must be practiced to keep the foliage free from dust which clogs the pores.



The fenced-in yards behind many New York apartment houses and tenements are bright with flowers all summer long. Here the reliable ailanthus tree provides a spot of shade in the lower corner, while morning glories clamber up an adjoining wall. Marigolds and other gay annuals bloomed profusely here in previous years, but this year vegetable patches will probably spring up wherever there is an abundance of sunshine, such as there is here.

A bower is made of morning glories in this New York back yard, where a tiny latticed summer-house provides a cool retreat. Plants in a wild tangle flower here exuberantly, seeming happy under city conditions.

The city garden is at its best in spring. The trees are not yet in full leaf and much color may be expected from flowering bulbs. Yet with few exceptions, bulbs will do well the first season only. They should be discarded after blooming (not thrown away but removed to the country) and new bulbs started in the fall.

It is interesting to note the diversity of ideas expressed in the uniform rectangular yards of the city. The usual pattern has of late years been redesigned and gardens have assumed greater character. Lawns, so difficult to maintain, give way to flagging, brick, or gravel, and the sunny areas are reserved for planting purposes. Raised beds with brick facings are often a part of good design, and here one need not even *stoop* to tend one's garden!

Occasionally a city plot boasts a swimming pool and an awning-covered terrace. Comfortable garden furniture helps to make such a spot a real summer resort. Potted plants may be arranged in decorative groups, to be whisked away when faded, their places filled by fresh color notes.

Informal gardens may feature a tree-shaded pool where ferns and violets, jack-in-the-pulpit, foam-flower and other woodland associates live happily together. A pleasant focal point may be a wall fountain which spills into a pool. Ferns and ivies placed nearby like the moisture, while goldfish add color and movement.

A sense of space may be achieved in a tiny garden by the use of a large mirror set into one of the walls. Its design must suggest an entrance into another garden. The mirror will reflect the cleverly planned garden and create an illusion of distance.

There are many beautiful community gardens wherein neighbors have agreed to remove their wooden fences. The combined areas are treated as one unit with greensward, trees, shrubs, promenade paths, and perhaps a playing fountain. "Jones Woods" in the East Sixties is a notable example.

In the crowded East Side there are whole sunny sections where of a summer morning the low picket fences between the yards are aglow with heavenly-blue morning glories. Magenta petunias run riot; drifts of snow-on-the-mountain almost waist high spread their green and white verdure everywhere. Clothes lines high over head are strung with fluttering sheets and billowing garments—a lively sight in the dazzling sunshine. And these gardens are planted by "green thumb" folk who raise their flowers from seed, having nothing to spend on nursery stock. This year no doubt Victory Vegetable Gardens will spring forth in such areas.

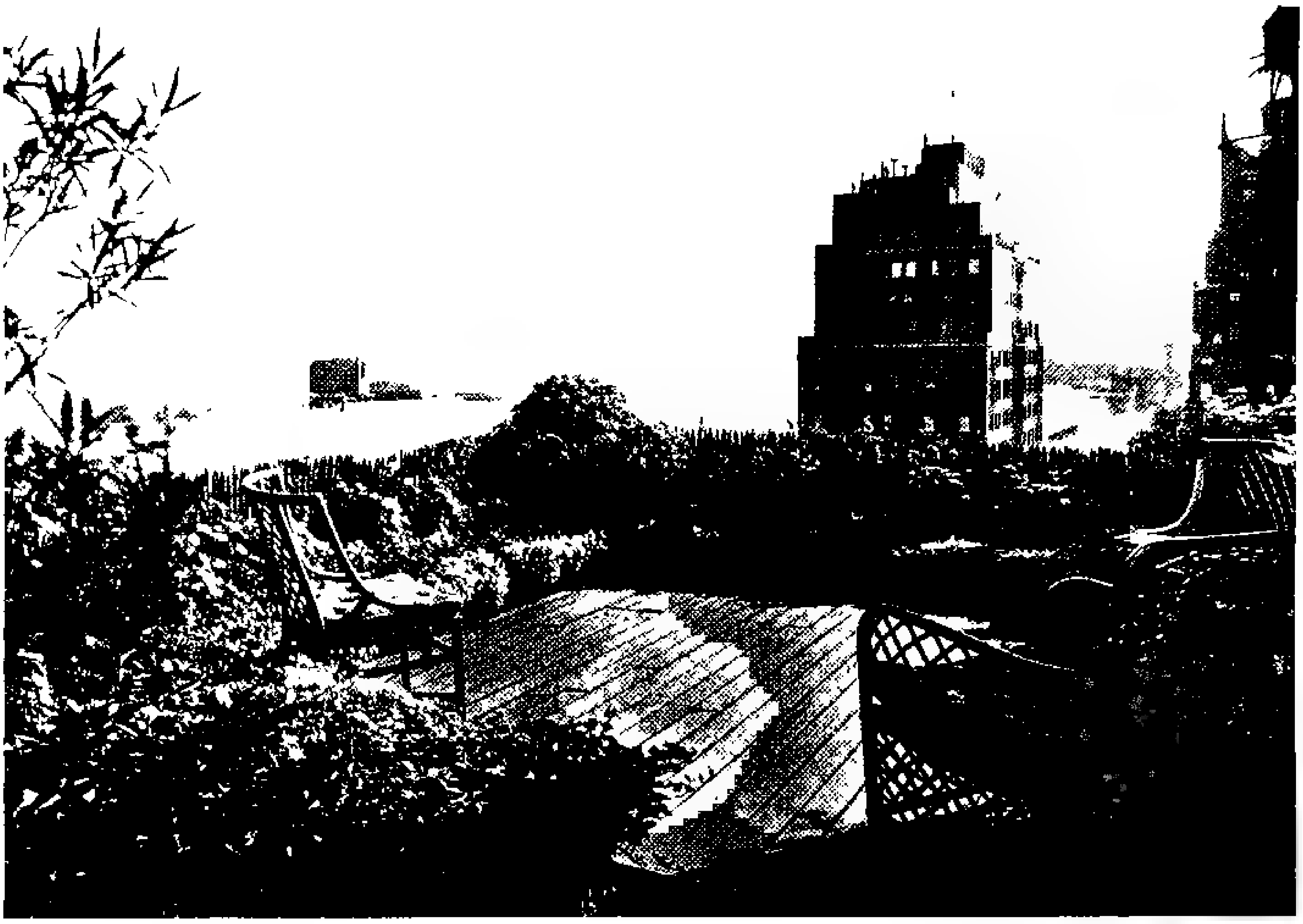
One sometimes sees spindly corn growing on fire escapes. There also are red geraniums, portulaca, sweet-william, and old discarded gift plants nursed back into bloom. Though color schemes are often disquieting, what fun these gardeners have in their fashion! And their successes are often enviable.

In East Harlem there is a row of houses set back from the street with yards in front, facing south, and iron railings with swinging gates to protect them from the passer-by. Morning glories festoon the old brick fronts and monstrous castor-oil plants spread wide their gigantic leaves. Each neighbor is proud of his neat little patch of lawn, his rubber-trees and incidental plantings. All are beautifully groomed, for someone no doubt sets the good example. One garden boasts the tallest coxcomb on record —even exceeding Bailey's maximum dimensions!

Towering above the city pavements we have our roof, penthouse and terrace gardens in a lofty world of their own. Be it remembered that here wind and sun may be as troublesome as the lack of these elements in the yards below. But dust, fumes and soot are less of a problem on high. Excessive wind may be counteracted by various means. A windbreak of plate glass if properly installed is an excellent solution to the draughty terrace. A fence of cedar saplings or of painted boards with perhaps a scalloped top can otherwise serve as a windbreak and as a background for the planting arrangements. The plants obviously must be set in huge tubs or long built-in boxes, the outer surface faced perhaps with brick or tile

This formal English garden, developed at Rockefeller Center as one of the "Gardens of the Nations," could be duplicated either on a penthouse terrace or on the ground where it could be enjoyed from a sunroom window.

A crab-apple flowering high above the street in a terrace garden brings a realistic spring to some of the city's skyscraper dwellers.



Overlooking the East River, this roof garden is protected from strong winds by a close-set rustic fence. A Russian olive and a rhododendron are seen at the left. Geraniums (magnificent specimens), sweet alyssum, and ivy help to fill the wide boxes of soil.

or with split cedar. Terra firma far below of course affords more space for root growth than do these restricted containers used on rooftops. It is therefore wise to select plants whose roots are reasonably willing to be confined.

Two outstanding trees for the roof garden are willow and Russian olive (*Elaeagnus angustifolia*). They sway with the breeze and thrive on much sunshine. Someone wrote that azaleas are the answer to a roof gardener's prayer, and this is well to remember, particularly as they flourish under varied city conditions. Small-leaved plants are especially good where space is limited. Dwarf Japanese hollies and dwarf yews are excellent small-scale evergreens.

In selecting the herbaceous materials to be used in roof and terrace landscapes, tall plants are usually to be avoided. They grow leggy and fall over in the wind. Remember that everything will be growing in the confines of comparatively narrow earth receptacles. Few perennials would winter here. Perhaps the showy sedum would do better than anything else, for is it not popularly called "live-forever"? Our best color notes for spring come from the florist's potted plants, such as pansies, hyacinths, marguerites, tulips, daffodils, geraniums. The florist's primroses around

Easter time come in pink, blue-lavender, white and other colors, and should bloom for months, given plenty of water and no intense sun. Begonias of the semperflorens relationship should do well for a long while, even the whole season through. Then the annuals in pots are ready to be purchased. Of these, "French" marigolds, as the survey proved, are among the easiest to maintain. The single pink or white blossoms of *Vinca rosea* stand prim amid the glossy foliage of this upright plant. With plenty of room and careful watering sweet alyssum might even come up well from seed, and if content, will billow over the sides of the boxes if given full sunshine. Coleus is a good foliage plant which resists wind. Sweet-leaved rose geranium (*Pelargonium graveolens*) should be tried. With plenty of water and periodic feeding, this plant will give long-lasting satisfaction, not only out-of-doors, but in winter on the window-sill in company with the other house plants.

For a list of plants recommended for city gardens, see pages 96 and 97.

Madder—Ancient and Medieval

By William F. Leggett*

IN the ancient languages which preceded Latin and Greek—Sanskrit and the parent Indo-European tongue—there was no root word to express *color* as a comprehensive term. The ancestor of our word (also of the Latin word) "color" is some primitive term which gave rise also to the Latin *occultare,* and later *celare,* both of which mean to cover up, conceal, or hide; and this expresses man's original use of color.

The ancient Britons, even before the coming of the Phoenicians to their island in search of tin, are known to have covered their bodies with the blue extract from the leaves of the native woad. Either they did this for magical purposes or as a primitive camouflage which concealed the face and figure behind the weird, grotesque disfigurations they made with the dye, in an effort to deploy ever-active evil spirits or to strike terror among their enemies. The color idea undoubtedly originated in some such manner. Then, very much later in the prehistory of man, various other plants were used to make dyes with which to "cover" the raw materials used in

*Mr. Leggett is Associate Editor of *Textile Colorist.* The material which he presents here is part of a book to be published in the fall.

baskets, snares, nets, and even crude clay pottery. Egyptians of the early pre-dynastic periods used color in limited combinations to cover otherwise bare walls; Greeks used it for the same purpose in various parts of temples, and Romans for brightening walls and ceilings of public buildings, baths and homes. None of these ancient peoples ever thought or spoke of "color" as such, and although some dyes had long been used to tint various fabrics, all preferred to express ideas of decorating in terms of sculpture, for ancient man thought first of concrete things.

Even after the first of a series of invasions of Egypt by aggressive northern nations who were familiar with color, and despite the fact that the Egyptians themselves were clever chemists, the priests and people of Egypt preferred white or at least uncolored natural fabrics for ceremonial functions and personal dress.

Nevertheless, the art of cloth dyeing dates from prehistoric times, its practice beginning with the dawn of civilization. The ornamentation of textile fabrics by means of crude geometrical and religious designs in color is very ancient, and since time immemorial has been practiced in more or less homogeneous effort—in India to express piety, and in China humanism.

The First Dyes Came From Plants

Primitive man and his age-old succession of descendants used only vegetable dyestuffs and long wrought within a narrow range of color, confined to red, blue, yellow, green and black, with only minor shade variants.

Trade in vegetable dyestuffs is even older than written records, for it was indeed a barren section of the ancient world that totally lacked plants for dyeing. Juices of berries and fruits, extracts from crushed flower petals, roots and leaves of herbaceous plants and shrubs, and bark of trees were the ancient sources for dyestuffs. Even today, many backward or geographically isolated people rely on similar supplies. The ancients did not know about mineral dyes, but later they learned about such dyes as purple from a shellfish and scarlet first from an insect found on Asiatic oak trees and very much later from a similar insect living on cacti in Peru and Mexico. While these discoveries changed dyeing practice to a remarkable degree, yet they did not entirely eliminate the use of vegetable dyes.

Early dyemasters, learning their first lesson from Asia, the ancient teacher, obtained brown and yellow from the versatile saffron plant (*Crocus sativus*) which also provided medicine, perfume and spices; blue came from the woad plant (*Isatis tinctoria*); purple originally came from a lichen (*Roccella tinctoria*) and was known as ORSEILLE or ORCHIL; black from the bark of alder (*Alnus* species), or just plain charcoal—like wood ash; green from a mixture of thistle and woad—probably the first instance of color mix—and red came from madder (*Rubia tinctorum*). Red was the most important of all these colors, not only because it was the fastest and most brilliant, but also for the reason that somewhere in its history it had been proclaimed the symbol of courage. This, however, did not confine its use to men. Consequently, since antiquity, the madder plant was the most important source of color. For many centuries it was known not only in the Near East but also throughout the Mediterranean area, long before it reached northern and western Europe, and it was not completely displaced until the advent of synthetic dyes during the seventh decade of the 19th century.

Symbolic Power of Dyes to the Ancients

It is intriguing to imagine that the original use of dyes for magic and war may have suggested a certain potency, both as a direct healing agent and also as something akin to cannibalism, which might impart vicarious strength, for we know that at very early times the discovery of a new use of dyes for the coloring of dress fabrics had its origin in the contact of ceremonial cloths with colored solutions prepared for those prior purposes. In some way or another, all of these vegetable dye plants served the ancients as therapeutical aids and until the more enlightened "Dark Ages," the use of these plants for medicinal purposes remained an important function.*

The Botany and Culture of Madder

Madder plants, of which there are about 35 species, belong to the family Rubiaceae. They are of sturdy growth, varying in height from three to ten feet, depending upon climate, irrigation, care in culture, age of plant, and whether or not the soil has a high calcium carbonate content. These plants are indigenous to many countries in the tropical and temperate zones, but are found more abundantly in Asia and Europe.

Roots having the greatest dyeing value are taken from *Rubia tinctorum*—by far the commonest of the Rubiaceae—and *R. peregrina,* both of which grow in the Near East, the Caucasus, and in Europe. A less important madder plant for dyes is *R. cordifolia,* which is a native of northeast Africa, Java, India, Persia, Asia Minor, and isolated districts in Europe, but this latter group of madder plants has not been much cultivated for dye purposes.

A plant of *Rubia tinctorum* has a square and jointed—but weak—stem, and at each joint grow four to six (or sometimes eight) leaves, each leaf pointed at both ends, 2 to 3 inches long and about one-fourth as wide at the middle. The upper side of the leaf is smooth, but the center nerve on

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* Incidentally, both brandy and tobacco found their way into common use because, originally, each was considered to be a medicine; then the use of it proved so pleasant that it became a continued habit.

the under side is armed with small rough prickles, more of which grow on the stem. Branches proceed from these joints and then divide into several branchlets which bear flowers usually in June, each with 5 (occasionally 4) yellow petals. The fruit, which contains a round seed, is a variety of berry. As ripening time arrives it is at first brown but soon turns black.

The bulk of the dye pigment is contained in the red mass between the outer skin and the woody heart of the root, the dye substance being present in the form of glucosides which are quite easily separated, the most important being ruberythric acid, which is broken down into alizarin and sugar. Madder plant roots are normally of considerable length, but in thickness rarely exceed the size of a common lead pencil, although some varieties attain the thickness of a finger, and each root greedily pushes itself as far as possible into the soil. Although European medieval madder growers did not always consider it advisable to increase the size of these roots and often took measures to keep them as small as possible, yet, in the Near East, it was often a custom to train madder plants on wooden frames, as this procedure was thought, incorrectly, to stimulate the volume of dyestuff material in the roots. European madder users vainly endeavored to check this Levantine custom, as it also increased the waste residue of each root—madder roots were bought by weight—but, failing to do so, at last introduced scientific madder cultivation into Europe, and were finally able to supply a rapidly diminishing local market for oriental madder roots.

Each madder plant root is surrounded by many small fibers, has a yellowish-red pith, and is covered with black bark or rind. Old roots were anciently considered to be more rich in color pigments than were younger roots; but in Europe, each plant was left in the soil for only twenty-four to thirty months.

After each root has been dug up it is thoroughly washed in pure water, allowed to dry, either naturally in the sun or artificially in kilns, then it is finely ground to powder and stored in bags or casks. In certain Near Eastern madder-growing districts, ancient and medieval madder culturists, before grinding, would store the roots for several months in underground pits, as it was thought that this increased tinctorial value.

Madder has been cultivated from an antiquity so remote that it is not possible to determine with any certainty just where and when it originated. Undoubtedly, it was first used in India, but chronologically, it appears to have been equally well known to ancient Persians and Egyptians, and considerably later to the Greeks and Romans. While very meager accurate data concerning the early history of this plant have been handed down to us, yet cloth, very plainly madder-dyed, has been found on Egyptian mummies in tombs of a pre-dynastic era. Ancient Hebrew laws permitted the culture of madder solely for household consumption, but strictly prohibited its growth for commercial purposes.

Some Notes From Early Scholars

Herodotus tells us that, in his day, "Rubia was used to brighten the cloaks of Libyan women." If critical comparison is made of what is known today about the madder plant and of what Dioscorides—that Greek medical genius and author of "De Materia Medica," a scientific work that remained popular for several centuries—wrote about a plant he called ERYTHRODANUM, it will appear that he referred to madder, for he tells of the "long square stem armed with a great many hooks, the leaves standing around the joints in the form of a star," adding that "at first the fruit is green, then red, and lastly black" and "the long slender roots which are red, serve for dyeing cloth." He also related that this plant "was cultivated with much profit at Ravenna and Caria, where it is planted among olive trees, or in fields prepared for olive trees." Dioscorides not only knew botany, but he knew the Roman Empire, for, although a Greek, he was once a medical officer who accompanied the Roman army on many of its campaigns. Other early Roman manuscripts mention that this plant had a name given to it by the Romans which, as Marcellus Virgil observes, "meant the same thing as RUBIA SATIVA, and in Etruria is called LAPPA MINOR, for like that burr, it adheres to other bodies." Because of its dyeing color the Romans also called this plant CINNABARIS.

Ancient writers, among whom was Theophrastus, the successor of Aristotle, mentioned EREUTHODANON, and Pliny and Dioscorides, some 200 years later, said that this plant in the Roman mother tongue was called RUBIA, and that "its red roots are used to dye wool and leather red." Pliny the Elder, the author of "Naturalis Historia," tells of madder cultivation in the vicinity of Rome in 50 A.D., or about thirty years before he lost his life in that famous eruption of Vesuvius in 79 A.D. Still another reference by that competent botanical historian, Dioscorides, relates that many Roman dyers of his era knew that madder which had been cultivated contained much more dyeing vigor than did madder plants which grew wild.

How Alexander Won With Camouflage

The red dye which, with characteristic forethought, Alexander the Great purchased for the use of his invading army in 330 B.C. may have been derived from kermes, which was the insect found on Asiatic oak trees, and not from madder—although both forms of red dye were known to him and to his Persian adversaries. It was this red dye representing probably the first important use of camouflage in war, that helped Alexander to defeat the Persians. With true strategic genius, Alexander one night had the clothing of a large number of his soldiers dyed red at a different spot on each garment. Next morning, when the Greek forces advanced—shall we say simulated a stagger?—to meet their enemies, the Persian leaders thought that the soldiers of Alexander's army had been pretty well damaged during the fighting of the previous day, with little opportunity for medical attention, so they may have been unduly careless when making an attack on what looked to them to be a helplessly wounded antagonist. Alexander (the Great!) won that battle!

Madder Cultivation Moves Eastward

With the collapse of the Roman Empire in the 5th century A.D., all record of European madder (except for isolated instances) ceases for several centuries, for that catastrophe temporarily shut off the flow of madder—and of course other products—from the East to Europe. During the following long period of unrest, even local cultivation of madder declined; so much so, in fact, that the dye trade of the world shifted back to the Orient where it grew into such an important element of Asiatic commerce that, for a long period, Bagdad was the most important center of world dye trade. For the first time in its long history in the Orient, the madder plant was actually cultivated instead of being permitted a "Topsy-like" development. This was because eastern dyestuff dealers realized that they had not been called upon to replace a more scientifically cultured plant no longer available to European cloth merchants, and, strange to relate, they broke free from normal lethargy and became so expert in madder culture that Bagdad even exported madder roots to India, a land which for centuries had practised a certain degree of madder plant culture.

Madder is not again referred to in European records until the early years of the 7th century, when it is recorded that madder "brought from the East" was cultivated at St. Denis, near Paris, which shows that at least some effort was made to revive a dye industry which for three hundred years had all but disappeared. The species introduced into France were *R. tinctorum* and *R. peregrina,* and for the next thousand years these remained the only madder plants used in Europe to any great extent. Soon medieval rulers became interested in madder, and in the 9th century, Charlemagne decreed that madder plants be cultivated "in these estates"—which may have been his rather extensive empire. Undoubtedly it was because of this edict that medieval peasant-farmers made a practice of growing madder in fields left fallow, because of a knowledge—startlingly modern—of the benefits which follow rotation of crops. In France, this crop rotation system was afterwards officially enforced for a long time.

From the 10th century on, madder appears more frequently in the historical annals of Europe,—especially in Italy where a revived dye industry grew rapidly because of a demand made upon it by cloth makers of Palermo, Genoa, Lucca, Venice and Florence. Not the least ardent in demand for color dyes were returning Crusaders who had seen and often purchased rich and beautiful oriental fabrics. During the Middle Ages, brilliant red dye was, next to purple, the most favored dyestuff, for that period of transition loved bright colors and the most colorful of all cloth was demanded for the dress of man.

As early as 900 A.D., having the benefit of both skill and material from the East, the Moors revived cultivation of madder in Spain, and finally developed a satisfactory export trade with both Portugal and England. France, it should be recalled, had introduced madder culture over two hundred years prior to this time, but the meager available records indicate that it supplied merely a local market for dyes, and it does not appear that France either imported or exported madder roots until several centuries later.

Travelers Tell Tales—And European Dye Trade Develops

The end of the Middle Ages witnessed a marked increase in volume and value of dyestuffs, both home-grown and imported. The rise in importance of the latter took place as a result of the tales of adventurous travelers—largely Venetians—who, from the 11th to the 14th centuries, brought back to Europe stories of many new sources for dyestuffs. Of the many arts and sciences reported on their return home by men like Marco Polo, none is more definitely of Asiatic origin than the twin activity of weaving and dyeing. For so far as Europe in concerned, the *art* of weaving and dyeing fabrics originated in Asia—and Far Eastern Asia at that. There was considerable coarse weaving in Europe prior to the time of Marco Polo, and dyeing, we have already seen, was known to aboriginal man in connection with nets, snares, and baskets; but dyeing as an art did not exist in Europe until about the end of the Dark Ages, or around 1400 A.D. Marco Polo and other Venetian travelers were primarily interested in the commerce of the city-states and brought back samples of dipped and block dyeing on cotton and silk. This resulted in certain dyed materials entering trade, but we find a space of several hundred years before Europeans learned artistically to dye the wool, linen, and cotton fabrics with which they were familiar. Although we must recognize that they used woad, saffron, indigo and madder, they did so in a rather crude manner.

The discovery of an all-water route to India in 1498 by Vasco da Gama contributed to the improvement of the European dye situation. Imports on a large scale, involving additional sources for dyestuffs, soon became possible, for the new sea route from the Orient to the west coast of Europe reduced costs (which formerly had been almost prohibitive because of the many intermediate handlings, each involving labor and commission fees) and also ensured the arrival of goods on fairly predictable scheduled dates. Soon after the da Gama discovery, Spanish forces in conquered Mexico and Peru discovered cochineal, which in those countries had been used for centuries as a red dye. While cochineal has no place in a story of madder, yet the combination of Portuguese ships bringing dyes from the Orient and Spanish ships bringing dyes from America meant that the center of the dye trade, so far as Europe was concerned, had moved from

Bagdad to Spain and Portugal, for all important dyes that could not be raised could now arrive by water from both eastern and western sources and be distributed from ports much nearer to places where the dyes were used.

(*To be continued*)

Plants From Palestine Being Shown In Easter Display At Garden

YOUNG trees and shrubs that have been raised from seeds collected in the Holy Land form an important part of the Easter display in the New York Botanical Garden's conservatories this year. The scene is being designed to represent the region where these plants originally grew.

The cypress tree, cedar of Lebanon, olive, almond, myrtle, also the pomegranate, carob, and acacia are among the specimens being shown. All of these are plants of Biblical significance, well known in Palestine at the time of Christ and before, and all mentioned in the Holy Scriptures.

Also in this unique collection of plants from the Holy Land is a passion-vine, the seeds of which were gathered in the Garden of Gethsemane. While this plant has been associated with the passion of Christ, because of the peculiar structure of its flowers, it is a native of South America, discovered there by early Spanish missionary-explorers. Therefore, wherever it is found growing today in the Holy Land, it is as a cultivated plant. Another native of tropical America in the display is the California pepper-tree. The crape-myrtle, camphor, and star-jasmine, all coming from China originally, and the firethorn, which comes from southern Europe and western Asia, are also to be seen. These foreigners have all made themselves so much at home in the Holy Land that they appear today as part of the native flora.

The seeds of all these plants were gathered there in 1938 (the last year that pilgrims were allowed to enter the country for the Easter service at the Tomb of Christ) by Mrs. Barbara Bowen, who has traveled and studied extensively in the Holy Land. She herself planted the seeds at her home in Brooklyn when she returned to this country, and she has personally cared for the young plants during their more than four years of growth.

At the close of the season, these seedling trees and shrubs will be transported to Burger Mountain at Murphy, N. C., in the Great Smokies, where they will form part of a permanent exhibit representing noted features of the Holy Land.

Other plants of the Bible have been brought to the display house from the Garden's permanent collections, and Easter lilies, narcissi, tulips, and azaleas and other flowering shrubs are also included in the Easter scene in the conservatories.

Monthly Programs for Members

THE Members' Day programs at the Botanical Garden continue to bring an enthusiastic group to the Museum Building the first Wednesday afternoon of each month, although on March 3 a severe storm somewhat curtailed the size of the crowd. T. H. Everett spoke that day on "Petticoats and Peonies," giving a timely talk on women gardeners and pointing out their problems and their opportunities. The previous month Dr. H. W. Rickett explained the history and purpose of the botanical names of plants in an informal talk entitled "'A' Stands for Allium" subtitled "Why Gardeners Use Such Names."

Some of the outstanding plants from the greenhouses have been used for display in the Members' Room at each meeting. Whenever one of them has been illustrated in color in one of the botanical magazines, the plate has been shown beside the specimen. Among the unusual plants displayed in March were *Moraea glaucopsis* from South Africa, which was then blooming for the first time at the Garden; *Kitchingia uniflora,* a crassulaceous plant from Madagascar; and the orchids *Odontioda* "Actia," *Odontoglossum pulchellum, Dendrobium nobile, Schomburgkia undulata,* and *Lycaste* (*Maxillaria*) *Skinneri.*

After the talk on April 7 by Dr. B. O. Dodge on "Priorities and Pest Prevention," the next Members' Day Program will take place on May 5, when Dr. R. R. Stewart will speak on "High Alpine Plants from Kashmir." The series will close for the season on June 2, with Dr. F. J. Seaver speaking on "Fungi in their Relation to Man."

THE GARDEN'S WAR WORK

Instruction in Vegetable Gardening

Vegetable Gardening Course At Macy's Store

IN a small auditorium built into one corner of the fifth floor at R. H. Macy & Co.'s store at 34th and Broadway, the New York Botanical Garden is giving a six weeks' course in Victory Vegetable Gardening. Instructors in the course, which was arranged at the request of the Macy Company, have largely been drawn from the Educational Program of the Botanical Garden. They are George H. Gillies, James B. Jack, James S. Jack, Thomas Little, E. L. Lloyd, Francis Paterson, and Dr. Cynthia Westcott. Mr. Lloyd is superintendent of the estate of Mrs. Charles Weinberg at Scarsdale, and is secretary of the Westchester branch of the National Association of Gardeners.

Lectures are given daily at 11 and 2:30 from Monday through Saturday and also on Thursday evening. Demonstrations on the stage are included in the lessons, and a question period follows each talk. The first week's subject was "Planning the Garden and Preparing the Soil," the second week's, "The Coldframe and Early Outdoor Seed Sowing." Subsequent topics, week by week, are: "Later Outdoor Sowings," "Thinning Out, Transplanting, and Planting," "Disease and Pest Control," and "Summer Care."

Members of the staff of the Garden are presiding and serving as moderators for the question hour at each session. Those who are taking part are Drs. A. B. Stout, F. J. Seaver, R. R. Stewart, E. E. Naylor, and Frances Wynne, and Misses Elizabeth C. Hall and Carol H. Woodward. T. H. Everett, who arranged the course, presided at the two opening sessions.

Sunday Afternoon Lectures

More than 200 persons attended on March 28 the first of a series of five free Sunday afternoon lectures on Victory Vegetable Gardening given at the Garden in co-operation with the Civilian Defense Volunteer Office of the Bronx. T. H. Everett was the first speaker, and he followed his talk with an outdoor demonstration of digging to prepare the soil properly for the vegetable garden.

P. J. McKenna was scheduled for the second lecture, on April 4, on the subject of seed-sowing. Each Sunday it has been planned to give directions for the home gardener's activities during the coming week. The concluding lecture, to cover summer care of the garden, will take place May 2, which is the Sunday after Easter. "Keeping Crops Growing" is the title assigned for the talk.

Radio Programs on Vegetable Culture

Over Station WNYC, the Municipal Broadcasting System, the New York Botanical Garden has been presenting a series of four question-and-answer programs on successive Monday evenings from 6 to 6:15, beginning March 22 and concluding April 12. These programs, like the Sunday afternoon lectures, are being given in co-operation with the Bronx C.D.V.O., the Victory Garden chairman of which Herman J. Forster, a frequent visitor at the Garden and a speaker at the Wild Flower Conference held here in May 1940.

Appearing on the four radio programs are T. H. Everett and Carol H. Woodward, with Elizabeth C. Hall, P. J. McKenna, J. H. Beale of the Boyce Thompson Institute, and James G. Esson, Editor of the *Gardeners' Chronicle of America* joining them on successive Mondays. These last two speakers are both instructors at the Botanical Garden.

Lessons for the Army.

About 120 officers and men from the New York Region, Anti-aircraft Artillery Command are coming to the Garden every Friday afternoon for lessons and demonstrations in vegetable gardening. The course is being given under the direction of T. H. Everett.

Short Course in Vegetable Gardening

Twenty-four men and women enrolled for the Three-Day Short Course in Vegetable Gardening, given March 29, 30, and 31 at the Garden. Lectures and demonstrations were presented to the class mornings and afternoons. The instructors were Edwin Beckett, James G. Esson, George H. Gillies, James B. Jack, Thomas Little, and Francis Paterson.

Spring Courses at the Garden

FOR the third successive year, a ***Three-Day Short Course in Practical Gardening*** will be given at the New York Botanical Garden this spring. The class will meet on April 26, 27, and 28. Instruction will include actual practice in each important gardening operation, as well as lectures and demonstrations daily. Instructors will be J. H. Beale, George Gillies, James B. Jack, James S. Jack, Arthur King, and Thomas Little. The fee for the course is $15. Advance registration is required, accompanied by a $2 deposit.

While the course is planned to cover any kind of outdoor gardening, the care of a vegetable garden will be stressed this year.

The first two days of June, the Garden will offer for the second time a ***Short Course in Disease and Pest Control.*** Modeled upon last year's lessons in this subject, the course will offer lectures, demonstrations, and practice in the fundamentals of keeping the garden clean and healthy. The instruction will be given by Drs. C. C. Hamilton, B. B. Pepper, P. P. Pirone, and Cynthia Westcott. The fee is $10, with a $2 deposit required with advance registration.

Garden Construction, under the direction of A. C. Pfander, will be offered again this year at the Botanical Garden. The class will meet on Tuesdays, May 4 to June 22, from 7 to 8:45 p.m. Partly by demonstration and partly by practice, Mr. Pfander will teach the construction of such garden appurtenances as dry walls, flagged paths, driveways, pools, curbs, terraces, and rock gardens. The fee is $10.

The care of house plants will be included in the spring course in ***Indoor Gardening Practice***, which begins at the Garden April 29. The class will meet for eight Thursday evening sessions, from 7 to 8:45. Edwin Beckett, Superintendent of Middletown Farm, Red Bank, N. J., will be the instructor. While this class is designed primarily to follow the winter lecture series on Cultivation of Greenhouse Plants, which was concluded March 25, it will be open to qualified persons who wish the instruction but who are not seeking the certificate offered in the Two-Year Course in Practical Gardening, of which both of these subjects are a part. The fee for this spring term of work in the greenhouse is $15.

Edible plants in the wild will be emphasized by G. L. Wittrock this spring in teaching the Saturday course in ***Field Botany*** which starts April 24. Mr. Wittrock plans to cover approximately

100 wild flowers and trees of the region around New York and to give special attention to those that can be used as food in emergencies. New York City teachers are granted alertness credit for this course and are also entitled to enroll for one-half of the $5 fee.

Dr. Maguire Appointed Curator

BEGINNING July 1, Dr. Bassett Maguire, who came to the Garden the first of the year as Visiting Curator, will become Curator at the New York Botanical Garden.

He received his B.S. degree from Georgia in 1926, became instructor in botany there, then in 1929 went to Cornell, where he served as assistant in botany while he worked for his Ph.D., which was granted in 1938, during a sabbatical leave. Since 1931, he has been at the State Agricultural College of Utah, first as Assistant Professor, then as Associate Professor of Botany and Curator of the Herbarium. He has also been a range examiner for the Soil Conservation Service of the U.S.D.A., and during the summers of 1929 to 1931 he worked as a botanist for the New York Biological Survey. In 1932 and '34 he was assistant aquatic biologist for the U. S. Bureau of Fisheries.

In 1925 Dr. Maguire went to British Guiana to collect Lepidoptera on an expedition of the University of Pittsburgh.

At the Botanical Garden he will continue his work on the floras of the Intermountain Region and of Utah and on the taxonomy of the Caryophyllaceae.

J. P. Morgan

THE loss to the financial world in the death of J. P. Morgan on March 13 means also a loss to the New York Botanical Garden, for Mr. Morgan had been associated with the Garden since the beginning.

Mr. Morgan's father was one of the initial incorporators of the Garden and contributed $25,000 to the original endowment fund, as well as $5,000 to the endowment fund for science and education. His father, likewise, was the first Treasurer of the Garden. The first financial report bears the signature "J. P. Morgan, Jr., for J. Pierpont Morgan, Treasurer." This was dated Jan. 13, 1896.

Less than a year after his father's death in 1913, the son, in January 1914, succeeded his father as a member of the Board of Managers and retained this post until April 1933. He remained in the Corporation until his death. In 1922, meanwhile, he became a Fellow for Life. In 1927 a contribution of $25,000 gave him the rank of Benefactor. Later gifts to the Garden amounted to $3,300 additional.

The first bank account of the Garden was in J. P. Morgan & Co. in 1895. The contact thus started with the elder J. P. Morgan and his banking firm, and continued with his son, is still maintained with the firm by Arthur M. Anderson, a member of the Board of Managers, a Vice-President of J. P. Morgan & Co., Inc., and the present Treasurer of the Garden.

Tracy E. Hazen

LESS than four years after his retirement as Professor of Botany at Barnard College and several months before reaching his 70th birthday, Dr. Tracy Elliott Hazen died at Waterbury, Conn., March 16. From 1934 to 1939 he had been an appointive member of the Board of Managers of the New York Botanical Garden, named to the post by the Torrey Botanical Club, with which he had been associated since 1898. He was also a member of the Corporation of the Botanical Garden, and remained so until 1942.

In recognition of his services for the Torrey Club, he was made an honorary life member in 1939. In addition to serving on many standing committees, he had been associate editor 1903-1911 and again from 1932 to 1939, and editor between 1924 and 1931. He was president of the club in 1934-35.

Starting at Barnard as assistant in botany in 1902, two years after receiving his Ph.D. from Columbia, he moved on steadily until he became Professor in 1931. Although he was keenly interested in the flowering plants, his special field was the algae, particularly the Chlorophyceae.

Dr. Hazen was a fellow of the American Association for the Advancement of Science and a member of many botanical and other scientific societies, including Phi Beta Kappa and Sigma Xi.

Selected Plants For City Gardens

Compiled by

THE CITY GARDENS CLUB*

New York

Trees

For the street

London plane (*Platanus acerifolia*)
Maidenhair tree (*Ginkgo biloba*)
Pin oak (*Quercus palustris*)

For the back yard

Carmine crabapple (*Malus atrosanguinea*)
Honey-locust (*Gleditsia triacanthos*)
Maidenhair tree (*Ginkgo biloba*)
s Tree of heaven (*Ailanthus altissima*)
English hedge maple (*Acer campestre*)
Hawthorn (various species)

For the roof

Russian olive (*Eleagnus angustifolia*)
Willow (*Salix*, various species)

Vines

s Boston ivy (*Parthenocissus tricuspidata*)
s Cinnamon vine (*Dioscorea Batatas*)
s English ivy (*Hedera Helix baltica*)
Fleece-vine (*Polygonum Aubertii*)
F Morning glory (*Ipomoea* varieties)
Silver-vine (*Actinidia polygama*)
s Virginia creeper (*Parthenocissus quinquefolia*)
s Wild grape (*Vitis Labrusca, V. vulpina*)
Wisteria (*W. sinensis*)

Shrubs

Evergreen

Inkberry (*Ilex glabra*)
Japanese andromeda (*Pieris japonica*)
Japanese holly (*Ilex crenata* and varieties)
s Leucothoë (in shade only)
Rhododendron (porous, acid, well drained soil)
Yew (*Taxus cuspidata* and other species)

Deciduous

s Azalea (porous acid, well drained soil; fine for roof)
Cork-bark Euonymus (*E. alatus*)
Deutzia (various species)
s Five-leaved aralia (*Acanthopanax Sieboldianus*)
Forsythia (various species)
Privet (*Ligustrum*, various species)
Rose of Sharon (*Hibiscus syriacus*)
Spiraea (various species)
Weigela

Annuals

Begonia	Petunia
F Geranium	Snow-on-the-mountain
s Impatiens	Verbena
Marigold	Four o'clock

Perennials

s Bugle (*Ajuga reptans* and *A. genevensis*)
s Canada mayflower (*Maianthemum canadense*)
s Christmas fern (*Polystichum acrostichoides*)
F Chrysanthemum (many varieties)
s Foam-flower (*Tiarella cordifolia*)
s Jack-in-the-pulpit (*Arisaema triphyllum*)
s Japanese spurge (*Pachysandra terminalis*)
s Lily-of-the-valley (*Convallaria majalis*)
s Myrtle or periwinkle (*Vinca minor*)
Showy sedum (*S. spectabile*, also others)
Wild blue phlox (*P. divaricata*)

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* A more complete list is on file in the office at 598 Madison Avenue.

F Full sun only. s Will tolerate considerable shade.

Marguerites, geraniums, and ivy are three good standbys for window-boxes, although in the city the marguerites do not retain their looks the entire season.

Flowering Bulbs

These may bloom one season only, unless conditions in your garden are very favorable.

House Plants

Begonia
Boston fern
s Chinese evergreen
Cissus antarctica
Crassula
English ivy
F Geranium
Grape ivy
Kalanchoë
s Nephthytis
Peperomia
s Philodendron
s Piggy-back plant
s Pothos
Wandering-jew
s Rubber plant
Sansevieria

Window-Box Compositions†

In sun or shade (even winter if mild):
Small yews
English ivy
Japanese aucuba

Sun in spring

Hyacinth
Begonia
Pansy

Sun in summer

Geranium
Petunia
Ivy

†See window-box bulletin published by the City Gardens Club

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.)

Pioneers—Old and New

THIS LAND WE DEFEND. Hugh H. Bennett & William C Pryor. 103 pages, illustrated with photographs, indexed. Longmans, Green & Co. New York. 1942. $1.50.

Here are two tales in one small, swiftly moving book. Dr. Bennett and Mr. Pryor know these two tales backward and forward for they have been telling them to us in America for over a decade. Now the two have become one story and they have written it down for more of us to see. Dr. Bennett and Mr. Pryor are, in a sense, prophets of a new order. They believe in the possibility of a more enduring and more secure America.

Their book is the story of two groups of pioneers. The first group, about which we are more familiar, was made up of the men and women whom we have thought of in terms of courage and fortitude as they moved west to conquer our continent. But it was these same forebears of ours who in all reality exploited and destroyed vast areas of our fabulously rich soil resources and natural wealth in their search for new homes and money. It is a fantastic tale and almost unbelievable, but one which we Americans must know and understand in all its bleak truth if we are to repair the damage.

The second story is one of modern pioneers, the farmers, the scientists, the technicians who are going out to make a new design for the land. There are more of these than one would suppose and their numbers increase. Moreover, the story of what they are doing is far more exciting than the tale of the men who destroyed. For the things they seek are security for the people who have never known security on their eroded fields, a better and more permanent agriculture, and a sounder and more enduring society.

It is perhaps due quite largely to the burning enthusiasm and sheer faith of Dr. Bennett, who is Chief of the Soil Conservation Service of the Department of Agriculture, that we have come as far as we have in this country along the road of conservation and the building of a permanent agriculture. We dare not neglect his teachings as we face this war and the post-war world.

P. Alston Waring,
New Hope, Pa.

Bibliography for Taxonomists

GEOGRAPHICAL GUIDE TO THE FLORAS OF THE WORLD. S. F. Blake & Alice C. Atwood. Dept. of Agriculture Miscellaneous Publication No. 401. 336 pages, indexed. U. S. Government Printing Office, Washington, D. C., 1942. $.75.

Here is a bibliography that will be welcomed by botanists everywhere. "Its aim is to furnish an annotated catalog of all the now useful floras and floristic works, including those in periodical literature, that list or describe the complete vascular flora (or the phanerogams only) of any region or locality, and to include as well, all publications dealing on the same scale with useful and medicinal plants, vernacular names, and botanical bibliography." Where there are no complete floras, partial ones are listed.

The list is intended to be complete through 1939. The part now published covers all of the world except Europe and Asia and the closely associated islands. More than three thousand titles are included. There is a geographical index as well as an index of the authors and periodicals cited.

This catalog makes it possible to see the many gaps which still remain to be filled. Many important regions such as Madagascar and large regions in Africa are without floras. There is still much to do in South America. Many floras are incomplete and others are out of date. There is plenty of work ahead for systematic botanists.

It is to be hoped that Part II will not be long delayed, for it will be welcomed by many.

R. R. Stewart.

Proven Popularity

THE BOOK OF PERENNIALS. Alfred C. Hottes. 272 pages, illustrated, indexed. A. T. DeLaMare Co., Inc., New York City. 6th edition, revised, 1942. $2.

The Little Book of Perennials was first published in 1923. That it had a popular appeal is evidenced by this, the 6th edition, revised. It is probably the most useful of the books on perennials, well illustrated, with usable tables, and pronunciation of generic names made clear. It deals with propagation, control of insects and diseases in a general way. The garden plans will be helpful to the novice. The sections on wild flowers and rock gardens are too brief to be of very much value, and represent one of the weaknesses of many garden books in that they try to be all-inclusive. The various genera of herbaceous perennials are considered as to use, culture, propagation. The author has been wise in not attempting to include ponderous lists of horticultural varieties.

C. H. CONNORS,
New Jersey State College of Agriculture.

Elementary Science Readers

LUMBER, 48 pages, and **ORCHARDS IN ALL SEASONS,** 44 pages, both illustrated in color and in black-and-white. Prepared by the W.P.A. Pennsylvania Writers' Project Albert Whitman & Co., Chicago, 1942. 50 cents each.

These two small children's books, which are co-sponsored by the Board of Public Education of Philadelphia, are part of a series of thirty or more prepared by the former Work Projects Administration in Pennsylvania. Dealing chiefly with plant and animal life, but also with weather, electricity, trains, airplane, and radio, they tell their stories clearly and entertainingly for the very young.

Notes, News, and Comment

V-Gardens. The report by T. H. Everett on the Victory Garden of 1942, published last month in this Journal, was based on records and data kept by P. J. McKenna, who is Mr. Everett's chief assistant. Mr. McKenna also gave valuable aid in planning the demonstration Victory Garden, both for 1942 and 1943, and in selecting the varieties to be grown. The plans for both gardens were drawn by Harold Wilson, who is also a member of the horticultural staff.

Writer. James G. Esson, who is a member of the Garden's teaching staff as well as being editor of the *Gardeners' Chronicle,* this spring has written a series of articles on vegetable gardening at the request of the *News,* New York daily paper.

Advisory Council. Dr. William J. Robbins addressed the Advisory Council at a meeting March 15 at the Beekman Tower Hotel, with Mrs. A. Barton Hepburn as the hostess. His subject was "The New York Botanical Garden—Its Past, Present, and Future."

Conference. Otto Degener spoke on "The Flora of Hawaii" March 10 at the monthly conference of the staff and registered students of the Garden. Mr. Degener has a unique distinction in the botanical world, which is described below.

Plant Family. The honor of being the only man living today to have a plant family named after him falls to Otto Degener. The family is the Degeneriaceae, and it is based on a magnolia-like tree from the Fiji Islands.

When Dr. A. C. Smith, formerly Associate Curator at the New York Botanical Garden, was exploring in Fiji in 1933 and '34, among the hundreds of different kinds of plants that he collected was one without flowers which no one could place in any existing plant family. It was something like a magnolia in leaf, but until it bloomed, no one could be certain of its identity. So it remained nameless.

In 1941, on the neighboring island of Viti Levu, Mr. Degener, who was then on the Archbold expedition, found the same kind of tree, and he was fortunate enough to find both flowers and a fruit. So he sent them, with many other specimens, to Dr. Smith at the Arnold Arboretum to be identified. Dr. Smith recognized his nameless tree from seven or eight years previously, but still he could not match it with any other plant or even any other plant family known to science. So, with the collaboration of Prof. I. W. Bailey of Harvard University, a new plant species, genus, and family were created and named after the second discoverer of the tree and the island where it grew. The plant is now known as *Degeneria vitiensis.*

Photographer. John J. Loughlin, who made the photograph of the April sunset shining through the dome of the Main Conservatories, which appears on the cover this month, is an amateur photographer who distinguished himself during the New York World's Fair by winning a number of prizes and honorable mentions. He uses a box camera, with which he says he has been making pictures for the past 20 years.

Sigma Xi. Dr. William J. Robbins represented the Missouri chapter of Sigma Xi at the installation of a new chapter at the Brooklyn Polytechnic Institute March 25. Dr. Bassett Maguire attended as a representative of his chapter in Utah.

Navy. Elmer G. Oringer, a former student gardener, is now in training at the U. S. Naval Radio School at Auburn, Alabama.

Hospital Gift. Twenty-five palms were presented to the Halloran General Hospital (new Staten Island military hospital) last month by the New York Botanical Garden.

Board of Managers. Francis Cormier of the New York City Park Department, has been appointed by Robert Moses, Park Commissioner, to succeed James Dawson as his representative on the New York Botanical Garden's Board of Managers. Mr. Dawson has recently entered the United States Army.

Redwood Grove. Mrs. Joseph M. Cudahy, a member of the New York Botanical Garden, is one of three members of the family of the late J. Sterling Morton who have provided a gift for setting aside an area in Humboldt County, Calif., to be known as the Morton Memorial Redwood Grove. The gift is announced by the Save-the-Redwoods League. J. Sterling Morton was once Secretary of Agriculture and was the founder of Arbor Day, first celebrated in Nebraska in 1872.

Student Groups. The classes studying Thallophytes and seed plants at Hunter College, under the direction of Jennie L. S. Simpson, made four visits to the Museum Building and Main Conservatories during February and March to make notes on the collections. Ross J. Marano of the College of Pharmacy at Fordham conducted a group of 25 students through the economic collections in the Museum Building March 11.

Visitors. Dr. Frederick L. Wellman of the U. S. Department of Agriculture at Beltsville, Md., spent March 26 at the Garden consulting with members of the staff prior to leaving for Central and South America for studies of economic plants.

Mr. James Waterston, Plant Pathologist of the Bermuda Agricultural Experiment Station recently spent some time in the United States and Canada studying methods of food dehydration. Several days were spent at the New York Botanical Garden in collaboration with Dr. F. J. Seaver in continuance of their study of the fungi of the Bermuda Islands.

Dr. H. M. Fitzpatrick of Cornell University spent a week at the Garden in connection with his work on certain groups of fungi which he is preparing for North American Flora.

Drs. Rogers McVaugh and Frank Egler worked in the Herbarium at the Garden late in March, and Dr. E. J. Schreiner of the U. S. Forest Service came to consult with Dr. A. B. Stout March 23. Other visitors of recent weeks include Fred Reuel Jones of Madison, Wisc.; M. A. Chrysler, New Brunswick, N. J.; Edwin Way Teale, author, New York City; Wanda K. Farr, Greenwich, Conn.; John C. Wister, Philadelphia; Antoinette Miele, Cornell; Dow V. Baxter, University of Michigan; William F. Rupp, Jr., Rutgers; H. K. Svenson, Brooklyn Botanic Garden, M. Le Hors of St. Pierre and Miquelon, and Ilda McVeigh, Connecticut College.

Movie. The Garden's motion picture was shown March 17 at Christodora House on Avenue B, with Elizabeth C. Hall as commentator. About 50 elderly refugees from Germany were invited to attend.

Lecture. Dr. F. J. Seaver, recently lectured on Bermuda at a conference meeting of the John Street Methodist Church, New York City.

To reach the Botanical Garden, take the Eighth Avenue Subway to Bedford Park Blvd., the Third Avenue Elevated to the Bronx Park station, or the New York Central to the Botanical Garden station; or drive up the Grand Concourse then east on Mosholu Pkwy., or, coming from Westchester, turn west at the end of Bronx River Pkwy.

MEMBERSHIP IN THE GARDEN

Established as a privately endowed institution, aided partially by City appropriations, The New York Botanical Garden is dependent for its progress largely upon benefactions and memberships. Through these means, though young as botanical gardens go, it has become the third largest institution of its kind, its library, herbarium, and horticultural collections ranking among the finest and most complete in any country.

Membership in The New York Botanical Garden, therefore, means promotion of scientific research in botany and the advancement of horticultural interests. Scientifically, the Garden is able to serve as a clearing-house of information for students and botanists all over the world; horticulturally, it often serves as a link between the plant explorer or breeder and the gardening public.

Through memberships and benefactions, provision is made at the Botanical Garden for the training of young scientists and student gardeners; hundreds of new books are added annually to the library, which is open daily to the public for research and reading; free exhibits are maintained in the museum, the greenhouses, and gardens, and lectures, courses, and free information in botany and gardening are given to the public.

Each individual member of the Garden receives:

(1) A copy of the Journal every month.

(2) A copy of Addisonia once a year, each number illustrated with eight colored plates of unusual plants, accompanied by descriptions.

(3) A share of surplus plant material of interesting or new varieties whenever it is distributed.

(4) Announcements of special floral displays, programs, lectures, and other events at the Garden.

(5) Credit to the amount of the membership fee paid, toward courses of study offered by the Garden.

(6) The privilege of borrowing lantern slides from the Garden's collection.

(7) Use of the Members' Room in the Museum Building.

A limited number of garden clubs are accepted as Affiliates. The privileges of affiliation are one lecture a year by a member of the staff, a share in the distribution of plants when they are available, a subscription to the Journal and to Addisonia, and announcements of special activities at the Botanical Garden. In addition, any member of an affiliated club may receive for the current year of membership a reduction of $5 in the fees paid for instruction. (This does not apply to the course for professional gardeners.) An Affiliate Garden Club may borrow lantern slides from the Garden's extensive collection, such loan being subject to the regulations for the use of lantern slides by individual members. Likewise, an affiliate club may engage without fee the Members' Room at the Garden for its meetings.

The classes of membership are as follows:

Annual Member	annual fee	$ 10
Sustaining Member	annual fee	25
Garden Club Affiliation	annual fee for club	25
Fellowship Member	annual fee	100
Member for Life	single contribution	250
Fellow for Life	single contribution	1,000
Patron	single contribution	5,000
Benefactor	single contribution	25,000

Fellowships or scholarships for practical student-training in horticulture or for botanical research may be established by bequest or other benefaction either in perpetuity or for a definite period.

Contributions to the Garden may be deducted from taxable incomes. The following is a legally approved form of bequest:

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

Conditional bequests may be made with income payable to 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, N. Y.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 521

MAY
1943

PAGES
101-124

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

A PRACTICAL PLACE

ACTIVITIES of the spring months at the New York Botanical Garden have brought to a great many people the realization that the Garden is a useful and practical institution as well as a place of ornament and beauty and of research in pure science.

Through the courses of study recently given at R. H. Macy & Co., for instance, several hundred men and women had their first lessons in gardening. Earlier, through the co-operation of the New York Times (following out the program inaugurated the year before), the Botanical Garden gave practical instruction in the culture of vegetables to nearly a thousand people. Then through the Civilian Defense Volunteer Office, by means of the radio and a series of free lectures, the Garden reached an unknown number of additional people with instruction in the growing of vegetables.

Through the New York Botanical Garden these students have acquired a field of knowledge useful not only as they struggle over their gardens of 1943, but of increasing service in the years to come, for they have been introduced to one of the most absorbing occupations man can undertake.

These activities represent but one aspect of the institution's work in being of practical aid to the public.

There are other courses, outlined in the Educational Program of the Garden, which have attracted a gratifying number of students in the past few months. There are also the many individuals who have come to the Garden with questions which have been answered for each one individually —questions running all the way from "When shall I thin my carrots?" to "How can the luffa gourd be raised commercially in the United States?" (The story of the luffa, incidentally, will be told in next month's Journal.)

All this while, the Garden's scientific work proceeds. Intensive studies are being made in the classification of plants. Research on fungi, on vitamins, on genetics, continues. The Garden's displays of flowering plants also are being maintained as effectively as possible with the shortage of help and the demands for extra work related to the war. These products of learning and these prospects of beauty at the Garden form the background and surroundings for the practical part of the institution's work—that part which directly reaches those people who are concerned with plants, and helps them in their efforts day-by-day.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | MAY 1943 | NO. 521

Priorities And Pest Prevention

A Survey Of The Situation In Chemicals And Equipment As It Affects The Home Gardener

By B. O. Dodge

(*Adapted from the address given on Members' Day at the Garden April 7*)

THIS spring, it is estimated that from five to ten million home vegetable gardens have been started in the United States in an effort to supplement the normal national food supply, on which so many extra demands are being made. How large will be the crops that are harvested from these gardens will depend in part upon the attention they are given through the summer.

Garden Cleanliness is Imperative

Sanitation, including clean cultivation, for example, is of prime importance; it is, in fact, one of the first essentials of good gardening practice. This year it is more important than ever, because some of the common fungicides, insecticides, and other garden aids are restricted or unobtainable for the duration; and in their absence, sanitation will help more than any other factor to keep away diseases and pests.

Keeping the garden *and its surroundings* free of weeds is one form of sanitation, for if weeds are allowed to mature, they will not only scatter a fresh lot of seed in the soil to make more work for the gardener later, but they will increase the diseases and pests to be fought. Weeds play the role of "Typhoid Mary" in the garden. They harbor insects and they are also hosts for many parasitic fungi and viruses which later move over to the garden plants, often being carried there by these same insects.

Mulching and composting are necessary for building up the soil, but one should use common sense and practice good culture, which means burning up or segregating debris which accumulates from seed-bearing weeds and from diseased or infested plants. Otherwise, weed seeds will live over winter in mulch piles, along with the eggs of nematodes and the eggs, larvae, pupae, and even adults of various injurious insects; and many parasitic fungi will live there also, either as spores or temporarily as saprophytes. When material from the mulch piles and compost heaps is later spread over the garden to enrich or improve the soil, the gardener may be providing a new source of infection or infestation, unless he has previously destroyed all plants that might bring trouble.

Farmers, orchardists, and those who raise vegetables on a large scale all now include under good culture the protection of their crops with fungicides and insecticides. I suppose in Duchess County any apple grower who does not carry out a regular spray or dusting schedule in his orchards is looked upon as a pretty poor specimen of a neighbor, as well as a nuisance or even a danger in the community. Good culture of potatoes in Maine or Long Island demands a frequent inspection for virus diseases and the roguing out of infected plants. Wherever late blight is to be expected, a regular spray schedule is followed simply as a matter of good culture. Last year there was reported a loss of about fifty per cent of the potato crop, in certain areas, due to late blight. Some of the farmers in Wisconsin, for example, who normally grow an acre or so of potatoes for home use seldom protect their crop by spraying with Bordeaux mixture. The result last year was that most of them were buying potatoes for food as early as December.

Grow Disease-Resistant Varieties; Use Disease-Free Seed

The demand for seed and stock for planting victory gardens has been so great that most people are forced to purchase almost any kind of seed and stock without regard to the question of the resistance or susceptibility of particular varieties to disease and insect pests. This is a phase to become informed about during the year. Varieties of tomatoes resistant to the destructive wilt disease are now well known. There are available cabbage varieties resistant to "yellows," asparagus varieties resistant to rust, beans resistant to mosaic, etc.

Those who grow beans on a large scale are accustomed to purchase seed that has been grown in California, where irrigation is necessary. This seed is free from "rust," or anthracnose spores. One should avoid growing tomato plants, for example, that are already infected with mosaic. As far as possible one should purchase garden seeds that are certified as free of disease or which have been treated to kill the fungi which cause disease.

Prevention Without Insecticides

Two examples will illustrate what may be done to prevent damage without resorting to the use of insecticides. Those growing garden beans in this vicinity will no doubt be visited by the Mexican bean beetle, especially late in the summer. If, however, one watches out for innocent-looking copper-colored, ladybug-like beetles wandering over the beans, these beetles should be killed. They are laying yellow eggs in clusters on the lower sides of the leaves, and these eggs should be crushed. After the main crop of beans has been gathered the vines should be destroyed by burying them deeply or by burning them to prevent the larvae, through lack of food, from maturing to become beetles which would live over winter in rubbish.

Squash bugs attack cucurbits of various kinds. Examine the under side of leaves of cucumbers, for example, and crush the clusters of yellow eggs. Lay small pieces of boards among the vines, and in the morning of each day crush the grayish insects that collect under the boards during the late afternoon and night.

What the Gardener May Expect

It would be discouraging to broadcast the idea that along with the ordinary good gardening practice it will be necessary to carry out rigidly a regular schedule of spraying or dusting for each vegetable or fruit to be grown in the home garden. It may be helpful, however, to remind people that certain diseases and certain pests must be expected, so that a reasonable defense may be provided.

There never has been any time in the past twenty or twenty-five years, that I can recall, when we had to give any thought whatever about the availability, even in large quantities, of any fungicide or pesticide known to be effective in the control of agents of disease or of harmful insects. Proper equipment in the shape of sprayers, dusters, or other types of machinery for the application of these materials as dusts, sprays, pastes, crystals, or otherwise, has always been plentiful and at reasonable prices.

The situation has been materially altered by the demands of war. The War Production Board has been forced to establish priorities and regulations having the force of law and which limit or restrict uses which may be made of certain fungicides and pesticides. It has also established priorities which limit the manufacture and sale of dusting and spraying equipment, which I shall mention later. Let us look at the situation relative to the chemicals and compounds, also the equipment, needed for keeping victory gardens healthy. Much of the information given below has been taken from the A. I. F. News, a bulletin being issued monthly by the Agricultural Insecticide and Fungicide Association. We are indebted to Mr. L. S. Hitchner, Executive Secretary, for complimentary copies, and also for verifying the situations mentioned in this paper.

(The chemicals used in fungicides and insecticides, some newly developed compounds and other products needed for keeping the garden in good health are discussed on pages 104 to 107.)

CHEMICALS FOR FUNGICIDES

Copper

Copper sulphate is used for the making of Bordeaux mixture and copper lime dusts. Copper also enters into ammoniacal copper carbonate sprays, copper oxide, and copper carbonate used for sprays or for seed treatment. The equivalent of 80,000,000 pounds of copper sulphate is used annually in the various copper fungicides. For the small user, there are no restrictions, *if* the finished products can be purchased.

Red copper oxide, a popular fungicide for seed treatment, is used extensively for the painting of bottoms of warships, so the supplies of this will be limited. However, copper oxychloride and yellow copper oxide are even more effective as sprays or dusts and are not as closely restricted. They are used on cucurbits, tomatoes, and other plants where Bordeaux mixture causes more or less injury.

Bordeaux mixture itself can be obtained as a powder ready for mixing as a spray. The lime that enters into this mixture is unlimited in supply, either as hydrated lime or burned rock lime.

Sulphur

Sulphur to the amount of 100,000,000 pounds a year has been used by agriculture. (This term here includes horticulture and floriculture.) It is used as an insecticide and general clean-up spray throughout much of the year. In March, for example, in this vicinity, while trees and shrubs are still dormant, lime sulphur is applied to destroy scale insects, the eggs of various other insects, and spores of fungi. It is then called a "dormant spray." A concentration of 1:8, which means 1 gallon to 7 of water, is used at such a time.

In the form of sprays for the control of apple scab, powdery mildews and other fungous diseases, we have the wettable sulphur, colloidal sulphurs and flotation sulphurs. As a dust of 300 mesh or finer, sulphur is also used either alone or mixed with 10% arsenate of lead for the control of leaf spots, mildews and other fungi. The arsenate acts as a stomach poison for the leaf-eating insects. Louisiana and Texas together have sufficient supplies of sulphur deep down in the ground to supply all possible needs for years to come, so there are no restrictions whatever.

Zinc

Zinc oxide is used as a seed disinfectant, while zinc sulphate with lime is used to a certain extent to control black bacterial leaf-spot of peaches, and has been recommended in place of copper compounds to avoid spray injury. Supplies of zinc sulphate are adequate in eastern peach-growing regions, and with supplies of zinc oxide equal to 1942, there should be enough for seed treatment in the East. There are, however, a number of other products, such as Spergon, effective for seed treatment.

INSECTICIDE MATERIALS

Arsenate Compounds

Supplies of lead arsenate are about 10% below the 1942 demand, but supplies of calcium and magnesium arsenate are not down. Nevertheless, to date, the use of these products on ornamental plants is forbidden, but this restriction is expected to be lifted a little later in the summer as the needs for arsenates on food plants have been supplied. The use of magnesium arsenate as a spray or dust to control the Mexican bean beetle has more or less been discontinued in recent years because of the availability of rotenone products. While it is allowable to use rotenone against this insect on beans and against the pea aphid and the pea weevil, as well as the European corn borer, the supply is strictly limited, so it may be necessary to use magnesium arsenate on beans up to the time the pods are being formed. It has been customary to wash all string beans which have been arsenated. They should be washed whether arsenated or not, because who knows where flies and other insects, especially where the gardens are in vicinities of barnyards, have been before they visited our food plants?

Where an adequate spreader or sticker can be added, the use of lead arsenate on cabbages for cabbage worms would be safe, provided application ceases as soon as the heads are about a third formed and provided also that the outer leaves are removed and the cabbage is washed before being prepared for food.

Rotenone

Rotenone, which is non-poisonous to human beings, is mentioned directly above, as an alternative to the arsenates. However, the commercial use of rotenone on cabbage is not allowed, according to present restrictions. Since there will be grown some 200,000 acres of cabbage this year, all available rotenone products would very soon be exhausted on this crop alone. However, the first of May it was announced that rotenone would be released for victory gardeners who are buying only a pint or a pound or less, so far as present stocks in packages of this size will permit.

Commercial use of rotenone meanwhile is permitted on peas against pea weevil and pea aphis, on beans against Mexican bean beetle, on sweet corn against European corn-borer, on cole crops, *not* including cabbage, against caterpillars and aphids, as well as on cattle against certain parasites.

Pyrethrum

Although somewhat limited, pyrethrum products now are available as contact insecticides for victory gardeners, to help them in keeping away sucking insects, such as aphids and leaf-hoppers, and also the caterpillars of certain leaf-eating insects, among them the larval stage of the Mexican bean beetle and the cabbage looper. Pyrethrum is one of the insecticides that is safe to use on vegetable crops, because it is not poisonous to people.

Cryolite

Cryolite is a sodium alumino-fluoride (Na_3AlF_6). It is used as a dust in place of arsenicals, but for cabbage worms it is said not to be very satisfactory. Its adhesive properties are not high. This material has only been known for about ten years. It is poisonous, but not nearly as poisonous as the arsenicals. We have used barium and sodium fluosicates for years against blister beetles, and found them more efficient than arsenicals. Since the use of arsenicals on ornamentals is restricted, cryolite will be a good substitute until the restrictions are lifted. The supply of cryolite is abundant with no restrictions.

Nicotine Products

Forty percent nicotine sulphate, also nicotine dusts, are used as contact insecticides against aphids, leaf-hoppers, plant bugs, thrips, etc. They can be used on ornamentals as well as on food plants. There are no restrictions, and there are adequate supplies available at ceiling prices.

Oil for Sprays

Dormant oil sprays, such as lubricating oil emulsions, miscible oils, and summer oils for legitimate purposes in connection with food plants and ornamentals may be purchased in adequate quantities. They are used principally as insecticides: in early March in this region as dormant sprays, later on as contact sprays in much diluted condition.

Mercury Compounds

Mercuric chloride (corrosive sublimate) and mercurous chloride (calomel), often used for treatment of cabbage, radishes and other related plants for root maggot, are restricted this year. However, the organic mercury compounds such as the New Improved Ceresan and New Improved Semesan for seed treatment and local soil sterilization are all permissible and they are available.

Tartar Emetic

A poison used to control thrips on such ornamentals as roses, gladiolus, iris, etc., is tartar emetic. It is used with brown sugar, which is rationed for individuals, but the supply of tartar emetic is adequate. This could be used no doubt with blackstrap molasses, which is not rationed.

Paris Green

Paris green is a very efficient ingredient of certain poison baits, such as those for cutworms and slugs, and it is also used to a limited extent against gladiolus thrips. Farm garden potato growers often use it against the Colorado potato beetle, in which case lime is added to prevent burning. Supplies are adequate for these purposes.

Organic Thiocyanates

While the supplies of organic thiocyanates will be adequate in amounts equal to those of last year, it may be that such products as Lethane will be in greater demand because of the restrictions on rotenone and pyrethrum. This is primarily a contact insecticide. Certain organic thiocyanates are compounded with rotenone, thus affording a saving of rotenone. While supplies available may be somewhat restricted, they will no doubt be adequate.

SOME NEWLY DEVELOPED COMPOUNDS

Spergon

This is a rather new non-metallic compound, used primarily for seed treatment. When pea seeds are treated the root rot fungi are killed and the plants are stimulated to grow more vigorously. Spergon does not destroy the bacteria that are applied as inoculations of legumes, whereas the red and yellow copper oxides (cuprocides) and copper oxychloride do destroy most of the bacteria. When used with proper fertilizers, peas treated with Spergon have increased their yields as much as 40%. Spergon gives good results as a treatment for spinach seed, but according to some reports it is not quite as consistent in its effects as copper and zinc compounds. Demands will absorb all that can be manufactured.

Arasan

As a seed treatment for spinach, to prevent damping-off and other likely bacterial or fungus diseases, Arasan is a promising new product.

Thiosan

Thiosan is a new fungicide well recommended for control of brown patch and other soil fungi. It is a tetramethylthiuram disulphide.

Fermate

This is a new and promising fungicide said to be a control for apple rust and scab, cherry spot, and brown rot of cherry. One should use a spreader with it. It is still in the experimental stage.

"DN" Compounds

Sodium dinitrocresylate, such as Elgetol, is a rather new water-soluble product said to prevent the development of the apple rust fungus on cedar trees. Other "DN" compounds are used by the orchardists primarily against fruit tree pests, applied as dormant sprays in the spring while the buds are still covered. They are effective against aphids, scale insects, bug moth, and European red mite. Supplies are limited.

OTHER PRODUCTS

Stickers and Spreaders

These products are added to insecticides and fungicides to obtain greater efficiency by helping them to spread and adhere. Casein spreaders, such as Kayso, Grasselli spreader and sticker, and H.P.C. stickers, are available for most purposes, though casein spreaders are somewhat tight on account of the limited milk supply.

Paradichlorobenzene ("PDB")

This fumigant finds an important place in the control of peach borers, and home gardeners often use it to drive blind moles from their gardens. About one ounce is necessary yearly for each peach tree. This saves much labor required for removing the borers by hand. The supply is adequate.

Cyanides

These products, such as Cyanogas, a calcium cyanide preparation, are in great demand as fumigants in greenhouses where vegetables and flower plants are grown on a large scale. Supplies are adequate at ceiling prices.

Weed Killer

The supply of sodium chlorate is not quite equal to the demand for it as a weed-killer, so the material is subject to allocation by WPB, though it is nearly sufficient without rigid quotas being established. There is therefore no occasion for hoarding, although it may be difficult to get the required amounts at certain times.

Spraying and Dusting Equipment

The WPB has established priorities or restrictions on the manufacture and sale of such equipment as follows: power sprayers, 20% of last year; traction power sprayers, 30%; hand-sprayers of less than 6 gallons capacity, 30%; hand-sprayers of 6 or more gallons capacity, 20%; dusters of all kinds, 40%.

Circulars and bulletins on the control of insects and diseases and other troubles in the vegetable garden, also in the orchard and garden where fruits are being grown, are usually available from the Agricultural Experiment Station in each state, also from the United States Department of Agriculture in Washington. Most of them are free.

A practically complete file of such publications, as well as other pamphlets, books, and articles on this subject, may be consulted in the library at the New York Botanical Garden.

NEWS REACHES AFRICA --

And a Letter Comes to the Garden

MANY were the expressions of sympathy for the loss which the New York Botanical Garden suffered last December when the heating plant burned in Propagating Range No. 2 and caused the death of some 80 percent of the plants that were being grown there for display. But none of them came from so far away as an air-mail letter which arrived late last month. Addressed to Dr. William J. Robbins and dated April 25, it is signed by a man whose name was not previously known at the Garden. He writes:

> "In a recently arrived copy of *The New Yorker* I read today of the tragedy that struck the gardens this past winter. As a years-long friend of the gardens I am much saddened by the event and can only hope that the damage incurred is as reparable as the magazine's notes would indicate. If there is any possible way in which I can render some aid from this faraway northeast corner of Africa, please feel free, in the name of *Primula kewensis* and her brothers and sisters, to ask it of me."

He refers to the article on the fire which appeared in *The New Yorker* of January 2. In this, *Primula kewensis* was mentioned as one of the valuable plants which was saved.

Madder—Ancient And Medieval

By William F. Leggett

(Continued from the April Journal)

THE impression that, except for isolated instances, general culture of the madder plant in Europe was not started until about the 16th century, is correct only in so far as that it was not until then that cultivation was undertaken on a large scale in order to supply a cloth market that had expanded beyond previous demands for dyestuffs. For many centuries prior to this, Europe had been quite self-sufficient in producing red, blue, purple, yellow and black dye material.

High Standards of Culture in Holland

About the year 1494, detailed instructions concerning cultivation of madder plants had been published in Holland and they reveal the high standards which that sturdy country endeavored to attain, although politically still under the heel of a conqueror. For the next 300 years the Dutch were the most advanced madder growers in the world. Possibly there were some contributing natural advantages, such as the moist climate of marshy coastal districts reclaimed from the sea and the alluvial soil of the many deltas, which contributed to make Holland ideally suited for the cultivation of madder.

However, no practical student of economics will overlook the fact that, for at least 200 years prior to 1500 A.D., Holland was also one of the foremost fabricating nations of Europe, and consequently a large importer of both wool and silk. Thus it may be inferred that it was not solely because of unsatisfactory quality of Asiatic dyestuffs that led to the local culture of madder. The thrifty Dutch may have had one eye on retaining valuable exchange in Amsterdam and Rotterdam to pay for raw silk and wool which they could not produce, but which must be kept flowing to their many cloth factories. Dutch farmers, too, undoubtedly applauded the decision to raise and improve local madder plants, for it meant income for home folks instead of for oriental strangers. Likewise, cloth merchants, who purchased the product of the factories, rested more easily, because they were certain of a dye pigment that formerly faced delayed, if not actually dangerous shipments by a combination of caravan and sea routes which, always in event of war, and often in times of peace, afforded uncertain promise of timely arrival and of a constant supply in sufficient volume.

To promote wide madder growing by farmers of the country, their foreign sovereign, Charles V, granted many special privileges to those of his Dutch subjects who consented to engage in its cultivation. These farmers soon became specialists in madder culture, and with canny foresight they, for the first time in the long history of this plant, ignored seeds as being of too uncertain heredity, and renewed their fields entirely with shoots, "no shoot to be planted before the time when apple trees bloomed in May," and each shoot being carefully trained "at times hallowed by the agricultural traditions of centuries." The parent plant from which each shoot was taken must be exactly two years old, and following planting, the shoots were "carefully watered in a manner which has become an art with skilled peasant farmers."

No madder plant was permitted to grow after three years had elapsed, the roots being dug up and dried over peat fires in specially designed drying houses. When thoroughly dried the roots were pounded in a mill, an operation that was always undertaken "by lamplight at night" for the careful Dutch believed that, if this step in processing the dyestuff was carried on in the sunlight or even in the early day and evening dusk, it might destroy the future luster of the pigment. In the coastal area of Holland, and later throughout the entire country, two years was the time limit for growth, as it was feared that older plants, having longer roots, might penetrate too far into the soil, and, reaching underground sea level, might cause a local flood, if not a more serious inundation.

After Dutch culturists had cleared a field of madder plants, it was not again planted with madder until ten full years had elapsed. In the light of what had formerly been common European practice, this cultural technique may appear rather involved, if not entirely unnecessary, especially when it is recalled that up to this time madder dyestuff imported from France, Italy and even from the Orient had, for many centuries, sufficed Dutch cloth fabricators. However, the diligence expressed by the Dutch in madder culture paid large dividends, for, during the 16th and 17th centuries, and even later, no European country could successfully compete with Holland in production of quality madder, and almost every European cloth fabricator recognized it as the sure basis for the fast and brilliant red color, so popular at that time. Holland kept its valuable market for approximately 300 years.

Madder Growing in France

Although not until the beginning of the 18th century did France become a serious competitor of Holland in madder sales to the rest of Europe, yet at this time it was the only country that offered any substantial check to the long-held madder market position of the Dutch. The genesis of this French competition was due solely to the economic step of preventing large sums of French exchange being sent out of the country, not only to Holland, but also to Italy and the Near East.

In 1666, Jean Baptiste Colbert, famous Comptroller-General of Finances under King Louis XIV, recognized the importance of native madder culture, and therefore attempted to introduce this plant in the districts surrounding the former Papal town of Avignon, but his efforts were not successful. Equally unsuccessful were other efforts to improve a species of madder which grew wild in Normany. The answer to this latter failure can be found in the fact that *Rubia tinctorum* and *R. peregrina,* those two species of madder which European dyers used almost exclusively, were products of over a thousand years of more or less intensive culture to meet exacting dyeing conditions. Therefore they could comfortably compete with another species which had been the object of mere hasty and expedient research for but a few years and under political pressure. This was true, although the incentive for wide culture of madder in Normany had been urged upon Colbert by an Armenian, who had been trained in madder growing in Persia, and who claimed that "a favorable conjunction of climate and soil" made it "an ideal locality to develop a native madder already growing there." Louis XV, the next King of France—who, incidentally, was the great-grandson of his immediate predecessor—directed one of his ministers of state to "arouse interest in madder growing among the peasants of Southern France," and although they ignored a primary Dutch theory by planting seeds, yet these seeds, which they imported from Cyprus and Smyrna, were described as being "specially treated" (irradiated?). A custom peculiar to French culturists of that era was to cut off the top of each plant three times each year during the period of growth, for they thought that this pruning assisted hasty development of the plant and thus contributed to the vitality of its roots. French culturists, however, fully equaled their Dutch brethren in irrigation engineering, and even went beyond the latter in some techniques, for, after but one year of growth, French madder farmers were urged to take up each plant for replanting and then to permit another year of growth before the roots were harvested. In the madder growing districts of Normandy, the French, as was also the custom of the Dutch in Holland, dried the roots artificially, but the more favorable climate of France permitted open air drying. When practised, this was accomplished by depositing the roots on stone blocks so placed as not to expose any of the roots to the rays of the sun. Although this process consumed from three to six days, yet the roots were seldom thoroughly dried for grinding or crushing, and they were often placed in an ordinary baker's oven after a baked batch of bread had been removed but while the oven still retained most of its heat.

In 1729 Frantzen brought madder seeds to Alsace, but the industry did not become important there until about 1772. The Alsatians practised a much slower drying method, merely laying the roots on frames placed in heated rooms, a proceeding that not only was slow, but also rather bothersome, for each room had to be frequently aired in order to rid it of fumes which had developed.

While the net results of French madder production efforts were so remarkable that entire districts in both Alsace and Southern France were soon covered with madder fields, and the product in a few years excelled in quality the madder previously imported from the Near East, yet it never won the approval of European dye masters so completely as did the madder of the Dutch.

Red Costumes for Soldiers

The coming of the French Revolution and the long period of political and economic unrest which followed played havoc with this thriving industry, and not until 1815 were any efforts made to revive it. Even then, it only partially recovered its former vigor. In an effort to succor a once prosperous home industry, King Louis Philippe, in 1840, ordered that the trousers and caps of the entire French army be "dyed red with madder." In so doing he was but following the precedent of an earlier English king who also ordered all army uniforms "dyed red with madder" —and American school children still know them as "redcoats"! These moves, of themselves, did not consume any great quantity of madder roots, but both the emotional French and the more phlegmatic English expressed a certain patriotism by demanding this brilliant red color in many forms of fabric both for the person and for the home, and to this degree were the efforts of both madder-reviving kings successful.

The Dye-Plant in England

When compared with Holland—and even with France—the cultivation of madder in other European countries was quite unimportant, although the plant was grown in Turkey and to a less extent in England, Italy and Germany. In an effort to foster a new industry, King Charles I of England, about 1615, decreed special privileges to those of his subjects who would cultivate the madder plant, but imports from Holland and France were always required to maintain a steady supply of this red dye for English cloth fabrication.

Not until 1730 did madder cultivation win any serious attention in England, where the plant had been grown sporadically for centuries. Small cloth dyers purchased what supplies they required from local farmers who raised madder mainly to sell to herb dealers and local physicians, for whom the plant was a medicine rather than a dye. For some reason which may have had historical basis, England preferred green or brown as a color relief in dress, and did not call for red to the extent that it was used on the continent.

A large part of the madder used in England passed through Norwich, making this town the most important madder distribution point in that country, and memory of this activity is preserved in an age-old local thoroughfare still called Madder Street.

Some Scientific Discoveries

In the year 1736, Dr. Belchier, an English surgeon, when dining at the home of a cotton printer, noticed that the smaller bones in the roast pork which was served at the meal showed a tinge of red. His host quickly reassured the doctor concerning the purity of the meat, explaining that the red tint in the bones was due to the fact that his cattle and swine were fed with bran mixed in water that had previously been used for boiling cotton cloth, thus sterilizing the water, but also coloring it with harmless red madder used in printing processes. This stimulated the curiosity of the surgeon, who performed many secret experiments, then made known his findings in a paper read before the Royal Society. The result was that other scientists continued his preliminary experiments, and brought to light many important physiological facts, not the least of which was that, while dye from the roots would color them, as the surgeon had already noted, forage from madder had no tinctorial effect whatever on the bones of man or any carnivorous animal. This delayed, but comforting, assurance justified the centuries-old practice of feeding madder tops to cattle and swine. However, it had long been known, both in Holland and France, that madder roughage had a tendency to impart a reddish hue to milk and a yellowish hue to butter, but neither of these tinted dairy products had ever had any deleterious effects upon the ultimate human consumer.

The scientific reasons for all this were not then known, although a French chemist of the 16th century was the first scientist on record to make these observations. It may be because of him that Dr. Belchier's "re-discovery" created more interest in France than it did in England, and French physiologists, agronomists and chemists joined in an effort to learn the secret of a mordant dye which made Turkey red the most brilliant of all scarlet dyes produced in the Orient. It is interesting to know that those French investigators finally arrived at the conclusion that the calcium content in the bones of cattle and birds—they had experimented with turkeys and pigeons—determined the deepness of the red tinge. As English and French dyers were well acquainted with this physiological characteristic of madder even before it was thoroughly understood by scientists, it may not be unreasonable to suppose that it was also known in countries which had produced madder before and during the Middle Ages. While we have no available data to support a surmise, it is likely that it was also known to Roman and Oriental dye users, and that Dioscorides merely overlooked mentioning it, although he came pretty close to it in his olive tree reference. These physiological experiments made so long ago in England and France have been amplified by extensive modern research in the use of color substances for therapeutical purposes. It is worth mentioning that neither woad nor saffron, also ancient vegetable dye sources, possesses the therapeutical possibilities of madder, which still holds considerable scientific interest.

Customs Outside of Europe

Non-European countries in which madder was grown included Persia, Mesopotamia, Egypt, Tunisia, Morocco and India. The ALIZARI (madder) of Arab merchants was at one time far superior in quality to European species of *Rubia*. It was allowed to remain in the ground for six years, for, unlike the peasant growers of Europe who introduced scientific cultivation, because they could ill afford to permit their land to bear but one crop for such an extended time, the Arabs depended entirely upon age for size of root, and, facing less economic pressure, could afford to adjourn to their tents and wait for it to bear the fruits of their apparently listless endeavor.

Madder grown in the Orient had one favorable characteristic which cannot be disputed, and this was the advantage of clean, pure, open-air drying of roots, which considerably increased the value of oriental madder when in competition with roots which had been dried in the always moist and often impure air of the usual European drying room of that period. Edward Bancroft, a celebrated English authority on dyestuffs, once slyly remarked that the difference between European dried madder roots and those dried in the Orient, was as great as the difference between a European and an Angora goat, but despite this distinguished endorsement, madder from the Near East—especially after the 12th century—never achieved marked success in Europe, undoubtedly because, with true Oriental stubbornness, the growers always prepared their madder roots for market with the outer covering, or skin, retained—a defect in preparation which not only decreased the purity of the dyestuff, but also involved complicated and expensive processes in dyeing before a desirable shade of brilliant red could be brought out on calico or wool cloth. We also find traces of characteristic Oriental trade trickiness. Although European madder actually contained a less amount of essential dye pigments, yet it was much easier to handle both in transit and use, for after the 13th century it was invariably marketed in powdered form, while madder from the Near East was accepted, if used at all, only in root form. This was because European cloth merchants had too frequently been forced to make claims upon the wily Eastern growers for falsification of powdered madder, so they soon flatly refused to accept shipments in any other form than roots.

An interesting angle appears in the fact that for many decades during and after the 15th century, the bulk of European powdered madder was packed in casks or linen sacks for transportation and sale, and in those remote days, no modern "guaranteed sample of package content" system had been devised to protect—or at least guide—the prospective buyer, and therefore it was practically impossible for him to know accurately the exact quality of the powdered dyestuff offered for sale, for only actual use could then develop that point. Thus he was entirely dependent upon what he knew about the integrity of the seller. Be it recorded with pride that the majority of European madder growers were reputable, and did their utmost to prevent falsification. Especially in Holland was this reputation preserved for centuries, as quality standardization was maintained by strict regulation which governed both manufacture and sale. Some of the regulations which had been put into effect in 1537 by Charles V were faithfully followed by the Dutch until the gradual decline of madder production in the 19th century.

A Variety of Colors

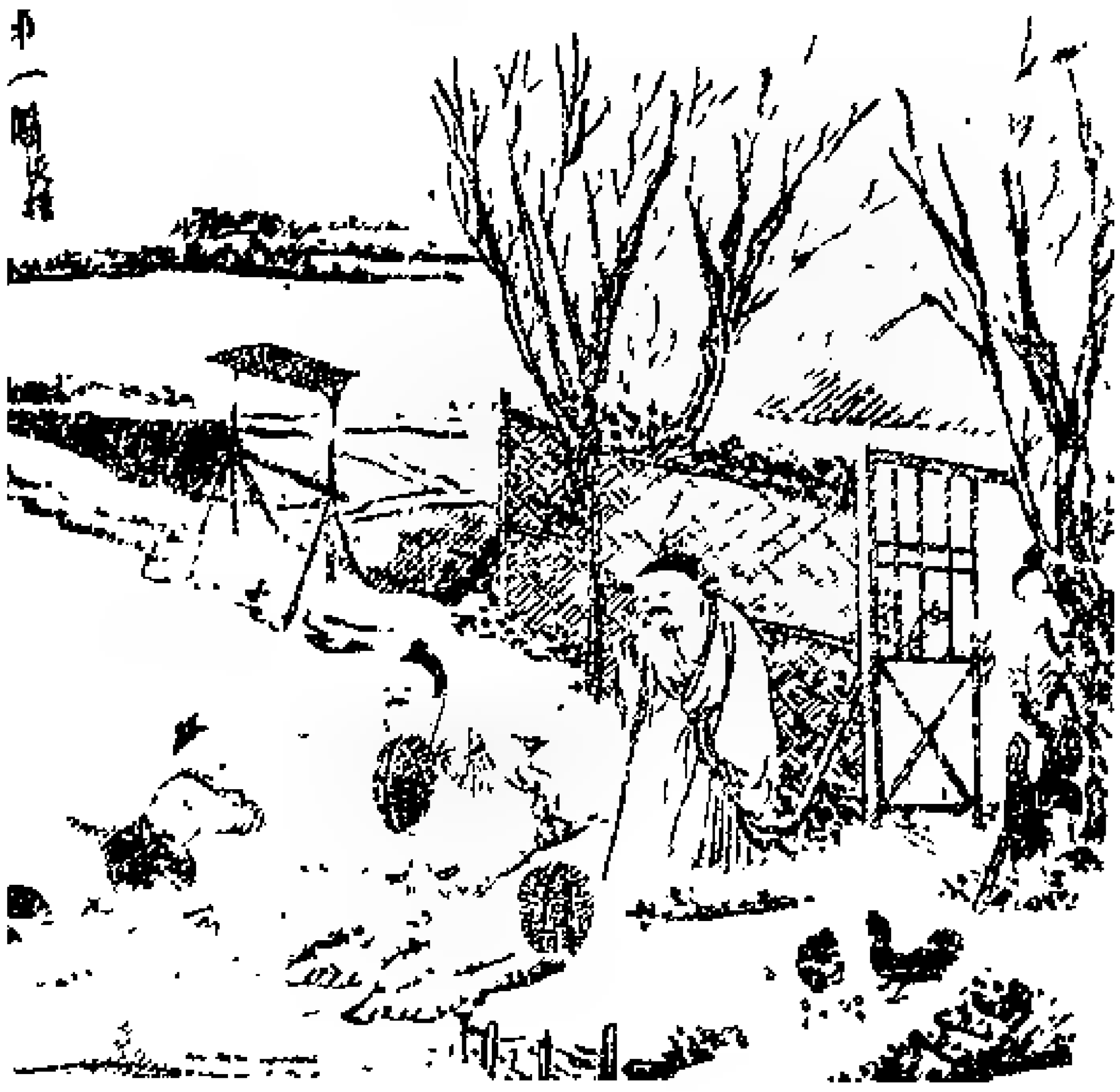
Prior to 1870, at which date synthetic dyes began to appear, madder, as soon as mordants became widely used, was the early choice of calico printers and Turkey-red dyers. The former favored it because of its ability to yield a variety of color, as for instance, red or pink when aluminum was used as a mordant; orange, when tin was the mordant; lilac or black, when mordanted with iron, and various shades of brown and chocolate when a mixed aluminum and tin mordant was prepared, and what was still more important, all of these colors were fast to both light and washing. Calico printers used both the alizarin and the purpurin elements of the madder root, but for most classes of their work, alizarin was the essential color agent. Turkey-red dyers used madder because their particular process called for the most brilliant and permanent red known at that period, and thus alizarin was the all-important element for them because pupurin, although apparently fixed on the cloth fiber, was subsequently more or less removed from it during this particular process. Pure alizarin used with an aluminum mordant gave a bluish-red shade, and when iron was the mordant, a comparatively bright lilac was developed. Pure purpurin, on the other hand, gave a yellowish-red tint when an aluminum mordant was used, and a gray-lilac tint with an iron mordant. It was quite early discovered that if madder roots had matured in soil deficient in lime, it was imperative to add chalk to the dye bath; later, chemists made it clear that calcium was a normal constituent of all madder colors and especially those obtained with aluminum and iron mordants.

When synthetic dye, in volume and variety, was finally placed on the market, madder cultivation started to decline all over the world, and within a decade had entirely retired in favor of the synthetic "alizarin," for the latter was one-fourth as costly and more effective.

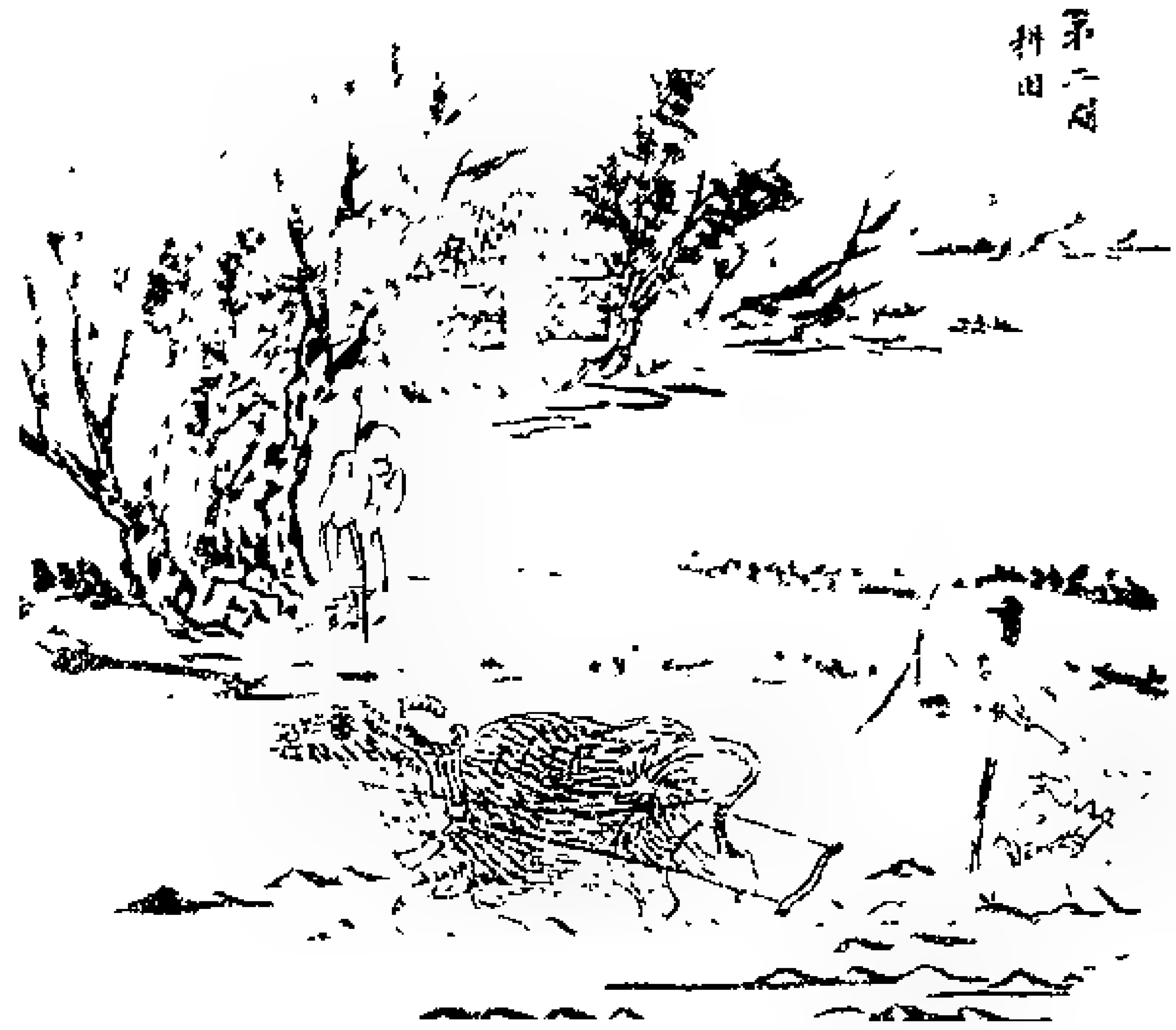
Today, madder is cultivated in rather limited quantities by a very few countries, solely to supply a demand of artists for a certain natural pigment of superior quality—and possibly a call from some physicians who still credit this plant with some of the virtues ascribed to it by the ancients.

The Story of Rice

Illustrations on these two pages are from a series of prints believed to date from the Ming dynasty, about 500 years ago. The method of rice culture is essentially the same today in China.

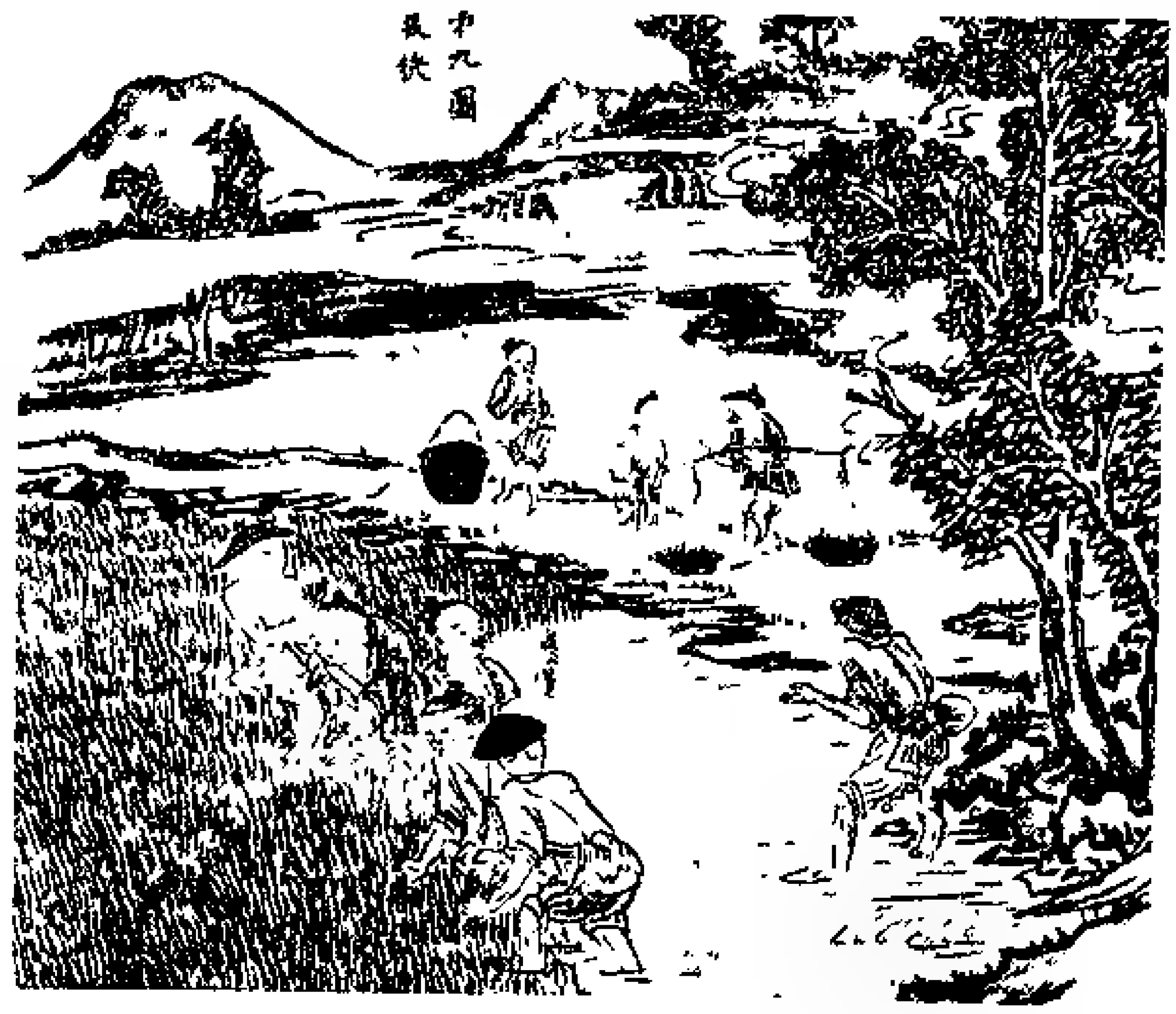


To hasten germination, the rice seed is soaked for about a day in bamboo baskets.



2. *A water-buffalo ploughs the flooded field to prepare it for the rice crop.*

The seeds are sown in nursery beds by being dropped from small bamboo containers.



4. *Rice seedlings are gathered from the original bed to be transplanted to the field.*

\ water-buffalo turns the wheel which raws water to the field from the river.

ater-buffalo turns the wheel which

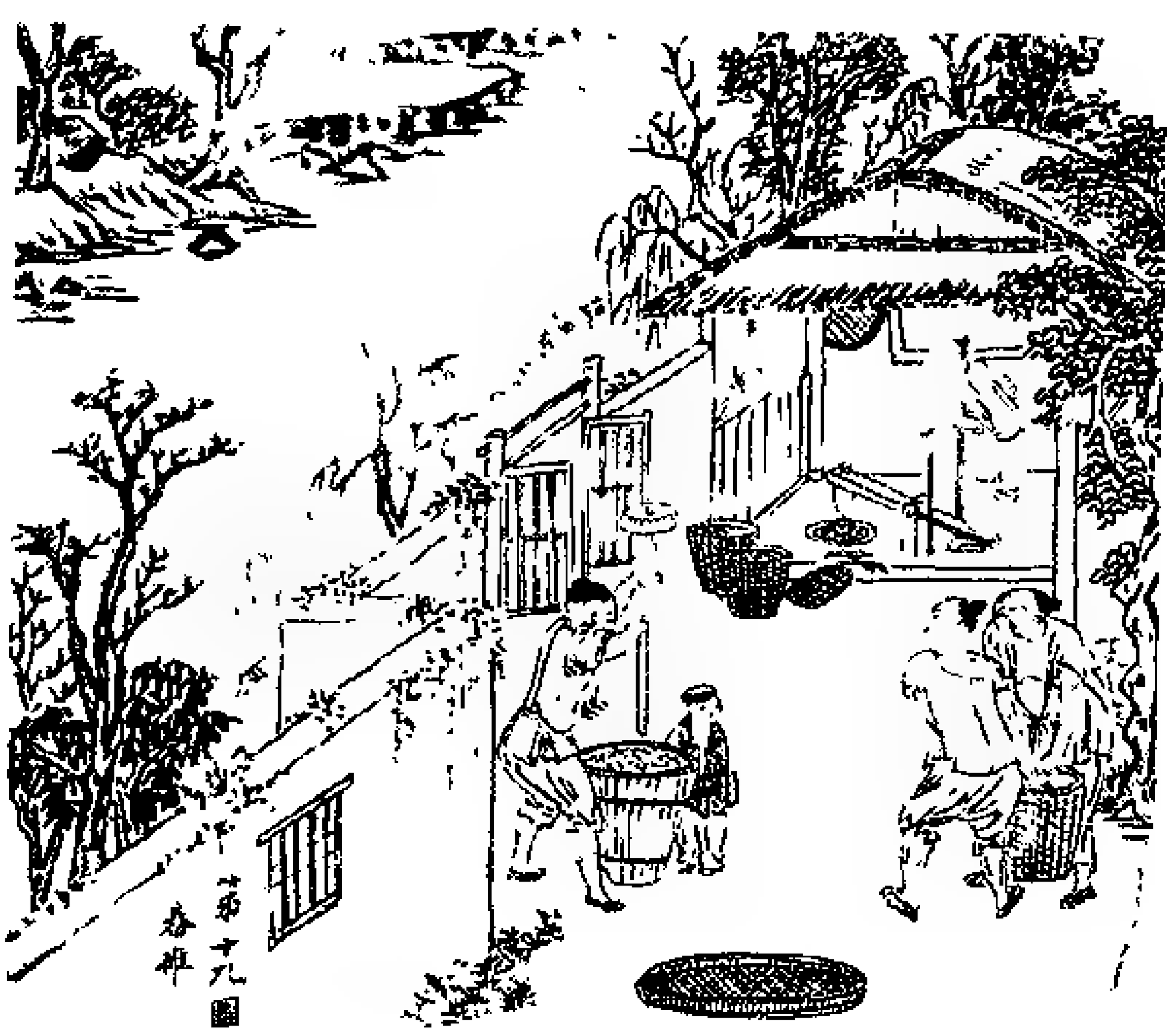
6. *The seedlings are set out in a field which here is watered from a bamboo pail.*

The Story of Rice (continued)

The prints that are reproduced here were obtained through the courtesy of the Foreign Mission Board of the Southern Baptist Convention and photographed by Fleda Griffith. Enlargements of them have been made for a permanent museum exhibit at the Garden.

7. *The harvest. Sheaves of rice are stacked for drying before they are threshed.*

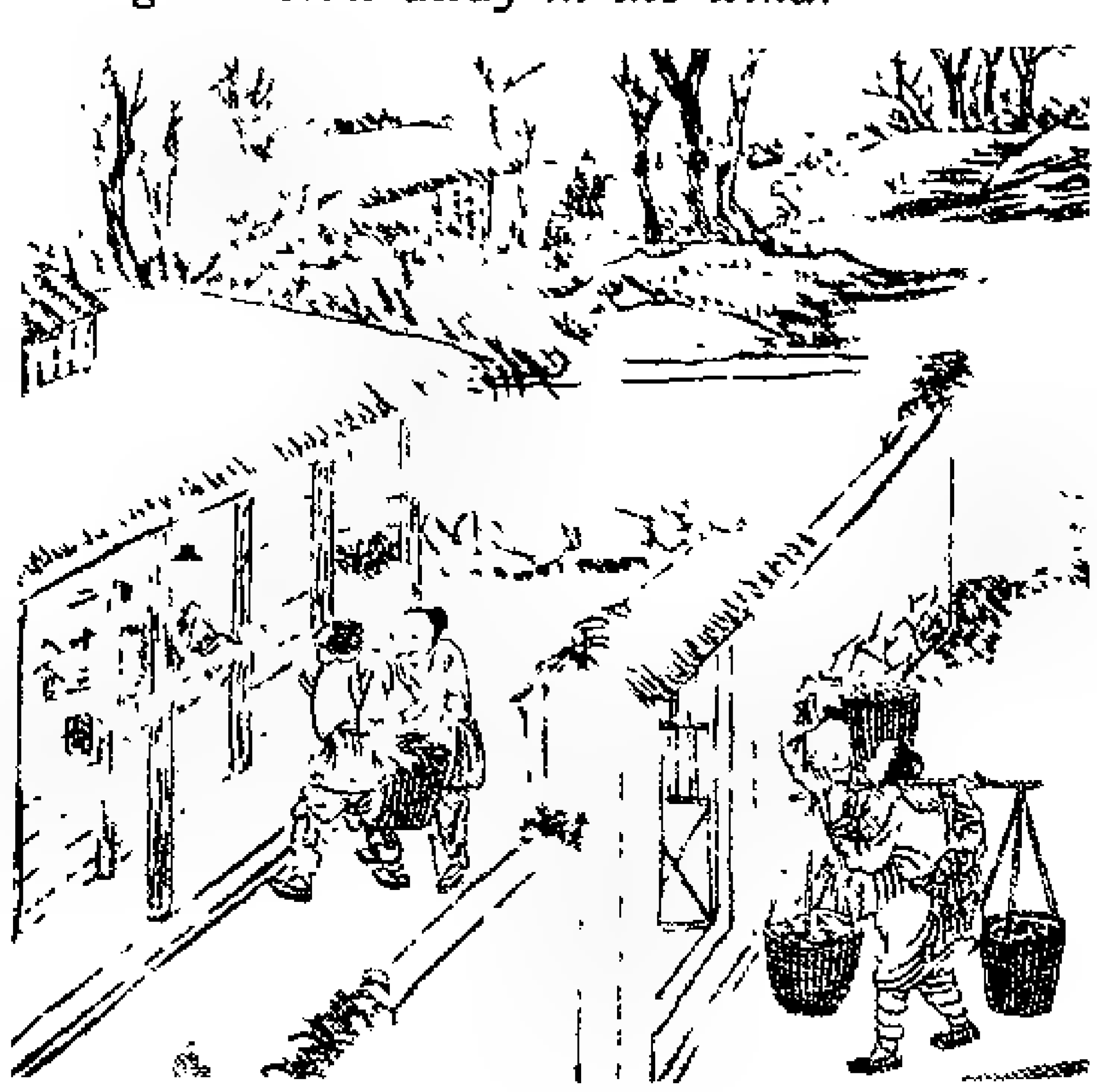
8. *The rice is threshed with bamboo flails wh separate the grains from the stalks.*



9. *An inverted pestle is used in a stone jar for pounding the rice to loosen the hulls.*

10. *Winnowing lets the broken hulls of the grain blow away in the wind.*

11. *In a primitive hand mill the brown coating is ground from each grain of rice.*



12. *The polished rice is carried in baml baskets to the family granary for storage*

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.)

America's Early Naturalists

NATURAL HISTORY AND THE AMERICAN MIND. William Martin Smallwood. 445 pages, illustrations, bibliography and index. Columbia University Press, New York, 1941. $4.25.

The history of the United States is unique in one respect. The men who cleared the wilderness, who tapped the native riches of the land and founded its cities, did not evolve from endemic savagery, nor did they arrive as invading barbarians: they were the emissaries of an older culture, who carried letters and science with them into a new world. Mingled with those who hunted for fur, felled trees and planted crops, and mined metals were men who collected specimens of plants, animals, and minerals, named them in Latin, and arranged them in a sophisticated system. Dr. Smallwood's book deals with these naturalists, with their writings and their teachings, with their training and their philosophy, and finally with what he terms their "passing."

Any attempt to depict so large a theme must struggle with a tendency to yield only a confusing mass of detail, an intricate mosaic of figures, titles, quotations, and dates. This book succeeds better than some others of similar scope in tracing a connected story through this fascinating wealth of images. From the earliest meagre and often inaccurate records we trace the awakening of general interest in natural history, its invasion of the colleges and its struggle for recognition in educational curricula, the rise of the academies and lyceums, and the contributions made by publishers and artists.

In one respect, indeed, the continuity of the book has been achieved (perhaps unavoidably) at the expense of a true perspective. In attempting to draw a line between naturalists and scientists one is led dangerously near to absurdity. Even though we may hesitate to speak of Audubon as a scientist, it is without misgiving that we refer to Darwin as a naturalist. The early naturalist was (naturally) less trained, less specialized than the later scientist; but every gradation existed (and still does), and it would be a mistake to conclude that some fundamental difference in method or outlook distinguished one from the other. How it would have infuriated Rafinesque to be rated as a naturalist by one to whom Torrey is apparently a scientist!

In discoursing on philosophy Professor Smallwood is—like most modern scientists—somewhat superficial. To picture the development of science as an outgrowth of the need for physicians is, I believe, an oversimplification. The impulse to research and discovery is more deep-seated than that.

The book is well printed and in general carefully done—even to a notable rash of "ibidity" and an extensive and useful bibliography. There are, however, some errors which shake one's faith in biologists—and University presses. Pierre Joseph Redouté should be well enough known not to be miscalled "Redonte." The misprint "Andromead" for Andromeda should not go undetected in the legend to a plate. And when we read "Venus flytrap (*Drossia rotundiphia*)"—well, words fail me.

H. W. RICKETT.

Character Sketches of Woody Plants

SHRUBS AND TREES FOR THE SMALL PLACE. P. J. van Melle. 298 pages, index. Charles Scribner's Sons, New York. 1943. $2.50.

This new book on shrubs and trees presents members of this important group in a rather different light than is usual on the printed page. The author had in mind those kinds especially suited for planting on places of modest extent, and presents a "candid camera" view of more than 400 deciduous shrubs and small trees available for the purpose.

Too often in the past such plants have not been used with the understanding their importance and duration in the garden scene demands, while selections are usually very limited and often unsuited to the location. Most kinds give but a brief floral display, and in order to spread the interest throughout the season the planter should look for other qualities, such as form, good foliage value, and fruit display.

A unique feature of this book is a Score Chart, based on the author's observations and long experience in nursery and landscape plantings. This chart puts the spotlight on 363 shrubs and trees, and shows at a glance their decorative value and adaptability to soil and light variations. Classified tabulations indicate special features, then follows a "character sketch" for each one listed in the chart, with faults as well as virtues pointed out in a clear-cut manner. The chapter on Shade Trees is charged with ideas that some may find hard to digest—but good none the less. Chapters on Planting, Pruning, and Hardiness give good clear and practical information. To this reviewer the book is a notable contribution to a better knowledge of shrubs and trees. It is a pleasant book to read, both for the subject matter and the manner in which it is presented on the pages. By way of a change in garden books there are no pictorial illustrations.

HENRY E. DOWNER,
Vassar College.

On the "Art of Growing Trees In Masses"

AMERICAN SILVICS AND SILVICULTURE. By Edward G. Cheyney. 472 pages, illustrated, indexed. University of Minnesota Press, Minneapolis. 1942. $5.

In this book Professor Cheyney has made a worth-while contribution to the literature of American forestry. He has brought together in conveniently arranged form a mass of information that is fundamental to the successful practice of silviculture in the United States. Because of its non-technical, almost conversational style, one constantly has the impression that he is listening to an authority speaking informally out of long personal experience. And such is indeed the case, since Professor Cheyney's period of service as professor of forestry at the University of Minnesota dates back for over a quarter of a century.

As the author defines the terms which make up the title of his book, *silvics* is that branch of ecology which "deals with the response of a tree to every factor that affects its growth in any way." Only when a forester has at hand a store of such data, systematically assembled and arranged, is he in position successfully to engage in the practice of *silviculture,* "the art of growing trees in masses." And this is equally true whether the objective in the management of any particular forest is the production of wood—as in most instances—or the safeguarding of a watershed cover, or for esthetic ef fect or recreation. Silviculture implies a plan which rests upon properly organized basic information.

Professor Cheyney divides his book into four parts under these heads: silvical factors; forest regions of the United States; silviculture; and silvical description of all important species. Actually somewhat over 100 species are enumerated, the order of arrangement being alphabetical, by genera and species. Part IV is supported by a bibliography of 466 items.

According to the author, the first three parts "constitute a textbook of forestry;" the fourth is "designed primarily for reference purposes." His approach throughout is that of an eminently practical land manager with a keen sense of the balance which must be maintained between what is theoretically desirable and what is economically possible.

Professor Cheyney makes it clear that American forestry still has much to gain from the experience of Europe, but that it is the mastery of broad principles which counts, not attempts to apply European methods to American forests.

The portion of Part III entitled "Application of the Silvicultural Systems to the Various Forest Types" is one of the distinctive features of the book and adds no little to its value. Although it must frankly be admitted that as yet we lack full knowledge of the silvical factors of many American forest trees, and for some species have but few such data, it is significant that the time has now come when definite recommendations as to the scientific management of particular forests can be made on the basis of exact information gathered through experiments, investigations and research.

RALPH S. HOSMER,
Cornell University.

Of the Rain and the Wind

WAYS OF THE WEATHER. W. J. Humphreys. 400 pages, illustrated, indexed. The Jaques Cattell Press, Lancaster, Pa., 1942. $4.

The development and rapid expansion of air transport has introduced a need for a popular, non-mathematical treatment of weather, which this book attempts to fill. Throughout, emphasis is placed on physical explanations of the commonly observed atmospheric phenomena and perceptible weather conditions. The reader will learn much about the atmosphere as a whole and the variations of its components which produce the weather. Many details of atmospheric electricity, optics and acoustics, which to the layman are both weird and puzzling, are made understandable. From this point of view, the book is admirably successful. However, the treatment of modern weather analysis is inadequate. The production, transportation and dynamic interplay of air masses, which control the daily passage of weather, are given scant treatment. Therefore, the reader will not feel acquainted with the operations of a modern meteorological station. Nevertheless, the reviewer does not hesitate to recommend this book highly for the vast amount of authoritative information that it presents in an attractively readable form.

BARBARA MCCLINTOCK,
Carnegie Institution of Washington,
Cold Spring Harbor, N. Y.

New Jersey Peat And Its Uses

THE PEATS OF NEW JERSEY AND THEIR UTILIZATION. Selman A. Waksman. 155 pages, bibliography of 339 titles, index, charts, tables, drawings and photographs. 1942.

An elucidation of the origin, composition, and uses of peat is given in this paper by Dr. Waksman, which is published as Bulletin 55, Part A, Geologic Series, of the New Jersey Department of Conservation and Development, and prepared in co-operation with the Agricultural Experiment Station at Rutgers University. It is hoped that Part B, to deal specifically with the important peat deposits of New Jersey, will not have to be canceled because of the termination of the services of the W.P.A., which assisted in the preparation of the present part.

Besides the agricultural and horticultural uses, it has been found that peat can be used to make fabrics and paper, insulation material, and other products, and that it can be used in tanning, as a catalyst, and for fermentation purposes.

An especially valuable part of Dr. Waksman's study is his attempt to arrive at a comprehensive definition and practical classification of peat, comparing and discarding many previously suggested differentiations.

CAROL H. WOODWARD.

Plants of the Rockies

MEET THE NATIVES. M. Walter Pesman. 216 pages, illustrated, indexed. Published by author at 372 S. Humboldt St., Denver. 1942. $1.25.

This is a booklet of pocket size, looseleaf, with ring binding, plentifully provided with good photographs and about 50 merely suggestive line drawings. The more than 700 plants treated are attributed to rather rigidly limited lifezones upon which the major divisions of the book are made. Further, each lifezone section is subdivided by paper of different color, each color indicating the habit of the plant or the color of its flowers. For example, green pages represent shrubs or woody plants; white pages, herbs with white flowers; pink pages, herbs with red or pink flowers, etc. A further division is sometimes made upon more immediate habitat as "on north slopes," or "on dry sunny slopes." A short description is offered for each plant or plant group.

The author intimately addresses himself to a non-botanically informed audience, freely admitting that his work is not for the botanist or technically trained. For this audience the booklet probably serves a useful purpose, and one does not expect to find authoritative or consistent application of technical names or organization in a work of this sort. It is somewhat of a shock, however, to find the poisonous mushroom, *Amanita muscaria*, placed under "herbs" without any qualifying statement.

In the use of common names, the author seems to indulge somewhat in his own fancy, as, for example: "lance-leaf shining bells—*Mertensia lanceolata;*" "little red elephant—*Elephantella groenlandica;*" or "gem-carpet beard-tongue —*Penstemon harbouri.*" Such apparent coinage of names even in a booklet of this character is unfortunate.

BASSETT MAGUIRE.

Written by a Rose-Lover

MY FRIEND THE ROSE. Francis E. Lester. 90 pages, illustrated, indexed. J. Horace McFarland Co., Harrisburg, Pa. 1942. $2.50.

Rose lovers will delight in this book, which is charmingly illustrated with reproductions of old-fashioned rose paintings, and beginners will profit by reading it.

The author tells of the rose's ancient history, in Egypt, Rome, and in Elizabethan gardens, and gives the names that have come down through the ages—*Rosa sancta, Rosa gallica*, the damask rose, the eglantine. Mr. Lester prefers these old roses of rich association; they have sturdiness, endure neglect, resist disease. He recommends that in growing roses you study your requirements—whether to cover a wall or bank, for a shrub or hedge or bed—for there are roses for every purpose and for every condition. He lists them, and you know he has culled them by experience.

He speaks of California and Southern rose gardens. I wonder if he has seen the roses in old Nantucket gardens in June or the eglantine hedges perfuming the fresh ocean air.

HENRIETTA McC. WILLIAMS.

Economic Crops

SOYBEANS: Gold From the Soil. Edward Jerome Dies. 122 pages, with tables, a map, chronology, bibliography, and index. Macmillan, New York, 1942. $1.75.

Yesterday a curiosity and today a major cash crop in the United States, the soybean has a history—and probably a future —comparable to a fairy story. In 1941 the United States produced nearly 107,000,000 bushels—one of the largest soybean crops in the world—and an effort is being made to increase the acreage greatly in 1943. At the start of the century the plant was practically unknown in the United States, although in the Orient it dates back to prehistoric times. Mr. Dies in his small book gives facts about the soybean and its production, processing, and marketing, that are of importance to the grower of this crop.

KAPOK: A Survey of its History, Cultivation and Uses. Stephen J. Zand. 119 pages, illustrated with photographs. Presented by the Trade Commissioner for the Netherlands Indies, New York, 1941. 50 cents.

A complete story of kapok, from the probable origin of the species of trees producing this useful fiber, to a list of its uses in modern warfare is given in this book. There are chapters on cultivation, analysis of the fiber, early uses, present ones, and methods of preparation, besides a survey of the trade in kapok during the last four decades and a bibliography covering five pages.

CAROL H. WOODWARD.

Note on Rubber

SCIENCE REMAKES OUR WORLD. James Stokley. 298 pages, illustrated, indexed. Ives Washburn, New York, 1942. $3.50

A very readable popular account of progress in several fields of modern science by an author who at present is associated with the famous General Electric Research Laboratory and who in the past has devoted his time and energy to scientific writing, partly in connection with Science Service. The only botanical account in the volume is a brief discussion of rubber.

E. H. FULLING.

Photosynthesis and Other Subjects

BIOLOGY FOR HIGH SCHOOLS. Sister M. Dafrose, O.P., Ph.D. 797 pages, illustrated, indexed; bibliography and glossary P. J. Kenedy & Sons, New York, 1942. $2.40.

A vast compendium of nearly 800 pages and over 1,000 figures, including chapters on Matter and Energy, the Solar System, Air, Fire, Light, Electrical Energy, Methods of Transportation, all groups of plants and animals, Soil, Farming, Forests, and other matters. According to Sister Dafrose, Indian pipe is "a fungi," and photosynthesis is "God's patent."

H. W. RICKETT.

The Chemical Point of View

CHEMISTRY OF INSECTICIDES AND FUNGICIDES. Donald E. H. Frear. 300 pages, illustrated, indexed. D. Van Nostrand Co., New York. 1942. $4.

This concise volume is the most up-to-date American publication on the chemistry of insecticides and fungicides. The first part deals with stomach poisons or protective insecticides, with one chapter each on the arsenicals, lead arsenate, and fluorine and miscellaneous stomach poisons. Part II, comprising a third of the book, is on contact poisons or eradicant insecticides. There are chapters on nicotine and pyrethrum, rotenone, sulfur, oils, and fumigants. Fungicides are taken up in Part III with one chapter on copper compounds and one on mercury and miscellaneous fungicides. Spray supplements and residue removal are discussed in Part IV. Part V is on analytical methods, both macro and micro. Subject and author indices are included.

The work is an outgrowth of a graduate course given by the author and as such represents a most valuable reference work. There is appended to each chapter a fairly extensive list of selected references. Recent developments in new insecticides and fungicides have been included. The book is strictly limited to the chemistry of the various insecticide and fungicide compounds. There is little or no discussion of the toxicology or physiological action of the chemical on the insect, the fungus or the host plant.

A unique feature of this work is the relatively extensive treatment of analytical procedures.

S. E. A. McCallan,
Boyce Thompson Institute For Plant Research.

Orchid Growers' Guide

AMERICAN ORCHID CULTURE. Edward A. White. 276 pages, illustrations, bibliography, index. De La Mare, New York, 1942. $5.

This third edition of American Orchid Culture as written by Professor E. A. White of Cornell is a very fine addition to American orchid literature and will prove to be of immeasurable help to all amateur, professional, and commercial growers. In writing about his trips where he has seen orchid plants growing in their native habitats the author imparts much valuable and instructive information.

The chapters on Orchid Houses and their Equipment, Propagation of Orchids, Orchid Hybridization, and American Markets and Marketing are all complete and comprehensive in detail.

Where Professor White speaks of soil mixtures for orchids in his chapter on General Culture, I would like to make the following comments:

The compost recommended for terrestrial orchids is rather heavy and compact in nature, and unless the growers use very great care in the watering of their plants many failures will result.

The compost recommended for semi-terrestrial orchids is of rather a close nature. The word "peat" should read "peat-moss," otherwise the word in general means orchid peat to most growers.

Chapter VII, "Orchids for Beginners" gives very concise and helpful suggestions on the subject and should be digested by all who intend to go into orchid growing on a small scale as a hobby. The remaining nine chapters are all replete with interesting and instructive reading matter and the book is worthy of a place in any horticultural library.

John S. Doig.

Outlook on Latin America

OUTLOOK IN THE WESTERN REPUBLICS by Jay C. Field; **BRAZIL,** Eula Kennedy Long; **WEST INDIES,** Edward A. Odell; **MEXICO,** Alberto Rembao; **RIVER PLATE REGION,** Hugh C. Stuntz. Mostly 64 pages each, illustrated with maps and charts. Friendship Press, New York, 1942. 25 cents each.

These attractively printed, paper-bound booklets, each written by someone who has lived a long time in the region under discussion, have a special value for the person who is about to settle in one of these sections of Latin America, rather than for the tourist or the casual visitor. They describe the populations, their industries, modes of living, educational opportunities, periodicals, some of their problems, and their religious situations—particularly this last, for each of the authors has been connected with religious education in the region of which he writes. A brief reading list comprises an appendix to each volume.

Carol H. Woodward.

Fruit Culture in India

TROPICAL FRUITS. Sukh Dyal. 275 pages, indexed, illustrated. Chemical Publishing Co., Brooklyn, 1942. $2.75.

This is a record-making book. It contains more errors than I have ever seen in a book published in this country. It has apparently gone to press without editing of any sort and the proof reader must have been up late the night before. Nothing is stated about the author but from internal evidence it seems that he is a lecturer in an agricultural school in the Punjab, North India. The book is full of Indian words which are not explained in the single page which passes as a glossary.

The author has brought together a lot of material which has been useful in his classes in fruit raising. There is need in India for such a textbook, for the fruit industry is very backward, but why the book was published in this country is a mystery. It could have been done much more cheaply in the Lahore Bazaar, where the Indian type of English would not have been so noticeable. Here are two samples of the English.

"*Olives.* It can grow even in rough soils which are found relatively dry for the grapes and gritty for other fruits."

"At present molasses are being disposed off at a ridiculous low rate."

The illustrations are miserable and the format is unattractive. Much more might be said. The book is not worth $2.75.

R. R. STEWART.

*Current Literature**
At a Glance

Mushrooms. Vitamins and minerals found in commercial mushrooms are listed by E. E. Anderson and C. R. Fellers of the Massachusetts Agricultural Experiment Station in the latest issue of the Proceedings of the American Society for Horticultural Science (Vol. 41). According to their tests, fresh specimens of *Agaricus campestris,* while they consist of 90 percent water, contain calcium, phosphorus, potassium, copper, and available iron, besides vitamins B_1, B_2, and C, and nicotinic and pantothenic acids in beneficial quantities.

Medicinal Plants. Botanical, native, and commercial sources of 49 drugs derived from tropical and subtropical plants are given in Foreign Agricultural Report No. 6 published by the U. S. Department of Agriculture. A. F. Sievers and E. C. Higbee are the authors of this useful reference work, which is designed to aid prospective growers of medicinal plants in the warmer sections of the western hemisphere. The importance of each drug is mentioned, also the amount of it that was imported in 1938, '39 and '40. Methods of propagation and culture for each plant are outlined, as well as the manner of harvesting the crop and preparing it for the market. In addition, sources of further and more complete information are given whenever it is available.

Vitamin C in Small Fruits. Tests made on several varieties of small fruits reveal from 16 to 18 milligrams (approximately) of vitamin C in each 100 grams of blueberries; 27 to 32 milligrams in dewberries; 20 to 32 milligrams in raspberries, and 12 to 23 milligrams in blackberries. Sun-ripened berries had a higher content of this vitamin than berries ripened in the shade. This information comes from Volume 41 of the Proceedings of the American Society for Horticultural Science, which contains an article on the vitamin C content of small fruits by R. A. Lineberry and Leland Burkhart of the North Carolina Agricultural Experiment Station.

Island Survey. "Making New Zealand" is the title of a publication issued periodically from the other side of the world. Subtitled "Pictorial Surveys of a Century," each number in the series shows impressive scenes, in which the plant life of the island is dominant. Afforestation, erosion control, and the wheat lands which provide the country's bread are among the subjects treated.

Tree Diseases. An annotated list of parasitic maladies of trees observed in Quebec has been issued by the Forestry Service there. The text is in French; the names of the trees and their diseases in French, English, and Latin.

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

Sprays. The *Arborist's News* for February summarizes the situation in spray materials, especially those for use on trees.

Children. Two more booklets have been published by the Brooklyn Botanic Garden to describe its work in teaching gardening and nature study to children. Two more are promised in this attractive series of five.

Catalog. An elaborate catalog with an abundance of colored illustrations, as well as countless photographs in black and white has been issued again by Wayside Gardens. It was preceded by an announcement containing a description of each of the novelties being introduced by the nursery this year. These new plants are among those which are illustrated in color.

Question Column

What are the largest plant groups in the world, as to the numbers of species known?

There are more different species of orchids in the world than of any other kind of plant. In this one family, the Orchidaceae, every member of which is easily recognized as an orchid, there are some 20,000 species. Legumes, which constitute all the peas and beans of the temperate zone besides thousands of tropical trees, shrubs, vines, and herbaceous plants, many of which are also useful to man, come second, with approximately 17,000 different species. Third come the Composites—the daisies and dandelions, dahlias, sunflowers, and chrysanthemums, the cosmos and zinnia which we carefully cultivate in our gardens and the hawkweed which we just as carefully pull up—these and a host of other plants which bear their flowers in heads each containing many florets constitute a single family with a membership of 15,000 species.

There are 7,000 species each in the Madder and the Spurge families, but we in the temperate zone know little of either of these, except that coffee, quinine and a red dye come from the one, poinsettias and rubber from the other.

Of grasses there are 6,000 species scattered throughout the world, and many of these have economic importance, for here we find our cereal grains, our corn, our plants for hay and grazing, besides the all-important bamboo of the Orient. The bamboo tribe alone contains more than 500 species of plants.

H. A. Gleason.

Notes, News, and Comment

Plant Distribution. Members of the Garden were given the opportunity of receiving three plants of varieties of Scotch heather (*Calluna vulgaris*), one plant of American holly (*Ilex opaca*), and one plant of Chinese holly (*Ilex crenata convexa*), considered the hardiest and one of the handsomest of its kind. The plants were distributed April 7 and 8 to about 250 persons.

Conference. Dr. Bassett Maguire presented two talks at the monthly conference of the scientific staff and registered students of the Garden April 14. He spoke first on the flora of the Great Basin, then on the taxonomy of the Caryophyllaceae.

Henry Lockhart, Jr. Henry Lockhart, Jr., of New York City and Longwoods, Md., a member of the Corporation of the Botanical Garden since January 1930, died April 14 of this year. He was made a member of the Board of Managers in November 1930.

Advisory Council. A new member of the Advisory Council, elected at the Executive Committee of the Board of Managers March 31, is Mrs. Rodney Proctor.

Life Member. Dr. Otis W. Caldwell, who has been an annual member of the New York Botanical Garden since 1920, was voted a Life Member by the Executive Committee of the Board of Managers March 31 in recognition of his many services to botanical science and to this Botanical Garden over a long period of years. Dr. Caldwell, who is General Secretary of the American Association for the Advancement of Science, is associated with the Boyce Thompson Institute at Yonkers, N. Y.

National Academy. Dr. W. J. Robbins and Dr. B. O. Dodge attended a meeting of the National Academy of Sciences in Washington, D. C., April 26 to 28.

George B. Hinton. News has been received from Mexico City of the death there on March 26 of George B. Hinton, who was well known as a plant collector. He went to Mexico years ago as a mining engineer, and soon, as an amateur botanist, began collecting plants as a hobby. When he sent sets of his specimens to Kew in England for identification, he learned that there was a market for them so he began collecting plants professionally. As a result, for many years he has been bringing out from neglected regions of Mexico many plants of great botanical interest. The New York Botanical Garden has a set of about 3,000 of his specimens. While he sent most of his collections to England to be identified, for many years the Melastomes that he found were all sent to Dr. H. A. Gleason, members of the Ericaceae to Dr. W. H. Camp, and all plants in the Verbena family to Dr. H. N. Moldenke at the Garden. The Kew Bulletin has published many new species from his collections, a large number of which were named after him. One genus, *Hintonia* also bears his name.

Returned. Dr. R. H. Moscoso, Director of the Botanical Institute of Santo Domingo, who has been doing extensive work in the Botanical Garden's herbarium for a number of months during a visit to this country, returned to the West Indies in March. Before leaving he presented the library with a copy of his monumental work, "Catologus florae domingensis—Parte 1, Spermatophyta," a volume of 732 pages, published early this year in New York City by the University of Santo Domingo.

Visitors. Among recent visitors at the Botanical Garden have been R. Donatello Herrera, who is one of the foreign students working under the Bureau of Agricultural Economics in Washington; also Dr. M. A. Chrysler, New Brunswick, N. J., Gertrude E. Douglas, Instructor at New York State Museum, Albany; Dr. G. Krotkov, Queen's University, Kingston, Ontario, and Dr. Edgar Wherry, University of Pennsylvania.

Groups. The garden section of the Woman's Club of Crestwood, N. Y., made a pilgrimage to the Botanical Garden April 26, visiting the rock garden, the naturalized narcissi, and the Main Conservatories.

The classes in the Department of Landscape Architecture of Columbia University, under the direction of Howard R. Sebold, resumed their visits to the New York Botanical Garden in April. They have been studying early flowering plants in the Thompson Memorial Rock Garden and the early trees and shrubs.

Navy. Vincent Walsh, who had been a student gardener since July 1941, left April 19 to join the United States Navy, and is now stationed at Sampson, N. Y. Mr. Walsh completed his studies for a certificate in the Two-Year Science Course for Professional Gardeners shortly before he left.

Laboratory. Mary Bartley (Mrs. Chris G.) Schmitt, who has just completed a year of work under Dr. Dodge on a fellowship from the American Philosophical Society, began a year of special work in vitamin research April 1 in the laboratory of Dr. Robbins.

Army. John H. Pierce, whose scheduled trip to South America in search of economic plants was prevented by an attack of pneumonia, left New York City April 7 for Camp Upton, N. Y., as a member of the U. S. Army. He is now in Seattle in the Medical Corps.

Addresses. The Biological Journal Club of Fordham University heard a lecture by Dr. A. B. Stout on April 18 on "Incompatibilities in Flowering Plants." The Women's National Book Association, meeting in New York City April 27, was addressed by Elizabeth C. Hall on "Garden Books." The Little Gardens Club in Greenwich Village was shown the New York Botanical Garden's motion picture with Dr. F. J. Seaver as commentator May 3. The Garden City Community Club heard a lecture April 12 by G. L. Wittrock on the "Dye Plants of the North American Indians."

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.

Plants of the Vicinity of New York, by H. A. Gleason. 284 pages, illustrated. A handbook especially compiled for the beginner in plant identification. 1935. $1.65.

Flora of Bermuda, by Nathaniel Lord Britton and others. 585 pages with 494 figures, covering algae, fungi, mosses, ferns, flowering plants. 1918. $3.50

A Text-Book of General Lichenology, by Albert Schneider. 230 pages. 76 plates. 1897. $2.50.

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.

Plants of the Holy Scriptures by Eleanor King, illustrated, and accompanied by a list of Plants of the Bible with quotations, in the March 1941 Journal. 15 cents.

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.

Hardy Ferns and Their Culture. Edited by Carol H. Woodward. 40 pages, illustrated; bound in paper. 1940 25 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.

Vegetables and Fruits for the Home Garden. Four authoritative articles reprinted from the Journal. 21 pages, illustrated. Edited by Carol H. Woodward. 1941. 25 cents.

An Herbal. First published by Richard Banckes in London. 1525. Edited and transcribed into modern English with an introduction by Sanford V. Larkey, M.D., and Thomas Pyles. 200 pages, including facsimile of original. Prepared by Scholars' Facsimiles and Reprints. 1941. Price to members of the Garden, $2.50; to others, $3.50.

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

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-first 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 a year; single copies 15 cents. Free to members of the Garden. Now in its 43rd 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 $1.25 each. Now in its thirty-fourth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers. Subscription price, $5 a volume. Now in its fourth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 90 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

OF

THE NEW YORK BOTANICAL GARDEN

Vol. 44
No. 522

JUNE
1943

In two sections:
Section Two
Pages 125 - 148

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

AID FOR THE NAVY

OCCASIONAL back-yard gardeners from Texas to New England have cultivated dishcloth gourds for years as curiosities, often making their own sponges from the inner fiber. In Cuba, where the summer season is suitably long and warm, the luffa, or sponge (or dishcloth) gourd, has long been raised on a commercial scale for household use. But the bulk of the supply required by the Navy has been coming from Japanese growers in the Far East.

These sponges have an important use in naval vessels, where they are packed tightly together or strung on wires and dumped into tanks to filter oil and other residue from condensing water that is to be used again in the boiler. They have another function on internal combustion engines, such as Diesels, being employed there for filtering carbon and metal dust from the oil.

Suddenly, after December 1941, there were no more luffa sponges coming from Japan, and the same calamity that stopped their importation increased the need for them enormously.

As a consequence, experiments were made with cellulose sponge, but it was too expensive to be practical. Turkish toweling was tried, but it proved ineffective. Coke was attempted—but coke, it was decided, is better used for other purposes. Spanish moss was another suggestion for a substitute, and it is now being tested in laboratories. Sponges from "wild" gourds that had escaped from cultivation in Chile, Mexico, Guatemala, Honduras, and Haiti, were also tested, but, as one experimenter said, "They are like anemic cucumbers." They did not make good filters.

Meanwhile, the need for a luffa supply was becoming acute. So the United States Government took measures to encourage the commercial cultivation of luffas in this country and also in those sections of tropical America where co-operative agricultural programs are being established.

It was a new venture, and one of the first places called upon for information on the culture and preparation of luffas was the New York Botanical Garden.

Last fall the first crops were harvested from the new luffa plantations.

When the Department of Agriculture of the Netherlands East Indies thirteen years ago presented to the Garden's Library a set of books on the useful plants of the islands, nobody dreamed that two or three pages translated out of one volume would help to start an important new industry on its career in America.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | JUNE 1943 | NO. 522

Luffa Sponges, A New Crop For The Americas

By Edmund W. Sinnott and Robert Bloch
Department of Botany, Yale University

THIS war is teaching us a great deal about economic botany. Many plants which were almost unknown before Pearl Harbor are now familiar to all of us, at least by name, and the vital importance of plant products in modern civilization has become obvious to everyone. Synthetic chemistry may do wonders, but the minute laboratories in the cells of growing plants are the factories where most of our organic raw materials are still produced.

To many people it has come as a shock to find that our country has become entirely dependent upon other parts of the world for some of the most important of such products, a particularly serious fact when these regions happen to be under the control of our enemies. Most of the rubber, quinine, and Manila hemp, for example, used in the United States come from plants grown in those parts of the Orient which are now in Japanese hands, and our supply is therefore cut off. Everyone has heard of these important plant products and of the efforts being made to find substitutes for them or to grow them elsewhere, but there are many other plants, less familiar, for which America has also come to depend upon eastern Asia, and the lack of them is already affecting our war effort.

Notable among these are the luffas, the dishcloth or vegetable sponge gourds, the fibrous skeleton of whose cucumber-like fruit gives us a remarkable product. Not widely known or grown in the United States, they have heretofore been imported in large quantities from Japan. Surprisingly enough, these gourds are of great importance to the Navy, for they have come to be widely used in naval vessels and other steamships as filters to remove oil and grease from water as it enters the boilers. During recent years the Japanese have built up a virtual monopoly in the production of these sponge gourds, our supply of which, of course, was cut off when the United States entered the war. The Navy and the Department of Agriculture have been making vigorous efforts to develop a supply elsewhere, but these have not been wholly successful, and a luffa scarcity has thus become one of the many minor bottlenecks in our war effort.

Luffas Are Tropical Cucurbits

Quite aside from their present strategic importance, the luffas are well worthy of attention for their own sake. They belong, with the other gourds and the squashes, melons, cucumbers, and pumpkins, to that large and interesting family, the Cucurbitaceae. The name is Arabic in origin and may be spelled in almost any way one wishes. *Luffa* is the technical spelling of the generic name. The Navy calls it "loofa," others often "loofah," and you sometimes see it spelled "loopha" or "lufa." Actually it is better known as the dishcloth gourd or vegetable sponge. The plant, like so many others in this family, is chiefly an inhabitant of the tropics or warm-temperate countries, and until this last year has rarely been grown in the United States except as a curiosity or for ornament. It belongs near the cucumbers and momordicas, and is only a distant cousin of the common gourds. There are several species, but only two of them—*L. cylindrica* and *L. acutangula*—are of economic value. Of these the former is much the more important.

The luffas are widespread in the tropics and probably native to the Eastern Hemisphere. They are rank-growing vines with lobed leaves and tendrils, like most of the other cucurbits. The flowers are yellow, those of *L. cylindrica* being especially conspicuous and attractive. Stamens and pistils are in separate flowers. The fruit in this species is green, smooth, and elongate, somewhat suggesting a cucumber, and in some varieties reaching a meter in length. The fruits of *L. acutangula* are provided with ten sharp ribs or flanges running lengthwise.

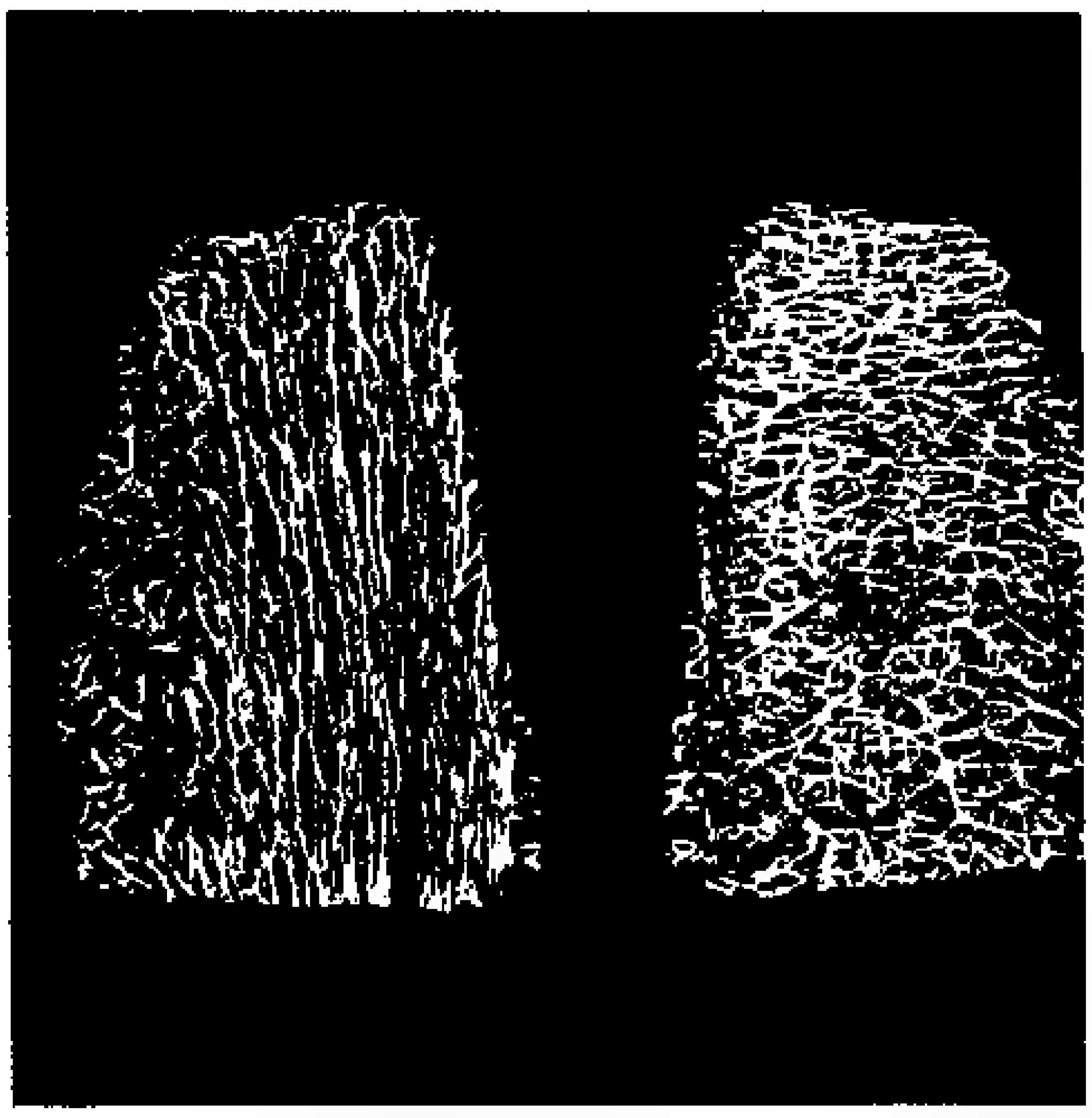
These fruits externally are not very different from those of many other members of the family, but their remarkable feature—and the one which gives them economic importance—is the possession of a net-like fibrous skeleton. All cucurbits have a series of strands running through the wall and pulp, but these are usually soft and inconspicuous. In the young luffa fruit they are like this, but as it matures the strands become hard and woody. When the fruit is ripe the outer wall may readily be removed, and since the soft tissue around the strands has mostly disappeared, only a compact fibrous network remains, the luffa of commerce. In the core of this net each seed is held in a pocket. The tip of the fruit comes off as a small lid or operculum at maturity, and the seeds gradually loosen and may be shaken out through the hole thus left, like dice out of a shaker. The

LUFFA GOURDS GROWN AT YALE UNIVERSITY

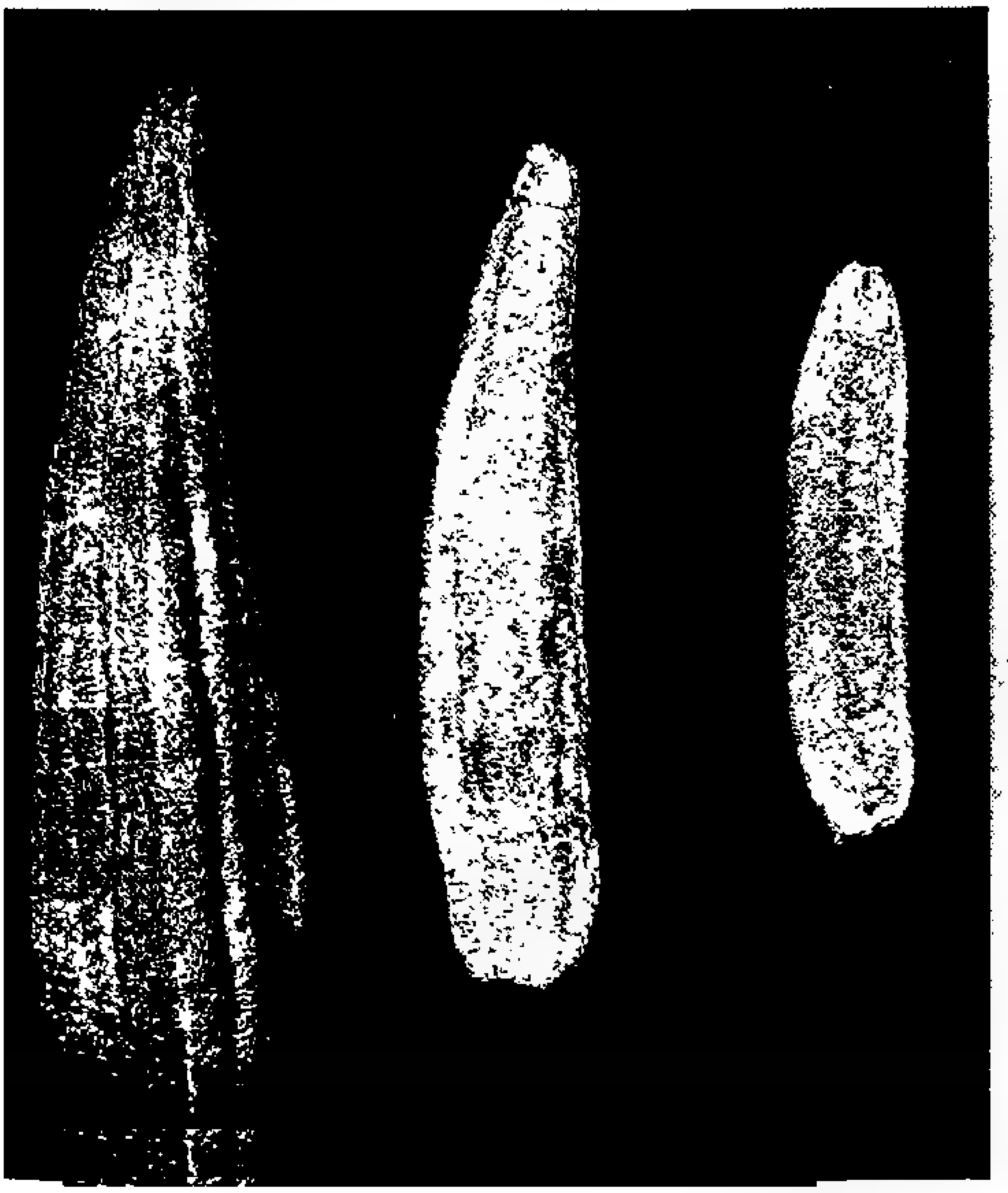
Luffa acutangula

← *Flower and young fruit of Luffa cylindrica*

Part of the fiber net of the luffa, as seen (at the left) from the inside and (right) from the outside. ↓



Fruits of L. cylindrica ↓



advantage of the fibrous skeleton to the plant seems to be that it provides for a gradual liberation of the seeds over a long period of time as the fruit hangs on the vine. This means of dissemination is not as spectacular as that of luffa's relative, the squirting cucumber, which discharges its seeds in one violent burst, but is probably as effective.

Uses of the Luffa Gourd

The luffa sponge network† has a number of advantages over other fibrous materials which give it economic value. Unlike the ones derived from stems and leaves, which occur in long, separate bundles, its strands form a compact network and thus make a continuous structure almost like a woven fabric. This has a large internal surface and therefore will hold a good deal of water though not as much as a true sponge. It is well adapted for washing dishes, glasses, narrow jars, etc.—hence one of its names—and particularly for objects like forks which may be thrust into the net to clean narrow spaces which are otherwise hard to reach. The toughness of their strands makes these "dish-cloths" very resistant to wear. They can be used even for mild scourings and are especially adapted to rubbing down painted surfaces. As bath sponges, luffas have been widely popular in England for a long time and are said to produce a fine glow on the skin, but for our less rigorous bathing habits here they seem a bit harsh.

The compact, closed network of the luffa also gives it a resiliency which makes it useful for many other purposes such as shock absorbers, table mats, slipper soles, and packing material for fragile objects, as well as for stuffing pillows, mattresses, and saddles. Its value as an insulator against heat gives it other uses, particularly in the manufacture of tropical helmets. The Japanese use luffas, in combination with other materials, in making matting, baskets, sandals, and toys. The young fruits, before their fibers have hardened, are often eaten in the Orient* much as squashes are here. The fast-growing vine when cut exudes an abundance of sap, which is believed by the Japanese to have medicinal value in respiratory complaints

† The development of the fibrous net is an interesting example of tissue differentiation. When the ovary is very small, only a millimeter or two in diameter and consisting of nothing but simple parenchyma cells, rows of cell divisions begin to appear in it running in various directions. The narrow cells formed in bundles by these repeated divisions elongate, as the fruit grows, into long fibers which have thickened woody walls and are bound firmly together into the tough strands which form the fibrous net. The individual cells are often more than three millimeters long. Toward the inside of the net most of the strands run lengthwise of the fruit, but outside their course tends to be at right angles to this. Those in the seed-bearing central core differentiate as fibrous pockets around the developing seeds. The width of the two outer zones of fibers, which form the bulk of the sponge and occupy what would be the fruit wall of most cucurbits, varies greatly in different races, as do the compactness of the net, the diameter of the strands, and the length of the fiber cells. Work done here at Yale shows that these traits are all inherited and thus capable of modification by breeding and selection.

* See the article beginning on page 134.

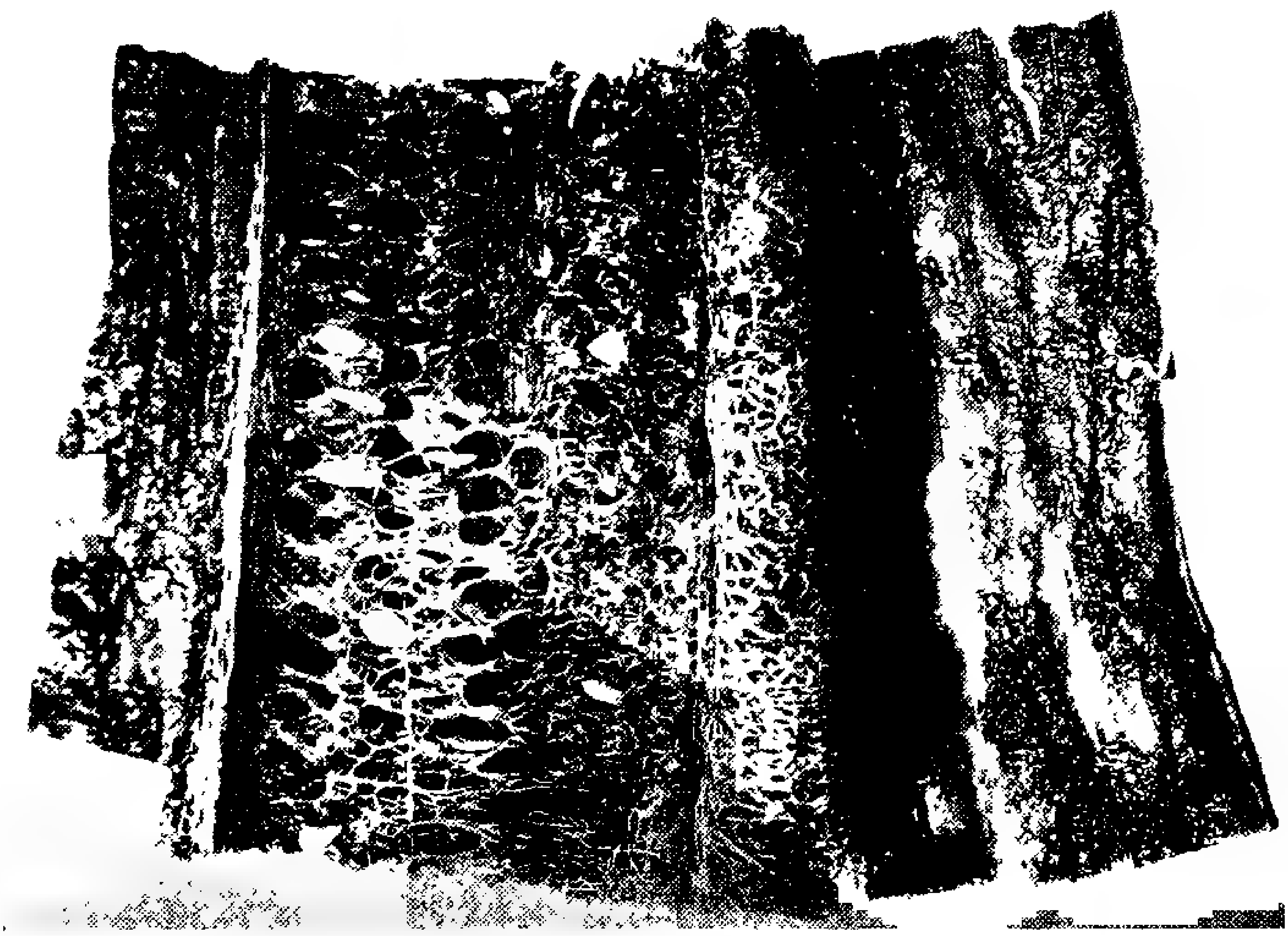
and to make a good toilet water. In Brazil an excellent oil, colorless, odorless, and tasteless, has been extracted from the seeds. It is a possible substitute for olive oil.

The chief economic use of luffa gourds at present, however, is as oil filters in steamships. Water from the boilers, after it expands and drives the engines, is condensed and passed into the boiler to be used again. In its course it picks up a good deal of oil and dirt which must be removed before the water is used a second time, and for this purpose it is passed through a filter consisting of several layers of closely packed luffa sponges. These have the fortunate ability to hold on their surfaces the oil droplets and particles of dirt but to let the water, now cleansed of its impurities, pass readily through. No other material has yet been found which will do this job as well as the luffas, and before the war this country was importing several million of them a year for this purpose. With the present increase in ship-building, the demand is even greater today.

How and Where the Luffa Can be Cultivated

Luffas may be grown in any tropical or warm-temperate region of the world, but since the nineties of the last century the commercial supply has come almost entirely from Japan. The climate and soil conditions are favorable there, labor is cheap, and intensive cultivation is possible. The result has been that Japan gradually gained a complete monopoly of luffa growing. After Pearl Harbor our supply was cut off and an acute shortage resulted. On April 8, 1942, the War Production Board issued an order forbidding the delivery, sale, or use of luffa sponges except upon a high priority. The government is now actively endeavoring to stimulate luffa culture in various places in the Americas.

Sponge gourds are best grown on stakes or trellises so that the fruits do not rest on the ground. These have to be strong, for the larger fruits weigh as much as five pounds and there may be many fruits to a vine. In Japan, the seeds are sown in beds in March or April and the young vines transplanted to the field, where the fruits ripen in September or October. The soil should be moderately rich and well cultivated. No extensive study seems to have been made of fungous diseases or insect pests, though doubtless there are many of these. We grew a large plot at New Haven during the past summer and had little trouble. Neither the cucumber beetle, the squash bug, nor the borer attacked our plants, though this may have been due to a favorable season and frequent spraying. The leaf-spot disease, so harmful to lagenaria gourds, was not found on luffas, nor did we have a case of mosaic. Luffas, like all cucurbits, are very sensitive to frost and in our northern states the growing season is hardly long enough to bring the fruits to maturity. However, by starting the plants indoors we were able to produce mature fruits with good fibers before frost. The southern states and Mexico and Cuba seem particularly favorable regions for luffa



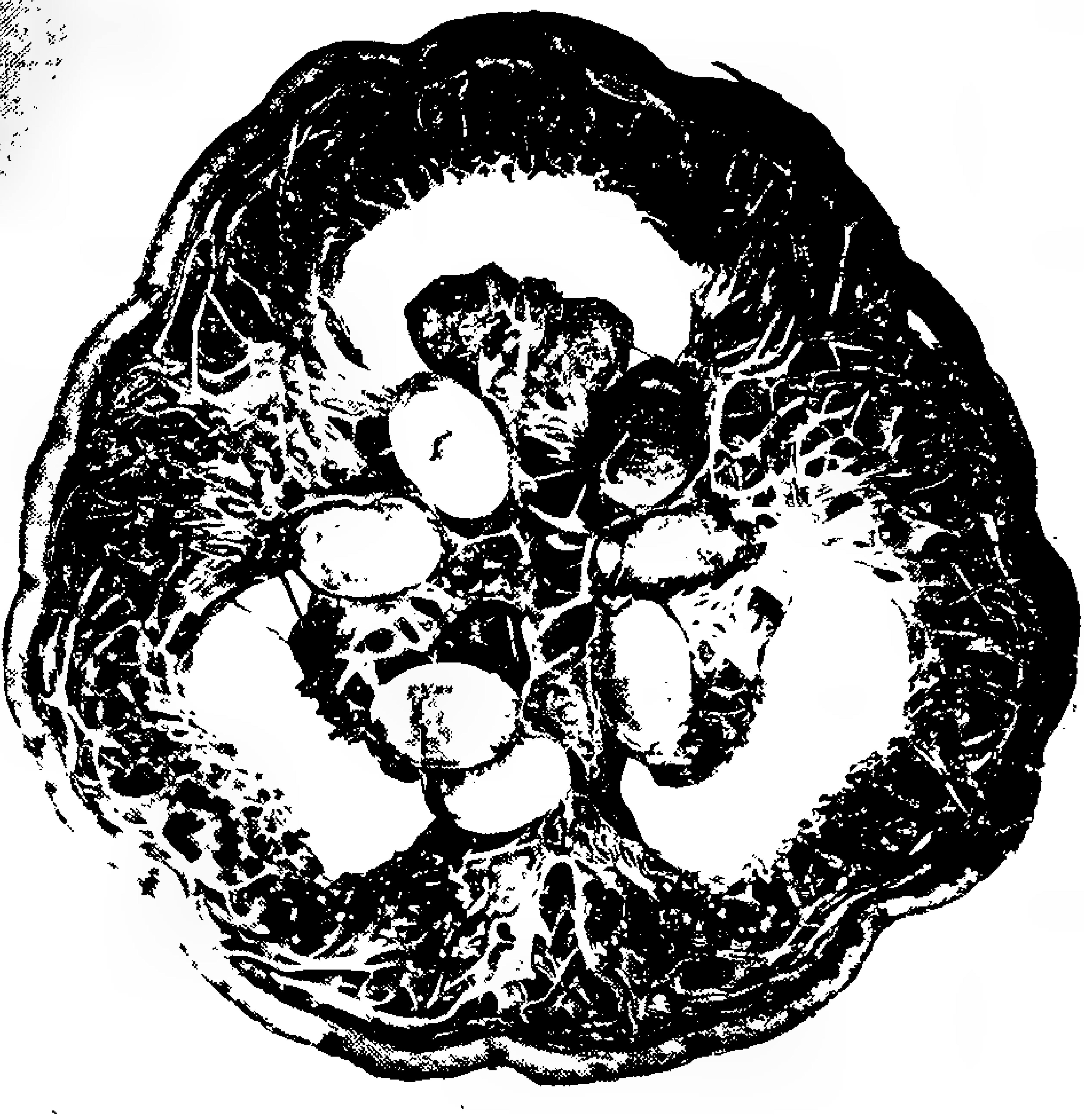
A short longitudinal section cut from a fresh luffa gourd, showing how readily the skin peels away from the flesh and fiber.

culture and during 1942 extensive plantings were tried there, in some cases with good results. In Japan, yields of 24,000 gourds per acre are common, but such high production is possible only under very favorable conditions and with careful cultivation.

Some growers recommend the removal of all the *early* female flowers, as these are said to produce smaller fruits. Our experience did not bear out this conclusion, however. We tried a number of growth substances, especially indole-acetic acid, on the stigmas or tips of young ovaries before pollination and obtained excellent fruits entirely free from seeds. The fibrous net seemed in these to be exactly like that of normal fruits; and such a practice, although involving some labor, might be worth while, since the removal of seeds is a time-consuming process.

The preparation of sponges for market requires a good deal of care. If left to ripen and dry on the vines, the outer pericarp can be shelled off, leaving the sponge. The common practice is to place the ripe fruits in tanks of running water for a few days until the outer wall goes to pieces and can be easily taken off. The small amount of non-fibrous material is removed by further retting, and the carefully cleaned sponges are then either placed on platforms exposed to sun and air, or strung on wires, until they are quite dry and bleached. Since the lighter colored fibers bring better prices, hydrogen peroxide is sometimes used to bleach them further. Before marketing, the seeds must be removed. The sponges are now graded and packed in bales for shipment. The latest naval specifications call for sponges at least eight inches long and two inches wide, free from pulp and containing not more than ten seeds. Many commercial sponges reach 18 or 20 inches in length.

Luffa acutangula is relatively unimportant as a source of sponges, for its outer shell is not sharply distinct from the inner fibrous tissues and is therefore much more difficult to remove from them at maturity. In the



A cross section made from the same fresh gourd, showing the rind, the fiber, and the seeds.

races of this species which we grew, the sponges were much less well developed.

There is very great diversity in the size, shape, and texture of luffas, and the commercial product is far from standardized. Evidently much work needs to be done in breeding them for uniformity and superior traits. The technique for this involves little difficulty. Controlled pollination is very easy, as with most cucurbits, since staminate and pistillate flowers are separate. In the late afternoon it is possible to determine which flower buds will open the next morning, for the tips of these begin to turn yellow. If the tips are tied up at that time with a loop of soft cotton string, the flowers cannot open and bees are thus prevented from entering them. On the following morning pollen can readily be transferred to the stigmas of pistillate flowers. The latter should then be bagged for a day or two or until the stigma dries. We have obtained fertile seed readily in crosses between many varieties of *Luffa cylindrica.* Self-pollination can also be made, but our experiments have not continued long enough to tell whether or not inbreeding will result in reduction in vigor. Seeds were produced by self-pollination in all races grown by us last summer which appear promising.

Luffa sponges seem to offer many possibilities for economic uses as yet untried, and their cultivation in our hemisphere, stimulated by the war emergency, may result in a new and important crop for the warmer parts of the Americas. These plants can also be grown in cooler regions, but probably not on a commercial scale. Luffas are interesting and ornamental in themselves, however, and many people will doubtless want to plant them for these reasons alone.‡

‡ See the article on the opposite page.

A dried luffa in its natural state, revealing the thinness of the peel, and beside it the fibrous "sponge" which fills the inside of the fruit. Both of these came from Mrs. Dolechek's vines, and are now in the Botanical Garden's Museum.

Luffas in a New Jersey Garden

ALTHOUGH the commercial culture of sponge gourds has always been confined to warmer regions, these useful plants can be grown to great size outdoors in the region of New York.

In the garden of Mrs. Josef Dolechek in Rahway, N. J., luffas measuring up to 26 inches in length were produced last year. One of the largest of these fruits was presented to the New York Botanical Garden last fall. Since then the dried fruit and the sponge shown in the illustration have been received and placed in the Garden's museum.

Mrs. Josef Dolechek of Rahway, N. J., who raises luffa gourds like these each year in her garden.

"I have been raising the plant sponge since 1917," Mrs. Dolechek wrote to Dr. Robbins. "It grows for me every year larger and larger."

When Dr. Robbins told her that men from the New York Botanical Garden had gone to Haiti to raise important economic crops, among them luffas, she responded that she hoped "the people from the Haiti Islands can't do any better."

From a single 40-foot row of luffa vines, Mrs. Dolechek harvested 140 ripe sponges on Oct. 20 last year, about half of them as large as the 26-inch specimen that was sent to the Botanical Garden. In telling how she prepares the sponges, Mrs. Dolechek wrote:

"To peel them is easier, though steeping them is good. After they are peeled the seeds have to be shaken out, and then the sponge has to be washed and rubbed out from the soapy substance inside. Then I hang it on a line to dry it out. If a sponge like the one I sent you lies around too long, it rots away or gets a dirty-looking color. When washed it has a nice white color and will keep fresh for years."

Mrs. Dolechek reports that she starts her luffa seeds in a hotbed, using chicken manure, some time in April. The plants are set out after May 15 and spaced about 30 inches apart. Chicken wire is used as a support for the lower part of the plants, and from there the vines climb, she says, "all over the highest trees." Each year she uses seeds from her own gourds for the next spring's sowing.

Luffas As They Are Used By The Chinese

By Willard M. Porterfield, Jr.

(While Government authorities are trying to promote the culture of the luffa gourd in the United States because its skeleton is needed to make filters in naval vessels, Chinese residents of this country are interested in obtaining the young fruits of this gourd as a vegetable. Dr. Porterfield, in the 12th of his series of articles on Chinese Vegetable Foods in New York, tells of the many uses that have been found for the luffas by the Orientals.)

AMONG the unusual fruits that can be found in the shops of New York are some of the melons and other cucurbits sold in Chinatown. Two of particular interest now are the luffas, for which the Chinese and other oriental peoples have a great many uses, including their preparation as a table vegetable.

The one most often found in the grocery stores is *Luffa acutangula*,[1] the Chinese name of which is SING-KWA. In appearance it roughly resembles the cucumber, except that it is longer, slightly curved, tapered at one end, and that it has ten prominent ridges running its entire length. The leaves of the plant are rounded in outline and only slightly lobed.

The other gourd of this genus, *Luffa cylindrica*, called SZE-KWA, is more frequently found in drugstores in its skeletal form. It has the same curved cylindrical form as the SING-KWA, but it is smooth, having ten dark longi-

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[1] By some authorities this gourd was originally put in the genus *Cucumis*, with the cucumbers. See Bretschneider, E. History of European botanical discoveries in China, **1**:143-4. London, 1898.

tudinal lines instead of ribs. While it normally reaches one to two feet in length, it is said that some varieties in warmer countries may reach a length of nine feet. This plant has distinctly five-lobed leaves.[2] The young fruits of both species when not more than four inches in length, are peeled, boiled and served with butter, pepper and salt, or used as an ingredient in curries, making an excellent vegetable,[3] though one for which a taste must be cultivated. The expressed juice of the leaves can be used as green dye for cloth.

According to Chinese lore [4] the seeds are planted in the second moon and the flowers bloom in the sixth or seventh moon. In the meantime the vine is trained over bushes, bamboos or houses, or a framework is made of reeds or bamboo poles over which it may run.

In Japan the young fruits of the SZE-KWA are sliced and dried for future use as a vegetable. When mature the pulp disappears and the vascular strands which traverse the flesh harden to form a dense network like the mesh of a sponge. In fact it is sold more often in the shops as a sponge for washing and drying than for food, hence the name "dish-cloth gourd" by which it is frequently called.

The analysis of the fruits of the two species is given below.[5]

Fruits	Water	Protein	Albuminoids	Amids (By difference)	Fat	Starch	Cane sugar	Reducing sugar	Crude fiber	Ash	Undetermined
Luffa acutangula											
Original material	94.90	.68	.54	.14	.24	.36	.10	1.57	.72	.43	1.00
Water free		13.39	10.68	2.71	4.70	7.03	1.95	30.86	14.03	8.43	19.61
Luffa cylindrica											
Original material	94.66	.51	.38	.13	.19	1.04	.12	2.15	.46	.41	.45
Water free		9.57	7.07	2.50	3.72	19.52	2.18	40.29	8.58	7.65	8.49

Further analysis shows that the fruit of *Luffa acutangula* contains an amorphous bitter principle called luffein which acts as a purgative. Luffa seed kernels from which oil is obtained have the following composition.[6]

[2] Bailey, L. H. Some recent Chinese vegetables. Cornell Univ. Agr. Exp. Sta. Bul. 67:195. 1894.

[3] Fawcett, William, and Rendle, Alfred B. Flora of Jamaica, **5**:453. 1926.

[4] Stuart, G. A. Chinese materia medica, 248. 1928.

[5] Blasdale, W. C. A description of some Chinese vegetable food materials. U.S.D.A., O.E.S. Bul. 68:30-31. 1899.

[6] Wehmer, C. Die Pflanzenstoffe, **2** (Ed. 2): 1195-6. 1931.

"Sing-kwa" —the angled luffa gourd which when young is used as a vegetable in China. The mature specimen above measures about 20 inches in length.

Seeds of	Seed: Testa %	Seed: Kernel %	Kernel Water	N in water-free substance	Fat	Crude fiber	Pentosan	Reducing sugar	Glucosides	Ash
L. acutangula Roxb.	46	54	6.48	6.38	48.41	4.84	2.24	3.61	0	4.77
L. cylindrica Roem.	49	51	6.13	6.55	45.72	2.89	2.31	3.11	0	4.75

In the kernel ash of the first plant there is present 24.94 percent of $P_2 O_5$ and in the second, 38.54 percent. The seed oil itself, similarly in both species, contains 67.5 - 70.0 percent of palmitic acid and 30 - 32.5 percent stearic acid, also some myristic acid as glycerides. The fruit of the second contains saponin and abundant mucous. The pressed cakes of SING-KWA (*L. acutangula*) are bitter and have a toxic reaction.

Wilson [7] stated that the fiber is also esteemed as a medicine. The ripe fruit of *Luffa cylindrica* burned and pulverized has a number of medicinal properties.[8]

The fruits of *Luffa cylindrica* have shown by feeding tests that in vitamin B they are low;[9] also by the dye method [10] they proved to contain only 122 international units of vitamin C. The latter was corroborated in 1938 by the work of Chu and Read,[11] who gave the fruit a dye titration value of 0.0626.

According to Forbes and Hemsley [12] the native country of the luffas is uncertain since they are both found throughout the tropical regions of Asia and Africa as cultivated plants. Bretschneider,[13] though he includes

[7] Wilson, E. H. A naturalist in western China, **2**: 57. 1913.

[8] The medicinal properties are, according to G. A. Stuart in his "Chinese Materia Medica," pages 248-9: "carminative, pectoral, cooling to the blood, antiseptic, anthelmintic, emmenagogue, quickening to the circulation, galactagogue, and is also used in the treatment of hemorrhage from bowels or bladder, hemorrhoids, menorrhagia, jaundice, hernia, and scarlet fever. Mixed with vermilion, it is used to dry up smallpox pustules. Fresh fruit is considered to be cooling and beneficial to the intestines, warming to the stomach, and tonic to the genital organs." Leaves are used in skin diseases and orchitis, the vine and root in decayed teeth, ozoena and parasitic affections.

[9] Sherman, H. E. Relative content of water-soluble vitamin B in thirty oriental foods. Philippine Jour. Sci. **38** (1):9-36. 1929.

[10] Concepcion, Isabela, and Gargaritano, Maria Luisa. Studies on vitamin C. II. The determination of vitamin C (ascorbic acid) in Philippine vegetables by the dye method. Jour. Philippine Med. Assoc. **18** (8):481-490. 1938.

[11] Chu, T. J., and Read, B. E. The vitamin C content of Chinese foods. Part II. Chinese Jour. Physiol. **13** (3):247-256. 1938.

[12] Forbes, J., and Hemsley, W. Index Florae Sinensis. Jour. Linn. Soc. **23**:314-5. 1886.

[13] Bretschneider, E. in loc. cit. **1**:143-4.

L. acutangula as one of the "Chinese" plants listed as being cultivated in the Royal Botanic Gardens at Kew in 1789, and though he quotes Linnaeus as saying that it is a native of Tataria and China, nevertheless never saw it in a wild state. The same may be said of *L. cylindrica,*[14] in spite of the fact that it is included in Bretschneider's list of northern Chinese plants first introduced by him into cultivation in Europe and North America. Another author states that *Luffa cylindrica* in indigenous to Arabia and Egypt.[15] However, it is stated in Chinese literature that *Luffa cylindrica* was unknown before the T'ang dynasty (600 A.D.). While this might imply that the plant was first introduced at that time, it might also mean that its use was only discovered then and that thenceforth, as its fame spread, the farmers learned how to bring it in from the wild and cultivate it.

The luffas are grown not only in China but in the Dutch East Indies[16] where in Malay *L. cylindrica* is called BLOOSTROO and *L. acutangula,* OYONG or PETOLA. Here not only the fruits of the former but the tops of the stems, the young leaves, the flower buds and the flowers are used in various dishes. One use of the sponge-like skeleton is interesting. When the aren, coco or the Palmyra palm is being tapped, one of these is often put into the mouth of the bamboo-joints, to serve as a sieve to protect the juice from pollution by bees or other insects feeding on it. The young leaves as well as the young fruits of the latter are eaten raw or steamed, the fruits often being sliced and cooked with coconut milk and other ingredients. Although these fruits may suit the Asiatic palate, they are not, according to Dr. L. H. Bailey and others, likely to become popular as food in the United States or in European countries.

Drying Plants in Three Dimensions

An Educational Hobby for Camp, Club, or Individual
As Devised by Frances R. Williams

WHETHER used for study, exhibition, or for decorative purposes, flowers and branches that are dried in three dimensions have an appeal that is lacking in the flat-pressed, drab-colored specimens that are attached to herbarium sheets. A flower thus treated can be presented in its natural form, and often with much of its natural coloring.

As a summer project for club or camp, the preparation of three-dimensional plant specimens becomes an absorbing pastime with educational possibilities, for the finished products can be used as a basis for the study of wild flowers, ferns, weeds, mushrooms, harmful or poisonous plants, such as ragweed and poison ivy, garden flowers, herbs, or any other selected

[14] Bretschneider, E. in loc. cit. **2**:1055.
[15] Wood, H. C. and La Wall, Chas. H. The Dispensatory of the U. S., 1455. 1937.
[16] Ochse, J. J. and Bakhuizen, R. C. Vegetables of the Dutch East Indies, 203-205. 1931.

category; they may be arranged for an exhibit, or they may be kept for future reference or study. Some have decorative value; in fact, the drying of small, colorful flowers to ornament the tops of boxes has been successfully tried as a form of occupational therapy. The boxes may be filled with lavender or with a pot-pourri of petals.

Experimentation in all these forms and uses of dried plants has been carried on for a number of years by Mrs. Frances R. Williams of Winchester, Mass., a member of the New York Botanical Garden.

Becoming interested in the life-like preservation of New England wild flowers and some of her garden flowers, Mrs. Williams began experimenting about four years ago with drying flowers in various powders to retain their natural shape. Some of her specimens have been sent to the New York Botanical Garden's herbarium. A large collection of others, attractively mounted in transparent boxes, was on display in the Library and Members' Room around the end of the year.

Although the exhibit attracted considerable attention, and the specimens generally met with acclaim, some observers, Mrs. Williams herself admits, have felt that they are ghostly things. Perhaps a few of them are, when compared with freshly picked flowers, but on the whole they are remarkably life-like, and when compared with herbarium specimens such as the plant collector makes, they are things of beauty.

Mrs. Williams looks upon the work as a fascinating game, yet more than a game, she says, for every flower that is dried is an experiment in the perpetuation of the form and color of a specimen of plant life. She is eager to have reports from others who may be attempting her methods or others of their own. "The aim," she says, "is to preserve the flower or leaf so that it will keep its original shape and color. This is done by covering it with some kind of powder, and leaving it there until it is thoroughly dry."

Here is the method Mrs. Williams uses:

TO dry a flower in three dimensions, a box is selected a little longer than the flower and an inch or more higher.

About half an inch of the drying powder is placed over the bottom of the box, then a mound of powder is built up for the flower to lie on. The flower must not be flattened by resting against the bottom of the box, but must be up in the air to keep its natural shape.

With fingers or a spoon, the powder is poured very carefully all around *under* the flower. When halfway up, a little powder is sprinkled into the blossom itself. Since very little powder will spread the flower open more than is natural, it should be well banked beneath with powder before it is finally covered. It is well to turn the box around and fill from every side. When the flower is completely covered, a half inch more of the powder is added over the top. Thus the flower cannot move or change its shape or position; it will dry the way it is arranged.

A large amount of powder is required. Three pieces of snapdragon, 15 inches long, will need 20 pounds of borax to cover them. The powder can be used again and again, but that used on mushrooms acquires a strong odor. Powder used on belladonna and poison ivy might well be kept separate.

Several plants can sometimes be dried in one box, with one-half inch of powder between them, one plant laid above the other.

It takes time and patience to put the powder on the flower and to remove it from the specimen. It is easy to get lazy and throw the powder on hastily, without taking pains to keep the shape of the flower. Then the petals will be flattened out and the flower will not retain its natural shape.

The box with the flower in it, completely covered with powder all the time, should be left in a room at ordinary temperature for three weeks.*

Until more is learned about the method, an index card with name, date, place, kind of drying material, and description of the color should be put with the specimen. The original colors might be matched to some color chart and noted. A piece of the plant should always be dried separately with no powder added, as a check. It might tell something helpful.

Various powders have been tried for drying. The list includes alum, three parts alum and one part plaster-of-paris, borax, boric acid, bread flour, chalk, cornstarch, dusting sulphur, elastic starch, French chalk, fuller's earth, naphtha flakes, orris-root powder, plaster-of-paris alone, potato flour, rice flour, salicylic acid, sand, opacified santocel, baking soda, monohydrated granular sodium carbonate, anhydrous sodium sulphite, powdered sugar, talcum powder, and whiting.

Borax is good for an alkaline powder, talcum for a neutral powder, and boric acid for an acid powder. If talcum powder sticks, it can be removed with a fine brush. Flowers seem to gain strength of texture from some of the drying materials, and on damp days in summer the petals and stamens can be poked about.

The box with the specimen in it should not be jarred or shaken after being filled. Motion tends to flatten the leaves and flowers. An auto ride also jiggles down the powder and the plant. When plants are collected far away, it is better to bring them home in water and then dry them, though of course the fresher the specimen the better the result.

Care in removing the powder is as important as care in preparation. From a box that lets down at the sides the powder can fall away gently. Perhaps a box or tray formed of chicken wire, set into a solid box, would let the borax fall out as the wire tray is lifted. But wire of ½-inch square mesh is not coarse enough for this.

Fingers are best to remove powder from specimens at first. A bent index card is good to use along the edges of the box. After a specimen is partly uncovered, it can generally be pulled out of the powder without damage. But it is a little rough on a group of specimens in 40 pounds of borax to pour the specimens and borax out together.

The powders generally shake off easily; if not at the first moment out of powder, they will be loosened by the next day. Tapping the stem with a pencil shakes off much of the powder.

Finished specimens may be kept in covered cardboard boxes or in transparent boxes, but these latter are easily scratched by borax. It is better not to brush loose borax off their surfaces, but to wipe it off with a wet tissue.

The dried specimens are sturdy enough to endure traveling. Snapdragon and gladioli were sent loose in a box, 1,200 miles by parcel post, not marked fragile, and were not at all broken in transit. Where practical, they should be sewed to the back of the box, and it is best to use no covering, as even the weight of tissue on dried flowers is too heavy.

Some of the problems to be met in three-dimensional drying of flowers are mentioned here.

CHEMICAL changes evidently enter into the drying. This is shown by the varied ways that identical daylily flowers are influenced by the different powders. *Hemerocallis fulva* flowers, for example, were changed from their terra cotta color to bright orange, faint pink, dirty whitish and other shades.

Clear pink and clear yellow flowers hold their colors well. Blues vary. The reds generally turn sand color or very dull. Twelve gorgeous red begonias when tested with litmus paper were as acid as vinegar. They were dried in different materials and all turned shades of sand color, though some had tones of faint pink. Gardenia and flowering dogwood have turned oyster color after three years, but not brown.

* Mushrooms and skunk-cabbage need six weeks or more. Flowers dried quickly over heat seem to get too brittle.

Mountain-laurel dried in its natural form has retained its color well.

Some flowers begin to look dull and tired after a year, and some have dulled in color only after three years. Some fade at exposure to direct sunlight and some do not. For herbarium specimens, fair success has been had with actinidia, butter-bur and mountain laurel, either drying in three dimensions and pressing afterward or pressing between corrugated cardboards with powder above and below the flowers, leaving the flower in powder till dry.

After three years, things dried in borax are becoming very fragile and crumble readily. Talcum powder and plaster-of-paris are making specimens that are remaining more pliable.

A flower of marica dried in plaster-of-paris has held well for over three years, and other specimens of marica are still good after nearly two years. That in talcum is especially true in shape and color.

Plants of the Lily and Composite families often fall to pieces, but the individual parts of the flowers are of excellent shape. Painting with liquid court-plaster seems to help keep shape and color in such delicate things as sweet-peas.

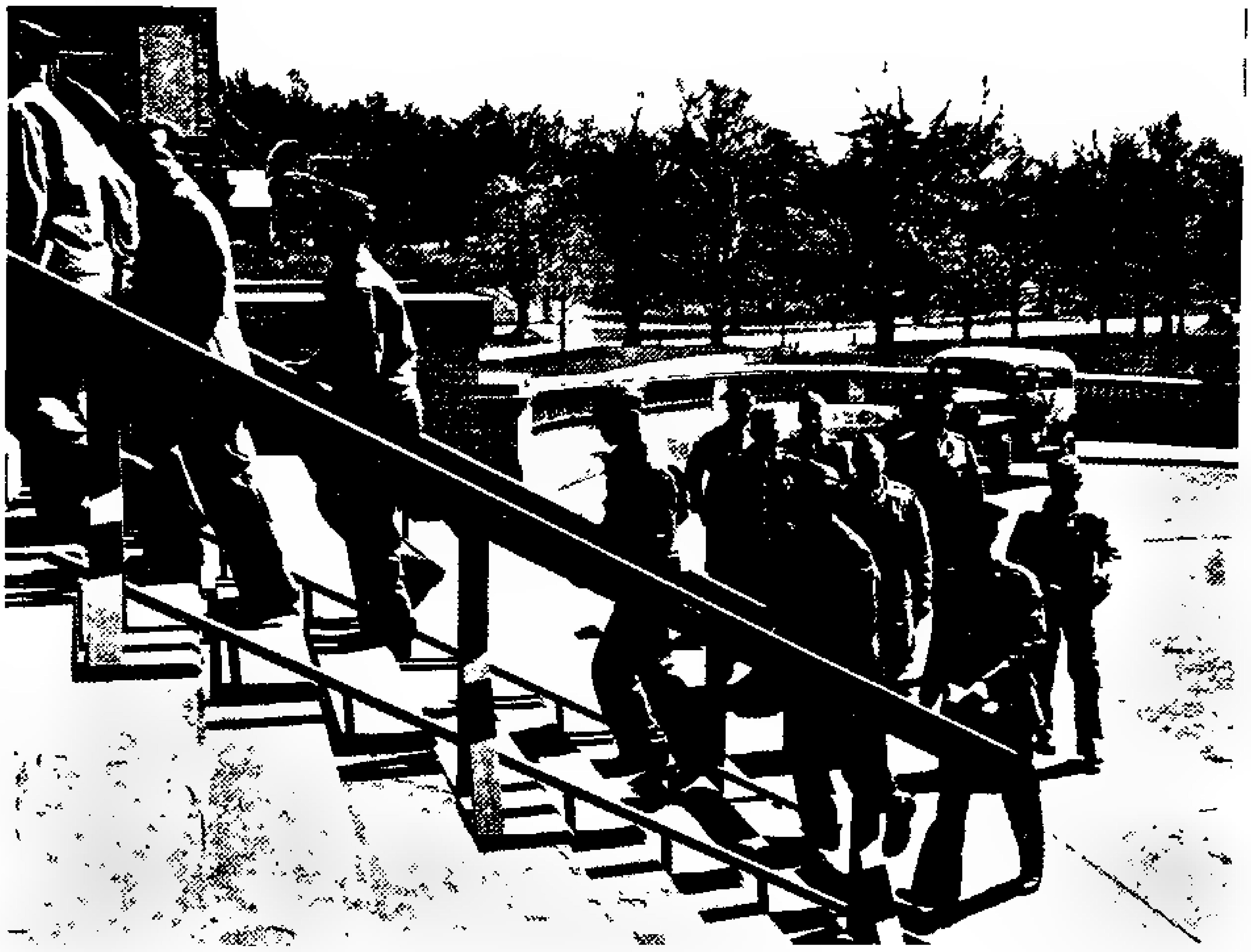
Always surprises are in store for the experimenter. A lovely snapdragon of vivid pink or yellow will look almost the same when taken out of its powder as it did three weeks before when the living plant was put away to dry. But Crimson Bedder nicotiana will turn from its dark rich red to a dull dark gray. A Heavenly Blue morning glory will change to a bright pink.

Many questions present themselves, as experiments go on. Will some acid powders dry red flowers to retain the red color? Will alkaline powders keep blue colors better? Will anything keep lily leaves green? Is there anything that will prevent some plants from turning black? Should a plant that grows in an acid soil be dried in an acid powder? Will painting with liquid court-plaster keep the colors over a longer period?

Can dry rot be prevented by covering plants with borax when they are shipped long distances from one botanist to another?

So the game goes on. One idea leads to another and there is always some new experiment waiting to be tried in drying flowers in three dimensions.

The Garden Teaches the Army How to Grow Vegetables



Above: Members of the New York Region, Anti-Aircraft Artillery Command, arriving on April 9 for their first lesson in vegetable gardening. Below (left): Practicing making a drill by drawing a hoe along a garden line, and (right) learning how to prepare the ground for some of the crops that require special treatment. One hundred and twenty officers and men, all volunteers, took the six weekly lessons offered by the Garden.

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.)

Seventy-seven Violets

WILD VIOLETS OF NORTH AMERICA. Viola Brainerd Baird. 225 pages, illustrated, indexed, bibliography. University of California Press, Los Angeles, 1942. $10.

This volume is the culmination of many years of devoted study of the wild violets of North America by father and daughter. Begun by the eminent scholar and natural historian, Ezra Brainerd, more than 40 years ago, it is now brought to completion by his daughter, Viola Brainerd Baird, who for so long was intimately associated with him.

In her own right Mrs. Baird has demonstrated herself competent for this difficult task, continuing field observations begun in the East under the tutelage of Professor Brainerd and extending her experience to become familiar with many of the western violets.

Brought adequately up to date, the work accounts .for most of the recently proposed names. Characterization of the 77 admitted violets is in non-technical language which, in conjunction with the illustrations, is sufficient for general identification. The "key," a compromise device, is not altogether satisfactory in its attempt at simplification for the lay reader. The student is led into violet-groups from which he must make selection, for final identification, by reference to a number of illustrations and descriptions.

The full-color illustrations of all the species treated except one have been done by F. Schuyler Mathews. Many were taken directly from the 25 color plates and numerous line drawings used in Brainerd's "Violets of North America." Others have been retouched or redrawn, while the remainder are apparently recently done. The drawing is accurate; the color, however, has frequently not been truly reproduced. The leaves generally suffer from too dilute a green and an over-use of yellow. The flower colors, for the most good, are occasionally flat and in rare instances misleading, as with Beckwith's violet in which the lower petals are characteristically more nearly white, rather than "lilac," and the flowers more sharply bicolored.

A bibliography giving citations, and sources of material from which the plates were made, will be of much help to the more serious student of violets.

Altogether, good paper, clear print and typography, readable and accurate descriptions, excellent drawing and mostly satisfying color have combined to yield a beautiful and helpful book which will delight the reader and which must be satisfying to the writer.

BASSETT MAGUIRE.

Standard Forestry Manual

SEEDING AND PLANTING IN THE PRACTICE OF FORESTRY. James W. Toumey & Clarence F. Korstian. Third edition. 520 pages, illustrated, indexed. John Wiley & Sons, Inc., New York. 1942. $5.

A new edition of this book is always somewhat of an event because as a manual it has long been recognized as rightly belonging in the group known as "classics."

Ever since the late Prof. James W. Toumey, former Professor of Silviculture and some time Dean of the Yale School of Forestry, brought out the first edition of this book in 1916, it has been regarded by most American foresters as the standard authority on almost all questions relating to both natural and artificial methods of reproducing forests. In the treatment of each branch of the subject, as well as in its breadth of field, Toumey's "Seeding and Planting" has always had encyclopedic character. And this policy has been ably continued, since Professor Toumey's death in 1932, by the junior author, Dr. Clarence F. Korstian, Professor of Silviculture and Dean of the School of Forestry of Duke University.

To those not already familiar with this book through its earlier editions, a glance over the present table of contents tends to surprise one by the broad scope of its chapters. After a brief introductory statement, Part 1 deals with the silvical and silvicultural basis, including full discussions of the principles which determine choice of species, composition of stands, and spacing. Part 2 is an exhaustive treatment of the whole subject of the formation of forests by seeding and planting, including a comprehensive consideration of forest tree seed and its use in direct seeding; of the establishment and handling of forest nurseries; of the planting and culture of forest nursery stock; and of nursery diseases and injuries. Each chapter is replete with a bibliography. These never contain less than six titles, and for two chapters exceed sixty.

In the second edition, of 1931, the notable changes from the first were in the addition of new information obtained, as the junior author says in his preface to the third edition, "through research and experience in the rapidly advancing art and science of forest nursery and planting practice."

After another decade the need was felt again to bring this book up to date, especially because of the new discoveries and developments incident, as Korstian says, to the "greatly enlarged activities of Federal and State governments and other agencies in forest and shelterbelt planting;" to the construction and operation of seed extraction and storage plants; and to "the mechanization of nearly all major operations" both in these plants and in stock production in large forest nurseries.

Other new developments covered by the third edition are the seed certification policy of the U. S. Department of Agriculture; specific gravity tests in judging seed maturity; and contributions from the Forest Products Laboratory in seed extraction work.

In each of these directions a distinct addition to the book has been the replacement of earlier pictures—many showing European practices—by a series of excellent photographs supplied by the United States Forest Service.

RALPH S. HOSMER,
Cornell University.

Below the British Standard

AN INTRODUCTION TO THE STUDY OF ALGAE. V. J. Chapman. 387 pages, illustrated, indexed. Cambridge: At The University Press. New York: The Macmillan Co., 1942. $3.75.

For many years the British have been leaders in the field of phycology; the scholarly, in fact masterly, works which have come from the hands of such able investigators as the Wests, Fritsch, Lebour and many others are standard references for all who work in the field. To those who have followed this school with admiration, it is unpleasant to discover that the most recent "Study of Algae" to come from England is of the caliber that it is.

Planned to serve as a text for courses in morphology, taxonomy and ecology of algae, the book has little to recommend it. It is clear that the author is not aware of much of the recent work on the taxonomy of this group of plants, or that he does not accept the work in entirety. While most of us would sanction heartily the author's desire to get away from the time-weary examples used to represent "typical" morphological forms for each of the many groups of algae, on the basis that such members are frequently the exception rather than the rule, it is not always possible to see the logic behind the choice of the substitutions.

For a book which is designed to treat all branches of the subject there are some glaring oversights which leave one wondering "why." To mention only one of these, the diatoms, a large group which is economically, cytologically, and morphologically important, are dealt with summarily in a total of about three pages of text; other groups represented by few and rare species are treated at length. The chapters on ecology are perhaps the worst in the book. Marine ecology is discussed without one word of mention for the phytoplankton. In view of the fact that so much is known on this subject, that it is the starting point for the economy of the sea, and that so much of the basic work was carried out by British biologists and oceanographers, this seems inexcusable. It appears evident the author should have familiarized himself more with his subject before writing a textbook.

LOIS LILLICK,
New York Medical College.

American Trees, Chiefly Tropical

TIMBERS OF THE NEW WORLD. Samuel J. Record and Robert W. Hess. 640 pages, index, references, illustrations. Yale University Press, 1943. $10.

This volume attempts to bring together information on the timbers of all the Americas.

Gymnosperms and Angiosperms are considered separately. Under each classification the families and genera are arranged alphabetically. A statement of size, geographic distribution and economic value introduces each family. This is generally followed by a brief summation of characteristics of woods included in the family. A somewhat similar plan is followed in treating genera, with the emphasis placed on description of trees and woods of those species which are or give promise to become economically important. These descriptions are concluded with a list of trade and vernacular names. The book contains 36 photographs of trees, 22 plates of wood photo-micrographs and 8 maps.

Although the book includes North American species, its chief value is in the information on tropical trees. The authors have succeeded in assembling a wealth of information of interest to those concerned with the utilization of tropical American forests. It is not the authors' fault that, to borrow from the preface: "the field covered is so vast and the material and literature often so fragmentary that the work is necessarily of the nature of a general reconnaissance . . ." It must be confessed, however, that a wood technologist expecting to find detailed treatment of timbers will leave this tome feeling somewhat frustrated.

A. J. Panshin,
Dept. of Forestry,
Michigan State College.

Tested by Student Use

A TEXTBOOK OF GENERAL BOTANY. Gilbert M. Smith, Edward M. Gilbert, Richard I. Evans, Benjamin M. Duggar, George S. Bryan & Charles E. Allen. 668 pages, illustrated (459 figs.), indexed. Macmillan, New York. 1942. $4.

This is the fourth edition of a text prepared by members of the Department of Botany of the University of Wisconsin for their introductory course. The general plan of the book has not been altered but there are a number of changes in arrangement and new material has been added. The chapter on Myxomycetes, omitted from the third edition, has been restored and chapters on plant diseases and fossil plants have been added. Minor changes have also been made to bring the work up to date.

Opinions naturally differ as to what should be taught in the first general course in botany. The reviewer feels that more space might have been given to familiar families of higher plants and less attention paid to a general survey of lower plants, for they will speedily be forgotten by most students. More material has been provided than can be covered in a first course in many institutions but this is an advantage rather than a drawback, as selection can be made.

Any student who has mastered the material presented will have a good foundation in botany. Having had the advantage of several revisions, after use with succeeding generations of college students, the book can be recommended with confidence.

R. R. Stewart.

How to Deceive the Enemy

INDUSTRIAL CAMOUFLAGE MANUAL. Konrad F. Wittman. 128 pages, illustrated. Reinhold, New York, 1942. $4.

This book is compiled mainly for students of industrial camouflage who expect to put its techniques into practice. The layman, however, will find it full of fascinating discoveries, and the horticulturist will be interested in the shrubs and trees, also representations of living plants, that play such an important part in disguising critical areas.

Discussed in this manual are the countless devices used to fool the enemy, vastly complicated by modern methods of detection—aerial observation and photography with new sensitive films. What happens to colors and shapes when seen at the great heights at which bombers fly today is also dealt with. The problems of the bombardier are described—the fact that he has 35 seconds in which to decide where to place his bombs and that this decision must be made nearly five miles before reaching his target.

The many models and sketches in the book explain only the theories of camouflage, as actual installations in this country are of course military secrets. There are included, however, a set of photographs of one of Germany's most interesting attempts at camouflage, showing also how it was discovered by British airmen.

Pratt Institute has been a leader in the field of training civilians to become "camoufleurs," and has accumulated a valuable collection of models, photographs and other data. Mr. Konrad Wittman and other members of the faculty of Pratt have done an admirable job in assembling this material in so illuminating a manner.

NANCY LEVERING.

More on Vegetables

THE VEGETABLE GARDEN. Edward I. Farrington. 176 pages, illustrations, appendix, tables, and index. Hale, Cushman & Flint, Boston, 1942. $1.25.

An excellent book for the amateur and beginner. The advice given is sound and is presented in a manner which the layman easily understands. It also possesses the excellent characteristic of brevity.

The last chapter of the book is devoted to a calendar of operations in the garden, month by month, and an appendix gives much useful information in tabular form.

EDWIN BECKETT.

For the Very Young

PICTURED GEOGRAPHIES — I. Argentina, Brazil, Canada, Chile, Panama, and West Indies. Stories by Marguerite Henry, pictures in color and in black-and-white by Kurt Wiese. 50 cents each.

PICTURED GEOGRAPHIES — II. Bolivia, Ecuador, Greenland, Guatemala, Honduras, Iceland, Peru, and Venezuela. Stories by Bernadine Bailey, pictures in color and black-and-white by Kurt Wiese. 50 cents each.

A picture adorns every one of the 27 pages in each of these books on geography for very young people. In texts of about 3,000 words, a remarkably adequate picture is given of the scenery, crops, industries, and inhabitants of each of the countries.

Notes, News, and Comment

Alexander P. Anderson. Discoverer of the principle by which puffed rice and wheat could be produced as breakfast cereals, Alexander P. Anderson of Red Wing, Minn., died in Florida at the age of 80 May 17. He was a Patron of the New York Botanical Garden and the donor of the Alexander P. Anderson and Lydia Anderson Research and Fellowship Fund of $10,000. A biography of Dr. Anderson, who did his early research at the Garden, will appear in a forthcoming number of the Journal.

Yucca From Mexico. The cover illustration this month shows an undetermined species of *Yucca* which was photographed on the road to Jalapa during a reconnaissance survey trip last summer in the region of Vera Cruz for the United States Board of Economic Warfare. The photographer of the occasion was Douglas A. Crawford, Vice-Consul in the Office of the Agricultural Attaché of the American Embassy in Mexico City.

"This yucca was approximately eight meters in height," writes Dr. William J. Bonisteel, who sent the photograph to the Journal. "There were presumably thousands of these blooming along the road in the area where this photograph was taken. If you look closely, you can see the bees flying around the plant. There were literally hundreds of them on this flower spike."

In Mexico. Dr. William J. Bonisteel, who is Head Production Specialist for the Board of Economic Warfare, addressed the Mexico City Garden Club April 1 on "Drug Plants in the World War." Dr. Bonisteel is on leave of absence from Fordham University, where he is Professor of Botany. He is also a special investigator at the New York Botanical Garden and a member of the Garden's Corporation. In commenting on the club in a letter to Dr. Robbins, he said, "This Garden Club, in my opinion, is one of the most successful garden clubs in the world because of the interest the members take in gardening and the extreme number of good works they are carrying on."

At the May meeting of the same organization, Robert Simpson, a former student gardener who is now a production specialist with the Board of Economic Warfare, spoke on "Landscape Gardening."

Garden Club of America. Invited by the Advisory Council, the Garden Club of America spent the morning and early afternoon of May 7 at the New York Botanical Garden during the organization's thirtieth annual meeting in New York. Luncheon, arranged by Mrs. Lazella Schwarten, was served to about 200 in the Museum Building. Guided by members of the staff, the visitors were shown the Main Conservatories and the Thompson Memorial Rock Garden outdoors, then, in the Museum Building, chiefly the library and laboratories.

Rock Gardeners. Twenty-four members of the American Rock Garden Society met at the Garden May 19. After an inspection of the Thompson Memorial Rock Garden, under the direction of A. C. Pfander and E. J. Alexander, the group had lunch in the Members' Room.

Chinese Scientists. On May 9 the Science Society of China, of which Dr. Roberta Ma is a member of the executive committee, met at the New York Botanical Garden. Tea was served in the Members' Room after a visit to the rock garden.

Gardeners. The Westchester and New York branch of the National Association of Gardeners met at the New York Botanical Garden the evening of May 20. Forty attended and visited the rock garden, the borders, the Main Conservatories, and the Museum Building.

Clubs. Under the leadership of Mrs. Jerome W. Coombs, the Garden Department of the Scarsdale Woman's Club visited the New York Botanical Garden May 10. The group inspected the Thompson Memorial Rock Garden and the Main Conservatories, had lunch in the Members' Room, and was shown the Garden's motion picture with G. L. Wittrock as commentator.

Columbia Dames, an organization at Teachers College which has the purpose of acquainting out-of-town faculty members' and students' wives with the points of interest of New York City, visited the greenhouses and rock garden at the Botanical Garden May 9, with Dr. R. R. Stewart serving as guide.

Navy. John G. Borin, Assistant Foreman in Range 1, was inducted into the U. S. Navy a few days after completing 20 years of service at the New York Botanical Garden. He began work May 7, 1923, at the age of 17. While his ambition was to become a gardener, his first job was the lettering of labels for plants. He still has the letter written by Dr. N. L. Britton appointing him to this position.

Eventually he was transferred to a gardener's job, and he worked in turn on the irises, the annual border, and in the Thompson Memorial Rock Garden when it was first being developed. Meanwhile, he was a member of the first graduating class in the Science Course for Professional Gardeners, receiving his certificate in 1934. Later he was made Assistant Foreman in Range 2, then, in September 1938, was transferred in the same capacity to Range 1, where he gave special attention to the Tropical Flower Garden. Shortly before the fire of December 13, he was transferred to Propagating Range No. 2, but was returned to the Main Conservatories, when the damaged range was closed.

Visitors. Dr. R. A. Silow from the Cotton Research Station in Trinidad spent May 14 at the Garden. An April visitor from Port-of-Spain, Trinidad, was Colin S. Pittendrigh.

Harvey Smith. For more than forty years an employee of the New York Botanical Garden, Harvey Smith died May 17 after a protracted illness. He had been Custodian of the Museum Building from January 1, 1901, until July 1, 1940. His health then failing him, he was transferred to the post of keeper at the Pelham Parkway gate. For many years Mr. Smith was known to the speakers and audiences at the lectures on Saturday afternoons, for he was always on duty to show the lantern slides. As Custodian he was succeeded in 1940 by Peter Johnston, who had formerly worked on the estate of H. E. Manville at Pleasantville.

Harvey Smith is survived by his brother, Joseph Smith, who is the Botanical Garden's oldest employee; by his daughter, Mrs. Mabel Archer, who worked for the Garden eleven years between 1917 and 1933, and by a granddaughter, Claire Archer.

From India. Diwan Bahadur Sir Samuel and Lady Runganadhan were visitors at the New York Botanical Garden May 15. They were accompanied by Mrs. E. Russell, the wife of Major General Russell, and her sister, Mrs. F. Sawyer, who had made the acquaintance of Sir Samuel and Lady Runganadhan while traveling in India. Sir Samuel had just received an appointment as High Commissioner for India in London. He was previously advisor to the Right Honorable L. S. Amery, Secretary of State for India.

Prize. In recognition of his research on the control of cancer, Dr. Charles Huggins of the University of Chicago was the first recipient of the Charles L. Mayer award of $2,000, presented by the National Science Fund of the National Academy of Sciences, at a dinner in New York May 19. Dr. Huggins read a paper on "Endocrine Control of Prostatic Cancer." Dr. William J. Robbins, who is Chairman of the Fund, announced that a similar prize in this same field would be awarded next year.

Members' Day. Watercolor paintings of about thirty plants of the Himalayas, done by Mrs. R. R. Stewart, were shown during the Members' Day program of May 5, when Dr. Stewart spoke on "High Alpine Plants from Kashmir." Among the living plants displayed that day were several specimens of *Cattleya Mossiae; Paphiopedilum niveum,* a small snow-white orchid from Malaya; *Primula pubescens,* a hybrid; *Pelargonium* "Mme. Fournier," a plant with small dark leaves and scarlet flowers; *Miltonia* "Marietta Armacost;" *Oncidium Kramerianum,* a showy orchid from Ecuador and Colombia; *Anthurium Scherzerianum* from Central America; *Dendrobium densiflorum,* with flowers of an intense yellow coloring; *Albuca setosa,* a native of South Africa; and *Tropaeolum boliviense,* a fringed nasturtium that is rare in cultivation; also a group of potted rock-garden plants: *Lamium maculatum, Draba elongata balcanica,* and *Lysichitum americanum,* the western skunk-cabbage.

Civil Service Jobs. A recent bulletin from the United States Civil Service Commission announces openings for Agricultural Specialists in extension, research, program planning, and conservation, and for Agricultural Aids in semi-technical laboratories and field work.

Radio. Mrs. Harriet K. Morse, author of "Gardening in the City" in the April Journal and the final speaker on the Garden's Saturday afternoon programs in the spring, was the guest speaker on May 20 in the first of a series of radio programs being given by the New York Botanical Garden over station WNYC. Rutherford Platt, also a lecturer at the Garden during the past year, a member of the Garden's Corporation, and the author of "This Green World" published last November, was scheduled for the program June 17. The guest speakers are introduced at these broadcasts by Carol H. Woodward. Further programs will be given on July 15 and August 19 at 5:45 P.M.

Author. Dr. H. W. Rickett is the author of a new book, "The Green Earth," illustrated with his own pencil sketches of plants. Subtitled "An Invitation to Botany," it is one of the books in the "humanizing science" series being issued by the Jaques Cattell Press of Lancaster, Pa. It will be reviewed in an early number of the Journal.

ANNUAL REPORT

MEMBERS of the New York Botanical Garden are receiving with this issue of the Journal a copy of the Annual Report of the Director for 1942. A booklet of 40 pages, it also contains the financial report of the year, a list of the publications of members of the staff, the dates of outstanding events at the Garden in 1942, a complete list of members, and a number of illustrations.

This report will be mailed without cost to any subscriber or other person or organization requesting a copy, as long as the supply lasts.

To reach the Botanical Garden, take the Eighth Avenue Subway to Bedford Park Blvd., the Third Avenue Elevated to the Bronx Park station, or the New York Central to the Botanical Garden station; or drive up the Grand Concourse then east on Mosholu Pkwy., or, coming from Westchester, turn west at the end of Bronx River Pkwy.

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.
Vincent Astor
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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 523

JULY
1943

PAGES
149-172

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

THE NEW WORLD'S RESPONSIBILITY

NEWS has recently come to American botanists in a roundabout way from Sweden that the great botanical garden at Dahlem on the outskirts of Berlin has been severely bombed. According to one communication:

"The Editor of *Chronica Botanica* (Dr. Frans Verdoorn) reports that word has been received from a trustworthy Swedish correspondent that the herbarium and library buildings of the Botanical Garden in Berlin-Dahlem have been completely destroyed during an air raid on the night of March 1 and 2. Practically nothing had been evacuated. With the exception of the fern herbarium and part of the fungi, everything is gone. According to an official statement publication of *Die Natürlichen Pflanzenfamilien* and *Das Pflanzenreich* will be discontinued."

This herbarium contained an estimated three or three and a half million specimens—one of the largest collections in the entire world. Some of the South American material obtained in the early 20th century by Weberbauer and Ule, for example, and in more recent years by Diels, was duplicated nowhere else in the world. There were also extensive collections from Africa—a continent less explored botanically than any other.

Realizing the importance of Africa in the coming world economy, and the present lack of botanical knowledge concerning that continent, Dr. William J. Robbins in his Annual Report, read before the Corporation in January and published last month as a separate section of this Journal, pointed to a study of African plants as one of the major projects for which he hopes an endowed curatorship may be established at the Garden.

The sudden loss of all these specimens in Germany, on which a great deal of botanical work in the future might have been based, makes it all the more imperative that the New York Botanical Garden, as a representative New World institution, find means to undertake, at the earliest possible date, botanical exploration and study on the African continent.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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THE NEW YORK BOTANICAL GARDEN

VOL. 44 JULY 1943 No. 523

An Era In Papermaking

The story of Dr. Jacob Christian Schäffer, a Botanist-Clergyman whose Experiments in the Eighteenth Century in the Use of Vegetable Fibers Form the Background of the Gigantic Papermaking Industry of Modern Times.

By Dard Hunter

PAPERMAKING had its origin in China as early as A. D. 105, in the ancient walled town of Lei-yang, province of Hunan, the Chinese artisans retaining the secret of their invention for more than five hundred years; it was not until about A. D. 625 that these adept celestial papermakers carried their beloved craft eastward to Korea, and then into the Japanese empire. In the westward spread of papermaking more than a thousand years were required for the craft to travel to Europe, for it was not until A. D. 1150 that the art of forming thin sheets of paper from macerated fibers was finally introduced into Xativa, Spain. This slow-moving westward journey traveled the age-old trade route through Samarkand, in A. D. 751, and on to Baghdad, then into Egypt, continuing the natural course along the Mediterranean to Morocco, where the Mohammedans were fabricating paper in A. D. 1100. Paper's short journey from Morocco to Spain was of comparatively brief duration, requiring little more than half a century for the transition.

In Cambridge, at the Massachusetts Institute of Technology, Dard Hunter has charge of the Paper Museum which bears his name. It is his own collection of papers, papermaking tools and equipment, and other materials pertaining to this ancient craft—an assemblage gathered during his travels over many years to probably every part of the globe where paper has ever been manufactured. Mr. Hunter is the only person known who has published books in which he himself has performed every step, from the writing of the text and making of the paper to the designing of the type, the printing, and the binding. He is the author of more than sixteen books and brochures on paper and papermaking.

The papermakers of China, Korea, and Japan made use of plant fibers[1] that were not indigenous to Europe, so upon the development of papermaking in Spain the European workers were obliged to seek materials that were readily procurable in their own locality. These fibrous substances were flax (*Linum usitatissimum*) and cotton (*Gossypium*), two of the finest of all papermaking materials. For the most part the linen and cotton were waste products in the form of cast-off rags.

From the establishment of papermaking in Europe during the twelfth century, linen and cotton as papermaking fibers continued in exclusive use for the following five or six centuries. It was not until 1765 that Dr. Jacob Christian Schäffer embarked on his important experiments in the quest of unused plant fibers suitable for the making of paper. Previous to the work of Dr. Schäffer there had been, of course, the worthy suggestions of René Antoine Ferchault de Réaumur (1683-1757) and the limited research of Franz Ernst Brückmann (1697-1753), Albert Seba (1665-1736), Jean Étienne Guettard (1715-1786) and John Strange (1732-1799),[2] but it remained for Dr. Schäffer to undertake the actual fabrication of usable paper by using the fibers of dozens of different plants never before employed for this purpose.

Not only were the experiments of Dr. Jacob Christian Schäffer in the use of vegetable fibers for papermaking infinitely more important than the work of his predecessors, but, what is more significant, he has laid before us the definite results of his experiments in the form of numerous examples of actual paper. These specimens, numbering more than ninety samples of paper, are incorporated in the six-volume treatise embracing his discoveries.

Dr. Schäffer was born in Querfurt, near Merseburg in Saxony, in 1718, but his family early moved to Regensburg, or Ratisbon, the capital of the Bavarian province of Oberpfalz, about one hundred and fifty miles south of his birthplace. Schäffer studied for the ministry and became a well known clergyman in Regensburg, but apparently he derived his greatest pleasure outside the church, as he devoted most of his time to the study of science and natural history. His work on the fungi of Bavaria is still regarded as a standard authority. Schäffer's interest in the flora of Bavaria directed his attention to the possibility of new materials for papermaking, and it is with his researches in this direction that we are

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1 Bamboo (*Bambusa* species); gampi (*Wikstroemia canescens*); hemp (*Cannabis sativa*); mitsumata (*Edgeworthia chrysantha* (*E. papyrifera*)); mulberry (*Broussonetia papyrifera*), etc. For details of Far Eastern papermaking see the following works by Dard Hunter: "Old Papermaking in China and Japan," 1932; "A Papermaking Pilgrimage to Japan, Korea, and China," 1936; "Papermaking in Southern Siam," 1936; "Chinese Ceremonial Paper," 1937; "Papermaking by Hand in India," 1939.

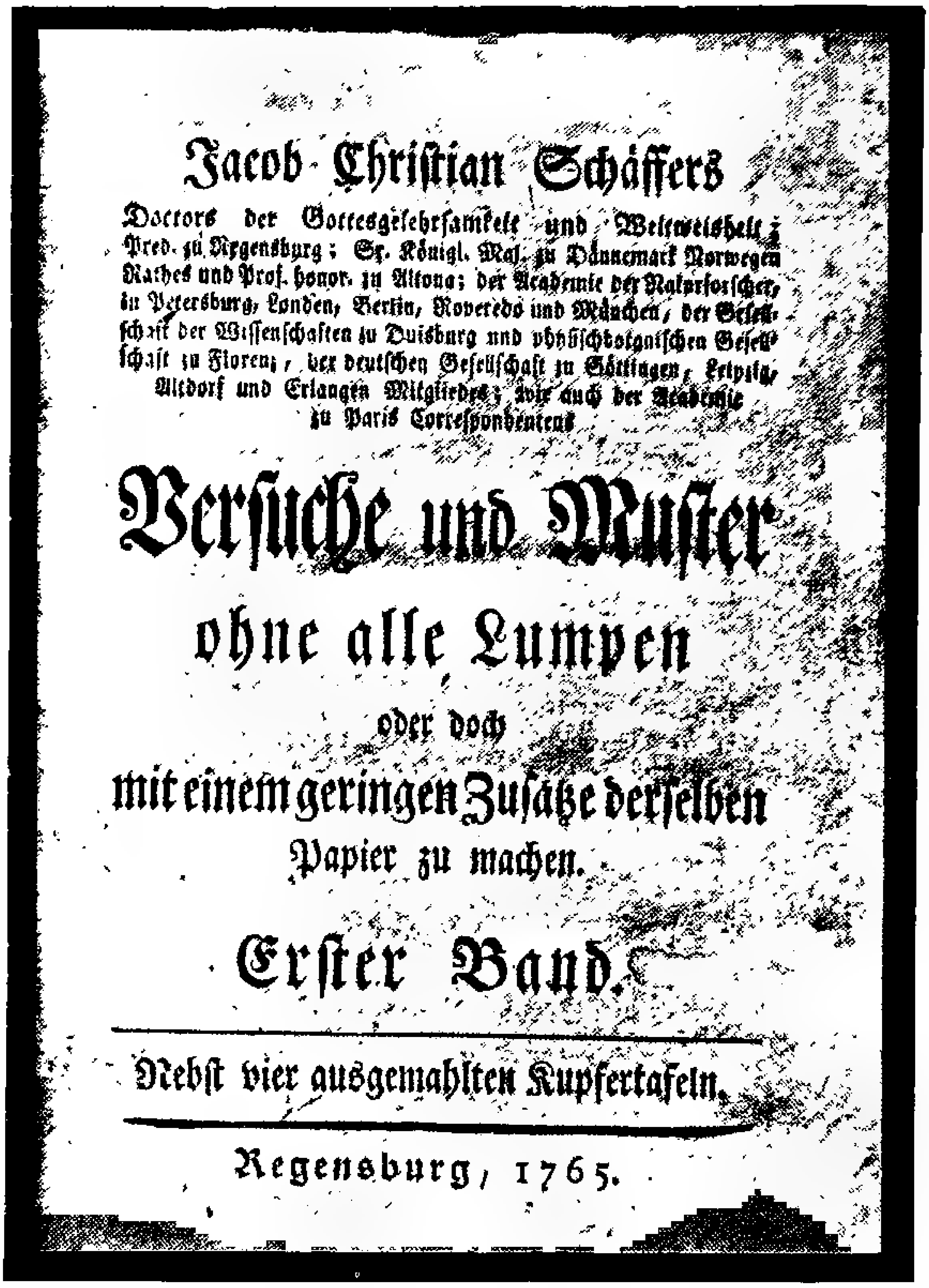
2 For detailed accounts of the work of these scientists see: "Papermaking, the History and Technique of an Ancient Craft" by Dard Hunter, which is reviewed in this issue of the Journal, and from which the photographs reproduced here are taken.

concerned. In his six-volume treatise Dr. Schäffer has left a permanent record of his experiments in the search for new papermaking materials, and the actual specimens of his paper establish the fact that he was the pioneer in the use of many vegetable fibers for the fabrication of paper. It was not Schäffer's desire, as he explains, to make well-finished paper; he simply wished to show the vast variety of vegetation available for the

Dr. Jacob Christian Schäffer, the Bavarian clergyman whose experiments foreshadowed a revolution in the methods of making paper.

purpose. As his experiments were carried on previous to the discovery of bleach,[3] his examples of paper have the tint of the original materials from which they were made. In most of the samples about one fifth part cotton rags was added to the pulp to bind the fibers together. A number of the specimens are sized, and nearly all have been printed upon, describing from what plant or fiber they had been made.

[3] The process of bleaching papermaking materials was invented in 1774 by Karl Wilhelm Scheele (1742-1786), a celebrated German chemist living in Sweden.



Jacob Christian Schäffers
Doctors der Gottesgelehrsamkeit und Weltweisheit; Pred. zu Regensburg; Sr. Königl. Maj. zu Dännemark Norwegen Rathes und Prof. honor. zu Altona; der Academie der Naturforscher, zu Petersburg, London, Berlin, Roveredo und München, der Gesellschaft der Wissenschaften zu Duisburg und physischbotanischen Gesellschaft zu Florenz, der deutschen Gesellschaft zu Göttingen, Leipzig, Altdorf und Erlangen Mitgliedes; wie auch der Academie zu Paris Correspondentens

Versuche und Muster
ohne alle Lumpen
oder doch
mit einem geringen Zusatze derselben
Papier zu machen.

Erster Band.

Nebst vier ausgemahlten Kupfertafeln.

Regensburg, 1765.

Title page of the first volume of Dr. Schäffer's work.

It is curious to note that one of the first specimens shown in Schäffer's books was made from wasps' nests—for was not the wasp, as Réaumur pointed out, the first papermaker? Dr. Schäffer's researches extended over a period of more than eight years, and all of the materials with which he worked in papermaking were gathered in his own garden or in neighboring fields. The mode of making the various samples of paper is given in detail. The materials, according to their nature, were first chopped by hand, the different kinds of wood having been reduced by a toothed plane.

Most of the experiments were carried on in Schäffer's own home, and for the purpose of macerating the materials he employed a miniature set of stampers operated by hand. In most cases the vegetable matter was subjected to the stampers without preliminary treatment, but with a few of the materials milk of lime was used. With some of the more stubborn materials the doctor used a stiff lime paste and suffered the material to remain in it for various lengths of time, and he noted that this treatment reduced the beating process.

There are not many copies of this work extant [4] and the specimens in the various sets are not always identical. The compilation is more often found bound complete in one volume than in the six original pamphlets as Dr. Schäffer issued his work. The six volumes are designated on the title-pages as volumes one, two, one, two, three, and four. The first volume of this valuable work was completed January 30, 1765, and the book contains fifty-five pages of text, five plates, and fifteen specimens of paper. The examples include papers that were made from wasps' nests, and from various kinds of wood, moss, and vines. In volume two, dated April 3, 1765, there are twenty-eight pages of text and one plate. The specimens embrace papers fabricated from hemp, bark, straw, and cabbage stalks. The third volume (in order of their appearance), dated November 3, 1765, has thirty-two text pages, and the specimens include papers made from asbestos, cattail (*Typha latifolia*) and burdock stalks (*Arctium Lappa*), thistles (*Carduus nutans*), and turf. Volume four was completed January 1, 1766, with twenty-four pages of text and eleven samples, including papers made from seed, mallow (*Abutilon Theophrasti*), St. John's-wort, and Indian corn husks. The fifth volume is dated April 15, 1767. and the sixth and last is dated 1771. These two books give specimens of paper made from genista (*G. tinctoria*) pine-cones, potatoes, old shingles, reeds; and bean, horse-chestnut (*Aesculus Hippocastanum*), walnut, tulip, and linden leaves; also paper from yellow- and brazil-wood.

Inasmuch as Dr. Schäffer's work is the earliest treatise in the Occident on the use of various plant fibers for papermaking, and owing to the text being unusually interesting, it will not be out of the way to quote at length from the book:

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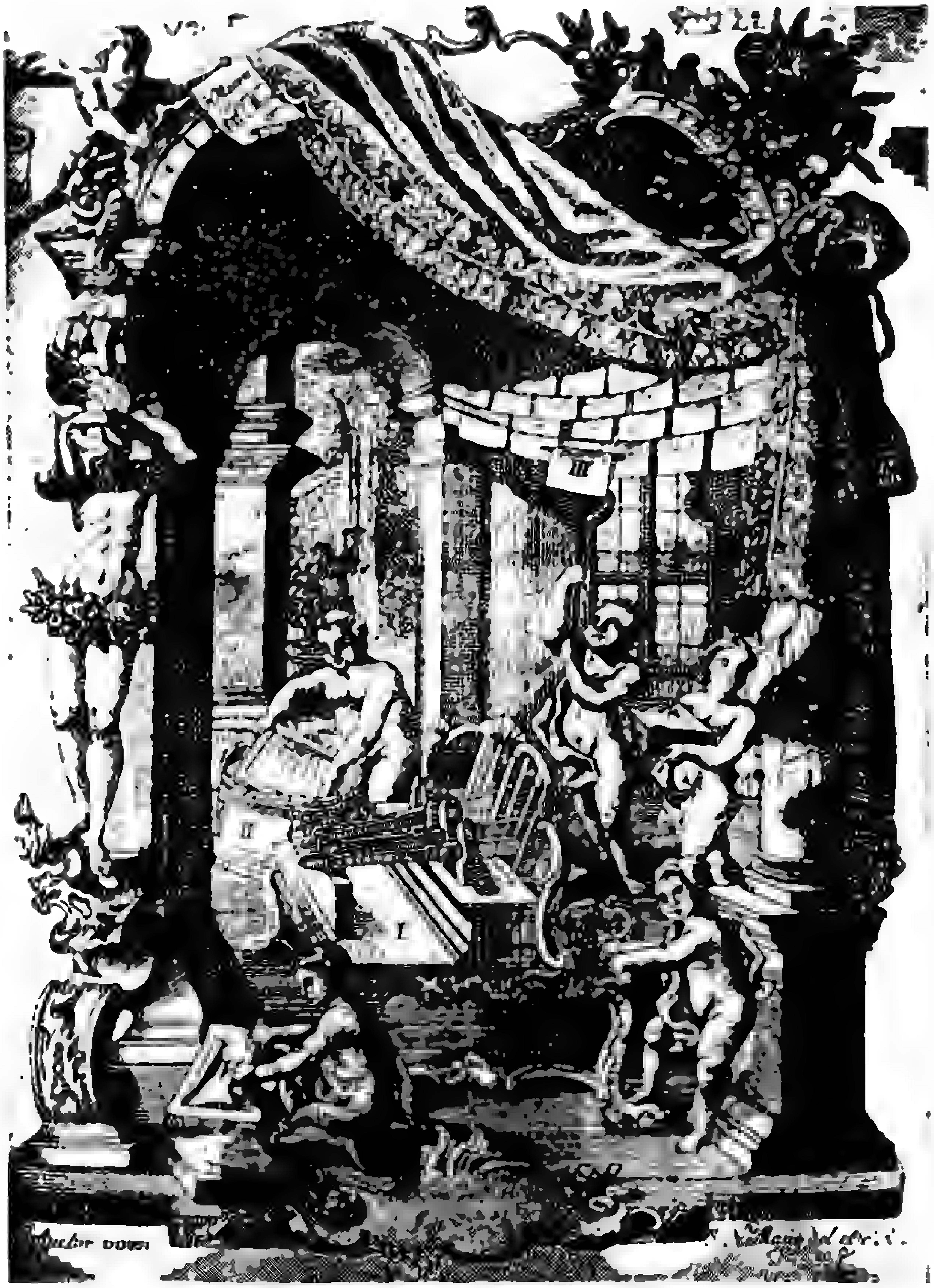
[4] Dr. Schäffer's treatise on papermaking may be seen in the following libraries: Columbia University Library (American Type Founders Collection); Congressional Library, Washington, D. C.; Harvard College Library (Philip Hofer Collection); Michigan State Library, Ann Arbor; Newark Public Library, Newark, N. J. (Jenkinsen Collection); Paper Museum of Mass. Inst. of Technology (1 complete copy; 1 incomplete copy; rare Dutch edition of 1770; four engraved portraits of Schäffer, etc.). This list should not be accepted as a complete census. The copies herewith listed are not all complete in regard to number of volumes, specimens of paper, etc. The only absolutely complete set that *we know* (with more than 90 specimens) is in the Paper Museum of M. I. T. About twenty years ago an incomplete set (lacking one volume) sold for $425.

"It is generally known that the paper which, according to all evidence, has been used in Europe since the twelfth century is made of rags and wornout linen. And the dearth of this material is now complained of everywhere. The most curious thing is that not only a certain kind of paper is wanting; statements of merchants reveal that in regard to wrapping paper, cardboard, etc., the want is even keener.

"This general lack of paper, and the harm done thereby to administration, science, and commerce, brought a few years ago to my memory what various scholars—like Seba, Réaumur, Guettard, and others—had in mind and proposed in regard to papermaking. They believed, and with probability proved, that one is not exclusively bound in papermaking to linen, but can make paper just as well of a great many other things. It is generally known that rags originally were made of lint and hemp, which are plants themselves; thus these scholars came to the conclusion that every material which—like hemp and lint—consists of such soft, elastic, easily separated fibers as through the action of water turn to pulp and by drying attain a certain stiffness and firmness must be fit for papermaking.

"Few objections can be reasonably raised against the statements of these scholars—and the more certain it is that besides hemp and lint there are many plants having the same necessary qualities, the more difficult it is to comprehend why these ideas have not been used for the benefit of the public, and why such experiments have not been longer, oftener, and in a more satisfactory way pursued. This regrettable neglect induced me three years ago to get to work with all possible energy. It seemed to me as if nature itself wished to encourage me in my task. Taking a walk outside of our town, chance led me to a place where one side of the field, from abundance of pappus of the poplar, and the other from 'wool-blade,' looked wholly white. At this sight the thought flashed through my mind: Could not paper be made from these plants?

"Without losing time, I started at once to experiment. I gathered the pappus as well as the wool-blade, then talked the matter over with the papermaker of the town, Herr Meckenhäuser. How happy I was when—after examining the pappus—this good-natured man declared that, though the wool-blade did not seem to him fit for papermaking, the poplar-downs must by all means be tried out. But my joy was gone when I learned that the papermaker wanted five to twenty pounds of pappus. It was impossible to get such a quantity, and it cost me a great deal of talk before I could pursuade him to make the experiment with the poplar-downs in a mortar. A few days later I received several samples of the new paper. It was, at any rate, paper; one could print or even write upon it. Only it was too ragged, and did not possess the necessary firmness, and besides it was full of little brown knots, the residue of the pounded kernels. Yet these first and imperfect samples provided the most convincing proof that the pappus of poplar is fit for papermaking, and the papermaker assured me that if a satisfactory quantity of pappus had been pounded in his



The frontispiece in one of the volumes of Dr. Schäffer's treatise on paper-making from vegetable fibers. The fanciful print depicts a set of stampers similar to the machine actually used by Schäffer in his experiments.

regular beater instead of in the mortar, and if it had been further duly treated and finished, we could have obtained a reliable and usable paper.

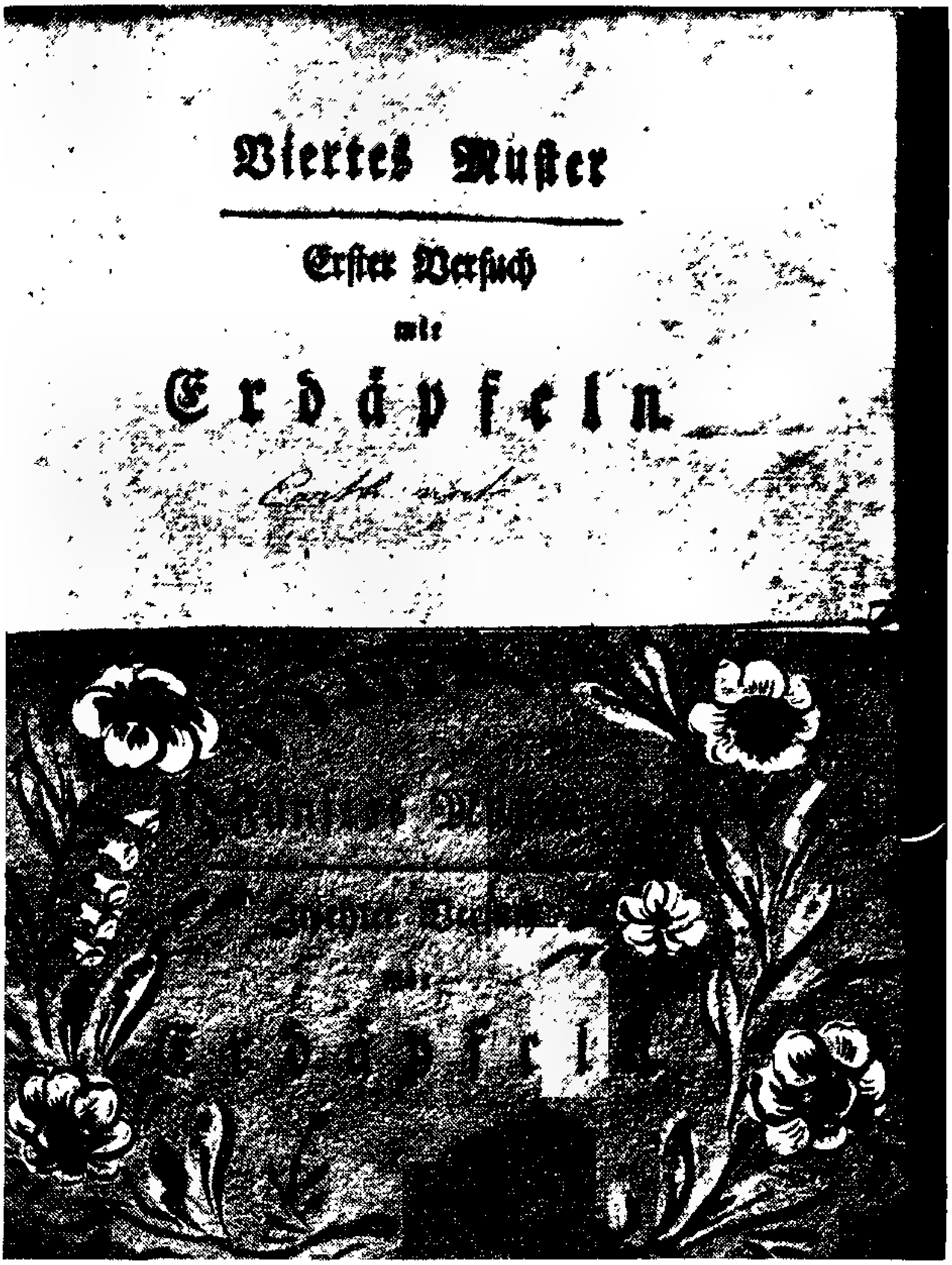
"Other occupations prevented me continuing my experiments in the following two years. Yet being urged from several sources, especially the

Academy, I resumed the experiments. I gathered again a basketful of poplar pappus and wool-blade and gave it to the same papermaker. After a while I obtained paper from both species. The wool-blade paper came out extremely poor; the paper made from pappus of poplar was incomparably better.

"I honored myself by submitting samples of the paper to the Bavarian Academy, and without delay I made preparations for experiments with all of the materials which I thought might be fit for papermaking. And since my former experience convinced me that my aim would be very slowly reached if I depended upon the papermaker alone, I decided myself to make all the experiments, from beginning to end, in my own house."

After Dr. Schäffer decided to become his own papermaker he employed a local artisan to explain to him the principles of the craft, instructed his servants, and after procuring several moulds he was ready to make his own experiments. The botanist-clergyman-papermaker had a small stamping-mill constructed which was operated by hand, and in this machine, which is pictured in his book, most of the beating was accomplished for producing the samples of paper shown in the six volumes. "And I started again to make paper," concludes the story of the ingenious Schäffer, "from poplar-downs, and shavings, and so forth. And what sweet satisfaction did I feel when I saw that everything came out better than I had imagined! In a short time I was able to produce a reliable new sort of paper. After such success, how could I forbear to make new and again new experiments?—especially when the cost of the tools had already been met. I decided, therefore, to make these experiments my regular winter occupation. I could do so the more readily since the paper made hitherto found the warmest acknowledgment and I was urged to continue my experiments."

In making the specimens for his books Dr. Schäffer frequently found that the same plant, collected at different times, gave different results, as is evident in an examination of the specimens. Experiments were made in the use of potatoes for papermaking and it was found that sheets of paper could be fabricated from both the skins and the insides of this tuber. However, when the good doctor was carrying on his researches in the use of potatoes he could not that year (1767) procure enough of these vegetables for his work. In fact, potatoes were so little known in his country at that time that Schäffer felt he needed to explain their use and wrote the following regarding them: "The earth-apple (potato) is a kind of plant known principally in Voigtland, France, Austria, and since some years also in Bavaria and the Pfalz, on whose fibrous roots there are produced, in the earth, uneven various-sized knotty and apple-like growths, which are known as earth-apples. These earth-apples are an uncommonly useful vegetable for the kitchen, particularly where there is a scarcity of bread. Poor people in many places not only eat these earth-apples, but the appetite is satisfied by them as well as by bread."



The two specimens of paper in Dr. Schäffer's book showing the use of potatoes as papermaking fiber.

As before mentioned, Dr. Schäffer's experiments in making paper from vegetable fibers never before used for the purpose extended over a period of eight years. In this time, as evidenced by specimens that are still extant, Schäffer not only made paper from the plants already mentioned in this article, but he was also the first to make use of the following fibers for making into paper: white thorn leaves, water moss, Syrian swallow-wort, fig-tree wood, Turkish wheat-straw, beech wood, coral moss, hop tendrils, sweet broom, fir apple, aloe, clematis wood, nettles, green willow, dried willow, bulrush, straw, etc., in all over ninety different trees, shrubs, and herbaceous plants. Aside from his pioneer experiments in papermaking Dr. Schäffer was the first scientist to fabricate woven cloth and lace from macerated vegetable fibers. His work in this field was also of a prophetic nature—the forerunner of the great rayon industry of today.

Dr. Jacob Christian Schäffer died in 1790 with little realization of the

An example of paper in Dr. Schäffer's treatise which was painted upon by the clergyman's daughter to show adaptability of the paper for this purpose.

importance of his pioneer experiments. It may be safely stated that the greater part of the gigantic paper industry of modern times and the vast production of synthetic woven fabrics rest upon the eighteenth century experiments and researches of this humble German clergyman.

Tomato Leaves Curled?

"Don't Worry," Is Advice

TELEPHONE calls came in to the New York Botanical Garden daily during the last of June with the question, "What shall I do about my tomato plants? The leaves are curling and they all look very sick."

In most instances, the inquirers were told, the extremely hot weather was the main cause, and they would doubtless still get a good crop of fruit.

Prof. C. H. Nissley of the State Agricultural Experiment Station at New Brunswick has reported that the trouble has been rather widespread this season in New Jersey. It is, however, merely physiological, he emphasizes. The condition is characterized by the lower leaves growing abnormally, becoming thicker and more brittle than usual, and curling in at the edges. The result suggests wilting, but it may occur even in wet weather or when the plants are being watered thoroughly. It is, in fact, a matter of water relations; that is, an unbalance between the intake of water by the roots and the outgo of moisture through transpiration from the leaf surface. Anything tending to upset the normal balance seems to result in the curling of the leaves. It might be a prolonged spell of excessive heat, or a sudden change of weather from wet to dry or from dry to wet; or it might be too deep cultivation of the soil, or the misapplication of fertilizers. Similar symptoms in the past have been diagnosed as caused by the use of too much nitrogen or potash or other commercial fertilizer.

Professor Nissley believes—and others have observed—that the trouble is aggravated by the practice of staking and disbudding tomatoes, since it occurs to a much less degree in tomato plants that are allowed to sprawl, as in field plantings. Since the condition is not caused by any virus or pathogenic organism, it does not call for the application or insecticides or fungicides.

However, Dr. B. O. Dodge, the Botanical Garden's Plant Pathologist, suggests that gardeners should inspect their tomato plants carefully, using a hand lens or magnifying glass to make sure that no insect pests are present on the leaves. Aphids, or plant lice, may cause somewhat similar symptoms in the way of leaf-curl. The red spider mite, which is practically invisible to the unaided eye, is also infesting tomatoes at this time of year. Both the red spider mite and the aphid can be controlled rather easily, Dr. Dodge says, by spraying with some contact insecticide, such as 40% nicotine sulphate (black leaf 40)—1½ teaspoonsful to a gallon of water to which 1 ounce or 1 cubic inch of laundry soap, shaved thin and dissolved in hot water, or one ounce of soap flakes dissolved, has been added. Nicotine dusts of 3 or 4% strength are easily applied and are also effective. Rotenone and pyrethrum, which are nonpoisonous, are likewise good, but at present they are difficult to obtain.

The work of the potato flea-beetle—that shy little insect that jumps when you approach—can be recognized by minute holes in the leaves. The same insect attacks potatoes. While a bordeaux-mixture spray will repel flea-beetles, it is known occasionally to cause some stunting of the plants and to aggravate blossom-drop if it is applied at the time the pollen is being shed. One-half of one percent rotenone may be used, if available, or a calcium-arsenate lime dust.

But, warns Dr. Dodge, *do not spray or dust unless there is a reason for doing so.*

Blossom-drop is a condition that often occurs at the same time as leaf-curl, though it may have an independent cause. It is sometimes associated with over-feeding, according to Dr. P. P. Pirone of the New Jersey Experiment Station and the Botanical Garden's teaching staff. It may also be caused by an extreme in weather, such as the heat that New York experienced recently. In fact, any shock to a plant, whether brought about by faulty cultural practices, improper use of fertilizers, unseasonable weather, or too much watering or spraying of the plants while pollen is being shed, may cause the flowers to fall. Injury of the pollen by a spray interferes with pollination and prevents the setting of fruit. However, with conditions improved or remedied, blossoms opening later in the season will develop fruit.

Therefore it stands to reason that, weather conditions being favorable, the gardener who gives his tomatoes the right sort of care (without too much misplaced kindness) will have little likelihood of trouble resulting from leaf-curl, blossom-drop, or insect pests.

Rose Growers, Amateur and Professional, Meet at Botanical Garden June 15

AN informal program devoted to roses attracted about 65 people to the New York Botanical Garden June 15. The occasion, called Rose-Growers' Day, was sponsored jointly by the Garden and the New York District of the American Rose Society, of which Paul F. Frese, Editor of *The Flower Grower*, is Councillor. Benches and tables were set out under a large ash tree across the road from the Rose Garden, and the entire program, including a picnic lunch, took place there. Amateurs and professionals alike took part in the discussions which featured the day.

After a brief introductory address, Dr. William J. Robbins brought Mr. L. C. Bobbink to the platform. Now aged 77, he still maintains an active interest not only in his business but also in the continued development of American horticulture. Looking back over the thirty years that he has had a personal interest in this rose garden, contributing to it the majority of the plants and always keeping a watchful eye on it from year to year, Mr. Bobbink said that today there were at least a dozen varieties of roses in the garden that had been planted there 25 years ago. Among these, ***Mme. Léon Pain*** is one of the outstanding varieties.

Mr. Robert Eisenbrown, Vice-President of Bobbink & Atkins, whom Mr. Bobbink called to take his place on the platform, spoke about hardiness in roses, saying that last winter the apple-cart was upset on hardiness rules. Of all the standard, or tree roses, in the Garden, he said, the only one that came through unscathed without protection was ***Carpet of Gold,*** and the only protected tree rose that withstood the winter was ***Miss Rowena Thom.*** Like most of the others trained in standard form, it had been covered with tar paper.

He spoke especially of an unnamed pink rose developed by Dr. Whitman Cross of Chevy Chase, Md., which came through the winter without a plant being lost. This is the fifth year that this variety, listed as No. 1223C, has been at the Garden, but it has not yet been introduced to the public, though it has proved itself popular every year.

Mr. Eisenbrown asked Mrs. Frederick L. Keays of Great Neck, an authority on old-fashioned roses, to speak, and she informally discussed some of her experiences in locating and identifying cer-

ROSE-GROWERS' DAY AT THE BOTANICAL GARDEN

In the front, left to right, are Dr. William J. Robbins, Richardson Wright, and L. C. Bobbink. Rear: Mrs. Walter Douglas, Mrs. Robert H. Fife, Mrs. George C. White (the daughter of Mr. Bobbink), James G. Esson, George H. Gillies, Robert Pyle, Mrs. F. L. Keays, and Mrs. Richardson Wright.

tain hybrid perpetuals, moss roses, gallica types, York & Lancaster, Maiden's Blush, and another alba type, Etoile de Malmaison. "It is easier to grow a rose than to classify it," she quoted.

Robert Pyle, President of Conard-Pyle Company of West Grove, Pa., spoke of a rose garden as a place "where the spirit of beauty can restore the spirit of man." He paid tribute to Mr. Bobbink as a great rosarian and issued a plea for a scholarship or similar opportunity for the study of roses at an institution like the New York Botanical Garden. He also expressed the hope that a fine collection of roses, such as that in the rose garden where the assembly took place, might be assured of maintenance in perpetuity by such an organization.

He said that commercial growers this year would produce only half as many roses as in other years and that there would be fewer varieties but that the increase in price per plant would be very small.

Both Mr. Pyle and Mr. Bobbink brought collections of roses for display, Mr. Bobbink showing more than a dozen kinds of old-fashioned roses, while Mr. Pyle exhibited some of the new introductions, among them No. 3440, a floribunda of exceptionally vivid coloring, to be named ***Floradora.***

Mr. Frese opened the afternoon session, introducing Mr. George H. Gillies, Head Gardener for the Marshall Field estate, as moderator for the open forum on rose culture. Winter injury, disease and pest control, and recommended roses were among the subjects discussed. The round-table discussion closed with the observation by Dr. Cynthia Westcott that healthy roses get fewer diseases and pests than neglected plants.

Everett A. Piester, Assistant Superintendent of Parks in Hartford, famous for the Rose Garden in Elizabeth Park, spoke briefly at the close of the program on the successful planting out of potted roses.

Among those who attended the program, besides the speakers, were Mr. and Mrs. Richardson Wright, Joseph J. Lane, Mrs. George C. White, F. A. Hodges, Jr., H. W. Hands, C. R. Schumacher, Ralph Bailey, Frederic Morley, Mr. and Mrs. L. Hollingsworth Wood, Dr. and Mrs. E. L. Scott, J. B. R. Verplanck, Forrest E. Kendall, Daniel Phillips, L. A. Howard, Mrs. Francis J. Clark, Miss Amelia J. Joaquim, Mrs. Robert H. Fife, Mrs. Walter Douglas, E. L. D. Seymour, Mrs. Leonard Barron, and T. A. Weston.

Sunshine and the Food Value of Plants

By Mary Elizabeth Reid
U. S. Public Health Service
National Institute of Health

WHEN the housewife goes to market to buy greens for her family she assumes that spinach is spinach regardless of variety, age, conditions of growth, and time of harvesting. She takes for granted that a pound of spinach or chard obtainable on one day is equal in quality to a pound on any other day, regardless of time and weather conditions. In the feeding of animals the farmer even assumes that two hours pasturing of his stock in the early morning is the equivalent to two hours in the late afternoon.

Actually these assumptions do not agree with the facts. Definite differences in the amount of starches, sugars, proteins, fats, minerals, and of vitamins as well may be found in plants subjected to different weather conditions, especially at and near the time of harvesting, or even in plants picked at different times of day. Differences, which are particularly noticeable in the leaves, may be found also in plants of different ages.

To increase our knowledge of one of the vitamins, namely vitamin C, studies were made to determine the effect of age, conditions for growth, and time of harvesting upon the quantity of this substance in edible plants. It was assumed that the amount of food in a pound of spinach or peas might depend upon how old the plants were when the vegetables were picked, on the age of the vegetables themselves, on the time of day when they were picked, and on whether the weather had been prevailingly cloudy or sunny during their growth, particularly around the time of harvesting. It was found that light has a remarkable effect upon the accumulation of vitamin C. Seedlings sprouted in light contained, after seven days, more than four times as much vitamin C as seedlings of the same age grown in darkness. Plants grown in the greenhouse during May and June in the neighborhood of Washington, D. C., contained twice as much vitamin C as plants grown during December and January. In more northerly latitudes it might be expected that the differences at the two seasons would be even greater. However, recent tests with tomatoes conducted at the U. S. Department of Agriculture's Regional Laboratory at Ithaca, New York, yielded differences in vitamin C values in the summer and winter months similar to those which had been found with other types of plants at Washington, D. C.

Fruit from the shaded side of a tree has been shown by other workers to have a lower vitamin C content than that from the sunny side, and even in individual fruits the sunny side has been found to have more than the shaded side. The changes in the amount of vitamin C in a plant under varying conditions of sunlight as compared to shade are noticed first in the leaves, though later differences may be observed in other parts, even in the roots.

Losses of vitamin C at night amounting to as much as 20 percent of the total quantity, and possibly even more, may occur in some types of plants. Appreciable losses at night occur only when the temperature is high enough to allow growth to take place. Similar losses of the vitamin may occur also during the day but the quantity thus lost is not readily measurable because the vitamin is manufactured more rapidly than it is used. So the net result is an increase in vitamin C. Manufacture at a slow rate occurs at night, but its magnitude is difficult to determine because the vitamin is lost much more quickly than it is made. These facts suggest that vitamin C is used by the plant in the process of growth. Just what it does with the vitamin is so far a secret with the plant. The evidence suggests, however, that it is used for some purpose in the growing regions such as in the tips of the roots and stems and in the development of the young leaves.

As a consequence of its own life processes, therefore, a plant starts the day with a lowered amount of vitamin C. If there then follows a succession of very cloudy days, and if the plant is growing rapidly, there tends to be a slow but progressive lowering of the amount of vitamin C. Comparable losses in the sugars and starches of plants under similar conditions have been recognized for a long time. Then comes a bright, sunshiny day. Marked gains in the vitamin are to be observed during the course of the day. Some types of plants may, under these conditions, have more than 25 percent more vitamin C by late afternoon than at break of day.

An interesting example of this variation in nutritional value of plants as related to time-of-day turned up in an experience in silkworm feeding. In sections of Italy where silkworm production has been an important industry from ancient times, it has been the practice to gather the mulberry leaves, used in feeding the worms, at dusk. These sericulturists have found by experience that leaves gathered at the end of the day tend to yield better results than leaves collected in the morning. Chemical studies of mulberry leaves have revealed why this is true. During the day, under the influence of sunlight, the leaves become enriched in nutritive substances, not only with carbohydrates such as starches and sugars but also with proteins, fats, minerals, and presumably vitamins, too, since vitamin C, for example, is known to be present in relatively high concentrations in mulberry leaves. Moreover, the protein of young mulberry leaves nearing full size has been found to be superior in quality, quantity and digestibility to that in well-matured leaves.

It seems strange indeed that one should have to turn to the lowly worm for information on the subject of nutrition but actually little is known of the influence of "time-of-day" for collection of food plants or even of shading upon their nutritive value to humans and to animals other than silkworms. It is true that variations in protein and non-protein nitrogen have been observed in a number of types of plants exposed to sun as compared to plants kept in shade, and also in plants harvested in late afternoon and evening in contrast to others collected in the morning. Just as in mulberry leaves, a greater amount of starches and sugars is found in plants kept in sunlight than in those kept in shade, and more also in plants collected in the evening than in those collected in the morning; but nothing was known until recently of the effect of variations in these different conditions on the amounts of any of the vitamins. It remains to be seen whether the amounts of the other vitamins in fruits and vegetables vary as does vitamin C with differences in light intensity, length-of-day, and time-of-day for harvesting. It seems probable that if differences occur they won't be so great as those of vitamin C, unless the vitamin in question, like vitamin C, is also used up in the life processes of the plant.

When the time comes to harvest fruits and vegetables, particularly vegetables of the leafy type, due consideration should be given to variations in the amount of light. Present results suggest that for good vitamin C values the harvesting of vegetables should not be done before mid-forenoon, say 10 o'clock, after generally clear weather. It is preferable to harvest, if possible, after a spell of clear weather, or, if it must be done following cloudy days, collection should be made late in the day. Because of the tendency of vegetables, especially those of leafy type, to lose vitamin C on standing, it would follow that when weather conditions permit, vegetables from the home garden should be freshly picked each day.

Particularly now, because of the war emergency, all available methods for the procurement of high vitamin values in foods should be utilized to the fullest extent practicable. The dehydration of foods, which has recently been greatly expanded because of economy of transit both by rail and water routes, involves considerable loss in vitamin content, particularly vitamin C. It is well known, too, that some loss of vitamins usually occurs in the cooking and canning of foods. Rather extensive destruction of vitamins may take place also during the shipment, storage and marketing of fresh foods, some of which could and undoubtedly will be lessened by improvement in methods of treatment. It is probably inevitable, however, even under the best of conditions, that comparatively large losses of vitamins will continue to occur in the handling, storage and cooking, or processing of foodstuffs. Therefore, in order to ensure each individual an adequate daily quota of these essential substances it becomes important that everything possible be done to provide both the processor and the housewife with foods having high original vitamin values.

Letters from the Journal's Readers

The Date of the Chinese Prints

THE photographs of the original paintings depicting the cultivation of rice in China, which were reproduced in the Journal for May, do not date as far back as the Ming Dynasty, according to Dr. L. Carrington Goodrich of the Department of Chinese and Japanese at Columbia University.

"You will find when you read the critical French, German, and English literature that you have embarked on a difficult problem," Dr. Goodrich writes. "We know what the originator of the pictures was Lou Shou (1090-1162) who completed them about 1145; that they were carved on stone in 1210, and first printed in 1237. After that there were many other editions. The question arises: Is your set of pictures really Ming Dynasty in date? I suggest that you compare it carefully with others before you come to a final conclusion."

It was the style of the costumes which determined the setting of the period in the Ming Dynasty, which is approximately 500 years ago, but Dr. Goodrich states that style in this instance can not be used as a criterion. A comparison of the pictures with several published sets found in the Columbia University Library shows them to be slightly different from any others known, but dating, apparently, around the 18th century, when there was a revival of interest in the subject. It is hoped that a study of them can be made during the coming year.

Another Genus Named After Hinton

FROM Charles Schweinfurth, Research Fellow in Botany and Assistant to Professor Oakes Ames at Harvard University, comes the news of a second genus of Mexican plants named for George B. Hinton, whose recent death was recorded in the Garden's Journal for May. The genus *Hintonia* was the only one mentioned in the article on page 124. Mr. Schweinfurth writes:

"It seemed to me that it might be of interest to report another genus named for this assiduous collector. It is *Hintonella,* a monotypic orchid genus from Mexico, named by Prof. Oakes Ames following our exhaustive study of allied groups. It appeared in Botanical Museum Leaflets of Harvard University 6 (1938) 186-7.

"Many, if not all, of his considerable orchid collections were referred to the Oakes Ames (Orchid) Herbarium of Harvard University."

Ching Tsai By Any Other Name . . .

THE name in northern China for the vegetable which the New York Botanical Garden introduced at the International Flower Show in 1942 is "Erh Yueh Lan," according to Dr. Hui-Lin Li, who writes to the Garden from the Arnold Arboretum, Jamaica Plain, Mass.

"To my knowledge, the plant is common in North China," he says, "and is known as 'Erh Yueh Lan'—or 'Second Month Blue'." Botanically, the plant, which was described in the April Journal of the Garden last year, is *Moricandia sonchifolia.* It is a member of the Cruciferae, the same family to which the cabbage and turnip and many similar vegetables, especially in the genus *Brassica,* belong.

According to a glossary of Chinese plant names which Dr. Li mentions in his letter, the plant is also known as "Chu-kuh Tsai," Chu-kuh being a surname, probably, he says, referring to some historical person in the past. "I am not sure," he remarks, "whether this is a purely literal name or is also of common usage. The name 'Ching Tsai' is commonly applied to certain species of *Brassica* in many parts of China, and I think it will be confusing to use it in this case."

The name "Ching Tsai," however, is not applied to other Chinese vegetables being used in the United States, according to Dr. Roberta Ma, who selected this name for the newly introduced vegetable. "The name," she says, "was chosen over several others because, of all the possibilities in names, this one was the easiest for an American to pronounce."

"Prove Things With Your Own Experience" Graduating Gardeners Are Told

Dr. Wister Also Urges Students to Advocate Finer Parks in Their Communities

"UNTIL you have proved it true with your own experience, don't believe a single thing your teachers have told you."

This advice was offered by John C. Wister to the students graduating from the Two-Year Science Course for Professional Gardeners and the Two-Year Course in Practical Gardening at the New York Botanical Garden the evening of June 24. Dr. Wister, who gave the leading address of the evening, is Director of the Arthur Hoyt Scott Horticultural Foundation at Swarthmore, Pa., and Secretary of the Pennsylvania Horticultural Society in Philadelphia.

"It is not possible," he said, "for anyone to put into a lecture, a demonstration, or a book all you want to know about horticulture. Nor can any of you remember correctly everything that you heard or read. Your teachers have given you a good start, but you must apply what you have heard and learn from your own experience. Observe, create pictures in your mind, and remember them. Use your mind; you will find plenty of exercise for it when you are working with plants."

As an example of this precept, he talked at length about hardiness.

"If you want to find out which plants are hardy in your garden," he said, "try things within reason first, and don't believe all that is told you about the more tender things. Try what you want, and shelter the doubtful plants while they are young, and watch the result. Temperature alone is not the criterion, but other conditions, such as the length of the cold, the time of year it occurs, the strength of the sun, the wind, the amount of water received by the plants in the fall, the degree of shelter afforded by the location, and whether the site is on a hill or in a hollow.

"When you go at your gardening, notice those little local differences that may mean the success or failure of a plant that is on the borderline of hardiness." Part of the success of the great English gardens, he said, comes from a knowledge of where to put each individual plant, a knowledge possessed only by gardeners who have worked many years in one garden.

Dr. Wister spoke of the debt the graduating students owed to the New York Botanical Garden. "You can't possibly pay the Garden for all it has done for you," he said, "but you can express your gratitude by passing along the gospel of horticulture, botany, and nature, and by doing splendid professional work.

"There is a solid satisfaction in working with nature," he emphasized, then quoted H. W. Collingwood, Editor, who wrote in the *Rural New-Yorker* more than twenty years ago: "Social remedies will fail till modern men and women get their feet back on the soil."

He said that he felt that a step in the right direction was being taken today in the getting of food from the soil instead of from cans.

"In various communities," he continued, "you can show your neighbors by example what it means to know trees, to love flowers, and to have vegetables from your own garden. Also you can show an interest in street trees, and see that your town or community acquires better parks than it has today. The more money spent on parks, the less will have to be spent on jails. You graduates of these courses can and should go into your own communities and urge more and better parks."

In the brief introductory talk which preceded Dr. Wister's address, Dr. William J. Robbins pointed out that since the Two-Year Science Course for Professional Gardeners was organized in 1932, there have been 890 students participating in the work of the various horticultural courses offered at the Garden, these students registering for 2,671 individual subjects. Including the four being presented that evening, 90 certificates have been given to date in the Science Course alone. In the Two-Year Course in Practical Gardening, 57 certificates have been presented since the first graduation took place in 1940. In addition, student gardeners at the New York Botanical Garden also have studied in this course.

Graduates this year are:

Two-Year Science Course for Professional Gardeners: Vincent Walsh, former student gardener, now with the U. S. Navy; Anne Seaman, gardener; Howard Mayer, former student gardener, now assistant foreman at Woodlawn Cemetery; and Carl Sahlin of Chatham, Mass., also a former student gardener.

Two-Year Course in Practical Gardening: Neil Erickson, John J. Fitzpatrick, and Mrs. Emma Page of Manhattan; Hugh Fiore, Mrs. Jessie Hantman, and Mrs. Ellen Lehmann of Bronx; Peter Haavind and Samuel Weinman of Brooklyn; Mrs. Edna W. Falter of Woodcliff Lake, N. J.; Viola Hafner of Jamaica, L. I.; Mrs. Catherine M. Somers of Jackson Heights, L. I.; and Mrs. Grace Waters of Mt. Vernon, N. Y.

A social hour, with refreshments served in the rotunda, followed the program in the lecture hall.

A. J. Corbett Retires After 43 Years With Garden

A CAREER which has followed the growth and progress of the New York Botanical Garden since the Museum Building was completed in 1900 came to a close the last of June with the retirement of Arthur J. Corbett, Superintendent of Buildings and Grounds. The occasion was recognized with a gathering of members of the staff in the main office on his last day of work.

He is being succeeded by Mr. A. C. Pfander, who as Assistant Superintendent of Buildings and Grounds for the past eight years, has been in charge of outdoor work. Mr. Pfander came to the Garden in 1932 to supervise the construction of the Thompson Memorial Rock Garden.

At the time that Mr. Corbett began his work with the Garden, on October 1, 1900, the Museum was completed but not entirely furnished, and he was personally responsible for the making of much of the sturdy oak furniture—chairs, tables, book-cases, cabinets, and desks—that is still in use. In 1909 he was made Custodian of the building, and in January 1911 he was promoted to the position of Superintendent of Buildings and Grounds.

As Superintendent, Mr. Corbett worked successively under each Director of the Garden. After Dr. N. L. Britton he continued under the directorship of Dr. E. D. Merrill (1930-1935); Dr. M. A. Howe (1935-1936); under Dr. H. A. Gleason as Deputy Director; then under Dr. William J. Robbins from 1937 until his retirement.

For many years the procedure was for him to make the rounds of the grounds with Dr. Britton every day between 8 and 9 a.m. In the early days the two were driven behind a horse by John R. Finley, who served as Foreman on the grounds. Later, when automobiles came into use, Mr. Corbett had the first official car that was used at the Garden, and this greatly facilitated the daily tour of inspection. Regularly at 9 a.m., when the morning trip was over, all heads of departments assembled in the Director's office to organize the details of the day's work.

During his years at the Garden Mr. Corbett was responsible for, among other things, the construction of nearly 20 miles of walks and surfaced paths.

Mr. Corbett has long had the reputation of being the only man who knew, without referring to drawings, where every pipe and wire, not only in the Museum, but over the entire grounds, had been laid. His ready knowledge of these details has been of indispensable aid, especially during recent years, when considerable reconstruction has been done on the Museum Building and the Main Conservatories. Since some of the Garden's area has been given back to the City, the City authorities also have depended on his knowledge and have consulted with him frequently while improving the land.

Mr. Corbett will reach his 75th birthday on August 6, and his good health and characteristic vigor have remained with him all these years.

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.)

An Invitation to the Plant World For the Intelligent Layman

THE GREEN EARTH. An Invitation to Botany. H. W. Rickett. 353 pages, illustrated with drawings by the author. The Jaques Cattell Press, Lancaster, Pa. 1943. $3.50.

Frankly aimed at the layman, this book by Dr. Rickett does not belie the promise contained in its subtitle "An Invitation to Botany." It is more than a mere invitation; it strikes me, rather, as the wide and sweeping opening of a door to enter, to share with the author a fascinating glimpse of a world whereof the economy and secret functioning we are just beginning to understand, though for centuries we have been familiar with its outward and visible manifestations.

The author does not insult the lay reader's intelligence by assuming *a priori* that he is an ignoramus, unfamiliar with the general principles which underlie science and its terminology. With that premise, he lets himself go into highly technical, yet always clear, expositions of the inner workings, the whys and *hows* of plant behavior, as well as the ways of the modern research worker to discover the hidden causes that produce some known effects. Osmosis, heredity, and tropism, for example, are interestingly and clearly treated, and the interdependence of the various forms of plant life is handled with lucid exposition.

Of particular interest are the chapters devoted to the strange life cycles of ferns and mosses, a circumstance that is all but unknown to the average layman. Those forms of life are so fascinatingly treated that it makes one wish to know more—a great deal more. The author's fine pencil drawings throughout the book further contribute to the reader's understanding.

The book has two grave faults. When referring to a particular discovery or experiment, the author only occasionally refers to his source; a footnote, at least, should declare the name of the individual responsible, and, more important, provide a source reference for the student who might want to pursue the subject further. Also, the lack of an index in a book of this sort (and written by a bibliographer at that!) is *INEXCUSABLE.*

As scientific literature, I would rank it high. Dr. Rickett writes with a style that should be a model of its kind. Not only are his expositions of many abstruse processes clear and understandable, but his occasional discursive wanderings into other fields and his own philosophical asides, especially, are beautifully and often poetically expressed. His is, indeed, the gift of the felicitous phrase.

ADRIAN VAN MUFFLING.

Industry, Civilization, and Paper

PAPERMAKING. The History and Technique of an Ancient Craft. Dard Hunter. 398 + xxiii pages, 162 halftone illustrations, bibliography, notes, and index. Alfred A. Knopf, New York, 1943. $4.50.

The Egyptians wrote on papyrus; the Singhalese scratched their curved characters on palm leaves; North American Indians did their picture writing on birchbark or on skins; and others among the ancient or primitive peoples of the world have used blocks of wood, stone, clay tablets, metal, parchment, strips of bamboo, and "rice-paper" (made not from rice but from the inner pith of *Tetrapanax papyriferum*)—but none of these is true paper. The first actual paper—that is, paper manufactured from *macerated* fibers, directly or indirectly derived from plants—was developed by a Chinese eunuch, Ts'ai Lun, in about 105 A.D. It was, of course, made entirely by hand. For his invention, honors and riches were heaped upon him by the court during his life and for at least five centuries after his death.

It took the western world a thousand years to acquire the art of papermaking, and for seven centuries more, paper all over the world continued to be made by hand. Then, around 1800, Nicholas-Louis Robert, a young inspector in a French paper mill, devised a machine for the manufacture of paper. Honors were heaped upon him too—but he apparently died dissatisfied and in poverty. Even the English stationers, the Fourdrinier brothers, who improved Robert's machine to make it practical, suffered great financial loss.

Dr. Jacob Schäffer, the German clergyman who is largely responsible for the first experiments in the Occident with plant fibers other than flax or cotton for paper, derived little more than a modest acclaim for his inspired work.

Today, as a result of the use of wood-pulp (and occasionally other fibers) and the easy, rapid manufacture of paper in great mills, the United States produces approximately 15,000,000 tons of paper annually.

Between these gleanings from some of the first, middle, and last chapters of Dard Hunter's book, there is an absorbing history of civilization and industry tied tightly in with the story of papermaking. The abundant illustrations and footnotes almost tell the story in themselves, but the casual reader can not remain casual long; the text itself is too engrossing.

At the end of the book there is an enlightening chronology concerning paper and its uses, covering 64 pages.

CAROL H. WOODWARD.

Informative and Whimsical

BIOLOGY—Season by Season. Sr. Mary Anthony Payne. 675 pages, illustrations, index and glossary. American Book Co., New York, 1942. $2.32.

The illustrations in this text are not only informative but also decorative and often whimsical. The age of reptiles is magnificently suggested in color; among others in color the team of huskies in the snow deserves special mention. Elsewhere a pair of pine cones exchange notes on their incipient dormancy. "Digestion begins in the mouth"—and the figure shows the bill of a pelican. To illustrate a chapter on control of pathogenic bacteria we are shown "a long sore throat"—of an ostrich. On another page three lion cubs crouch in fear before a woolly lamb. These must enliven the dullness of scheduled studies. For such mercies we may forgive the numerous minor errors, which are inevitable in the encyclopedic treatment fashionable in schools today. The book is attractively designed and well printed, and contains a wealth of informative and interesting detail.

H. W. RICKETT.

The Latest in Biochemistry

TEXTBOOK OF BIOCHEMISTRY. Benjamin Harrow. 3rd ed., revised. 537 pages with 118 illustrations, appendix, index. W. B. Saunders Co., Philadelphia, 1943. $4.

This useful biochemistry text is designed for the general student as well as for the medical student. The chapters of the second edition have been revised and a new chapter on immunochemistry and chemotherapy has been added, emphasizing the sulfa drugs, arsphenamine, and the bacteriostatic agents produced by bacteria and fungi.

F. W. KAVANAGH,
University of Rochester.

Current Literature At a Glance*

Pest Prevention in Reverse. Many pests can be prevented from damaging crops in victory gardens if they are not allowed to enter the garden in the first place. To keep them all away would be quite impossible, but a number of practical tips are given by the Connecticut Agricultural Experiment Station at New Haven in a new free circular, No. 155, "Controlling Pests of War Gardens." One means of keeping the pests away is to raise vegetables which are seldom afflicted with troubles. Another is to outwit the pests by growing crops at seasons when the ravagers are inactive. Many

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

other wise suggestions are offered, among them the necessity for clean cultivation and removal of all weeds, as was emphasized also by Dr. B. O. Dodge in the Garden's Journal for May.

New Vegetables for England. Eleanour Sinclair Rohde is a devotee of unusual vegetables, and she suggests a number of little known new and old ones for British gardeners in a recent number of *The Guild Gardener.* Squash, especially for making squash pie, she recommends instead of the usual vegetable marrow grown in England. Roots of Hamburg parsley, she says, make a good winter vegetable, or they can be grated raw and added to a salad. The blue coco bean, robin bean, Jersey bean, and the pea bean with edible pods are others on her list, which she presents with a number of recipes. Scorzonera (salsify) has been renowned for centuries, she says, for its effect on chronic indigestion.

Calcareous Algae. An annotated bibliography of 72 pages is presented by J. Harlan Johnson in the first Quarterly of the Colorado School of Mines for 1943 in a subject that has been of importance to the New York Botanical Garden through the work of the late Dr. Marshall A. Howe. In the few pages of text that precede the listing of literature, the author tells of the importance of the lime-secreting algae in building up "coral" reefs, large sections of mountain ranges (in the Tyrol, for example, also in New Mexico, California, Pennsylvania, and other places), and in forming "future strata of the earth's crust."

Giants Among Trees. A list of big trees compiled by the American Forestry Association has been published in the March and April numbers of *The Arborist's News.* The smallest of the "big trees" reported is a witch-hazel with a trunk circumference of 1 foot 1 inch and a height of 22 feet. It is in Dunes State Park, Ind.

Chinantla. The spring number of *Chronica Botanica* has as a frontispiece a previously unpublished sketch by F. M. Liebmann showing the foothill vegetation in a narrow pass in the Chinantla region of northeastern Oaxaca, made about 1850 for his unfinished account of the palms of Mexico.

Asters. Five new members of the Asteraceae, collected in Oaxaca by Dr. W. H. Camp in 1937, are described by S. F. Blake in the Proceedings of the Biological Society of Washington, Vol. 55.

More Asters. Arthur Cronquist presents in the March number of the *American Midland Naturalist* a revision of the western North American species of *Aster* centering about *Aster foliaceus* Lindl., which he regards as the most primitive species of the group. The account is condensed from the master's thesis he prepared at Utah State Agricultural College.

Redwood Flora. Some of the trees, shrubs, and flowers of the Redwood region in the West are described in a 16-page leaflet by W. L. Jepson, published at 10 cents a copy by the Save-the-Redwoods League.

Asia and America. The similarity between the geology and climate of eastern Asia and eastern North America explains the similarity in the flora of these two regions and the ease with which eastern Asiatic plants can be transported to new homes in eastern North America, writes John M. Fogg, Jr., in the Morris Arboretum Bulletin for August 1942.

Insect Control. C. H. Curran of the American Museum of Natural History, has prepared a booklet for victory gardeners telling them how to get rid of the pests that infest their vegetables. It is published as the Museum's Science Guide No. 117.

Gardening for Five. Using a plot of ground 25 x 100 feet, Henry Teuscher, Curator of the Montreal Botanical Garden, has developed a vegetable garden with crops for a family of five. The complete plan, with alternative suggestions for some of the crops, and discussions of crop rotation, insecticides and fungicides, and herbs and their uses for seasoning, is given in a booklet published by the Montreal Garden in the spring. Useful tables for sowing, harvesting, and preserving are included, also recipes for some of the less familiar vegetables. "To raise more vegetables than one can use means a waste of time and labor, as well as of seeds," is the wise advice of this booklet.

Notes, News, and Comment

Mission to Mexico. Dr. H. W. Rickett left the last day of June for a four months' trip to Mexico under the auspices of the Committee for Inter-American Artistic and Intellectual Relations. The United States Government funds provided for his mission south of the border are made available through the Coordinator of Inter-American Affairs.

Editor and Fruit-Grower. After 11 years in the service of the New York Botanical Garden, P. J. McKenna, who as Foreman Gardener has been the chief assistant to the Horticulturist in recent years, left on July 7 to devote his time to editing, writing, lecturing, and fruit-growing. He has been named an Associate Editor of *Home Garden* magazine, of which F. F. Rockwell is Editor-in-Chief and Robert S. Lemmon is Managing Editor. In addition to his work with the magazine, he plans to lecture on gardening subjects and to undertake the commercial culture of fruits near the New York market. Mr. McKenna was a member of the first graduating class in the Science Course for Professional Gardeners in 1934. He has been teaching regularly in the Garden's practical gardening courses, and has given many individual lectures. Before coming to the Botanical Garden in 1932, he was superintendent of a private estate at Bayport, L. I., and during that time he attended a number of short courses at Cornell University.

Radio. After the Journal for June was on the press, the day and hour for the New York Botanical Garden's two forthcoming broadcasts over WNYC were changed. The July program then was scheduled for Friday, July 16, at 3:30 p.m. and the August one for Friday, August 20, also at 3:30.

Fellowships. Dr. Margaret Fulford of the University of Cincinnati is spending the summer at the New York Botanical Garden, continuing her work in the taxonomy of tropical American hepatics. She is here as the first recipient of the Marshall A. Howe Fellowship, established this year through a gift of Mrs. Elon Huntington Hooker for research in Cryptogams. Dr. Fulford is accompanied by Gladys Carroll, who has been working with her during the past year on the problem of regeneration in the leafy liverworts under a fellowship from the American Philosophical Society. Miss Carroll received a master's degree from Cincinnati in 1941 and worked last year on a graduate fellowship at the University of Tennessee.

Technical Assistant. Arthur Cronquist arrived June 15 at the New York Botanical Garden to become a Technical Assistant on the taxonomic staff. He was a student of Dr. Bassett Maguire at the State Agricultural College of Utah, where he received a B. S. degree in 1938 and an M. S. in 1940. Since then he has been working toward his Ph.D. at the University of Minnesota. At the Garden he is spending part of his time working on tropical plants of economic importance under B. A. Krukoff.

Mrs. Jonathan Bulkley. The Advisory Council lost a member of 22 years' standing in the death on June 21 of Mrs. Jonathan Bulkley of Mt. Kisco and New York. She had been elected to membership in the group on Feb. 20, 1931. Two years later she was elected to the Corporation of the Garden.

Advisory Council. Mrs. Henry S. Fenimore Cooper of New York City was elected a member of the Advisory Council of the Garden by the Board of Managers on May 27. Another recently elected member is Mrs. Rodney Procter, also of New York City.

Visitors. On a few weeks' furlough from their wartime exploration for cinchona in the South American wilds, Drs. William C. Steere and F. R. Fosberg both visited the New York Botanical Garden for a few days in early June. Dr. Fosberg was to return at once to Colombia, while Dr. Steere expected to continue his work in Ecuador.

Professor Marie-Victorin, Director of the Montreal Botanical Garden, also passed several days at the Garden in mid-June on his way from Cuba to Montreal.

Mrs. M. Alice Cornman of San Diego spent about a week studying ferns.

Other visitors of the month included Drs. W. C. Coker of the University of North Carolina; Dow V. Baxter, University of Michigan; L. C. Petrie of Cornell; David R. Sumstine, Carnegie

Museum; M. L. Fernald of the Gray Herbarium; and Norman C. Fassett, University of Wisconsin; also Oscar W. Richards of the Spencer Lens Co., Buffalo, and M. D. C. Crawford, Fairchild Publications, New York City.

Sigma Delta Epsilon. Dr. Roberta Ma is the new president of the New York (Kappa) chapter of Sigma Delta Epsilon, graduate women's scientific fraternity. At the meeting May 14, when the officers were installed, she spoke on "Vitamin Deficiencies in Fungi." Dr. Mary Bartley Schmitt addressed the group on "Vitamin Deficiencies in Tomato Roots."

Addresses. Dr. Ralph R. Stewart spoke before the New England Botanical Society at Harvard May 7 on "Plants of Kashmir." G. L. Wittrock addressed the Men's Club of the Bedford Park Presbyterian Church May 14 on "Dye Plants of the American Indians." Elizabeth C. Hall showed the Garden's motion picture before a group of retired librarians from the New York Public Library at the Women Engineers' Club May 19 and on May 20 she spoke on "Garden Books" before the garden section of the Hollis, Long Island, Women's Club.

Mosses. Mrs. Inez M. Haring of Poughkeepsie returned there last month after spending several weeks working on the collections in the Elizabeth Gertrude Britton Moss Herbarium.

Microscopes. At the meeting of the New York Microscopical Society May 7, Robert Hagelstein spoke on the "History of the Microscope," and his talk was illustrated with examples from the Botanical Garden's collection which depicts the development of this instrument from the time of van Leeuwenhoek to the present day. Paul Rittenhouse, who lectured on photography this spring at the Garden, was in charge of the meeting.

Committee. Dr. William J. Robbins was appointed a member of the national committee for the celebration of the Copernican Quadricentennial, which took place at Carnegie Hall, New York, May 24. Dr. Harlow Shapley, Director of the Harvard Observatory, was the chairman. Committee members were chosen from the nation's universities, colleges, and other educational institutions by the Kosciuszko Foundation, which sponsored the celebration.

Squash Blossom. The cover illustration this month is taken from a lithograph by Miss Elizabeth Saltonstall of Chestnut Hill, Massachusetts. It was exhibited last year at the Institute of Modern Art in Boston, from where it went to the permanent collections in the Library of Congress. It is reproduced here by courtesy of the artist.

Charles O. Dexter

THE hybrid rhododendrons which have been planted in recent years near the northern end of the Rock Garden stand today as a memorial to their donor. Charles O. Dexter, who presented much of this large collection to the New York Botanical Garden in 1940, died on April 14. Most of the plants were hybrids created by Mr. Dexter himself.

At his home at Shawme Farm, Sandwich, Mass., he had one of the country's finest private collections of rhododendrons and other ericaceous plants, among them many rare species. His special interest was the development of large-flowered fragrant hybrids, chiefly of *Rhododendron Fortunei.* Though this group has often been considered not especially hardy, those at the Garden survived the difficult winter of 1942-43.

For his outstanding work in the hybridization and propagation of rhododendrons, Mr. Dexter was awarded the Jackson Dawson Memorial Medal in 1932 by the Massachusetts Horticultural Society.

The plants that he gave to the New York Botanical Garden form the nucleus of an ever growing collection, which is planned as a major feature of the grounds in years to come. With gifts from others, the planting has already been extended from the glade north of the Rock Garden along the edge of the Hemlock Forest as far as the Boulder Bridge. The roadway which they border has come to be known as Burma Road.

Mr. Dexter was elected a Life Member of the New York Botanical Garden in 1940 by the Board of Managers, in recognition of his gift to the institution.

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.

MEMBERSHIP IN THE GARDEN

Established as a privately endowed institution, aided partially by City appropriations, The New York Botanical Garden is dependent for its progress largely upon benefactions and memberships. Through these means, though young as botanical gardens go, it has become the third largest institution of its kind, its library, herbarium, and horticultural collections ranking among the finest and most complete in any country.

Membership in The New York Botanical Garden, therefore, means promotion of scientific research in botany and the advancement of horticultural interests. Scientifically, the Garden is able to serve as a clearing-house of information for students and botanists all over the world; horticulturally, it often serves as a link between the plant explorer or breeder and the gardening public.

Through memberships and benefactions, provision is made at the Botanical Garden for the training of young scientists and student gardeners; hundreds of new books are added annually to the library, which is open daily to the public for research and reading; free exhibits are maintained in the museum, the greenhouses, and gardens, and lectures, courses, and free information in botany and gardening are given to the public.

Each individual member of the Garden receives:

(1) A copy of the Journal every month.

(2) A copy of Addisonia once a year, each number illustrated with eight colored plates of unusual plants, accompanied by descriptions.

(3) A share of surplus plant material of interesting or new varieties whenever it is distributed.

(4) Announcements of special floral displays, programs, lectures, and other events at the Garden.

(5) Credit to the amount of the membership fee paid, toward courses of study offered by the Garden.

(6) The privilege of borrowing lantern slides from the Garden's collection.

(7) Use of the Members' Room in the Museum Building.

A limited number of garden clubs are accepted as Affiliates. The privileges of affiliation are one lecture a year by a member of the staff, a share in the distribution of plants when they are available, a subscription to the Journal and to Addisonia, and announcements of special activities at the Botanical Garden. In addition, any member of an affiliated club may receive for the current year of membership a reduction of $5 in the fees paid for instruction. (This does not apply to the course for professional gardeners.) An Affiliate Garden Club may borrow lantern slides from the Garden's extensive collection, such loan being subject to the regulations for the use of lantern slides by individual members. Likewise, an affiliate club may engage without fee the Members' Room at the Garden for its meetings.

The classes of membership are as follows:

Annual Member	annual fee	$ 10
Sustaining Member	annual fee	25
Garden Club Affiliation	annual fee for club	25
Fellowship Member	annual fee	100
Member for Life	single contribution	250
Fellow for Life	single contribution	1,000
Patron	single contribution	5,000
Benefactor	single contribution	25,000

Fellowships or scholarships for practical student-training in horticulture or for botanical research may be established by bequest or other benefaction either in perpetuity or for a definite period.

Contributions to the Garden may be deducted from taxable incomes. The following is a legally approved form of bequest:

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

Conditional bequests may be made with income payable to 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, N. Y.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 524

AUGUST
1 9 4 3

PAGES
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A ROSARIAN'S PROPOSAL

ENJOYMENT of the rose is part of the heritage of our race, yet this fragrant and lovely flower occupies a precarious place in our American culture.

We can recount the building of several extensive and valuable collections of roses, lovingly assembled and intelligently cared for, each throughout the lifetime of one man, only to be lost soon after his death. If such a garden could be perpetuated, it would have immeasurable value as a reference collection and as a source of material for rose-breeding. At the same time, it could be a spot of beauty for the public to enjoy.

A large collection of roses, kept in fine growing condition, deserves an adequate financial foundation in order that the generations that follow us may not, through our neglect, be denied the knowledge and beauty which it is our privilege and responsibility to pass on to them. Yet, individuals can scarcely be expected to support indefinitely such a museum of living specimens, and neither can commercial firms be counted upon to take the long view into the future and provide for the permanence of their plantings.

Therefore, to avoid the loss of rare and precious varieties of this important group of plants, and to conserve the positive gains which each generation of human beings makes in the study and culture of roses, an institution is needed with sufficient support provided to continue such a collection in perpetuity. In performing such a public service, an institution thus becomes the lengthened shadow of a man, carrying on his work beyond the point where he, as a mortal being, can go.

The succession of curators who would head a permanent rosarium should be capable men with highly specialized training. Where could they better gain their needed background than at an institution where an extensive rose collection has already been established? There, while some men were being prepared for direction of the great future rosarium itself, others could be trained for the leadership that is also needed in the increasing number of America's municipal rose gardens.

The New York Botanical Garden already has a splendid rose garden, which, it is hoped, the institution always will maintain. *It is therefore proposed that an endowment be set up at the New York Botanical Garden that shall provide periodically for a scholarship for the advanced study of roses,* this scholarship to be competed for by qualified candidates from the national or international field.

ROBERT PYLE.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

CAROL H. WOODWARD, Editor

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | AUGUST 1943 | NO. 524

Creator of Puffed Cereals—And Benefactor of Science

The Life Story of Alexander P. Anderson, Who Made His Famous Discovery at The New York Botanical Garden

By Carol H. Woodward

ON a shelf in the Members' Room at the New York Botanical Garden, there stands a small square oven bearing a placard which reads in part:

DISCOVERY OF PUFFED WHEAT

Puffed starch, puffed rice and puffed wheat were discovered at the New York Botanical Garden with this oven by Dr. Alexander P. Anderson, December, 1901.

The discovery was not accidental but the result of a prearranged experiment on starch granules. Dr. Anderson, then a student working in the laboratories of the New York Botanical Garden, was investigating the effect of confined heat and pressure of starch. As part of this investigation he heated starch grains of wheat and other cereal grains in sealed glass tubes in this oven to a temperature of 400°F. and a pressure of 200 pounds per square inch. The tubes were then taken out of the oven and with suitable precautions cracked while still hot with a hammer. The sudden release of pressure exploded the wheat grains to several times their original size, while the grains still retained their original shape.

The commercial products which resulted from these experiments made it possible for Dr. Anderson to endow the New York Botanical Garden with a fund of $10,000 for research and fellowships, and to promise an additional $15,000, of which $2,500 was paid in January, 1942.

Dr. Anderson died at the age of 80 on May 7, 1943, while spending the season in Florida.

His experiments with starch grains, carried on at the New York Botanical Garden, were the result of a dream of many years, engendered while he was studying at the University of Munich, hearing lectures on the Meyer theory of starch by Dr. K. Goebel. After receiving a Doctor of Philosophy degree from Munich in 1897, he returned to America with the hope of finding a position that would enable him to pursue his research while he was earning a living. This opportunity did not come until 1901 when he was offered a post at Columbia University in the Department of Botany, with the privilege of using the laboratory at the New York Botanical Garden. Dr. M. A. Howe, who was then an Assistant Curator at the Garden, used to recall how he would remain evenings at his office while young Anderson worked alone in the third floor laboratory, and he would tell of the loud explosion that occurred when those first sealed test-tubes of heated starch were smashed by Anderson's hammer.

Within a few years the humble young man who had worked his way through college was both wealthy and famous as the result of his experiments.

Boyhood on a Minnesota Farm

Dr. Anderson was born in a primitive prairie home near Red Wing, Minn., on November 22, 1862, of Swedish immigrant parents, John and Britta Anderson. He was the sixth of seven children.

From the time he was old enough to read until he was 18, he simultaneously attended the district school and worked on his father's farm. At 19, having passed the State examinations, he taught in the same school to earn the money for a year at the University.

One year was all he could manage at the time, however, for his money gave out and his father needed his help back on the farm. So for several more years he taught in a country school near his home, walking six miles a day back and forth (a total of 5,000 miles on foot during those years, he once figured), and at the same time he worked in the fields (walking up and down another 5,000, he estimated).

After the death of his parents he returned to the University in 1890,* making his way by carrying papers, mowing lawns, and tending furnaces so successfully that, with the help of a scholarship, when he was granted his Master of Science degree in 1895 he had $600 in the bank. With this as a nucleus, he borrowed enough more to carry him to Munich for a year, where he received his Ph. D.

* During his student days at Minnesota, the University published the results of an ingenious study that he made of the growth in weight of a pumpkin by training the vine into the laboratory and resting the fruit in the scale-pan of a self-registering balance.

For a few months, after his return from abroad, he did some research at the Missouri Botanical Garden, then in January 1897 he went to South Carolina to teach botany at Clemson College, which had been established only a few years previously. Except for the year 1899, which he spent at Minnesota as Associate Professor of Botany, he remained at Clemson until 1901. During his second year there he was married at Highlands, North Carolina, to a Glasgow girl of Scottish-Swedish descent, Lydia McDougall Johnson.

At Clemson there was not much opportunity to work, as he had hoped to do, on the Meyer starch granule theory, which he had heard so much about in Munich. So the offer to become Curator of the Herbarium at Columbia University was an open door to his ambitions and dreams, for it also meant that he could do research at the New York Botanical Garden.

His Experiments Described

The story of his investigations is told in "The History of the Quaker Oats Company" by Harrison John Thornton, published in 1933 by the University of Chicago Press.

"Anderson quickly developed his opportunities, and, in December of 1901, undertook an experiment with the object of resolving his old perplexity as to the nature of the starch granule with reference to its free and hygroscopic moisture. Of the actual outcome of that experiment he had not the faintest preconception, his thought being that by exploding the starch granules by means of their own moisture he would secure a product similar to cooked starch.

"For his experiment he took six test tubes, each 4 inches long, and about ¼ inch in diameter. Three of the tubes he filled with cornstarch, and three with wheat flour. All of the tubes were then hermetically sealed and placed in an oven, whose temperature was maintained at about 500°F., and heated from 5 to 10 minutes until the visible contents of the tubes began to change in color from white to a slight yellowish brown. One by one the tubes were withdrawn from the oven and cracked with a hammer, inside of a wire screen, before any cooling took place. The breaking of each tube produced a sharp explosion. The contents of one of the tubes containing the cornstarch, it was observed, had been expanded to some ten times the original volume. Examination showed that all the cornstarch granules had been exploded and disrupted to such an extent that in reality no starch granules remained; in their place was a porous puffed mass, white as snow. The persistent scientist now considered his old problem solved, being satisfied that free, or condensed, water in the starch nucleus, unable to escape during the heating period because of the pressure, had flashed into steam at the moment of the explosion, and shattered the starch granule. 'Thus,' reminiscently writes the professor, 'cornstarch was the first puffed product made.' There followed immediately great activity among the grains and test tubes, and much exploding and puffing. Rice was treated in the same way. Likewise, wheat, barley, buckwheat, millet, and many more grains. Almost every known seed was subjected to the heating-exploding process during that winter of 1901-2 in the laboratories of the New York Botanical Garden."

A footnote to the Thornton story indicates the attention accorded the young scientist in New York. It says in part: "The director of the Gardens, Dr. N. L. Britton, and the director of the laboratories, Dr. D. T. MacDougal, displayed much interest in Anderson's work, freely placing room and equipment at his disposal."

In the annual reports of both these men published in the Bulletin of the New York Botanical Garden in 1902, reference is made to Dr. Anderson's work with starch grains.

He was also, evidently, dipping into plant pathology, for, according to the Bulletin for 1901 (p. 265), he had been doing research on a disease of conifers, and during the year he had presented a paper on the subject. In addition, two notes in the Journal for January 1902 speak of him as participating in the Botanical Garden's investigations in plant diseases.

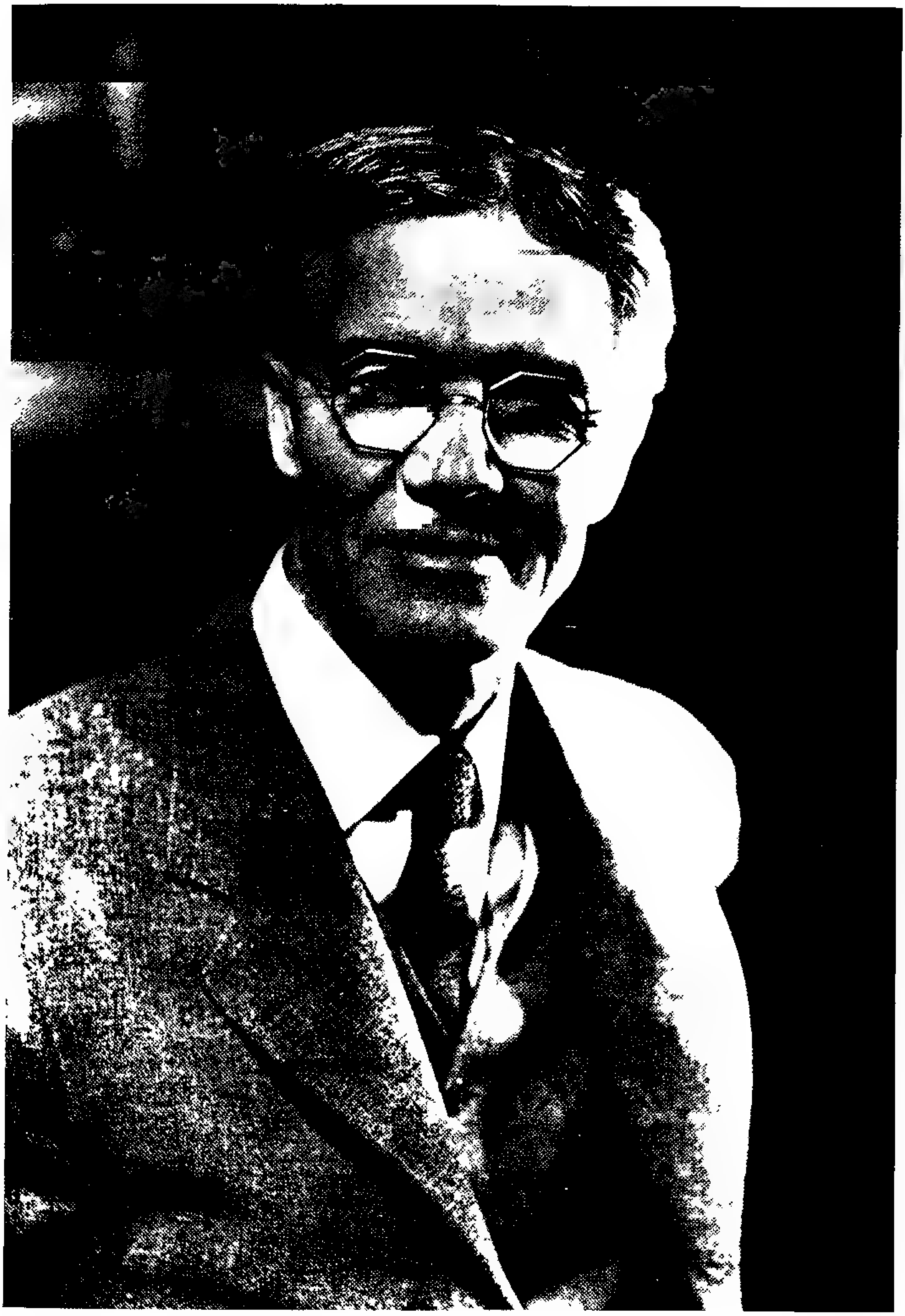
Farewell to the University

The fact that he felt he had found an answer to the question on starch that had been uppermost in his mind since his days in Munich spurred the young scientist on to more extensive research. At the same time he realized at once the economic possibilities of his discovery, and soon his university days were over. In August 1902 the Journal of the New York Botanical Garden announced that various members of the staff would co-operate with investigations in the several subdivisions of plant pathology, adding: "The position formerly held by Dr. Anderson in Columbia University is now filled by Dr. Tracy Hazen, who will participate in directing investigations on the morphology and taxonomy of the algae."

It was not until September, however, that the notice of his resignation appeared, saying: "Dr. Alex. P. Anderson has resigned his position of curator of the herbarium of Columbia University, and has taken up his duties as expert to the syndicate now engaged in developing the new method of treating starchy grains, etc., recently discovered by Dr. Anderson in the laboratories of the Garden. Dr. Anderson is fitting up a special laboratory for the continuance of his work at Minneapolis."

"The elated professor," Mr. Thornton continues in his history, "believing the result to have commercial value, now proceeded to secure patents on his processes, and to seek opportunities for industrial production. He went to Minneapolis in the spring of 1902 and interested a group of men who agreed to finance further work. A special retort, 4 inches in diameter, and 36 inches long, and a special oven for heating it, were made at the plant of the Minneapolis Steel and Machinery Company, where, also, experimental work was carried out. Anderson using rice rotated the retort while it was being heated, working up the pressure as one after another the attempts to duplicate the test tube puffing failed. The exploding of the retort was a crude and hazardous process. His personal participation and interest came close to termination when, on one occasion, the head blew off and struck him dangerously, but he went on increasing the pressure and wielding the sledge. Presently, he found the combination, and out of his retort, following the steam and the roar, came a shower of perfectly puffed rice, each berry shattered within but unbroken without.

"On that very day, so it happened, Henry P. Crowell, Robert Stuart, and Walter D. Douglas were in Minneapolis to consult with interested groups in respect to these activities. The outcome of negotiations was an agreement between the Quaker Oats officials and Mr. Anderson providing for further experimentation, large-scale production, and marketing. The company's plant at Sixteenth and Dearborn Streets, Chicago, then became Anderson's laboratory, with the mills at Cedar Rapids and Akron co-operating. Out of the test tubes and the slender retort finally evolved what have properly been called guns, a muzzle-loading cannon of murderous caliber that



ALEXANDER PIERCE ANDERSON
1862-1943

would have been in place on a colonial frigate, or a ship of the line. From the loading chamber these are deftly moved on carriages to the ovens into which they are pushed for heating and rotation. While in the ovens, high-pressure, superheated steam is injected into the guns. This steam prevents the oven heat from driving off the moisture in the grain which is essential to the puffing, and serves also to put pressure behind the cap sealing the muzzle, thereby assisting in rapid explosion when the cap is removed. This process completed, the guns are withdrawn and moved by the carriage to what might be termed the exploding chamber. Into this they are pointed, the end caps removed, and the grain 'shot' out like a blast of canister."

The First Published Report

A brief article appeared over Dr. Anderson's name in the Garden's Journal for May 1902, explaining the work he had been doing. Under the title "*A New Method of Treating Cereal Grains and Starchy Products,*" it said:

"The cereal grains including wheat, rice, barley, oats, maize and rye form a most important part of the food of the human race. The chief value of the cereals lies in the starch which they contain, which may amount to as much as 50 to 80 per cent, of the weight of the dried kernels.

"Starch occurs in plants in the form of globose, ovoid, and oblong bodies of rounded outline, the exact shape assumed in any plant being more or less characteristic of the species. Almost any growing green plant will be found to contain starch grains in all stages of formation from the most minute to the maximum size. Those of the potato often attain a diameter of a hundredth of an inch, being visible to the naked eye. An examination of the granules with a magnification of a few hundred diameters shows that they are constructed of concentric layers or coats of alternating denser and watery layers, the centrum around which the layers are arranged being of the latter character. The granule contains from 15 to 22 per cent of water when in an air-dry condition. Investigation of these interesting bodies with reference to their formation shows that they are really built up like crystals, being in fact sphaero-crystals.

"Starch granules when intact are acted upon but slowly by chemicals, especially the digestive enzymes. Consequently starchy substances are made more suitable for food by cooking or some method of treatment by which the granules are broken up. When starch granules are warmed in water they begin to swell up at a temperature of 55° to 60°C., and burst at 75° to 80°C., being converted into a uniformly translucent mass known as starch paste in which the minute particles are suspended in the water, but are not dissolved.

"It is well known that starch grains do not swell or break up to any great extent when heated in an air-dry condition at the temperatures employed in bread-making by ordinary methods. Although bread is one of the oldest and most widely used food preparations yet it is by no means to be considered as an economical use of starch since the granules in the center of a loaf are practically unchanged and therefore digestible only with great difficulty. The desired changes do ensue to some extent in the crust, but in prevailing methods of preparation the proportion of the whole amount of starch present made available for rapid digestion is very small.

"As a result of almost continuous work during the past year I have been so fortunate as to develop a method by which, with the application of heat to starch grains and to air-dry starch in many forms, the granules or particles are expanded to many times their original dimensions, being fractured into innumerable fragments during the process. As a result of this treatment a grain of rice is expanded to eight or more times its original volume, while still retaining its original form. Other cereals exhibit similar behavior. The process is applicable to nearly all starchy seeds and starchy substances, greatly increasing their nutritive availability. The products obtained are pleasant to the taste, and the process may be varied to produce a great variety of flavors with any given cereal. Furthermore the material prepared in this manner is absolutely sterilized and may be preserved or stored for long periods. I am led to hope from the approval the products have met from food and chemical experts that the process may prove of great economic and commercial value.

"The experiments by which this method was developed were begun at Clemson, South Carolina, in the spring of 1901, but no results of any direct bearing upon the process mentioned were obtained at that time. Upon my removal to Columbia University in August, 1901, time was afforded me to resume the investigations, and in the Laboratories of the New York Botanical Garden every facility was given me for the prosecution of the work. I am indebted to the latter institution for the use of a chemical laboratory which was placed at my disposal and for a plentiful supply of material of all kinds as well as for encouragement and helpful suggestions from the members of the staff.

"In view of the fact that I have received letters making claims in connection with the results attained above, and also that many unauthorized newspaper notices have been published in which the facts are incorrectly reported I take occasion to say that I have never heard a lecture on 'pop corn' or any other subject which suggested the investigation noted above and that the principles used in the process were discovered directly in my own experiments, being entirely different from the 'popping' of corn or other grains. The above note is the first statement I have made for publication upon this subject, and I do not hold myself responsible in any degree for the various sensational and misleading newspaper reports that have appeared purporting to describe the methods used."

"Food Shot From Guns"

People who can remember the World's Fair in St. Louis in 1904 can perhaps recall the "food shot from guns," and the bags of puffed rice that were sold like popcorn to the visitors. It was not until the following year that puffed rice was put into its "proper" class as a breakfast cereal.

Two years later, puffed wheat was added to the Quaker Company's products, originally under the name of "wheat berries," but it did not go well. The man who from this point on directed the advertising campaign for puffed wheat and rice considers the eventual success of these two products as one of the triumphs of his advertising career. Later, through Dr. Anderson's further research, "crackels" made of wheat, corn, and oats combined and "puffed" were put on the market by the same company.

Dr. Anderson worked for many years at the Quaker Company's Laboratories in Chicago, testing not only starch grains under high heat and pressure, but also wood, clay, and even bacteria, these last experiments being, however, finally carried on by other investigators. Fifty volumes comprising 12,000 hand-written pages form the record of some 15,000 experiments he performed over a period of 35 years.

From 1917 on, his work was carried out in his own private laboratory, called Tower View, at Red Wing, where he established himself in a new home near the old farm of his boyhood.

During all his years of active research, his wife maintained a close interest in his accomplishments and often worked with him. She was his constant companion. When he decided in 1928 to present a research fund to the New York Botanical Garden in appreciation of the privileges that had been accorded him there as a young investigator, he did not have it put in his name alone, but also in that of his wife, and it became the Alexander P. Anderson and Lydia Anderson Research and Fellowship Fund. Originally $10,000, the fund was increased to a tentative $25,000 through an agreement made with the Garden in 1936. Dr. Anderson also endowed scholarships at Minnesota and at Clemson, besides establishing a children's home, with 400 acres of ground, including farm buildings and a residence, adjacent to his Minnesota home.

In 1937 Dr. Anderson was awarded the Charles Reid Barnes honorary life membership by the American Society of Plant Physiologists. He was also a Fellow of the A.A.A.S. and member of the Minnesota Academy of Science; Minnesota Society of Geologists; Minnesota Horticultural Society; Minnesota Historical Society; Goodhue County (Minn.) Historical Society; and a Founder and Life Member of the Highlands, N. C., Museum and Laboratory.

During the years that Dr. Anderson was busy working in his laboratory he had an overwhelming desire to write a book—not a scientific treatise, but a book to sit down with and enjoy a page or two at a time. The book appeared in 1941, and the foreword best explains the desire and purpose he had in preparing this volume of short stories and verses, many of which hark back to the days of his childhood and youth, but some of which were inspired as recently as the summers he spent in Hawaii during the latter part of his life.

"When a pupil in that one-room schoolhouse, at the time when the McGuffey's Readers were used in most all country schools, I had advanced from the First to the Third Reader. I sat in my seat and looked at the big boys and girls reciting in the Fifth and Sixth. I looked at them and wondered if I would ever know enough to study the Sixth. To me that would mean that I would know all there was to know.

"As years went by, I, too, finished the Sixth. I then had an ambition to go up through the Seventh Reader. I soon found out there was none. . . .

"I even thought that if I knew more, I could write a Seventh Reader myself, one for myself to read. It never occurred to me that anyone else would ever want to read it. Nor did I think, even for a moment, that I could write one as good as the McGuffey's series. No, not even now.

"This *Seventh Reader* is, therefore, the result of a lifelong desire. Naturally, my first idea was to make it a 'big book,' that is, larger in size than the Sixth of McGuffey fame. . .

"Perhaps some stray reader who lived in town trotted off to school, too. You, too, studied the Sixth. Perhaps now you would like to read the Seventh.

"The Reader is not intended to be of a classical nature. Rather, I hope that it is simple and of the kind we children out there liked to read and recite in that little one-room schoolhouse."

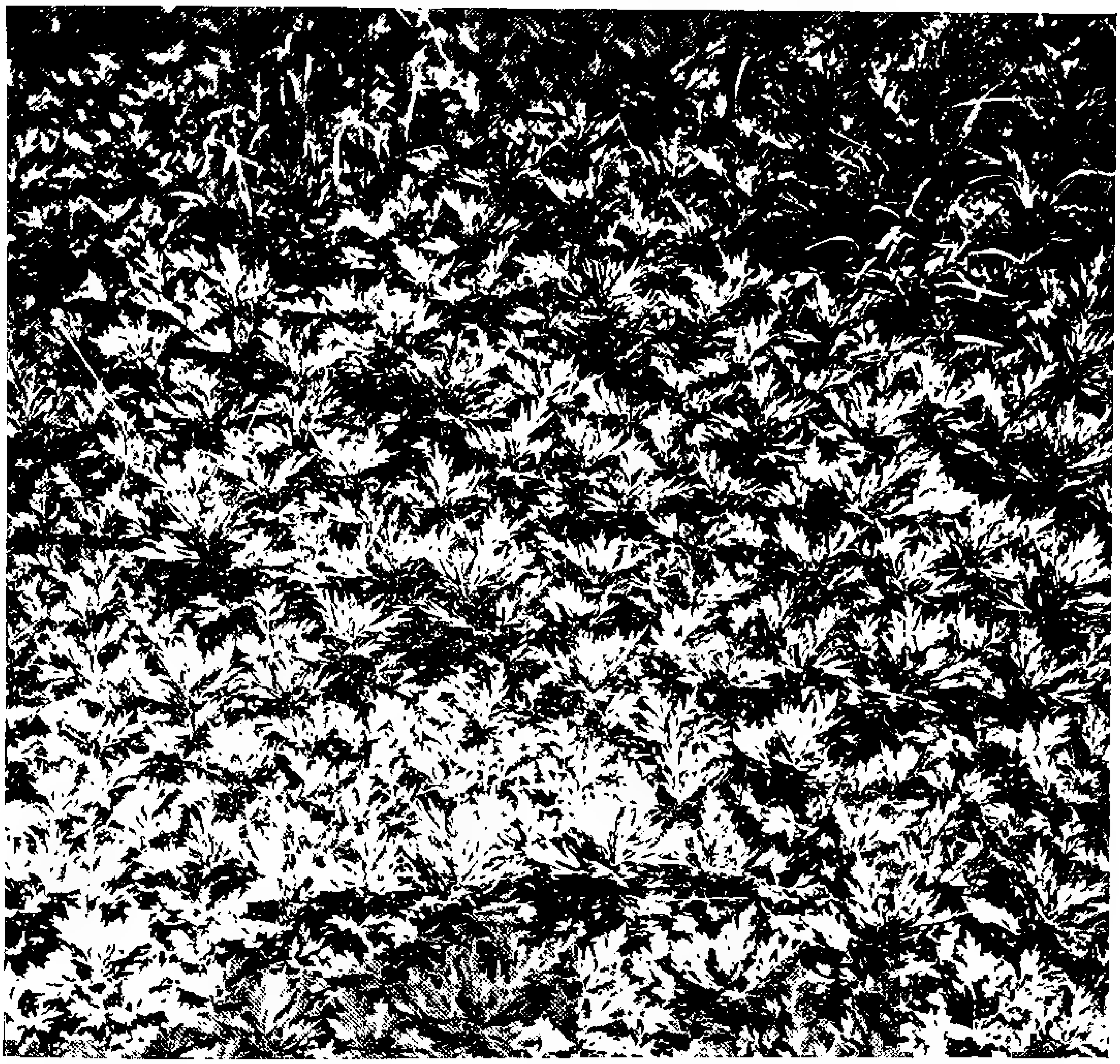
Mrs. Anderson had long shared in his desire to write, but she died in 1934, long before the book was finished. It is dedicated to her as "the sweetheart of the valley," with the added note, "She wanted me to write this book."

Mugwort—A New Invader to Eradicate

By E. E. Naylor

THE perennial herb called "mugwort" is without doubt one of the easiest plants in the world to propagate. It spreads so rapidly by underground parts that it soon becomes a first-class weed pest.

Known botanically as *Artemisia vulgaris,* mugwort belongs to a large group in the Composite family. The genus includes a great variety of bitter and aromatic herbs well known for their medical and culinary uses, though their medicinal properties are not too well understood.*



Part of a solid stand of Artemisia vulgaris that has established itself near the Botanical Garden

* The leaves of *A. vulgaris* itself have been used in the treatment of epilepsy and rheumatism, and also as a substitute for quinine. *A. Cina,* of the Orient, is the source

This plant grows to a height of about 4 feet and produces small yellow flowers in great abundance in late summer. The leaves, which are divided into several segments, produce a rather pleasing ginger-like odor when crushed. At a casual glance the plant resembles the common ragweed or the chrysanthemum, and has frequently been confused with these. It thrives on poor dry soils and because of its rapid method of propagation, soon becomes so rampant that it completely crowds out everything except the surrounding shrubs and trees.

The underground portion of this plant is a long branching structure referred to as the root in many books. Technically, this is not a root at all, but a creeping underground stem, or rhizome. It has typical stem structure and produces rudimentary leaves at rather poorly marked nodal regions. In the axil of each of these leaves is a dormant bud so small that it can scarcely be seen without a hand lens. The growing tip of the rhizome, as it pushes its way through the soil, is responsible for the initiation of these buds. The roots are numerous and grow out at any place along this creeping stem, developing from the cambium layer inside.

If the rhizome is cut into pieces about 2 inches long and kept in moist sand or soil, each segment will produce new roots and several leafy shoots within 5 to 10 days. These shoots originate from the dormant buds, which occur at about 1-inch intervals. Experimental cuttings only ¼ inch long have produced healthy plants within a week. Any piece of the rhizome which is long enough to include a single bud will quickly make a whole new plant.

This capacity for rapid propagation explains how the plant spreads over new territory, and also why it is so difficult to eradicate once it gets started. Cultivation of the soil merely tends to break up the rhizome and scatter the pieces about. They can withstand considerable desiccation and frequently live a long time when left exposed on the surface. The transfer of soil and leafmold from a spot where the plant has recently grown may serve to introduce small segments to new locations. New plants are extremely vigorous. In several places here at the Garden they have invaded the lawn, where they endure frequent clippings of the mower.

The plant was originally introduced at the New York Botanical Garden in 1901, having been raised from seed obtained from the Botanical Garden at Lausanne, Switzerland, and grown under the name of *Artemisia Purshiana,* which is a white-flowered, woolly-leaved, ornamental native of western North America. References to taxonomic manuals make little,

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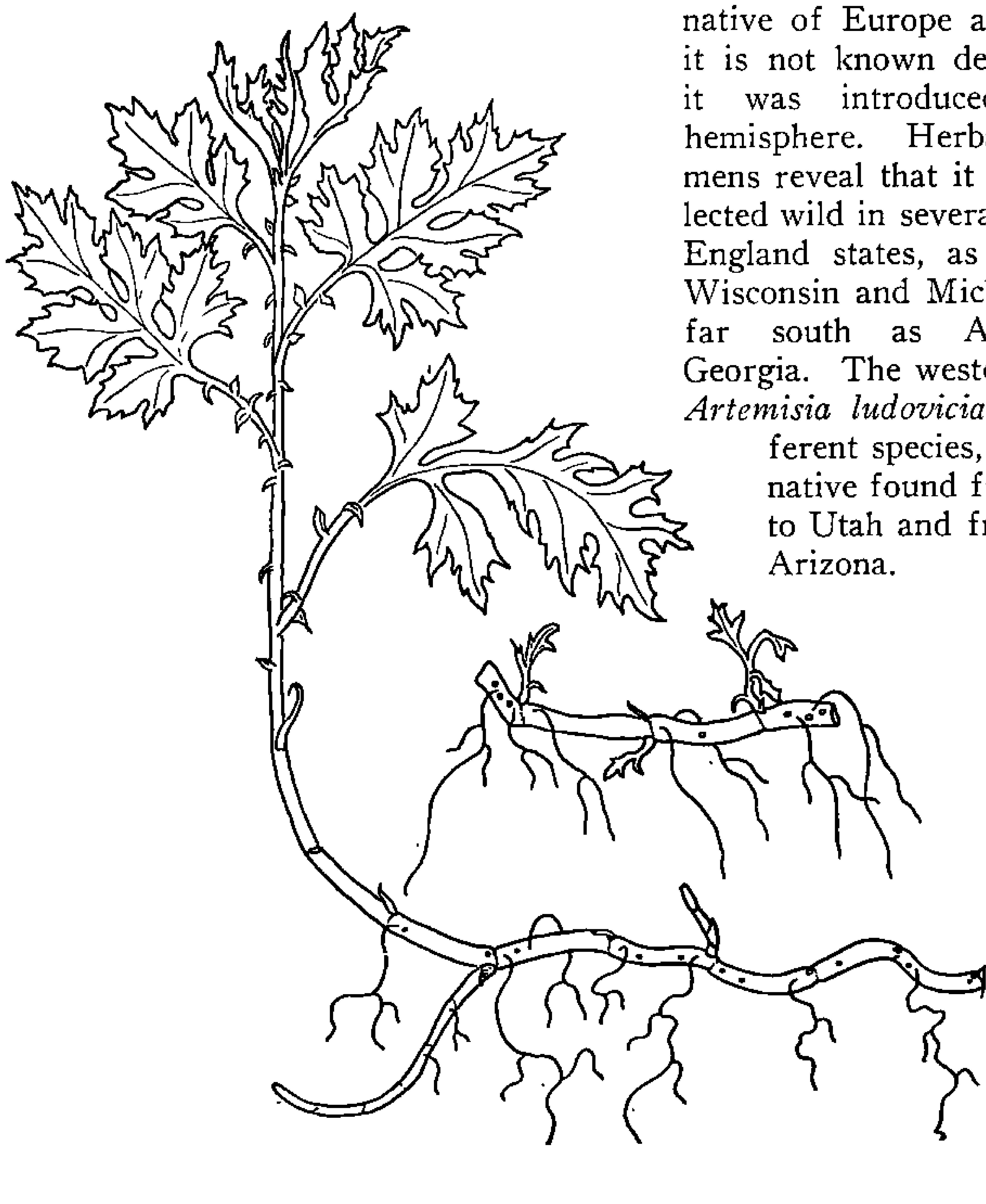
of santonica, which is obtained from the dried flower heads and used as an anthelmintic drug. Old-fashioned wormwood tea, made from the leaves of *A. Absinthium* is well known to many as a general tonic. This plant also furnishes the absinthe which is popular in certain types of drinks. The dried leaves of *A. Dracunculus* make the well known tarragon which is a savory addition to certain meat dishes. The fresh leaves may also be used in salads or made into a tarragon vinegar or liqueur.

if any, mention of seed formation in *A. vulgaris,* so it seems doubtful whether it spreads as rapidly from seeds as other Composites.

Complete eradication can be accomplished only by a thorough job of digging out every part of the branching rhizome. Pulling the plants by hand is not at all successful because a considerable portion is left behind in the soil to give rise to more individuals. Chemical sprays have not been tested, but even if the leafy portions were killed it remains doubtful if the underground parts would be affected.

By virtue of its general habit of growth and rapid propagation, mugwort would make an excellent plant to prevent soil erosion, but it is not considered advisable to introduce such a dangerous weed intentionally near farm lands. It might easily escape to cultivated fields where it would seriously compete with crop plants.

Though it is now found growing in waste places from Nova Scotia to British Columbia, mugwort is a native of Europe and Asia, and it is not known definitely when it was introduced into this hemisphere. Herbarium specimens reveal that it has been collected wild in several of the New England states, as far west as Wisconsin and Michigan, and as far south as Alabama and Georgia. The western mugwort, *Artemisia ludoviciana,* is a different species, and is a true native found from Missouri to Utah and from Texas to Arizona.



Detail drawing of a young plant of Artemisia vulgaris, one-half natural size, with a piece of rhizome shown sprouting three new plants after ten days in a moist petri dish.

A. vulgaris is variously known as fellon-herb, sailor's tobacco, green ginger, and motherwort, the last term alluding to the fact that in early times the plant was used to treat women's ills. The common name of mugwort seems to be derived from an old Teutonic root-word for moth or midge, because it was long ago recommended by Dioscorides to keep away moths from clothing. The smoke produced by burning the dried leaves is said to repel mosquitoes. The ancients believed mugwort to be a symbol of happiness and tranquility, and it was thought to relieve fatigue. For this reason it was used in the bath, and also worn in the shoes on long journeys.

Uprooted plants of mugwort, showing the branching rhizome and the new plant starting to grow at the tip of the longest branch

Reforestation: Timber-Growing Or Land Conservation?

A Discussion of Objectives in Tree-Planting

By E. W. Littlefield
New York State Conservation Department

REFORESTATION—the planting of extensive areas to trees—is in its fifth decade as a major activity of government here in North America. New York State, a pioneer in this movement, was also, for the better part of forty years, a leader both in furtherance of the reforestation idea and in the output of forest planting stock. From experimental beginnings in the Adirondacks at the turn of the century, this project grew in public enthusiasm—reflected in legislative support—till in one year (1936) the number of seedlings and transplants distributed from Conservation Department nurseries reached the impressive total of 72 million trees. Of these, 63 million were planted on State or other public lands while the remaining nine million were furnished at cost to private individuals and organizations.

The past seven years have witnessed a sharp decline in the New York program, more particularly in that phase of it which is related to the acquisition of submarginal farm lands for reforestation purposes. This decline is attributable to various factors, including decreased appropriations; abandonment of Federal relief programs, such as the Civilian Conservation Corps, from which much of the planting and maintenance labor was drawn; and the present war. On the other hand, the demand among private landowners for planting stock from the State nurseries has been maintained approximately on the level with former years. Overshadowed for a decade by the so-called "Enlarged Reforestation Program" for planting State-owned lands—to which the State was committed by the Reforestation Amendment of 1931—the individual tree planter has once more assumed a dominant role.

At this juncture we may well ask ourselves in the words of the popular bulletins: "Why Plant Trees?"

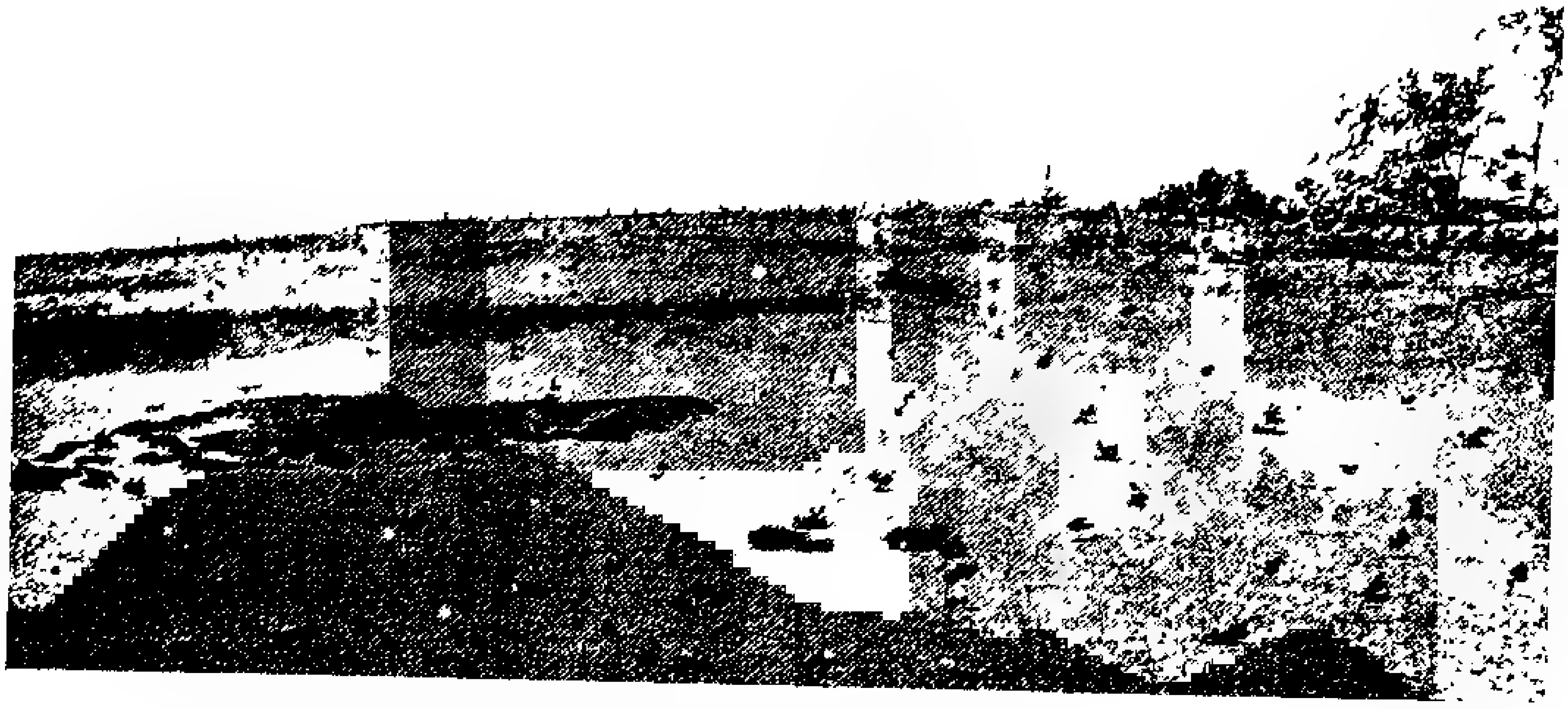
Few public projects have been more readily taken for granted yet less clearly understood, than reforestation. As a concept derived principally from the experience of central and northern Europe, it meant the perpetuation, by artificial means, of a comparatively limited timber resource. As such, it was brought to America, and the initial attempts at reforestation were nearly all predicated on the assumption that this was the best way to assure a continuing supply of timber in a given region or locality. This assumption, which offered a practical economic appeal, had little difficulty in obtaining public funds, on the basis of a good capital investment; while on the sentimental side, the thrill of creating new forests—

"watching the trees grow"—found ready support among a large body of citizens who were becoming conservation-minded.

Forty years of trial-and-error, in New York and elsewhere, have not entirely borne out the validity of the timber-growing principle. As a problem in applied biology, the establishment of coniferous forests proved more complex than was first anticipated. Questions which arose as to the adaptability of species to site, disease control, cultural measures—all these combined to increase the difficulties of the foresters assigned to doing the job. Plantations were for the most part widely scattered, more on the basis of available land than with any regard to existing processing plants or future softwood requirements. And, as a rule, there was more and better timber in the native woods. Regardless, however, of the merits of *timber-growing,* a number of *secondary* benefits from reforestation have become evident, which in the minds of many observers have justified much of the cost and effort which had been expended. As a means of arresting erosion, for instance, the young conifer stand has no superior, and has become fully recognized as such an agent in soil conservation work. In the matter of water conservation and regulation, the role of the planted forest is equally important, though less easily demonstrable. The successful farm windbreak or shelterbelt, while it has little value as "stumpage," is priceless from the standpoint of the owner's comfort, and the protection of his livestock and orchards. Where there is a scarcity of evergreen cover, as in much of the southern New York plateau, areas of pine or spruce furnish admirable shelter for various kinds of wildlife. Less appreciated by the layman, but perhaps most fundamental of all, is the humus-building capacity of the forest plantation. To realize this we have only to note the seedlings of the more exacting species, such as white ash, which come in so abundantly where a conifer plantation, once established, has been opened up through cutting operations or mortality. Such observations are not new. More than a century ago, the botanist Michaux wrote in the following vein: "The faculty which I have ascribed to the Wild Pine* of growing in climates, soils and exposures extremely different, is of inestimable value, and its cultivation has been attempted on lands abandoned during ages of hopeless sterility. Plantations may be formed from the seed, or with young stocks from the nursery. . . . A large tract . in the Department of the Marne, called *la Campagne pouilleuse*, has begun within forty years to be covered with it after lying waste from time immemorial. The proprietors who conceived this fortunate plan have already seen their barren grounds acquire a tenfold value. *After the first growth of evergreen trees, the soil becomes capable of sustaining the Birch, the Hornbeams, the Oaks, etc.*† which in time render it proper for the production of cereal plants. In Belgium, large heaths have in this way been transformed into rich arable land."

* Now known as Scotch pine (*Pinus sylvestris*) a European species used extensively in American forest planting. Other species commonly used are the native white pine (*P. Strobus*), red pine (*P. resinosa*) and white spruce (*Picea glauca*), together with Norway spruce (*Picea Abies*) and larch (*Larix decidua* and *L. leptolepis*).

† Italics are the author's.



Denuded hilltop near Malone, N. Y., just after being set out to trees.

The same area as the first illustration, eight years after planting. The trees in the background are jack pine (Pinus Banksiana); those in front are red pine (P. resinosa), planted after the jack pines were established.

In other words, we find that many forest plantations have a greater value *in themselves,* as permanent fixtures on the land, than as potential tree crops. Two local examples may be cited from the hundreds of such in New York: one in Montgomery County, on the high, exposed ridge of land that separates the Mohawk from Schoharie Valley; the other near Malone, in the region of sandy deposits which characterize the upper reaches of the Salmon River. In the one case we have a windbreak, planted with Norway spruce, which is serving to protect a farmstead from the winds which blow almost continuously across this upland during the winter. Not only does this plantation retard the wind, but it stops much of the snow which formerly accumulated around the farm buildings, blocking driveways, piling up at the back door, and, in general, adding immeasurably to the burden of winter chores. Today, this volume of snow is laid down in compact drifts sometimes ten feet high, directly in the lee of the windbreak, while the farmyard is relatively clear. I visited this farm early in March. It was a bitter day, overcast, with a "snow chill" borne on a cutting west wind, the temperature a few degrees above zero. After a punishing day in the field, it was good to stop in here for a moment's chat and a chance to get thawed out in front of the kitchen stove. As I came into the yard, within the influence of the spruces, the change was more than perceptible, it was striking. The air was almost still, the snow lay banked against the windbreak, about 200 feet back from the road. In a hen-house in front of the trees a flock of leghorns prated contentedly; no blast came through the barrier to penetrate the interior of the building or howl around corners. Farther on, a dozen sheep were turned out in the yard to feed. A cheery assemblage of birds fluttered in and out of the branches, protected from the rigors of the wind. I had been there many times in more hospitable weather and had seen photographs taken in midwinter. But here was a demonstration, practical and personal, of what the windbreak would really do. For fifteen years or more the plantation has furnished protection of this kind. The original planting stock, comprising about a thousand trees, cannot have cost more than four or five dollars and a day or two of labor. The trees will probably never be cut for pulp, lumber or any other forest product. But who will say they are not "worth their salt"?

Now let us take the second case-history: In the northern part of Franklin County, as in other localities bordering the Adirondacks, farmers have to deal not only with severe winters and a short growing season, but also, in many instances, with blowing sand, where clearing followed by pasturage has destroyed the organic layer, exposing the sandy subsoil. On the farm in question an entire hill had become denuded in this way. Lying as it did, on the west side of the property, it soon started traveling before the prevailing winds till it had begun to encroach on the crop lands below. When the winds were especially strong, blowing sand reached the

Windbreak planted with Norway spruce, in Montgomery County, showing how the entire farmstead is protected.

The same windbreak at close view, showing the protection of the barnyard.

farm yard a quarter of a mile away. In 1933 the owner commenced to reforest this hill with jack pine* and other species. The accompanying illustrations tell the rest of the story. By 1940 the top of the hill had become fully stabilized; the farmer's good wife no longer had to brush sand particles from the wash on Monday morning; and with subsequent planting the sand problem is disappearing entirely.

Several widely known examples of reforestation undertaken primarily as a land-conservation measure may be taken from history to substantiate what we have seen in local instances: The revegetation of the sand-dunes

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* *Pinus Banksiana,* a hardy northern species especially adapted to sandy soils.

The same windbreak in Montgomery County, after heavy snowstorm. (Photo by Floyd Ecker).

of Gascony, commenced by Brémontier in 1786, continued through the Revolutionary period by (strangely enough) the same Brémontier, and completed under the Republic; the transformation of the famous Landes district on the west coast of France in the 19th century; and the reforesting work of the Danish Heath Society. This last has been described in effective language by that distinguished American of Danish origin—Jacob A. Riis. In "Hero Tales of the Far North"* he tells how the "ghost of the Heath was laid." With the establishment of the forest, he says: "The sand blast has been checked, the power of the west wind broken. The shrivelled soil once more takes up and holds the rains, and the streams will deepen, fish leap in them as of yore. Groves of beech and oak are springing up in the shelter of their hardier evergreen kin. . . . [We are] . . . beholding great forests taking the place of sand and heather; a change that is transforming the barren moor into the homeland of a prosperous people."

In our own country and generation we may point to projects of this nature, such as the forestation of the Nebraska Sand Hills, and the shelterbelt plantings on the Great Plains. Regarding the advantages of the latter, one author says: "I believe all these points could probably be brought under the one head of *livability;* and this, in turn, makes for stabilization, a better system of tenure, and a longer tenure."

I have selected the examples given above because they illustrate rather dramatically a phase of reforestation that is apt to be overlooked in the discussion as to whether reforestation is "practical" and whether it has been "successful." To emphasize this matter of what I shall again refer

* The Macmillan Company, publishers.

to as "land-conservation"—that is, conserving the soil and the human activities related to it—does not mean that we can wholly disregard the factor of commercial timber growing (including short-term products such as Christmas trees, which are already being harvested in quantities from both State and private plantations). But it does mean that a program of reforestation, whether carried out on public lands or through the distribution of trees to private individuals, should not stand or fall on that basis alone.

If there is a revival of interest in tree-planting (as there is likely to be) in the post-war period, it should be undertaken with a fuller realization of what is to be gained, as well as of the difficulties and limitations involved. Objectives should be clarified so that both public officials and individual tree-planters will understand better what it is they are trying to do. If a large public investment in reforestation projects is to be made in the future, as in the past, it should be accompanied by a searching investigation to determine how far the previous efforts have been justified, to what ends they have been applied, and with what degree of success. Such an investigation should include not only an appraisal of the local program, but those of other regions and countries as well, where reforestation has been undertaken in a large way; including, particularly, the extensive operations of this sort carried on by Great Britain and in the British Commonwealth in the southern hemisphere—South Africa, Australia and New Zealand—affected as they may have been by war conditions.

And always, it should be borne in mind that in northern climates, at least, no reforestation program, once its course is arrested, can bloom again overnight; for it takes from two to four and a half years to produce forest planting stock, once the seed has been sown in the nursery bed.

Reforestation stopped too soon. On the right, erosion has been checked by the planting of pine trees. At the left, erosion continues.

Notes, News, and Comment

Cinchona Breeding. Dr. Florence Clyde Chandler has resigned, effective July 15, from the scientific staff of the New York Botanical Garden in order to participate in a project of breeding *Cinchona* for high yields of the alkaloids which include quinine. Since September 1, 1927, Dr. Chandler has been Technical Assistant in the research of Dr. A. B. Stout. She has been especially concerned with cytological studies in respect to sterilities and with the experimental production of tetraploid races of *Petunia* and *Lobelia* in relation to sterilities of spore abortion and incompatibilities. She has also assisted in the hybridizations and selective breeding in *Hemerocallis*. Dr. Chandler is the author and co-author of several papers reporting results of research at the New York Botanical Garden. In 1940 she was granted the degree of Doctor of Philosophy from Columbia University. Her thesis, based upon work at the Garden, was published in the Bulletin of the Torrey Botanical Club in November 1940 under the title, "Microsporogenesis in Triploid and Diploid Plants of *Hemerocallis fulva*."

Radio. Two radio programs will be given each month during September and October by the New York Botanical Garden over station WNYC. Dates and hours will be announced in the daily papers.

Foreman. Stuart Longmuir, who has been Head Gardener on the estate of Mr. Clarence McK. Lewis at Sloatsburg, N. Y., came to the New York Botanical Garden August 1 as Foreman Gardener, to succeed P. J. McKenna. In this capacity he will serve as chief assistant to T. H. Everett, Horticulturist.

Mr. Longmuir started his gardening career under his father's direction on Sir Harry Greer's estate in County Kildare, Ireland. From there he went to Scotland, where, after gaining experience in both inside and outside work on two estates, he spent four years at the Royal Botanic Gardens, Edinburgh, working in the herbaceous grounds and rock garden and in the propagation department. Coming to America at the end of the nineteen-twenties, he did landscape work for two years for Wollcot Nurseries, Jackson, Mich., then in 1931 went to Skylands Farm, Mr. Lewis's estate.

Technical Assistant. Anita G. Appel has been appointed Technical Assistant in the laboratory of Dr. A. B. Stout, to succeed Dr. Florence Clyde Chandler. A graduate of the University of North Carolina in 1942, Miss Appel has spent several summers working at the Garden, both as a volunteer and as a scholarship student, and had been serving as an assistant in Dr. Dodge's laboratory from last September until her new appointment.

Exhibit. Sixteen enlarged photographs of succulent plants which had appeared in the Journal and in the Garden's booklet, "Succulent Plants of New and Old World Deserts" by E. J. Alexander, were exhibited in Detroit last May for a special meeting at the Detroit Garden Center.

Groups. Nearly 50 teachers who were enrolled from many sections of the United States in the June Intersession course in community study at Teachers College spent the afternoon of June 17 making ecological observations at the New York Botanical Garden. They were guided through the meadows and hemlock forest, then past the flower borders, by G. L. Wittrock. On Aug. 5, the Interlaken Garden Club of Eastchester visited the demonstration vegetable garden, the borders, rock garden, wild flower area, and main conservatories.

Radio. G. L. Wittrock spoke on the Nancy Booth Craig hour over WEAF May 12 on the subject for the Saturday lecture he was giving a few days later: "Plants Essential for our Wartime Needs."

Lecture. Dr. A. B. Stout gave a lecture during August on "Grapes" at the Berkshire Garden Center in Stockbridge, Mass., at a joint meeting of this Garden Center and the Lenox Garden Club. Mrs. William Felton Barrett, the president of both of these organizations, is a member of the Advisory Council of the New York Botanical Garden. An experimental planting of grapes has been made at the Berkshire Garden Center to determine which varieties are most hardy and most certain to yield fruit in that locality, in which the growing period from frost to frost is sometimes limited to about 90 days. Most of the best horticultural varieties of grapes grown in New York State require a growing period of at least 160 days for good yields of fruit.

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.)

Photography For The Nature Lover

NATURAL HISTORY WITH A CAMERA. L. W. Brownell. 292 pages, illustrated with photographs by the author, indexed. American Photographic Publishing Co., Boston, 1942. $3.75.

Mr. Brownell's book will be enjoyed by three groups of readers.

The nature photographer will appreciate the illustrations most for he knows how much skill and patience go into the making of any and every wild-life picture.

For the amateur who is planning to try his hand at nature photography a careful reading of the book will be a great help. Difficulties are not glossed over. Mr. Brownell warns that personal comfort must be disregarded. One who can not stand the blazing sun, who dislikes getting his shoes muddy, tramping through snow and wading in ice water and carrying a camera under all conditions "had best forswear nature photography before he begins."

For the nature lover with no camera or desire to be bothered with one, the book has interesting stories of the life and habits of many small creatures.

The first chapter contains a discussion of equipment and a description of methods. Then follows a chapter for each month of the year, beginning with March and the first signs of spring and carrying through to the year's maturity.

FLEDA GRIFFITH.

Textbook on Bacteriology

MICROBIOLOGY AND MAN. Jorgen Birkeland. 478 pages, indexed. F. S. Crofts & Co., New York. $4. 1942.

Dr. Birkeland's textbook of microbiology, although not as all-inclusive as the title implies, is a valuable addition to the list of texts for elementary science courses. The book is apparently meant to fall in line with the policy adopted by Ohio State University some years ago to present introductory science courses not for the few who will later become specialists in the field, but for the many who will have the layman's view of the subject.

The book deals almost entirely with the medical aspects of bacteriology, and although this is the phase of microbiology with perhaps the greatest popular appeal, it is by no means the entire picture. The factual material presented is for the most part entirely accurate, though not always up to date; however, there is some excuse for this in a general text such as Birkeland's, where the inclusion of the results of research projects might possibly be considered merely to confuse the beginner.

The author's style is interest-holding, especially when he is dealing with historical subjects, and on the whole there is much to recommend the book to the audience for which it is intended.

LOIS LILLICK,
New York Medical College.

West Indian Studies

TREES OF PUERTO RICO. L. R. Holdridge. Occasional Papers Nos. 1 and 2. 105 pages each, illustrated, with glossary, bibliography and index. Tropical Forest Experiment Station, Puerto Rico, April and September, 1942.

In these two fascicles on the trees of Puerto Rico, the author reports 100 species of trees native or introduced on the island. Other fascicles, he plans, will follow until 600 species will have been published.

The descriptions are written in popular language and at the end of each fascicle there is a vocabulary that will help the non-scientific reader. The illustrations are good, but some of them lack little botanical details; however, the work fulfills its purpose. The species are not treated in taxonomic sequence, but a family index is given on the first page. Unfortunately, the author employs several botanical names not so much in usage now-a-days, and the lack of synonymy makes this more notable.

The popular names are only those of Puerto Rico, otherwise the book might be of great use for all the West Indies.

J. P. CARABIA.

Effects From The Air

CAMOUFLAGE WITH PLANTING. Ralph Rodney Root. 79 pages, indexed, illustrated. Ralph Fletcher Seymour, Chicago, 1942. $1.50.

A landscape architect looks at camouflage. The use of living and growing plant material and the handling of natural features in permanent camouflage problems are treated here by a man who has many years of experience in a complementary field.

A table of 195 genera is keyed to show the difference in leaf color tone as seen by the eye of an aerial camera, thus facilitating the selection of plant material and the creation of a picture that harmonizes with its surroundings.

HAROLD J. WILSON.

Annual on Enzymes

ADVANCES IN ENZYMOLOGY. Vol. III. F. F. Nord and C. H. Werkman. 408 pages, illustrated, subject and author index. Interscience Publishers, New York, 1943. $5.50.

This is the third annual volume of a series devoted to short monographs on a variety of subjects related to enzymology. I found of particular interest Chromosomes and Nucleoproteins by A. E. Mirsky, the two sections on Carbohydrate Metabolism, one by E. S. G. Barron and one by H. A. Krebs, The Chemistry and Bio-Chemistry of Pantothenic Acid by Roger J. Williams, The Chemistry and Biochemistry of Biotin by K. Hofmann and The Role of Micro-organisms and Enzymes in Wine-Making by W. V. Cruess. This volume, like the others, is a useful and valuable book to anyone working in any biological field that touches upon vitamins and enzymes.

F. W. KAVANAGH,
University of Rochester.

Current Literature At a Glance*

Alcohol. Sweet potatoes may acquire a new role in wartime industry. According to the *Chemurgic Digest* for June 15, they are to be tested soon for alcohol production, the product to be utilized as an ingredient in the manufacture of synthetic rubber and for conversion into motor fuel.

Early American Science. The American Philosophical Society has devoted the September (1942) number of its Proceedings to a series of papers presented at its midwinter meeting on "The Early History of Science and Learning in America." F. W. Pennell, writing on "Benjamin Smith Barton as a Naturalist," calls him not only the Father of American Materia Medica, but also Father of American Botanical and Zoological Instruction and the Father of the Scientific Study of the American Indian. M. L. Fernald writes on "Some Early Botanists of the American Philosophical Society" and E. D. Merrill on "A Generally Overlooked Rafinesque Paper." In this, Dr. Merrill not only discusses the paper, which contains 31 generic names and 15 binomials, all overlooked by botanists, but he also discusses many aspects of Rafinesque's career, adds many titles to previous Rafinesque bibliographies, and, because Rafinesque was a pioneer in the private publication of botanical periodicals, he lists both American and foreign publications in this field that have been issued by individuals since the late 18th century.

Shrubs. Manual 3 of the Illinois Natural History Survey is a "Fieldbook of Native Illinois Shrubs" by Leo R. Tehon. Consisting of 307 pages, with drawings, color photos, a glossary and index, it treats 210 species of shrubs in 43 families. The book is a neat, handy pocket manual, and it gives the impression of completeness. Copies are obtainable at Urbana for $1.25.

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

Monographs. Among the major treatments of plant groups appearing in the Annals of the Missouri Botanical Garden for 1942, are a commentary on the Commelinaceae of North America by Robert E. Woodson, Jr.; a revision of the genus *Bumelia* by Robert Brown Clark; and a monograph of the genus *Malvaviscus* by Robert Walter Schery.

Photography. Jay T. Fox, who has a private museum of natural history at Seaford, L. I., writes on "Biological Photomacrography with Kodachrome Film" in the June Journal of the Biological Photographic Association, describing his equipment and technique in detail.

Quinine. The dramatic story of quinine and the men who have been largely responsible for its culture and effective use today—Ledger, the two pharmacists Pelletier and Caventou, and even Dr. John Sappington of Arrow Rock, Mo.—is told by Norman Taylor in the *Scientific Monthly* for June. In writing of the present quinine situation, the author discusses the manufacture and use of totaquina and the efforts being made by the United States Government to establish quinine culture in tropical America.

Pronuba. "A Desert Romance" is the sub-title of a well illustrated article on the Pronuba, or yucca moth, by J. D. Laudermilk, which appeared first in *Desert* magazine last December and since then has been reprinted in the *Cactus and Succulent Journal.*

From Abroad. The 1942 numbers of four important German botanical periodicals came through in late June. They are the *Botanisches Zentralblatt* and *Flora, oder Allgemeine Botanische Zeitung,* both published in Jena, *Botanisches Archiv* from Leipzig, and *Berichte der Deutschen Botanischen Gesellschaft* from Berlin-Dahlem. These are the first publications received from there for a year or more.

Celery Oil. Obtained chiefly from southern France before the war, oil of celery is a product which celery growers in the United States can help to put back on the market in this country. Ernest Guenther surveys the entire industry in a recent number of the *Chemurgic Digest.*

BROADCAST

RUTHERFORD PLATT, author of "This Green World" (which was reviewed in the Journal last January) was the guest speaker on the New York Botanical Garden's second monthly radio program over station WNYC the afternoon of June 17. Mr. Platt, in addition to being an author, photographer, and lecturer of note on the subject of plant life, is an official of Platt-Forbes Advertising Agency. He is also a member of the Corporation of the Garden.

Below are some excerpts from the address he gave over the radio.

PERHAPS one reason why many people miss the thrill and drama that is organized for all New Yorkers to see at the New York Botanical Garden is because we are brought up on so much sentiment with regard to trees and flowers. I do not belittle that sentiment. I can understand how people can miss a heartbeat when they read "Poems are made by fools like me, but only God can make a tree." And I can feel the lovely appeal to the spirit which flowers make—but I do say that so much sentiment tends to obscure much of the interest of plant life, which can be very exciting indeed.

Now the New York Botanical Garden is available for a nickel subway ride (ten cents round trip) to almost everybody in New York. This very fact, that the wonderful Botanical Garden is always at hand and free to enjoy, might make it seem commonplace. But that's just what it is *not*—commonplace.

Let's look at it this way. Let me promise you that on a steaming hot day when the city seems oppressive and the streets are strident with noise and grimy with dirt, these walls about you can be made to vanish, that you can be brushed by a cooler breeze—fragrant with that delicate aroma of freshly cut grass and the cool foliage of a forest—and that you can be transported to a magic place. Right here let me remind you that the New York Botanical Garden is one of the famous places of the world, and people have traveled from Africa, from India, South America—many miles to visit there. . . .

Now I want to suggest some of the things to look for at the New York Botanical Garden when you go there just for an afternoon of adventure.

First I propose that you shall look at the trees as though you had never seen them before. They are carefully labeled. Here's one that says TULIP TREE. Its characteristic is the tall straight column of its trunk. This trunk is more marvelous that any Greek pillar. The tulip tree is one of the ancient trees and a monarch of this region, a native American, older than the American Indians.

Here's a small tree that is labeled GINKGO. It is remarkable, for its leaves are shaped like exquisite little fans. The ginkgo is perhaps the most ancient tree in the world. It's like a living prehistoric relic surviving from an age when most of our other plant life had not yet even taken form. The ginkgo was rescued from extermination by a Chinese monastery. Evidently the people in that monastery kept the species alive for hundreds of years and thus bridged the gap of the ages.

Here is a DOUGLAS FIR, one of the big timber trees from the Pacific Coast. It has a beautiful, symmetrical shape with a rounded top. Compare that to the sharp spire like a church steeple on the SPRUCE.

Look for the label WHITE PINE. This is the king of the pine trees in the eastern United States. You will notice that the branches of the white pine grow out horizontally so that it tends to make the shape of a square-rigged ship in full sail. . . . This is just a hint of how to look at trees and know them by their personalities and by their architecture. You will find endless wonder when you see how differently they are built instead of just vaguely regarding them as a lot of foliage. It's more fun than playing a detective game. . . .

The Hemlock Grove is an original forest that was growing there long before the New York Botanical Garden existed. It has been beautifully maintained by the authorities of the Garden and native plants that grow naturally in such a place have been added through the years to create more realism. An agreement has been made with the City of New York that this hemlock forest shall be left in its natural condition as a perpetual monument to the native flora of this vicinity.

What a wonderful thing that is when you stop to think of it! How the miles and miles of streets and buildings of the great city have blotted out the wonder of the woods as they were here on Manhattan Island—and yet here in the Bronx, still within the City's limits, is some of it preserved for all time for you.

Appreciation From a Group Of Young Visitors

One of the most enthusiastic of the classes of school children that visited the New York Botanical Garden during the spring was the 2B class of Public School No. 8, located less than a mile from the Garden. After a visit in April, one of the pupils wrote for permission to come again in May, so the class was again assigned a guide from the staff. With them on their second visit they brought the poem printed below, neatly written on paper bordered with gay flowers done in wax pencils and further ornamented with a drawing of three of their group in front of the Museum Building.

OUR TRIP

It was a cloudy Wednesday
When 2B was waiting for the sun.
We wanted to go to the museum
And there to have some fun.
When the sun came out
We started to shout,
"Hooray, hooray for the sunny day."
And we started on our way.

On Bainbridge Avenue we saw many flowers
And two big church towers
We turned east on Bedford Park
And we weren't so very far
Houses, stores, a private school too,
Trains, tracks, and cars very few
These are some of the things we knew.

We went into the museum
Where many plants were seen
A tree trunk so big and old
It was a thousand years we're told.

A botanist was picking weeds
He wasn't planting seeds
"Good-bye" we said to the man
"We'll come again if we can."
Then we started on our way
We had a good time that day.

Composed by Class 2B
P. S. 8 The Bronx
Teacher, Frieda Kleinsinger
Lillian Barthelemy, May 1943

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.

Plants of the Vicinity of New York, by H. A. Gleason. 284 pages, illustrated. A handbook especially compiled for the beginner in plant identification. 1935. $1.65.

Flora of Bermuda, by Nathaniel Lord Britton and others. 585 pages with 494 figures, covering algae, fungi, mosses, ferns, flowering plants. 1918. $3.50

A Text-Book of General Lichenology, by Albert Schneider. 230 pages. 76 plates. 1897. $2.50.

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.

Plants of the Holy Scriptures by Eleanor King, illustrated, and accompanied by a list of Plants of the Bible with quotations, in the March 1941 Journal. 15 cents.

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.

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.

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.

An Herbal. First published by Richard Banckes in London. 1525. Edited and transcribed into modern English with an introduction by Sanford V. Larkey, M.D., and Thomas Pyles. 200 pages, including facsimile of original. Prepared by Scholars' Facsimiles and Reprints. 1941. Price to members of the Garden, $2.50; to others, $3.50.

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

The Victory Gardens of* 1942 *and* 1943 *at the New York Botanical Garden, with plans and suggestions for home growers, by T. H. Everett. 24 pages, illustrated, paper-covered. 1943. 10 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-first 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 a year; single copies 15 cents. Free to members of the Garden. Now in its 43rd 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 $1.25 each. Now in its thirty-fourth volume. Twenty-four Year Index volume $3.

Brittonia. A series of botanical papers. Subscription price, $5 a volume. Now in its fourth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 90 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

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | SEPTEMBER | PAGES

No. 525 | 1 9 4 3 | 197-220

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

GOOD WILL IN THE AMERICAS

WHEN Dr. T. H. Goodspeed, Director of the University of California Botanical Garden Expeditions to the Andes, started more than a year ago for a trip that was to take him into Colombia, Peru, Chile, Argentina, and Uruguay on a good-will mission from the United States, he took with him a 15-minute motion picture reel in natural color, depicting scenes at the New York Botanical Garden. Other botanical gardens in this country also gave him some film to use, so that he had a full-length reel to show. Nothing can better express the effect of these films in the South American countries than some quotations from a letter received from him since his return.

"In Bogota," he said, "I showed the film in the National Library at the regular weekly hour for moving pictures there. There was so much interest that I was asked to repeat the film the following day. . . The Minister of Education of Colombia saw this second showing and the following day the President of Colombia requested that the film be shown in the Palace The President . had it shown twice . . . In Chile the film was shown on a number of occasions, but of special interest was a private showing before President Rios which I was asked to arrange by the Ministry of Agriculture.

"In all cases I used the film to emphasize the character and functions of a proper Botanical Garden in the hope that interest would be encouraged in South America in developing similar institutions. In large part through the film, encouragement was given to the rebuilding of the old Botanical Gardens of Lima, to which end I was requested to return to Peru for two months as the guest of the University of San Marcos. At the present time, over half of this Botanical Garden has been rebuilt and a great deal of public and governmental interest has been attracted to the proposal. I was similarly requested to return to Santiago by the Government of Chile to select a site and draw plans for a National Botanical Garden. . . In Argentina and Uruguay, the film was used to encourage interest in existing gardens or stimulating enthusiasm in the establishment of new ones."

Dr. Goodspeed also noted in his letter that the "particularly fine sequence" of the New York Botanical Garden's film was "universally admired."

Dr. H. W. Rickett, who is now in Mexico, also on a good-will mission for the Government, has with him the New York Botanical Garden's full-length motion picture to show in the numerous places he will visit.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | SEPTEMBER 1943 | NO. 525

The Last Cruise of the "Cheng-Ho"

*By Otto Degener**

The Beginning of an Eight Months' Collecting Trip in Fiji Sponsored by Mrs. Ann Archbold

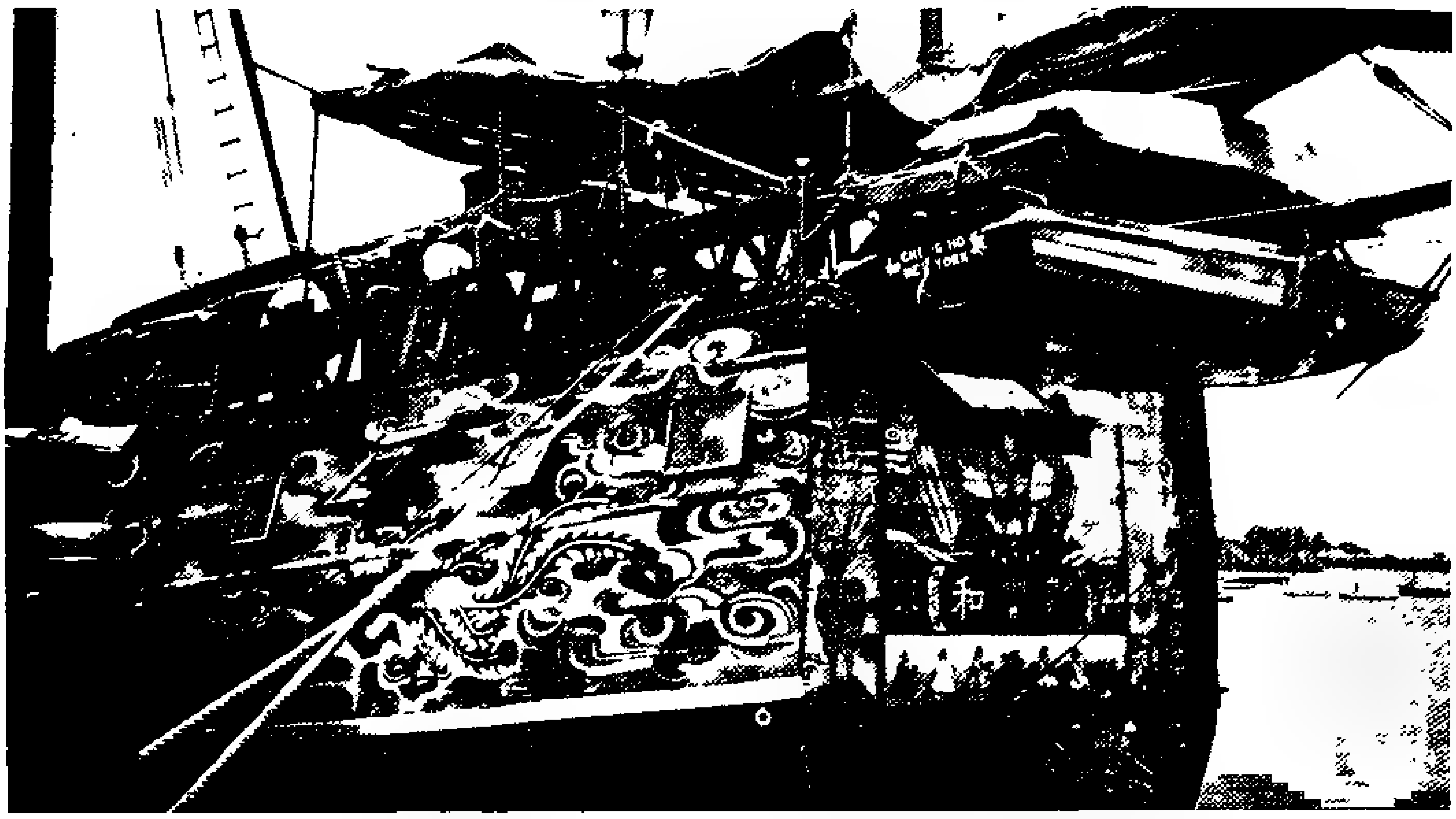
WHILE sitting one sunny day in semi-retirement under the proverbial vine and fig tree (a coconut and papaya) on my little strip of coral beach on rural Oahu, I spied a telegram in the stack of mail which my young Hawaiian-born assistant was bringing me.

DOCTOR MERRILL RECOMMENDS YOU GO COLLECTING HERBARIUM SPECIMENS MELANESIA ALL EXPENSES ABOARD YACHT PAID, read the message, signed ANN ARCHBOLD. Six weeks later—in November 1940—my Filipino assistant, Emilio Ordonez, and I, with all botanical equipment, were aboard the palatial "Cheng-Ho" in Suva Harbor, Fiji.

The "Cheng-Ho," a junk-yacht, was built in Hong Kong by Chinese workmen under the direction of an American architect. She was partly copied, with all modern conveniences added, from a famous junk used during the 15th century. This original vessel, according to a descriptive tablet in the temple of Tien Fei, Patron Goddess of Mariners, just outside Nanking, was one of a fleet of 500 junks owned by the Admiral Cheng-Ho. These early vessels made five or more voyages as far as Persia, and from Suez they brought the first giraffe ever seen in China.

Our boat was about 100 feet long, with a 39-foot beam and 12-foot draught, and two 110-horsepower Diesel engines. Built of Bornean yakal

* During his explorations in Fiji, the author discovered a flowering tree which became the type of a new family—the Degeneriaceae. Mr. Degener is the only living botanist for whom a plant family has been named. See Bailey & Smith in Journ. Arn. Arb. **23**: 356-365, *pl. I - V*. 1942. For scientific discussions and descriptions of the plants collected in Fiji during the "Cheng-Ho" cruise, see Smith, A. C., in Sargentia **1**: 1-148. 1942. For a description of Dr. Smith's own expedition to Fiji in 1933-34, see Journ. N. Y. Bot. Gard. **35**: 261-280 (December 1934).



Detail of the elaborate painting on the stern of the "Cheng-Ho"

wood, it had teak and sandalwood ornamented with hand carvings in the interior. Birds surrounded by clouds and waves were painted on each side, while the allegorical Yei bird peered from the stern. Two figures representing Cheng-Ho's name stood for Unity and Harmony. These qualities blessed the quarters of the captain and Chinese crew in an earlier voyage but refrained from doing so with the new captain and crew on the Fiji cruise.

Mrs. Archbold, owner of the "Cheng-Ho" and sponsor of the collecting expedition, is the daughter of the late John D. Archbold and the aunt of Richard Archbold, who recently explored the wilds of New Guinea by plane. On completion of a previous "Cheng-Ho" expedition accompanied by Dr. and Mrs. David Fairchild, Mrs. Archbold had returned to her home in Washington, D. C., leaving the junk in charge of a captain newly engaged in the Philippines.

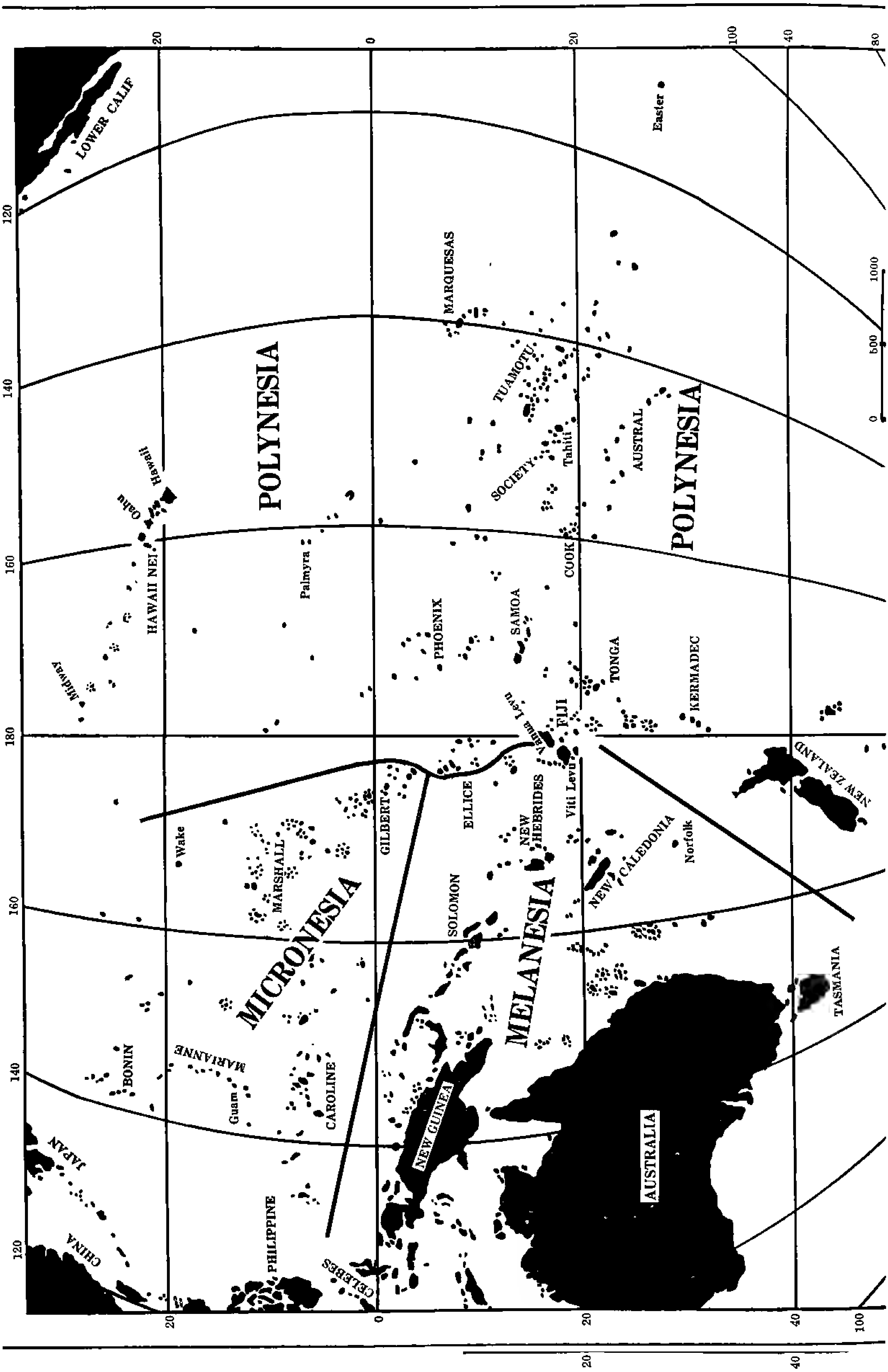
Our crew, consisting of two white boys, a Samoan chief who had performed the intricate sword dance in a well known motion picture, and a fine group of better-class Filipinos, had been signed on in the Philippines during Mrs. Archbold's absence. The captain, a short, proud, pompous white man formerly in command of a missionary vessel in the Philippines, had told them glowing accounts of the forthcoming trip and added that the "Cheng-Ho" would be in New York Harbor by Christmas 1940.

But when the cat's away the mice will play! During the long voyage from the Philippines to Suva, the food was bad and the treatment of the non-Caucasian members of the crew was worse. On my own arrival in Suva I heard rumors of past mutinies on the high seas and of the necessity of calling out the Fiji police; and before Mrs. Archbold could arrive in Suva from Washington, I lived through one mutiny and my assistant suffered personal indignities for being born with a golden instead of a white skin.

Though with Mrs. Archbold's arrival the treatment of the crew greatly improved, irreparable damage had been done. After cruising about the Fiji Islands until Christmas, the day the disillusioned crew had expected to be in New York Harbor, I heard that they planned on leaving the ship at the next American port of call. With the voyage jeopardized by labor trouble and with my being intrigued by the wealth of interesting plants to be found in the islands, I asked Mrs. Archbold to permit me to limit my explorations to Fiji. This granted, my assistant and I, continuing "members of the expedition *in absentia* from the 'Cheng-Ho'," left the vessel in beautiful Savu Savu Bay, Island of Vanua Levu.

On my return to Hawaii in July 1941, Mrs. Archbold and I met again to talk over our various adventures. She had had further disagreeable experiences culminating in thefts, mutinies and desertions, and had decided to give the "Cheng-Ho" to the United States Navy. After the war, the

Interior view of the junk, showing the hand carving in a corner of the lounge


LOWER CALIF
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Midway
TONGA
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Vanua Levu
FIJI
Viti Levu
NEW ZEALAND
ELLICE
NEW HEBRIDES
GILBERT
Wake
MARSHALL
NEW CALEDONIA
Norfolk
MICRONESIA
SOLOMON
MELANESIA
TASMANIA
BONIN
MARIANNE
Guam
CAROLINE
NEW GUINEA
AUSTRALIA
JAPAN
PHILIPPINE
CHINA
CELEBES

vessel is to go to Annapolis as a training ship for midshipmen in learning "the ropes" of one of the oldest type ships in the world. Mrs. Archbold was pleased to hear I had collected about 2,100 numbers of Fijian plants, most of them represented by 15 to 30 duplicates. These, after study by Dr. A. C. Smith of the Arnold Arboretum and other specialists, are being distributed to leading educational institutions by Dr. E. D. Merrill, Administrator of Botanical Collections and Director of the Arnold Arboretum, Harvard University; and by Dr. W. J. Robbins, Director of the New York Botanical Garden. Both institutions kindly granted funds to aid in the extended land explorations.

* * *

Fiji is practically a mirror image of Hawaii Nei, as the entire Hawaiian Archipelago is sometimes called. Its many islands are almost as far south of the equator as Hawaii is north of it. They are blessed with a similar climate; their strong KONA storms, however, come from the wrong direction and are called hurricanes. Instead of the southwest slopes of the islands tending to be dry, as in Hawaii, Fiji's northwest or leeward sides are dry. The windward sides, cooled by cloud-bearing trades, are moist in both archipelagos. The moist jungles of Fiji, however, differ from those of Hawaii in being freer of introduced weeds; in often actually reaching down to the ocean; and in having many more lianes to trip the traveler.

The native Fijian is Melanesian; in appearance and custom practically an Hawaiian possessing a Negroid strain conspicuously evident in his magnificent head of hair. Today there are 100,000; a splendid, clean, kindly, religious race of people. During native rule the average Fijian, like the average Hawaiian, was half-slave, half-serf. His property, yes, even his person and those of his wife and children were at the more or less arbitrary disposal of his chief. Passing through a gradual process of political evolution, the Hawaiian has become emancipated and today is as free as a man of any other race. With this gift of freedom, members of this race have won for themselves enviable standing in their community. The Fijian, on the contrary, is still a prisoner within the narrow confines of his islands. Indeed, he cannot even leave his native village without permission! He is no longer a slave, to be sure, but he is still, in this twentieth century, only a partially emancipated peon hedged in by strict laws not applicable to white residents. Evolution has not progressed as fast in medieval Fiji as it has in twentieth-century Hawaii, with the unfortunate result that the pathetic natives are restive and dissatisfied. The islands are quaintly, often distressingly, 100 years behind the times, but, under stress of war, should struggle to catch up with Hawaii and other democratic regions.

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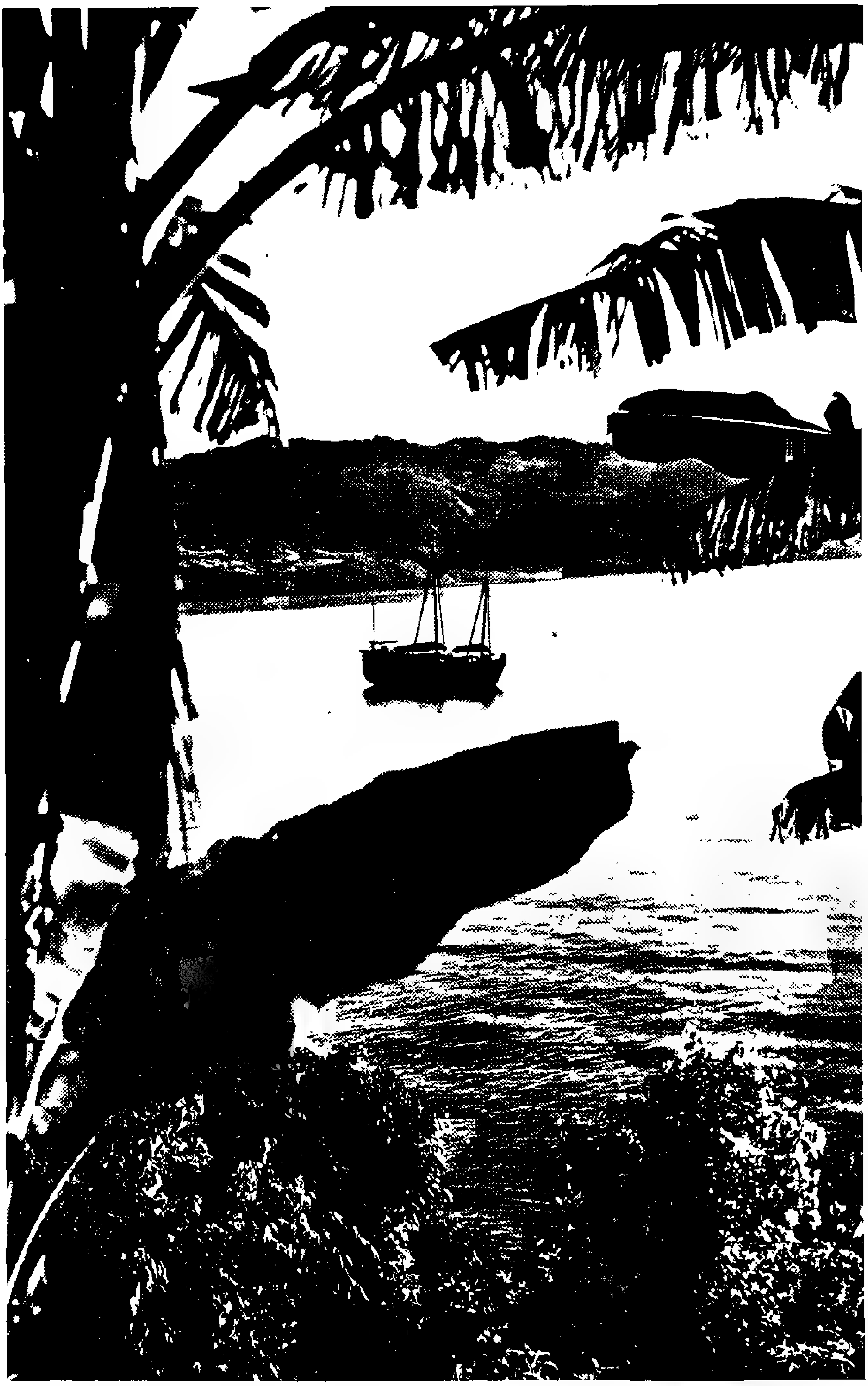


The "Cheng-Ho" at anchor in the South Sea Islands

The "Cheng-Ho" Dec. 23, 1940, with all of us aboard, sailed far up Savu Savu Bay, Vanua Levu, anchoring about 1:30 P.M. In the distance near shore, toward the head of the bay, I spied the rusting galvanized roof of a house half hidden among slender coconut palms and jungle growth. To find the owner, Mr. Mark Dods, I went by launch to the village of Valethi, and there arranged to rent the house and surrounding plantation. The weekly rental of £ 1 ($3.70) included not only the house but also products of his coconut palms, milk and butter from his cows, eggs when occasionally laid by his many chickens, tapioca or cassava (*Manihot esculenta*), DALO (*Colocasia esculenta*), KUMALA or sweet potato, and even his man servants.

The house on "my copra plantation" at Balanga, Savu Savu Bay, was typical of houses in the South Sea Islands where simple food is plentiful but boats with the outside world are scarce. Time and the elements had taken their toll of everything excepting the black and white cats that came meowing hungrily to greet us, rubbing their arched backs against our legs. Everywhere were makeshifts, patches, and articles that would have been discarded in homes nearer centers of civilization but that here had been wisely kept to serve in some emergency. Hence the 2 x 4 girders projecting along the walls of the rooms and porch were repositories for fish-hooks, buttons, rusty nails and screws, patent medicine bottles half to completely empty, gold ore specimens, and the broken claw of a giant crab. On the floor were boots and shoes in all stages of wear; a few pieces of rusty machinery; and some chipped and cracked crockery. In a corner, leaning against the wall, was a dust-covered tombstone with the name of some member of the owner's family and the date of her death—I believe the year was 1927. What is time in the South Seas? The stone, ordered after the sad occasion, simply had not yet been erected over the grave!!

The furniture at Balanga was not abundant but adequate. The shelves were filled with books by Shakespeare, Dickens, Thackeray, Darwin, and Guppy (whom my gracious host had guided through the jungles in his youth), roach-corroded and almost as moldering as the long-dead authors themselves. My bed was a huge four-poster affair boasting an excellent net, a necessity in this region where mosquitoes bearing filaria causing elephantiasis are common. A rusted piano, luckily unable even to give forth noise, served as a hiding place for my passport and money. "Modern improvements" were in the yard. We had no running water in the house but fetched our supply from a low, sluggish stream in back of it. This also furnished us with a modest supply of OURA, or fresh water shrimp. Bathing in the bay was almost impossible because of the man-eating sharks that swam into shallow water in search of food. A few years before, I was warned, a native had his heel bitten off while he was standing barefoot, net in hand, in shallow water in front of the house.

* * *

Picnic in Fiji, with Tucker Abbott, malacologist, shown toward the left; beside him, Dr. John Coulter, geographer; Mrs. Ann Archbold, sponsor of the expedition, center; Miss Mary Keegan, nurse and companion to Mrs. Archbold, and Mr. Judd, District Commissioner and guest, with three Fijian helpers.

During a delightful stay of about three weeks in Balanga, I learned to appreciate the immense usefulness of the coconut for food and drink. Ordonez and I did not touch a drop of the questionably pure fresh water, but limited ourselves instead to boiled milk, tea, and chiefly to the refreshing, slightly Vichy-like "water" of coconuts in the MBU stage. MBU nuts, prime for drinking, are well developed but unripe, with the solid endosperm soft and, toward the cavity of the nut, jelly-like, and with the husk still green. Samu (Sam), a Fijian belonging to the place, climbed the palms every morning to furnish us with an abundant supply. After drinking the cool "water" from a husk-bearing nut whose stem end had been cut away by three or rarely four deft blows of the ever-present machete, it was slit in half with one or two more dexterous blows and thrown to the chickens. These frantically scrambled among themselves to feast on the meat, or solid endosperm, until the semi-circular half rolled over and made further pecking impossible. Yes, even the cats ate coconut meat. Should Ordonez or I care to eat any of the firm jelly-like endosperm, Samu with his machete simply knicked off a roundish sliver of husk to serve as a spoon. To improve the almost perfect drink, we at times inserted a sharpened twig or strip of bamboo through the cut orifice of the MBU nut and scarified the meat to liberate the creamy "milk." The resulting potion, perhaps prepared by a friendly native Hebe or Ganymede, is truly Fiji nectar. For our daily trips into the "bush," or jungle, Samu and some of the youngsters would free MBU nuts of all but a scalp-lock of husk, tie half a dozen or so together, and readily carry them along as natural canteens. Such coconuts, however, spoil in a day or two.

As a coconut sprouts, the foot or haustorium (actually the second cotyledon of a monocot) enlarges by the absorption of all endosperm, finally filling the entire cavity. This foot is spherical, almost white, crisp-spongy, and tastes not unlike some fragrant, light cake. It is delicious but the Fijians maintain that eating too many may cause a slight digestive disturbance. With the copra industry practically bankrupt in Fiji, sprouting nuts were everywhere about each parent tree and actually becoming increasingly harmful. The copra plantations were fast reverting to a jungle of struggling, never-bearing coconut seedlings and thorny wild lemon trees that were threatening to crowd and starve out the properly spaced bearing trees. To eradicate and destroy the myriads of developing seedlings would take a tremendous amount of labor and funds, both unavailable to the poverty-stricken, part-Fijian planters.

* * *

While Ordonez and I were unloading our belongings from the launch and carrying them into the house a mile or so away from the "Cheng-Ho," the crew was engaged loading the remainder of my equipment from the "Cheng-Ho" onto the dory tied alongside. First they stowed away bundles of newspapers, blotters and kerosene lanterns. Then they lowered my cumbersome metal plant drier on top of the pile. This contained batteries of lanterns and a large collection of blotters between which I was still drying plants recently collected on Ovalau and on Makondronga, one of the leper islands. As the sailor untied the sling holding the metal drier, vulgarly nicknamed my "bathtub," the overloaded dory just teetered a bit and then suddenly turned turtle. The sailor, fortunately, bobbed to the

Fijians in an outrigger canoe in Savu Savu Bay; in the distance, on the shore, can be seen the roof of the house which the author rented on a copra plantation surface unhurt; but all my scientific equipment, including valued plants, sank to the bottom of the ocean. Grappling in 200 feet of water was of no avail. I was botanically bankrupt. I was rescued from my plight by the generosity of young John Swingle, colleague and official photographer of the "Cheng-Ho," by the gift of his small supply of blotters, given to him by his father with the admonition that he collect *Citrus* species. This equipment I supplemented by the purchase of Coleman lanterns and paper at the little town of Valethi. I likewise cabled to Suva for excess supplies I had stored at the Department of Agriculture through the kindness of its Director, Dr. H. W. Jack.

* * *

The entire personnel of the "Cheng-Ho" celebrated Christmas together. This day, so emphasized our religious captain, was the one single day in the year when he ate with a colored crew—an honor, I thought, perhaps not fully appreciated. We sailed to the head of the bay where the crew killed, cleaned, and then roasted some suckling pigs on a spit over an open fire in Filipino fashion. Little went to waste. The aged, impoverished Chinese storekeeper, in whose nearby store the shelves were almost empty, gladly accepted the intestines which he carefully turned inside out with aid of a stick and meticulously washed. Cut into convenient lengths and cooked, this was a feast to his liking.

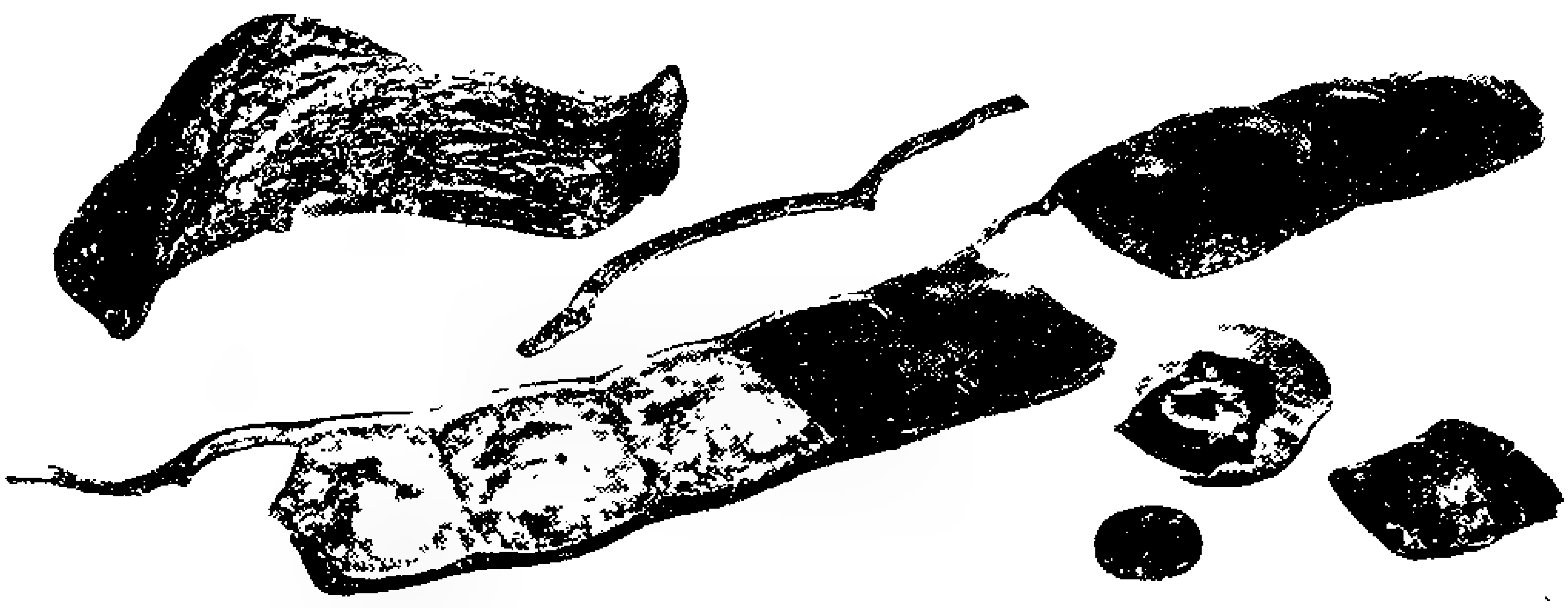
* * *

At Balanga, gentle, herculean Wiliami (William) attended to our wants, supervised the milking of the cows, and rowed miles over the bay to deliver butter for sale in Valethi, on the return trip bringing our groceries and "benzine" (gasoline). He had studied for the ministry but, disillusioned, at length found employment on this copra plantation. Samu, a Fijian not acquainted with the English language, acted as our bearer and guide. He was faithful and industrious but of no help in giving the names and uses of the plants collected.

In this general region Ordonez, Samu and I, often surrounded by a bevy of Fiji youngsters, ranged the surrounding hills and shores for specimens. We discovered a rather pretty *Tectaria,* later named *T. elegans,* on neighboring Savuthuru Mountain. Another novelty was the terrestrial *Habenaria scrotiformis,* the smallest-flowered rein orchis known to occur in Oceania. A nettle which Dr. A. C. Smith had named *Elatostema insulare* was likewise new. Not far from our house I happened to look up into the trees and was flabbergasted at the sight of enormous pods strikingly resembling the loments of *Desmodium,* but more than 2 feet long and 4 inches wide. They belonged to the almost pantropic giant bean or, accord-

Christmas dinner. Above: Roast pig for the members of the expedition and the crew. Below: The pig's intestines being prepared by the Chinese storekeeper for his feast.

ing to the natives, THIMBI (*Entada phaseoloides*), a remarkable plant with its massive grooved stems curving about the ground and reaching up to the tops of the highest trees. Whenever we were thirsty and the palatable MBU coconuts were not at hand, one of the Fijians simply severed one of the arm-thick trunks with his machete. Then with one deft stroke he cut about a two-foot length from the pendent end of the vine and quickly handed it to one of us. With mouths agape and a piece of vine held overhead, we had only a few seconds to wait before a small stream of almost tasteless, frothy, water-clear sap gushed forth to quench our thirst. Had



A giant bean with pod more than two feet long, and a piece of the thick stem from which a drink can be obtained

he cut a segment below the original cut, not a drop of liquid would have escaped from it; nor did I observe any bleeding from either end of the vine from which our segment had been taken.

* * *

Besides collecting several hundred kinds of miscellaneous plants which Wiliami rowed to the post office as soon as dry for mailing to Dr. Albert C. Smith for monographing,* we found some rather novel or interesting specimens worth special mention. In the forest we collected a 10-foot ginger (*Alpinia Parksii*), called LOTHOLOTHO by the Fijians. Its corolla is white while its fruit is pale yellow. The plant is very rare, and known thus far only from Vanua Levu and Viti Levu. A second interesting monocotyledonous plant was the banana-relative *Heliconia Bihai,* hitherto unreported from Fiji but common in Samoa, New Caledonia, and the Solomons. It is a well known ornamental, being grown in greenhouses in temperate regions and outdoors in warmer ones.

While we were coming down a jungly mountainside one day, several of the Fiji youngsters, who were wont to rush ahead, became excited about a small tree with white flowers. They proceeded to break off the smaller twigs and the coarse leaves (thus wrecking potential herbarium specimens) to allow a sticky, milky juice to exude. After a half minute or so they touched it gingerly to determine whether it had hardened. In two or three minutes several globules of latex popped into each mouth and each boy proudly and merrily masticated Fiji chewing gum. Noticing no ill effects, I followed suit with a fresh, clean piece. The tree proved to be *Alstonia costata,* one of the Apocynaceae, or Dogbane family, notorious for some very poisonous members. Later I was to collect this species again, for

* See *Sargentia* **1** : 1-148. 1942.

FOOD AND DRINK IN THE FIJI ISLANDS

A native planting of cassava

Climbing for "mbu" coconuts

Getting a drink from the stalk of a giant bean

(The author is shown in the middle)

Dalo, one of the staple articles of food

Catching "oura" — fresh water shrimp

Catching "oura" — fresh

example in the vicinity of Ngaloa, Island of Viti Levu, where it was called MBULEKI or MBULEI. These Fijians not only used its latex for gum but told me how they used its sap. They put the younger branches in the fire to wilt and heat them, scraped off the bark, placed it in the brown fibrous sheath taken from the base of a coconut palm, and squeezed the juice into sore eyes to cure them. To what eye disease they referred I could not make sure. *A. Reineckeana,* a 12-foot tree with orange flowers, and *A. vitiensis,* a 16-foot tree with white flowers, both collected in the same region, were called by the same name and were similarly used. Instead of scorching the bark of *A. vitiensis* my informant, however, merely mentioned scraping it. This genus should be studied for its possible economic value, particularly in war times. I have tried to import seeds but thus far have failed.

About Balanga I found a rather common small tree or shrub with bright yellow flowers, each with a single white sepal tinged with yellow, reminding me of a yellow poinsettia seen from a distance. It is *Mussaenda frondosa,* one of the Rubiaceae, or Madder family, well worth cultivating for ornament in warm countries. During my Fiji stay I observed this plant on most if not all islands visited. According to Mr. Dods, who has a wealth of interesting Fiji lore, its native name is *vombo* in some regions and *mbovo* in others. About Waina the bitter bark is scraped and made into a tea that is drunk as a reputed remedy for kidney disease.

* * *

The reason why a certain wide-spread plant like this mussaenda may have two or more different names is easy to surmise. Fiji lies within the easternmost range of Melanesian migration and roughly on the western fringe of Polynesian migration. It is, however, more Melanesian than Polynesian. These two linguistic stocks, each with probably several languages and numerous dialects arising from waves of migration from various regions of the west and east, have intermingled. The degree of this intermingling varies on different islands. In course of time, through divergent evolution, insular isolation, mountain barriers, and social barriers kept alive by frequent warfare and cannibalism, present-day Fiji has become a confused Babel of tongues. The natives from one island frequently cannot understand those coming from another. To state, as many writers have done, the "Fiji name" of a certain object is confusing unless the dialect is mentioned or at least the name of the region in which that particular name is used.

The confusion of tongues in Fiji is bad enough. To make matters worse, we are plagued with a confusion of sounds not found in the English language, and with the colonial's queer method of spelling these sounds. In one of the better-known native languages, some of the letters of the alphabet are pronounced as follows:

B is pronounced like *mb*; C like *th,* softly as in "that;" D like *nd* as in "end;" G like *ng* as in "song;" Q like *ng,* as in "longer;" R like *rr* with a heavy trill; U is pronounced *oo*; and V is often confused with our sound for "B." F, P, Y and Z are not ordinarily found in Fiji words unless introduced from some other language, like Polynesian or English.

S. M. Lambert in his frank and interesting book "A Yankee Doctor in Paradise," explains why the spelling of Fiji names is so unusual. The early missionaries in Fiji, he says, ran out of type. As no G and D sounds exist in Fiji except with a preceding N sound, to save his N's the printer simply did not use them. Thus the name "Nandarivatu," a region where I did much botanizing, in Fijian is spelled "Nadarivatu." The same occurred with M before B. Consequently the Fijian orthography for MBOVO would be BOVO. I have tried to spell Fijian words the way they sound to an average American rather than the way a printer with a paucity of type spelled them some 100 years ago.

* * *

It was in the mountains back of "my" Balanga copra plantation that Samu found a plant of *Pittosporum rhytidocarpum.* He poked a twig into its ripening, walnut-shaped fruit and proudly began to "write" with the juice-wet twig on his tattered, once white shirt. It left a brown stain reputed to be indelible. As neither Ordonez nor I spoke Fijian and Samu spoke no English, I thought it unsafe to transcribe his grunts and other sounds to my field notes; therefore I do not know the name of this pittosporum in his dialect. In the region of Serua, Viti Levu, it was called NDUVA.

Building a fish fence, or weir, from reeds fastened with fern rhizomes

A lovely little herb with pale blue flowers carpeted a springy clearing in the forest above the house. I saw it in no other place. It proved to be *Limnophila rugosa,* a "scroph" cited by Seemann, under a different name, from Fiji in 1866. This, by the way, is not endemic but grows from India to Malaya and Polynesia but excludes Hawaii. Another herb of springy clearings was *Lobelia zeylanica,* the only representative of the family known from Fiji, a truly remarkable fact in comparing its flora with that of the Hawaiian Islands where this family outdid itself in producing a number of endemic genera comprising more than 150 kinds!

Another anomalous floristic fact occurs in the Pepper family, or Piperaceae. In Fiji *Piper* is common in species as well as individuals while *Peperomia* is rare. In Hawaii, on the contrary, *Peperomia* is common in species and individuals while *Piper* is entirely wanting as a component of the native flora. Hawaii harbors simply two introduced *Piper* species: *Piper methysticum,* known as AWA by the Hawaiians, KAWA by the Samoans, and YANGONA by the Fijians, spread throughout most of Oceania by prehistoric man as the source of a valued ceremonial drink; and a form of *Piper Betle,* the betle pepper, introduced during the last century probably by the Chinese.

Pogostemon Cablin was the only mint I collected in a stay of over seven months in Fiji. My first specimen I found in a clearing near the summit of Vatunivuamonde Mountain. It was a coarse, sprawling shrub. Months later, I gathered it in the weedy lowlands of Vatukarasa, Viti Levu. There it was called TUKILAMLAM. The Fijians, after squashing the leaves and partially drying them in the sun, add them to coconut oil to impart fragrance to it. This is then used to anoint their bodies and sparingly their hair. Though this is the first record of the plant for the Fiji Archipelago I suspect it to be of early introduction, as it is generally cultivated in tropical Asia and Malaya.

Pantropic weeds and cultivated plants have become naturalized in the Fiji Islands in large numbers. Yet, because they tend to be ignored by the collector for more precious botanical treasures, they are not well represented in herbaria. One of these hitherto unrecorded, humble weeds was *Spilanthes Acmella,* one of the Compositae. It had become naturalized in a swampy pasture near my collecting headquarters. The nearest record to Fiji Dr. Smith could find was in New Caledonia.

The old coconut trees in this same pasture had their trunks overgrown with the two pretty epiphytic ferns, *Humata heterophylla* and *Cyclophorus lanceolatus*; and with various small orchids, mosses and lichens. *Stenochlaena palustris,* a very coarse, coriaceous fern, grew in tangles at the base of the trunks, clumsily appressed and twining about them to a height of 6 to 12 feet. The young, somewhat flaccid fronds, cooked, made a delicious potherb. In making their fish-fences or weirs (some of which I passed while Wiliami, bulging-armed and smiling, was rowing me from Balanga to Valethi) the Fijians tied reeds or brush with the aid of its wiry rhizomes. These had been made pliable by being thrown into a fire for a short while. The Fijians maintain that the rhizome of this fern, known to them as MINDRI, withstands exposure to salt water better than any other plant fiber available.

In the open jungle between Balanga and Valethi I found *Salacia vitiensis,* a member of the unusual Hippocrateaceae. It is a liane with green flowers and fruit. This was the third time the species has ever been collected. Later, in June 1941, I was fortunate to find a new species, afterward named *Salacia pachycarpa* by Dr. Smith. It grew, however, on Viti Levu near Rewasa, where it was known as WASAM.

On Vanua Levu I collected two kinds of *Tacca—T. maculata* and *T. pinnatifida,* the latter called FARASIKO at Balanga. One kind of arrowroot starch is gained from the corm of this species but, according to a native friend, "if chickens eat the scrapings of the root, they die." *T. maculata,* according to a 12-year-old Fijian, is inedible. Both plants are coarse erect herbs of odd appearance, belonging to an anomalous family consisting of two genera and less than fifty species.

In the Hawaiian Islands the lowlands are beautiful from a distance with their pale green trickle of silvery KUKUI or candlenut trees (*Aleurites moluccana*) spilling down the gulches and ravines. These narrow forests consist of pure stands. But in Fiji I saw nothing like that—simply an occasional scraggly tree. The KUKUI or TUTUI of the old Hawaiians is known to the Fijians speaking the Sabatu dialect as TOTO, interesting philological evidence of the two peoples' blood relationship. Though the kernel of this euphorbiaceous tree was the chief source of illumination for the Hawaiians, it was not used by the Fijians—at least not by those of the Nandarivatu (Viti Levu) region, as they preferred kauri gum or resin instead. Today they are forbidden to tap the kauri for resin even on their own lands, thus preserving the trees for lumbering and obliging the natives to buy kerosene from the white man to fill their lamps.

Another plant that surprised me, long-resident of Hawaii, was the mountain apple, *Syzygium malaccense,* one of the Myrtaceae, which I had pictured in color in my "Flora Hawaiiensis" in 1933 under the old name of *Jambosa malaccensis.* In the Hawaiian Islands this tree grows gregariously in the darkest, most hidden ravines below about 2,000 feet elevation. There it bears its crimson flowers close against the branches from March to May, and its polished, waxy "apples" from July to November. These fragrant but somewhat insipid fruits are more a delight to the eye than to the palate. While the genus is rare in Hawaii, it is well represented in species in Fiji, yet, of this particular species, so common in Hawaii, only a few isolated trees, apparently native ones, were found in the Fiji Islands.

The photographs appearing with this article are mainly by Mrs. Ann Archbold, members of the expedition, and Mr. N. L. H. Krauss.

(*To be continued*)

The Sycamore Plant Bug

By B. O. Dodge

FOR a few years past, during June, we have observed an injury on the leaves of our plane trees, especially the American plane, or sycamore, *Platanus occidentalis.* Having seen similar trouble in other years caused by the lace bug, *Corythucha ciliata,* on sycamores in the wild, we assumed at first that this same insect was the culprit. We were unable, however, to find a single lace bug infesting these trees at the New York Botanical Garden. Only a few pale leafhoppers tinged with yellow seemed to be feeding here and there.

The trees were immediately sprayed with bordeaux mixture to which was added 40% nicotine sulphate, one pint to 100 gallons of the spray mixture. The next year the injury suddenly reappeared and the trees were again treated with the spray, but the applications both times were apparently given too late to have any beneficial effect.

This year, therefore, a closer watch was made early in June. The damage to the leaves even then was rather pronounced. Practically no leafhoppers could be found at this time, but there were numerous grayish plant bugs which appeared to be feeding on the upper side of the leaves, sometimes singly, other times five or six together. They had the general appearance of the tarnished plant bugs, although not so highly colored.

Various views of the sycamore bug, Plagiognathus albatus, enlarged about 2 diameters.

Later on, after the middle of July this year, the leafhoppers had apparently increased in number, while the grayish plant bugs had practically disappeared. Leafhoppers were always found on the under side of the leaves, but the plant bugs, when feeding, were usually on the upper side.

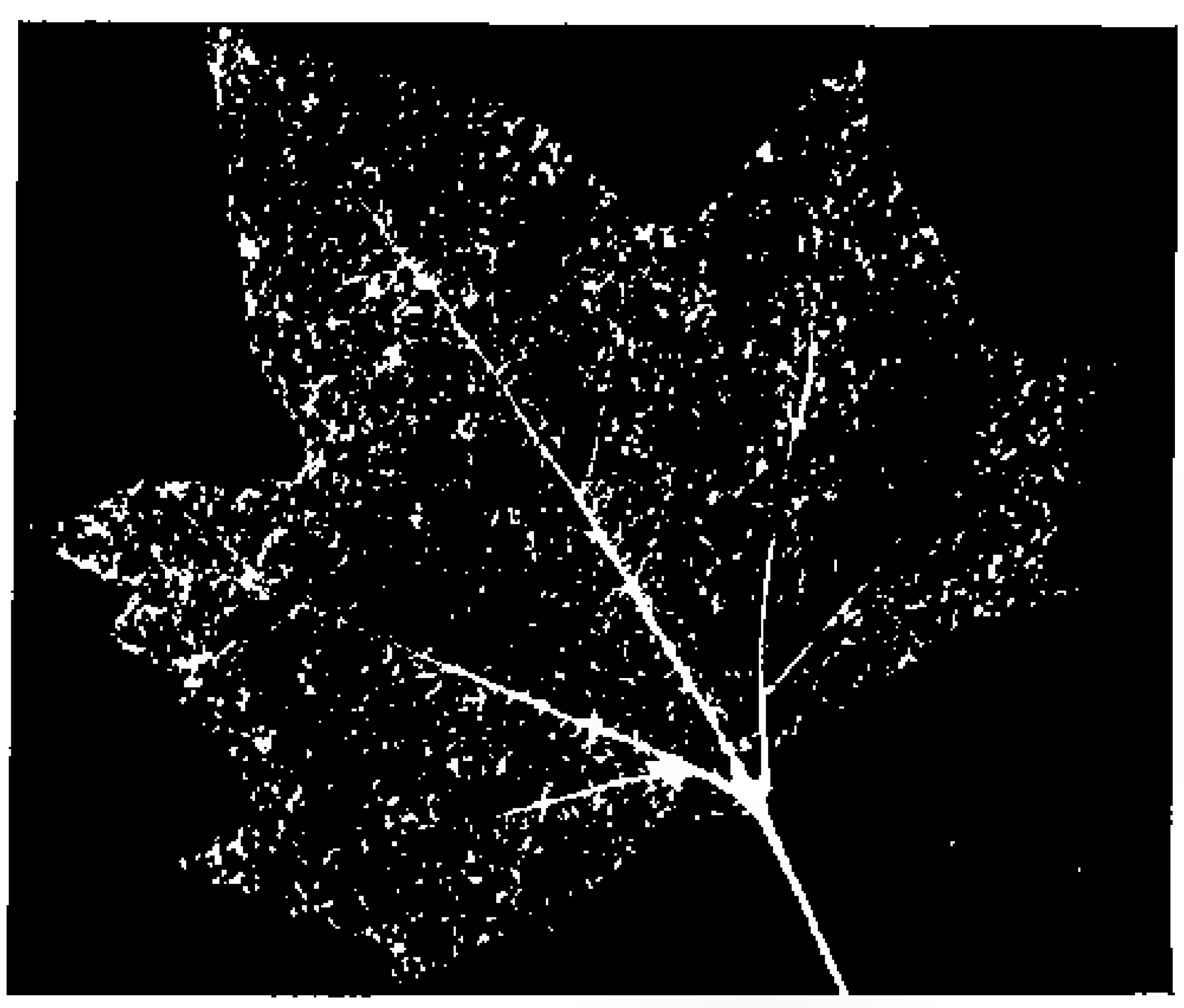
Dr. C. H. Curran of the American Museum of Natural History, who agrees that the plant bug has been causing the major injury to the sycamores, identified the specimens we sent to him as *Plagiognathus albatus*, which is described in the "Hemiptera of Connecticut."

None of the works on diseases and insect pests of ornamental and forest trees available in the Garden's library lists a plant bug as a sycamore pest. "A List of the Insects of New York" by M. M. Leonard, however, does mention this plant bug as collected several times in New York State on sycamore.

Under side of leaf of the American sycamore, showing the irregular holes in the leaf which are no doubt caused by the poisons injected by the plant bugs, causing a shrinkage and tearing away of the leaf tissues.

While these sycamore plant bugs are rather shy and often run around to hide on the under side of the leaves or jump off when disturbed, they are easily captured. The body of the female is a dingy creamy white, often with a few short, rather dark brown or blackish, transverse stripes on the body part. The wings, characteristic of the group of plant bugs called the MIRIDAE, often show a slight iridescence and are marked by two or three small blackish-brown spots. The body of the male of this species is darker than that of the female, being dark gray to almost black. The males seem to be somewhat more shy than the females.

Injury to the American sycamore is much more pronounced than to the London plane, *Platanus acerifolia,* where only



Upper side of leaf of the London plane tree showing the puncture marks caused by the sycamore plant bug. A few angular holes appear especially along the central veins.

a few of the leaves at the tips of the branches are riddled. Since infested leaves do not show a striking browning and shriveling or curling, one is apt to overlook the injury at first. The leaves merely show numerous small whitish specks on both sides and many irregular angular holes which apparently result from the shrinking of leaf tissue following the injection of poisonous substance by the bugs. The leaves of the London plane tree do not exhibit quite as many of these angular holes.

Brief surveys of the trees along some of the streets and in our New York City parks, where the London plane is often planted, indicate that very commonly the leaves at the tips of branches show the same whitish puncture spots and also the small angular holes with thickened reddish-brown borders. Mr. David Schweizer of the City Parks Department informs me that for several years past he has noticed a plant bug that was causing such an injury to plane trees, and that while the trouble is widespread throughout the city, also on Staten Island, it is not usually serious on the London plane.

But on the American sycamore, certainly, control measures should be carried out. Since the injury is practically over by the end of June it is clear that one should begin spraying with bordeaux mixture with added nicotine sulphate by the first of May, repeating the operation two or three times at 10-day intervals. This should not only repel the plant bugs themselves, but also the leafhoppers, and at the same time act as a contact insecticide. It would also help as a fungicide to control anthracnose, or twig blight, which infects the sycamore.

Phytophthora, Potatoes and Policemen

NEW York's police force owes some of its character to a fungus, Dr. F. J. Seaver implied to the audience at the closing Members' Day program of the season, June 2.* This fungus, *Phytophthora infestans,* is the blight which infected the potato crop in Ireland during the nineteenth century. The infection caused the loss of the entire crop, which caused the great Irish famine of 1846-47, which, in turn, resulted in a great migration of Irish people to the United States. It is from the families of these immigrants that large numbers of the New York police have been recruited.

Dr. Seaver, speaking on "Fungi in their Relation to Man," mentioned fungi as food, in the form of mushrooms, and issued a warning against the popular cooking tests, such as the silver spoon and the onion test, for determining poisonous mushrooms. He spoke of fungi that are used medicinally, such as

* See page 220 for an announcement of the Members' Day programs for the fall.

ergot, which is a smut disease on grains of rye, and *Fomes officinalis,* a bracket fungus which is employed in hospitals to prevent night sweats in tuberculosis. He told of how special forms of fungi now are being cultured for the ripening of cheese. Formerly, he said, cheese manufacturers relied upon chance infection, but now cheeses are being inoculated with the proper fungus to impart the flavor desired.

He referred to the fungi that cause human diseases, such as athlete's foot and other skin affections, and to the countless fungi that are responsible for plant diseases, such as the famine-breeding potato blight, which even today in the United States causes crop damage estimated at $36,000,000 annually.

In 1923 Dr. Seaver spent part of the year in Puerto Rico making a study of the fungi that cause diseases of cultivated plants. The resulting survey that was published listed 1,500 species. Among all these, only one powdery mildew was found in fruit. Discovered on a weed of the Mallow family, it was apparently an uncommon pest and, up to that moment unknown to science.

"About six years later," Dr. Seaver continued his story, "I received a paper from a Mr. Abbott for publication in *Mycologia,* on a disease of cotton in Peru, caused by a new species of powdery mildew, the only powdery mildew ever found in fruit in Peru. This served to refresh my memory. A specimen of the Puerto Rican material was sent to Mr. Abbott and he agreed that the two fungi were identical. In Peru, he said, it was 'one of the most common diseases of cotton, occurring in all of the cotton growing valleys of the coastal region where cotton is a major crop.' In the fall the leaves have the appearance of being covered with a light fall of snow, giving rise to the local name 'manta blanca' or white mantle. Here," concluded Dr. Seaver, "is an illustration of a fungus collected for its scientific interest, and later found to be of economic importance."

New Floras to be Published Through Co-operation of Botanical Garden With Utah State College

BETWEEN the State Agricultural College of Utah and the New York Botanical Garden an agreement was signed in July by which the two institutions will co-operate in the field work for and the preparation and publishing of two important floras: (1) A Manual for the State of Utah and (2) A Flora (illustrated) of the Intermountain Region.

Both of these projects had been started by Dr. Bassett Maguire during the years he spent at the State College in Utah. Now, as Curator at the New York Botanical Garden, he will be enabled to continue his work of collecting and writing on the plants of these regions, while his successor in Utah, Prof. A. H. Holmgren, will aid in the work. Three more summers of exploration are planned: 1944 to complete the work in the State of Utah, 1945 and '46 to be spent in western Nevada and eastern Oregon and Washington; and 1947 to be devoted to a final round-up of the entire intermountain area.

The two institutions are to share equally in all collections, and while the writing of the proposed floras becomes jointly the responsibility of both, the publication of the Manual for Utah is to be largely the responsibility of the Utah State Agricultural College, while the publication of the Flora of the Intermountain Region is to be largely the responsibility of the New York Botanical Garden. This region is the only major physiographic area of the country that has not heretofore come under the influence of the Botanical Garden, and it is the region perhaps least known botanically. It has never been adequately collected or completely treated floristically.

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.)

Negro Genius of American Agriculture

GEORGE WASHINGTON CARVER. Rackham Holt. 342 pages, illustrations, index, bibliography. Doubleday, Doran & Co., Inc., New York. 1943. $3.50.

THIS is the long awaited life of an unusual man with a most remarkable and interesting history. George Carver was born of slave parents on a farm near Diamond Grove, Mo., about 1864. In infancy he lost his father and was carried into captivity with his mother, who was never heard of again. He was bought from his captors for a race horse costing $300 and was returned to his former home in Missouri.

This was the beginning of Dr. Carver's life; he ended it full of well-deserved honors. Like Benjamin Franklin before him, he was made a member of the Royal Society, the oldest scientific society of Great Britain, and Congress has just passed a bill making his birthplace a national monument.

GEORGE WASHINGTON CARVER*

This full-blooded Negro and ex-slave became a creative chemist whose contributions to agricultural economics were of inestimable value. His boyhood full of struggle against poverty and illness ended with a bitter collegiate rebuff. He finally entered Simpson College and went on from there to Iowa State where he studied under two future Secretaries of Agriculture, James G. Wilson and H. C. Wallace.

After graduation he received the appointment of assistant botanist in the Experiment Station. He was chosen because he was the most brilliant student, the best collector, and the sharpest observer. He was put in charge of the greenhouses where his work with amaryllis proved that he was such a master of crossing that the Iowa Agricultural Society employed him to cross and hybridize orchard fruits. Carver stayed there for two years and then Booker T. Washington asked him to become the head of the Agricultural and Dairy Department of Tuskegee, the new Negro Institute that he was starting in Alabama. His professor and friend, James Wilson, deeply regretted his going, realizing the full value of the man as well as his scientific skill.

The rest of Dr. Carver's life was spent at Tuskegee, which developed rapidly and became what Washington had dreamed of making it an integral part of the Negro community. One of Carver's most valuable contributions to it at this time was "Tuskegee on wheels," a demonstration wagon which penetrated into remote districts and taught the backward Negro farmer better and more scientific methods of agriculture.

* *From the original by Amy Spingarn, 1935, in the James Weldon Johnson Memorial Collection in the Yale University Library.*

But Dr. Carver's chief work was not in the fields but in the laboratory. He experimented with the common things around him; the soil of Alabama and its ordinary plants, the peanut and the sweet potato. From them he extracted hundreds of by-products, and millions of people are better fed and more prosperous for his labors. Thomas A. Edison once offered him $100,000 a year but he refused it. He refused to profit from any of his discoveries. He lived on his salary of $1500, and gave his life savings to establish a foundation of creative chemistry.

He belonged to no particular sect but was deeply religious. Before undertaking any experiment he would withdraw and concentrate in prayer. He believed all things were put on earth for some useful purpose and that it was his function to discover as many of these as lay within his power. That was his faith and he lived up to it.

Mrs. Holt has done a commendable piece of work in collecting the facts of Dr. Carver's life.

AMY SPINGARN,
Amenia, N. Y.

Rock-Gardening Guide

ALPINES IN COLOR AND CULTIVATION. T. C. Mansfield. 277 pages, 80 colored plates and 30 drawings. E. P. Dutton & Co., New York, 1942, $3.75.

A welcome change from the overflow of Victory Garden literature, this book on alpines and its allied subjects will greatly appeal to the rock-garden enthusiast the country over, and probably will create excitement and interest in many a non-rock-gardener.

Every phase of rock-gardening is briefly but explicitly covered, from the selection of a site, the planning and construction, mixing of soils, maintenance, and the control of pests, to the scree and moraine, the path and the wall garden and other specialized subjects, including the alpine house.

The hundreds of species and varieties described have actually been grown. Although the practices are English and the plants have been grown under English conditions, there is no reason why many or all of them could not be grown in some parts of this country, with its wide ranges of climate and temperature.

About 400 of these plants have been photographed in color and are illustrated in harmonious combinations.

All told, this is a most enjoyable and useful book, well worth having.

HILDEGARD SCHNEIDER,
The Cloisters.

Natural Dyes And What They Are Made Of

THE CHEMISTRY OF NATURAL COLORING MATTERS. Fritz Mayer, translated and revised by A. H. Cook. 354 pages, indexed. Reinhold Publishing Co., New York, 1943. $10.

In this translation and revision of the third German edition of Fritz Mayer's "Chemie der organischen Farbstoffe," the authors have extended the scope of the original beyond those natural coloring matters which have a substantivity as dyes and have included those compounds which play some role as pigments in nature. Slight reference has been given to the biological properties of these compounds, a subject of growing importance and worthy of separate treatment.

It is impossible in the space allowed to give justice to the recorded information of the thousands of treated compounds, most of which are represented by graphic formulae and detailed properties, with means of synthesis where known.

The index is a model for scientific publications, listing as it does the compounds by their popular names and by the chemicals they contain, thus allowing ready reference to a desired subject. An idea of the completeness and thoroughness of the research of the authors may be gained from the Author's Index, which includes the names of some 1,500 investigators.

W. F. LEGGETT,
Associate Editor,
The Textile Colorist.

Handbook for Flower Growers

FLOWER GARDENING — Pocket Guide. Montague Free. 486 pages, illustrated, indexed. Pocket Books, Inc., New York, 1943, 25c.

A handy handbook, taken from the author's excellent volume, "Gardening—A Complete Guide to Garden Making." Probably the most complete and reliable work on the subject.

BROADCAST

ON the New York Botanical Garden's radio program of August 20 over station WNYC, Percival Wilde, playwright and author and amateur mycologist, spoke on his hobby of hunting and studying mushrooms. Below are some excerpts from his talk in which he warned other mushroom hunters of the fallacy of the silver spoon and salt and peeling tests for poisonous varieties, and also told of the pleasures he and his sons have had in learning to know and enjoy the mushrooms they have found together.

BECAUSE America has learned to eat only one mushroom out of dozens of varieties which are as good and better eating, we are allowing tons of the most delicious and abundant food we possess to go to waste, and that at a time of a national food shortage. Have you ever stopped to consider what would have happened to the wretched populations of the occupied countries, the French, the Dutch, the Belgians, the Jugo-Slavs, the Poles, if they had not known mushrooms, and had not been able to supplement their meagre rations with foods we never touch? . . .

The layman, and under that heading I include myself, is too fond of saying, "All toadstools look alike." Ah, but they don't. If I were to show you a rose, and say "Isn't that a beautiful violet?" you would correctly assume that I had gone mad. But that is because you have been taught, all of your life, to know the difference between those two flowers, and are positive which is which. But if I were to hand you a box of crayons, and ask you to make crude but recognizable sketches of three different mushrooms, you probably would be helpless, for in spite of the fact that when you visited the country you saw hundreds of varieties growing in the fields, in the woods, along the roads, on tree-stumps, and even on other mushrooms, you passed them by without a second glance. And yet there are mushrooms in many forms: short stems, long stems, no stems; round caps, flat caps, funnel-shaped caps; large gills, small gills, toothed gills, no gills; and they may be white, gray, yellow, red, brown, green, or black, and some of them may exude a milky fluid when you break them. Many of them are poisonous if eaten—that we must remember, and the poisonous ones should be learned first, so that we may be sure to leave them alone—but because there is bad among the good, as there is in nearly everything, it is a mistake not to look twice, not to study some of the excellent books which have been published on the subject, not to seek guidance from better-informed friends, not to go to the New York Botanical Garden, where a small but excellent collection of mushroom models and a large and complete library will teach you something about this fascinating subject. . . .

It pays to be careful.

If what I have said encourages my listeners to study mycology, which is the science of mushrooms, I shall be pleased; but I do not wish to take upon my soul the responsibility of encouraging beginners to eat mushrooms which have not been positively identified for them by friends who really know, for their first mistake may easily be their last. . . .

There is only one way in which you may learn to know the mushrooms positively, and that is to study them so that you may recognize them quite as easily as you recognize Jones, and Smith, and Robinson, and the rest of your friends. Excellent textbooks are published by the botanical departments of the various states, and because the states are not interested in making money, they are sold at absurdly low prices. Some of the best textbooks are issued by the office of the State Botanist, at Albany, New York, who will send you a list of them if you ask for it. If you wish to look them over before buying them, you can do so at the library of the New York Botanical Garden. You will have questions to ask. You will find experts at the Garden who will be delighted to answer them for you. Let them check your findings until you yourself know what you know—and know also what you don't know. But until many of you accept that invitation, and learn, with the help of the Garden, to make full use of our natural resources, we Americans shall continue to afford the rest of the world a sad spectacle, for we shall be starving in a land of plenty.

Autumn Events at the Garden

Members' Day Programs

THE FIRST WEDNESDAY OF EACH MONTH
AT 3:30 P.M. IN THE MEMBERS' ROOM

Oct. 6 *Penicillin*—Life-Saving Substance From A Mold
William J. Robbins, Director, New York Botanical Garden

Nov. 3 *Summer in the Great Basin*
A Report of the Garden's 1943 Expedition in the West
Bassett Maguire, Curator, New York Botanical Garden

Dec. 1 *Drug Plants and Plant Drugs*—Their Place in the Modern World
George M. Hocking, Pharmacognosist, S. B. Penick & Co., New York

Radio Programs

ALTERNATE FRIDAYS AT 3:30 P.M. OVER WNYC

Sept. 24 *Questions and Answers on Landscape Gardening*
Carl F. Wedell, Head of the School of Horticulture, State Institute of Applied Agriculture, Farmingdale, N. Y.; Chairman of the Greater New York Victory Garden Council; and Instructor in Landscape Gardening at the New York Botanical Garden

Oct. 8 *Tips on Trips in New York City* and its vicinity for autumn coloration

Oct. 22 *What the Woman's Land Army is Doing*
Elizabeth C. Hall, Librarian at the New York Botanical Garden

Free Illustrated Lectures

SATURDAY AFTERNOONS at 3 o'clock

Sept. 25 *How to Preserve the Victory Garden Crops*
Esther C. Grayson, Writer and Lecturer

Oct. 2 *Autumn Flowers of Field and Garden*
E. J. Alexander, N.Y.B.G.

Oct. 9 *Growing Vegetables in New York City*
Joseph W. Tansey, N.Y.B.G.

Oct. 16 *Victory Gardens of 1943 in the Bronx*
Harriet K. Morse, Greater N. Y. Victory Garden Council, with a group of Bronx home gardeners

Oct. 23 *Away with Garden Pests! –It's the Fall Campaign that Counts*
Bailey B. Pepper, New Jersey Agricultural Experiment Station

Oct. 30 *Gardens of England—Before the War and Now*
Frederick W. Raetz, Photographer

Nov. 6 *Food and Drug Plants of the American Indian*
G. L. Wittrock, N.Y.B.G.

Nov. 13 *Why Eastern Soils Must Be Conserved*
P. J. McKenna, The Home Garden Magazine

Nov. 20 *Spices, Food, and Health*
M. L. Van Norden, American Spice Trade Association

Nov. 27 *Vitamins and Vegetables*
Ilda McVeigh, Yale University

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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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 526

OCTOBER
1943

PAGES
221-244

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

PROCESSION OF BOOKS

A NEW volume has now been added to the notable shelf of books that have been sponsored by the New York Botanical Garden. This is the 638-page book on garden diseases and pests that has developed out of the 25 years of work in plant pathology at the Garden by Dr. B. O. Dodge. It has been written in collaboration with Dr. H. W. Rickett and published by the Jaques Cattell Press.

A full-size book in the horticultural field is a new departure for the Garden. From the earliest days it was acknowledged that one of the purposes of the institution should be to publish authoritative volumes about plants, but this is the first book that has not been taxonomic in nature. All of the others (except some volumes of the Memoirs) have consisted of descriptions of the plants growing wild in North America and the surrounding regions.

Before the Garden was actually established, work was begun on the famous set of books that has come to be laconically known as "Britton & Brown." This is the three-volume work entitled "An Illustrated Flora of the Northern United States and Canada," written by the first Director of the Garden, Dr. Nathaniel Lord Britton, and one of the first of the Scientific Directors and later President of the Board, Judge Addison Brown. When the third volume appeared in 1898, the set was hailed as the first botanical work in America in which every plant described was illustrated. And there were 4,162 species of plants treated in the first edition.

Following this were Britton's "Flora of Bermuda" (written in collaboration with a number of other botanists); Britton & Rose's "The Cactaceae," which still stands as the authoritative treatment of this family; Dr. John K. Small's monumental "Manual of the Southeastern Flora" and his other books which were published over a period of more than 30 years; Dr. P. A. Rydberg's "Flora of the Prairies and Plains of Central North America," which appeared just after the author's death in 1932; and Dr. H. A. Gleason's "Plants of the Vicinity of New York"—this last a miniature of a mere 284 pages in comparison with the others, being a pocket handbook for the beginner, but still a book devoted, like the others, to the identification of plants.

Breaking into a new field, the Dodge & Rickett "Diseases and Pests of Ornamental Plants" is a worthy addition to the 45-year procession of books that bear the signature of the New York Botanical Garden and members of its staff.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 | OCTOBER 1943 | No. 526

The Last Cruise of the "Cheng-Ho"

By Otto Degener

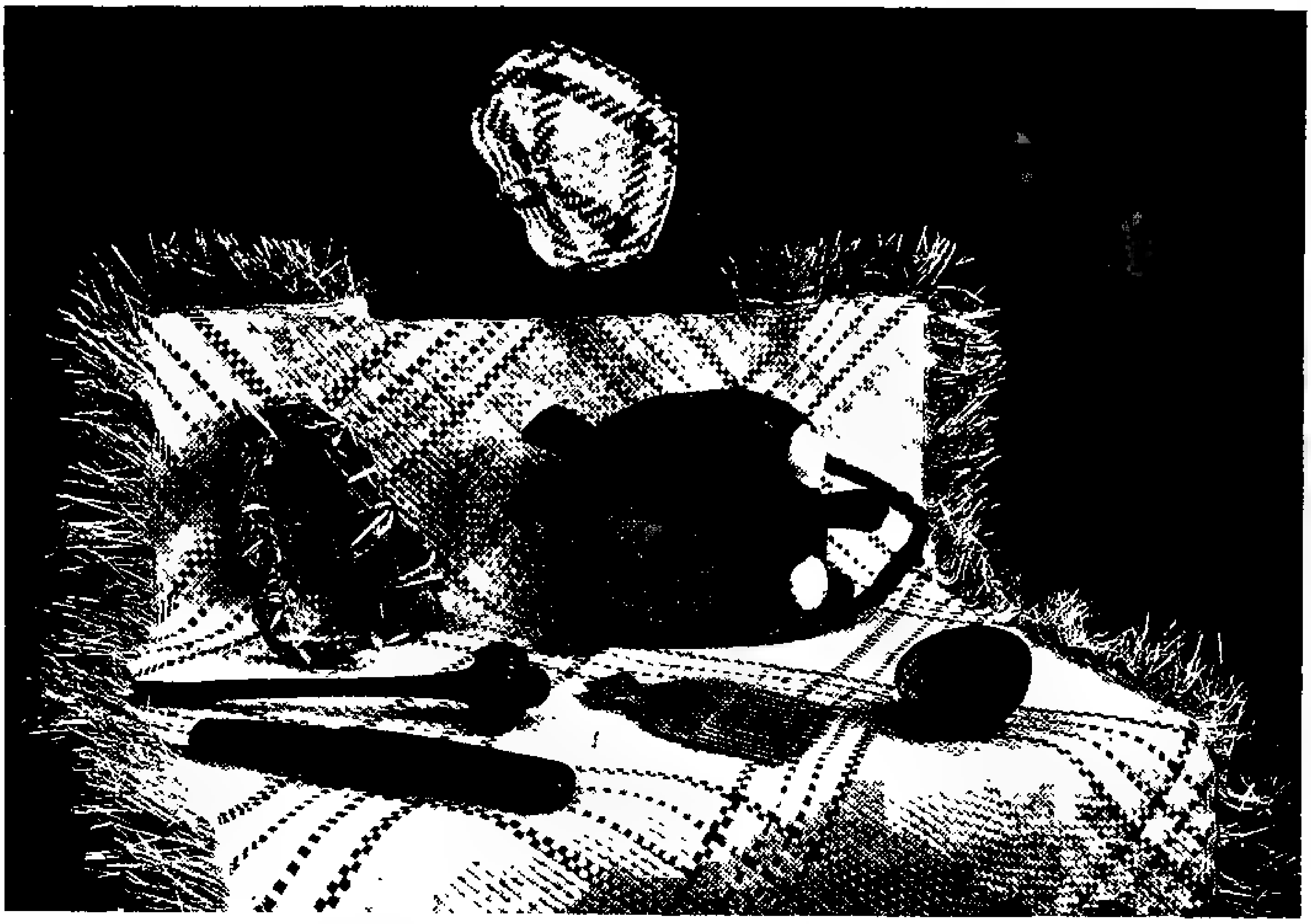
The Beginning of an Eight Months' Collecting Trip in Fiji Sponsored by Mrs. Ann Archbold

(*Continued from the September issue*)

BEFORE leaving Honolulu for Fiji in the fall of 1940, I had been informed by several friends how advantageous it might be for me to have various trinkets on hand for trading with the natives. Consequently I visited a 5-and-10-cent store in Honolulu where I spent $10 each on costume jewelry, individual 10-cent bottles of perfume; and the most gaudy, large size socks imaginable.

After about a week's stay at Balanga, where the last Caucasian house along Savu Savu Bay was located, the handful of natives daily passing along the beach discovered that my assistant, Ordonez, was interested in unusual shells and I in almost any kind of native artifact. They could not quite understand why this queer American "millionaire" (most Americans were thought to be millionaires by the natives) would buy outright for cash or would barter many valuable things for their home-made bark cloth, mats, fans, combs, clubs, spears, and bowls, and for utter "rubbish" such as insects, hermit crabs, land mollusks, and even plants which they knew had no value. The word spread. Fijians from the head of the bay, along the shore and from inland hamlets, came to my house carrying interesting bundles.

I tried to dispose of my supply of screamingly loud socks, but, as Fijians go barefoot—some of the chiefs and city dwellers occasionally wear sandals without socks—I, heavy-hearted, took the socks back home to Hawaii with me where after many, many months of shame I wore them out myself. I also tried barter with my perfume and jewelry, which I was always careful to admit was "PAPALANGI (white man's) rubbish," but



Native artifacts from Fiji: fan; mat of pandanus; dry roots of Piper methysticum from which the national drink "yangona" is made; yangona bowl carved in the shape of a turtle; yangona cup made of darkened, polished coconut shell; fluted "boli-boli," or throwing club, of casuarina wood; "masi," or bark cloth, beater also of casuarina; native comb

was unsuccessful. They liked it but could not afford to gratify their craving for personal adornment. With the copra industry bankrupt and no remaining way to earn cash, these people were frantic for a little to be able to buy matches, kerosene, tobacco, needle, thread, scissors, a knife, a "singlet or a shirty," or some yards of cheap print cloth. For these ragged natives to be able to pay their taxes was utterly impossible. Fortunately for them, under the more enlightened rule of young Mr. Sykes, the District Commissioner (some "DC's" are brutes and scoundrels), they were excused from this burden and the prevalent jailing of natives for tax delinquency in the Fiji Islands was here suspended. Had the law for tax violation been enforced, the entire native population of the district would have been languishing in jail.

First I simply bought things from the natives. In paying perhaps 7 shillings for a handsome 3 x 6 foot mat of pandanus, I would add as gift, if the seller were a man, a tiny bottle of perfume; if a woman, a piece of jewelry. Both parties were satisfied. When my supply of cash got threateningly low, with no bank at hand to honor a check and the mail both irregular and infrequent, I began to exchange an old shirt, or an under-

Above: Tucker Abbott using a glass-bottom box in search of mollusks. At the right: Vincente Raval—faithful, efficient Filipino, First Officer of the "Cheng-Ho"

shirt and pair of drawers, for such a mat. As I gradually bartered away all my torn and threadbare articles of clothing, and interesting Fiji artifacts were still coming to my door, I broached my supply of better clothes and at length even my new ones. When I finally left Vanua Levu, my wardrobe consisted of little except a change of hiking clothes, a new suit, and my tuxedo! When jolly Father Laplante, a dynamic and practical-minded priest of French-Canadian extraction, dropped in from his mission for tea one afternoon, I told him what I had been doing. He laughingly exclaimed that now the mystery of last Sunday's strikingly well-dressed native congregation had been solved. All my clothes had gone to church!

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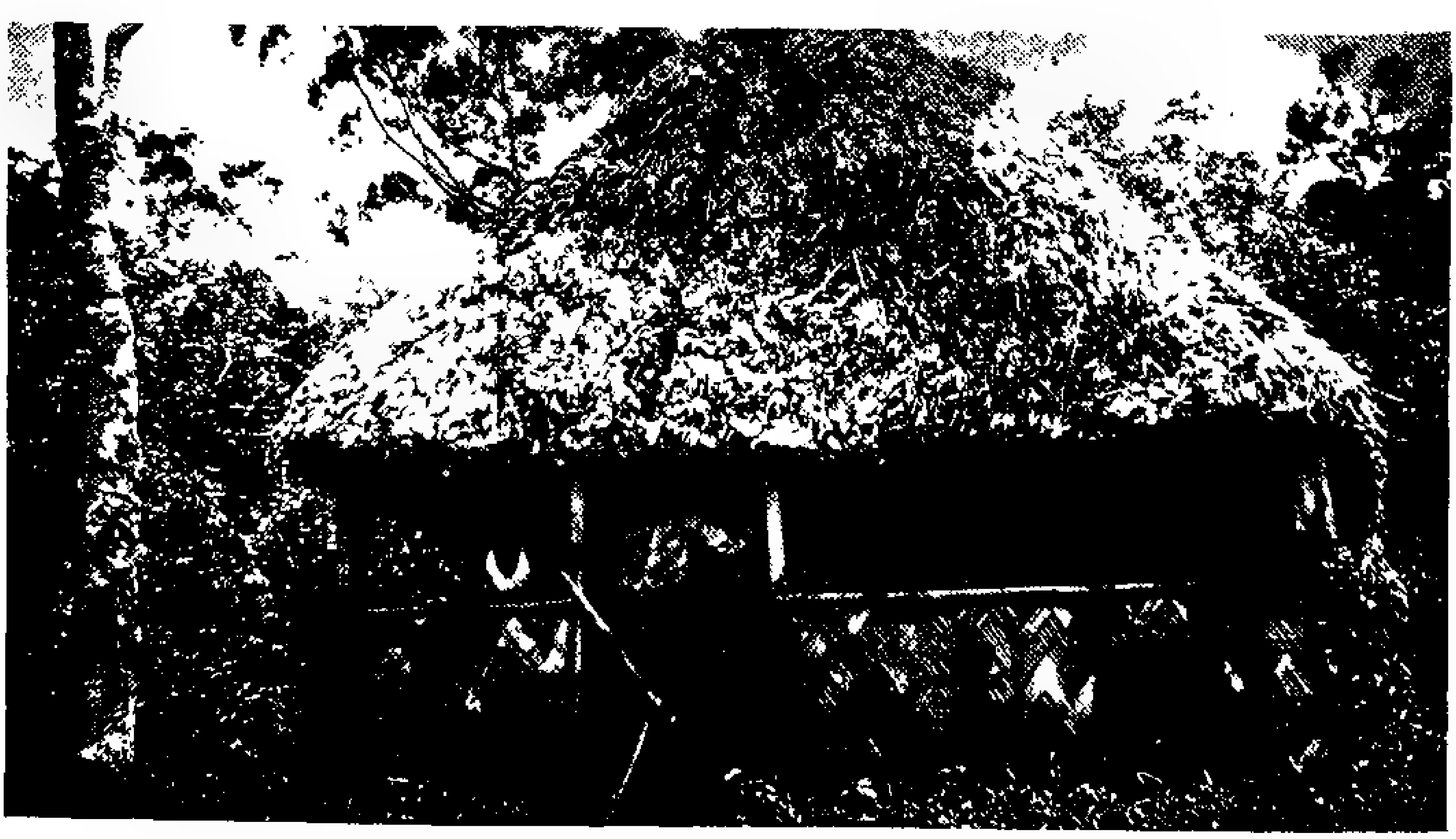
Mr. Mark Dods was not only my landlord at Balanga, but soon became my friend and even patron. With me simply paying for the gasoline, he procured a leaky, teredo-infested launch and a miserable, staring, part-Fijian idiot whose sole task was to keep bailing to prevent the launch's foundering. Mr. Dods, a boat-builder friend, a congenial gold prospector, Ordonez and I then set out one morning for the mouth of the Yanawai River just over the horizon on the other side of Savu Savu Bay. The day was fine; the water so clear as to show incredibly loosely branching corals at considerable depth; and the sea so smooth that I could easily observe large numbers of compact, silvery, marine water striders darting like lightning away from the chugging boat.

Mr. Dods owned forest land along the Yanawai and here in a Fiji-style house overlooking the river we set up our headquarters that afternoon. With our host in the lead, carrying his gun to bring down some of the large brown fruit pigeons we occasionally heard booming in the tree tops, Ordonez and I trailed slowly behind in our search for plants. We continued this procedure daily for the next few days. We found many interesting specimens, some quite outstanding.

Knowing that Tucker Abbott, my malacologist colleague of the "Cheng-Ho," would never collect in this isolated region, I thought I would surprise him by mail with a few of the local shells. I therefore pulled over an occasional rotting log or branch in my search. While doing so on a densely forested slope devoid of underbrush, I noticed a stiffly erect, almost invisible, purplish-red plant with stem not much thicker than a horse hair or pig's bristle. It bore no flowers but tiny glomerules resembling in shape, perhaps, a coarse, seedy, dried blackberry. I did not know what this was—not quite sure whether it was some strange fungus or, after all, perhaps some higher plant like the giant snowplant of our western states. I took off my hat and laid the plantlet upon it, resolving to throw the mystery away if I could find no others. Why drive an identifying botanist crazy with a single two-inch plant that is so degenerated and so far gone in maturity that it lacked any sensible characters to identify it by? It would simply lead to gnashing of teeth and pulling of hair in an otherwise sedate museum laboratory. I then looked around carefully to see if any black wood-ants might be around, the kind that energetically grabs a mandibleful of skin with a bulldog grip, quickly arches its body like a frightened cat, and then seems to plunge a red-hot poker into your flesh. They had jumped



The gold prospector and the writer in field headquarters overlooking the Yanawai River

A view of the Yanawai River, Vanua Levu

me into the air a few times before from comfortable seats in the woods. With the coast clear, I went down on my knees and carefully combed the neighborhood. I succeeded in finding quite a number of matured plantlets scattered here and there in the well-rotted leafmold.

The plants I collected on my knees were identified by Dr. A. C. Smith as *Andruris vitiensis,* member of the Triuridaceae, a family I (and perhaps the reader?) had only vaguely heard about before. As we know it today, the family consists of six or seven genera comprising about 75 species, all saprophytic and small. It has an extensive but scattering range in the tropics, is very rare, and so imperfectly known that the monographer, H. Giesen, in 1938 stated that it was not yet certain whether the Triuridaceae is a monocotyledonous or dicotyledonous family! Evidence, however, points to a probable relationship somewhere about the Liliaceae or Alismaceae, or actually intermediate between these two families. The Triuridaceae had not been reported in the Pacific east of the New Hebrides, until Smith discovered the species in a "northern limestone section, forest, slightly above sea level, April 2, 1934," on Vanua Mbalavu. He described and figured it two years later. His specimens seem more robust than mine and (according to his drawing) a bit different.

At Yanawai, as well as in several other wet, moderately open forests, I collected some good specimens of *Alpinia Boia,* a member of the Ginger family. It is a striking herb ten to twenty feet high with purplish petioles, leaf-blades up to one and a half feet wide, and a large pendent panicle of distichous, bracteate spikes finally bearing pale yellow fruit. According to the Fijians of the Nandarivatu region of Viti Levu, the plant was of no use to them but the wild pigs ate the rootstocks. In Sabatu, and presumably most dialects, it is called BOIA. It is their "ghost banana" and according to Seemann "cannot be touched by mortals with impunity." It would be a good subject for outdoor planting in tropical gardens.

Not far from our grass house overlooking the Yanawai River—in fact, where we roasted the wild pigeons Mr. Dods had shot—I found a few scraggly trees of *Casuarina nodiflora,* which was known to my host as THAUKOURA. Standing about 35 feet high they appeared very strange to me with their flat-topped masses of erect, foliar twigs. The tree is considered useless for timber there, as the wood rots too fast. I was to see specimens later about Maravu, Vanua Levu, where it was likewise said to be of little value; and some specimens about Ngaloa, Viti Levu, where the natives gave me conflicting data about its vernacular name and its uses. To Seemann it was known as VELAU.

Casuarina nodiflora grows in rainy forests in rich soil and, according to Seemann, it frequently reaches 60 feet and more, a height which *C. equisetifolia* does not attain in Fiji. I collected this latter species, known as NOKONOKO, near Salt Lake, Vanua Levu; and later saw it growing very commonly, though always scattered and singly, in the dry barren stretches on the leeward side of Viti Levu. In this species the foliar branches are pendent. The Fijian plants at a distance have a very different aspect from the introduced ones that are known as *C. equisetifolia* in Hawaii. The NOKONOKO, because of its "iron" wood that is so heavy as to sink in water, is considered good timber. The Fijians used it in olden days for their throwing clubs, several of which were carried stuck in their loin-cloths to be handy for immediate use; and for their MASI, or bark cloth, beaters. We learn from Seemann that the tree's "sombre aspect, and the wailing sound caused by the playing of the breezes in the branches, forcibly appeal to the poetical sentiment; and hence the Nokonoko is planted in masses about tombs; a fine grove of that kind is seen at Lakemba, surrounding the burial-place of a departed chief."

At the edge of a clearing Mr. Dods drew my attention to a coarse-leaved tree bearing large fruit. This was *Parinarium glaberrimum,* a member of the Rosaceae, found from Java and Borneo pretty well across Malaya to Polynesia. Its putty-like kernel was used by the early white settlers to cement broken pieces of crockery together.

Here and there in the more open forest I found a rather weedy shrub or small tree growing to about six feet in height. It was *Melastoma malabathricum.* In both the Yanawai region and about Ngaloa the Fijians chew the leaves as a remedy for thrush, a fungus disease of the mouth and alimentary tract. I ate the small fruits with impunity; but about Serua,

Village scene. One family often has three houses, one for father and sons; one for mother and daughters; one for cooking. The rocks in the foreground show where a house has formerly stood.

Viti Levu, where the plant was called KAUNISINGA, the Fijians informed me they never ate them, though the flying fox or MBEKA did.

Where I found the melastome I likewise found that remarkable gymnosperm, *Gnetum Gnemon* var. *domesticum.**

The tree I found was about 12 feet high, bearing a few bright red, drupe-like, naked seeds on a ratty, rough strobilus. The Fijians about Savu Savu Bay eat these seeds and the young leaves cooked. A Fijian of Serua informed me that they called the plant WASOKAU, used the wood simply for kindling, and ate the seeds but not the leaves. According to Dr. A. C. Smith, who visited Fiji ten years before I did and who kindly identified most of my collections, the natives called the plant SIKAU on Kandavu; MBUI NI VONDRE about Thakaundrove, Vanua Levu; and MBELE SIKAU on Koro. It is truly a remarkable plant, probably not the actual "missing link" between gymnosperm and angiosperm, but certainly very close to it.

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* Formerly, three genera were believed to comprise the Gnetaceae: *Gnetum*, consisting of about 30 tropical species; the widespread *Ephedra;* and the remarkable African *Welwitschia,* which bears only the same two leaves throughout its entire life span of upward of 100 years. Less conservative workers today, however, consider *Gnetum* the sole genus of the family Gnetaceae. Though called a gymnosperm, it smacks strongly of the angiosperms in having true vessels in its secondary wood. It also bears paired, leathery, ovate to lanceolate leaves that are pinnately net-veined and appear like the leaves of hundreds of kinds of angiosperm trees such as one might expect to find in any jungle. Yet to us living here in temperate America should we not expect *Gnetum,* like all "respectable" gymnosperms or evergreens, to bear something like pine needles? I would!

Above: The leeward, or drier side of Fiji. Below: A forest scene on the windward, or wetter side

There was one plant Mr. Dods prized above everything else on his Yanawai property. It was the forest-loving *Balaka cuneata,* a small, slender, feather-leaved or plumose palm. With his machete he shallowly cut out of the ground quite a number with their round base of crowded rootlets. After proper trimming and polishing, this rootstock would form the head of a palm cane to be sold at a good price to gaping tourists in Suva. I salvaged the leaves and leafy stems, and the inflorescences bearing their small flowers and their dark red fruit, for herbarium specimens. Among these scattered toy palms, I did find a few very large ones which proved to be *Vitiphoenix sessilifolia.* In former years the Fijians in this region carved their spears from the hard outer part of its trunk where the fibrovascular bundles are the most numerous.

During our palming in the dense forest, Ordonez and I came across a single plant of an unusually pretty *Piper.* It was about three feet high and bore a number of stiffly pendent orange flower spikes hidden among the leaves. The spikes that bore the ripe, bright red fruit, on the other hand, were stiffly erect and very conspicuous. Dr. Smith, who kindly named this find *P Degeneri,* mistook well-advanced yet unripe, reflexed spikes in my dried herbarium specimens for fully ripe ones. He therefore expected them to be erect really before the proper time. "A member of the Section *Eupiper* C. DC., the new species is not closely related to *P. insectifugum* C. DC., the only previously known indigenous Fijian member of this section," he wrote. Instead, it seems most closely allied to a common Philippine species.

Fiji seems to be the center of distribution of the thymeliaceous genus *Phaleria.* There are about nine species known from the Islands, most of them rather variable. The one I collected about Yanawai, and also elsewhere, was *Phaleria acuminata.* It is a cauliflorous shrub or small tree with shiny red fruit one-half to one inch long. According to Smith it bears "flowers fragrant." My native informant stated they were fragrant *only at night.*

Wiliami harvesting copra from the coconut trees at the writer's temporary copra plantation at Balanga

Besides many other specimens, Ordonez and I picked up a new myrtle later described as *Syzygium simillimum.* It is a sparingly branched tree about 10 feet high with pink sepals and pale green petals. The dark red fruit was barely a third of an inch long. The plant shows a remarkably strong resemblance to *S. Beccarii* of Sarawak, Borneo, according to Merrill and Perry.

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Inter-island boats in Fiji run not so much on a regular schedule as according to the amount of freight that is available, the time involved in getting it off and on the boat and, some settlers maintain, according to the particular mood of the captain. Should a squall or a protracted rainstorm arise while loading or unloading copra, all this work must end immediately for fear of having this perishable cargo get wet, mold, and spoil. Work can be resumed only when danger of wetting is past. Under such circumstances the best advice we could get from the colonials was that the "S. S. Yanawai," named for the river we had just visited, "is expected to arrive January 12 but may be delayed two or three days or perhaps may omit this trip entirely."

After collecting all afternoon of January 11 and the next morning at Mr. Dods' Yanawai place, we felt we simply had to leave to catch the steamer that night to take us back to Suva, Viti Levu. We therefore carried our few possessions and prized plants to the crude landing, next waded with them to the launch and stowed them away on the seats to keep them dry. We roused our staring idiot, who mechanically started bailing, and shoved the boat into deep water a little after 1 P.M. Because of an unfavorable wind and to save time, we were to cross nearer the mouth of Savu Savu Bay. We threw a line or two overboard on the chance of catching a fish, and chugged on. The breeze rippled the water and our idiot bailed. After a while Ordonez hooked and, with some difficulty, actually landed a three-foot fish resembling to a certain extent the ULUA of Hawaiian waters. After this excitement Ordonez and I lay sprawling on our backs on the sunny launch roof while our idiot bailed. The waves gradually got higher and whiter, and we were not even a quarter of the way across the bay. Both Ordonez and I had experienced rough weather in the "Cheng-Ho" and felt physically comfortable. Intermittently, our idiot bailed. I looked ahead; I looked back. We were not half way across and the waves were getting still higher and whiter. Nevertheless, the headland should cut off the full force of the ocean swell and breeze. Our idiot bailed. Occasionally cold spray slapped across Ordonez and me, and staying glued to the roof of the launch became increasingly difficult. Our idiot bailed. Ordonez and I got occasional drenchings and experienced a few sudden lurches that brought my heart into my mouth. Clutching whatever I could, I crawled ignominiously to a seat in the launch. The

Some of the inhabitants of Fiji: Upper left—a girl combing her hair with the comb shown on page 222. Right—a negroid type of native with hair plastered down with black dye. Lower left—Polynesian type of native. Right—sounding the "lali" or wooden drum, to call the villagers to church idiot bailed. I was getting increasingly nervous; our host and his cronies were chatting about the wind, landmarks, the fish we had caught, the "S. S. Yanawai." The staring idiot, cool as a cucumber, mechanically bailed. The foamy crests of the waves occasionally spilled into the boat; I thought of my tightly laced, heavy boots and tight hiking trousers. The idiot bailed; the spray flew. At least no shark would eat me *alive*—the idiot bailed—for after a few gulps of salt water my heavy boots would sink me to the bottom of the bay, there to rest with my metal drier. Our idiot bailed more slowly—in a case like that I would be spared the ordeal of breaking the sad news to Ordonez' loving parents—the waves seemed getting smaller—the wind was abating with the headland now in front of us to the right. I came back to earth, as it were, from my musing, relieved, elated, and proud that I had not lost "face" by outwardly showing my fright. No! I should never again be in a teredo-riddled launch, or any launch, on anything larger than a shallow mill pond. That I could promise myself (if I cared to). We reached Balanga toward dusk, after an actually uneventful afternoon.

On stepping ashore faithful Wiliami told us that the "S. S. Yanawai" was expected to arrive soon at Valethi for her trip back to Suva. Ordonez and I gobbled a little food, packed frantically, gave away some last odds and ends to our kind Fijian friends, and sincerely thanked Mr. Dods for his many kindnesses from the very depths of our souls. We piled all our belongings, Fijian and others, into the launch; the poor idiot was stirred into bailing again; and we chugged the three miles to Valethi with Mr. William Witherow, the boat builder, at the helm. Rounding a small island, we saw the welcome lights of the "Yanawai" in the distance. I sighed with relief at the evident ending of a long but successful day. But wait, what is this? The lights, instead of becoming brighter, gradually fade out over the horizon and disappear in complete darkness. We had missed our boat!

Indigo—The Medieval "Devil's Dye"

By William F. Leggett
Associate Editor, The Textile Colorist

ONE OF THE MOST ANCIENT of vegetable dyestuffs known, indigo remained the most important source of blue coloring matter throughout much of the world for more than 4,000 years.

The dye of commerce has come principally from the leaves of *Indigofera tinctoria,* a perennial member of the Pea family, or Leguminosae, native in southern Asia, but other species of *Indigofera* are widely distributed in Asia, Africa, the East Indies, the Philippines, and America, and in all these parts of the world they have been a source of blue dyes. From very early times the natives in all countries where some form of indigo grew seem to have known how to utilize its water-soaked leaves to obtain a brilliant blue coloring. Garments found in Egyptian tombs and others unearthed from Peruvian Inca graves, as well as many miscellaneous remnants of primitive cloth from other regions, all testify to a wide but unconnected ancient knowledge of indigo. A garment dyed with indigo that was found at Thebes is known to date from 3500 B.C. Early Sanskrit records described methods of preparation and gave evidence of the remarkable fastness to light and water that is characteristic of this pigment. From then until the early years of the 20th century, when the blue of coal-tar dyes began to take its place, indigo held sway in the dye market.

For many centuries previous to the discovery of America, all natural indigo for dyeing cloth and for producing the required blue paints and cosmetics in Europe and the Near East came from India. The word itself, which earlier was *indico,* comes from the Latin *indicum,* originally used for any import from India, but later applied specifically to the beautiful blue dye that was brought from there. As such, it replaced the former Arabic word *al-nil,* which not only stood for "blue" but also became the ancestor of the modern dye-word *aniline.*

Source of the Coloring Matter

The dye elements of the indigo plant are contained solely in its leaf, for, unlike other vegetable dye sources, the stalks and twigs do not contain enough color substance to warrant processing. The substance is in the form of a colorless glucoside known to dye masters as indican. It is soluble in water and it yields its coloring matter, indigotine, by the joint action of atmospheric oxygen with an enzyme which is present in the leaf.

The indigo plant attains a height of from three to five feet, and can be harvested twice or more each year. When ready for its simple processing, it is cut down early in the morning, and as quickly as possible placed in vats, weighted down, and steeped in water for about ten hours. It was quite early noticed that the percentage of indican is affected by the freshness and moisture content of the leaves. The liquid, which varies in shade from yellow-orange to olive green, is drawn off to beating vats, where it is activated and exposed to oxidation by air. Only recently has the ancient method of striking the surface of the slime-like substance with strong bamboo sticks been replaced with mechanical paddles in India. This operation causes a gradual change in the color of the liquid to dark green and finally to blue. As soon as the precipitate settles, beating is discontinued, and the mixture is permitted to rest for about two hours, the top water being then drawn off and the indigo sludge led into a reservoir from which it is placed in a large cauldron where it is heated tc prevent further fermentation. When cool this sludge is filtered through strong linen or cotton cloths stretched over vessels of stone, where it remains until it reaches the consistency of a still paste. This is formed into bars which in turn are cut into the indigo cakes of commerce.

The ancient tanks for both steeping and beating vats were often hewn from stone, but more usually were constructed of brick and lined inside with an early form of cement. These vats were placed, one above the other, in two long rows so that the steeping units could drain into the oxidating, or beating units. The steeping vats, usually of smaller dimensions than the beating vats, are estimated to have had a capacity of approximately 1,000 cubic feet.

Indigo in Ancient Days

Herodotus, writing in 450 B.C. of the people then living on the borders of the Caspian Sea, refers to indigo for the first time in any European language, telling us that these people "have trees whose leaves possess a most singular property. They beat them into a powder and then steep them in water, thus forming a dye with which they paint figures of animals on a garment, and the impression is so strong that it cannot be washed out, and wears as long as the garment." About two centuries later, an Arabic writer confirmed the findings of the Father of History but specifically described the combination as being indigo and beeswax. It is not known whether the early Egyptians used a native indigo, or whether they imported this dye from India. For many centuries the Chinese allocated a portion of their cotton fields to the cultivation of dye plants such as madder, saffron and indigo, thus exhibiting managerial genius far in advance of any other country of that period.

Indigo had long been used for dyeing and painting in Europe at the time of Pliny and Dioscorides, although in those early days it must be understood that every kind of blue pigment separated from plants by fermentation and converted into a friable substance by desiccation was ignorantly called indigo. At one time the dye was even thought to be a mineral—"a blue stone brought out from India and used for painting and dyeing." In fact, as late as 1705, an English patent was granted for "obtaining indigo from mines." However, what Dioscorides called "indicon" and what, with slight variation, both Pliny and Vitruvius called "indicum" were undoubtedly what we today know as indigo. This caked blue pigment, when pounded, yielded a black powder which when immersed in water became an agreeable mixture of blue and purple. Because it was a costly dyestuff, it was often adulterated by adding common earth, and on this account, those pigments which were "soft without any roughness and which resembled an inspissated juice" were considered the best, and Pliny remarked that "pure indigo may be distinguished from that which is adulterated by burning it, as the former gives an exceedingly beautiful purple flame, and emits the odor of sea water." Both Pliny and Dioscorides—each an experienced botanist—speak of two kinds of indigo, one of which "adheres to reeds in the form of slime or scum thrown up by the sea," and the other, Dioscorides specifically mentions, was scraped from the sides of the dye pans in the form of a purple colored scum, and was collected in this manner in all establishments using a purple dye. Anciently it was classed as an astringent medicine, as "it cleaned wounds and was used for ulcers and inflammations." Dioscorides highly praises the medicinal properties of indigo, and some experiments made as late as the 17th century seem to confirm his estimate of the value of indigo "for internal use."

It is noteworthy that everything said about "indicum" agrees perfectly with the indigo of the later Middle Ages. It was mentioned very frequently in almost every century of recorded Oriental history, and was never referred to as a new article.

It would, indeed, have been strange had the merits of indigo, either as a medicine, cosmetic, or a dye, reached the Greeks and Romans free from legends, which either were related by merchants interested in its sale, or emanated from the long journey from its place of origin in the East, through so many countries each with a different language. The earliest records were of the "blue slime deposited on reeds," and this suggests the fermentation without which the pigment could not be separated from the plant. Who knows but that some ancient chemist deposited indigo plants in stagnant water much in the same manner as the ancient Egyptians prepared their flax? Who knows whether, after open air fermentation, these plants were not then removed from their bath, the coloring matter adhering to the leaves and stem then being washed off and collected? Of course, the quantity of dyestuff collected in such a crude manner could not be very great, but at least it was a start for a dye which attained, and for centuries held, the second most important place in the ancient and medieval fabric world, madder being the first. We know that, within historic times in many parts of India, indigo plants were formerly fermented in pits, and in Malta, where the indigo plant was cultivated until the 17th century, it was fermented in reservoirs. Thus we may deduce that the original indigo actually appeared as a slime made by water from a reed which, when stripped of its bark, carried the indigo element with it.

Medieval Commerce in Indigo

The Venetians appear to have been the first medieval Europeans to use indigo. There is a record dated 1194 A.D. which concerns the importation of both indigo and brazilwood (*Caesalpinia Sappan*) from India.

Among other early historical references to indigo was a treaty between the Italian towns of Bologna and Ferrara, which mentions indigo as an article subject to pay duty.

The Venetian traveler and merchant, Marco Polo, who had spent twenty-six years in Asia at the end of the 13th century, and whose lively account of his travels is one of the most important sources of information about that era, refers to both indigo and brazilwood from East India as products familiar to Europe. He relates that indigo "is won from a species of herb which is plucked out by the roots, and put into tubs of water, where it is left to rot. Then the sap is pressed out which, when exposed to the sun, evaporates, leaving a kind of paste behind it, which is cut up into small pieces of the shape also familiar to us."

In the middle of the 14th century, some Italian writers called indigo "indaco disi baldacco" suggesting an origin at Bagdad, from where it was sent to Europe, packed in hides, leather bags, and sacks. It is known with certainty that the Italians were the first people in Europe to perfect the methods of using indigo, and it is the opinion of some historians that the Hebrew dye-masters of Bagdad were responsible for introducing indigo dyestuff into Italy. The cloth-dyers of Italy became so expert in securing beautiful blue colors with indigo that a knowledge of this Asiatic dye spread from there to other countries. It is not improbable that indigo ranked close to gems and spices as important cargoes of the many vessels which went to India after the all-water route was discovered in 1498, for travelers and merchants all mention it as one of the most frequently carried articles. Indigo became the most important dye of the Middle Ages.

Barbosa, who afterwards accompanied Ferdinand Magellan on his famous voyage around the world, perishing with his leader on the island of Cebu in the Philippine group, collected much information about indigo, and also reported the prices which were demanded for it at Calcutta in 1516. Another Portuguese explorer, writing from India in the same year, mentions the fact that "indigo is among the wares of Camboya*." In 1563, an unnamed Italian traveler in listing merchandise purchased from the Portuguese by Antwerp traders, specifically mentions "indigo from the East Indies."

Devil's Dye versus Woad

Its use, however, in northern and western Europe was retarded for some 200 years by the growers and distributors of its native rival, woad (*Isatis tinctoria*). Such opposition was offered both on the continent and in England, that numerous laws prohibiting indigo were enacted and enforced. Indigo was even called a "devil's dye" and reported to be injurious to fabrics. The reason for this was probably that, about this time, dyers began to use certain astringent juices in dyeing, and because of unfamiliarity with the chemical action of these new agents, they caused the cloth to become exceedingly tender when it remained in the coloring vats too long.

* So named by the early Portuguese. Later called Cambodia, now a part of Indo-China.

About 1602, a Netherlands trading company was organized "to render indispensable and necessary to the Europeans, cottons, tea. sago and other things of which they could always hope to find a sufficient supply in India." One of these products was, of course, indigo. German cloth merchants complained that their native woad "was being banished by indigo" and traced this situation to Netherlands importers, for this dyestuff had been introduced into Germany about 1604. One amusing angle to this German complaint was the charge that "gold was given to the Dutch for a worthless dye, while our woad industry was allowed to decline." That the importation of indigo by Dutch merchants was very great can be seen from a Dutch import tariff list of some ships that arrived from India in 1631. The first ship carried 13,539 pounds of indigo, the second 82,734 pounds, the third 66,996 pounds, and in all, seven vessels had brought 333,545 pounds, having a value in guilders to a current equivalent of about $500,000.

Soon after the discovery of America, the profit in indigo trade became an incentive to cultivate this plant in the New World, for Spain was a commercial rival of Portugal, and Spanish adventurers had noted that the American Indians tinged their bodies and faces a blue-violet color, the pigments for which came from a native plant closely resembling the indigo plant of Asia. It was mentioned by Francisco Colón (Columbus) in his "Life" of his renowned father as among the valuable products of Hispaniola, the present Dominican Republic. Further mention of this dye-producing plant has been made by other Spanish explorers and writers, especially those who were familiar with Mexico. The first American indigo brought to Europe was obtained in Guatemala, but not many years passed before Mexico provided a large quantity.

Until indigo was cultivated in the West Indies, it was expensive, but when it entered the European market the price decreased, an important factor being the slave labor that raised it. Both the native indigo (*Indigofera Anil*) and the Asiatic species (*I. tinctoria*) were grown commercially there.

With indigo now entering Europe from both the East and the West, it very quickly superseded woad in the dyehouses of Europe, for it not only possesses ten times the concentration of pigment that woad does, but there is great superiority and richness in its dyeing quality. At first, a small quantity of indigo was added to woad in order to improve quality, but soon the proportion of indigo became so large that woad was used merely to revive fermentation of indigo, as woad of itself was incapable of contributing any additional color. Contemporary chemists observed that cloth could be dyed more cheaply when indigo was combined with a small quantity of woad than when the latter was exclusively used as had been previous practice. This led to economic repercussions, for woad farmers of Germany, France and Italy lost a market which had been profitable for many centuries.

It was indigo, therefore, which finally crushed the centuries-old use of woad, and it did so in spite of all the obstacles placed in its way. In many countries there was a sincere belief, arising, no doubt, from inexpert use of the dyebath, that indigo was actually harmful, that it would destroy fabrics on which it was used. Into the late 17th century, decrees were still being proclaimed against the use of indigo, but despite all such measures indigo became the most popular dye in Europe.

Eastern and Western Competition

In the early years of the British occupation of India, this dyestuff formed an important item in the trading activity of the East India Company, but because of the crude method of native processing, the trade declined in favor of the more skilfully prepared product of America and the West Indies. In 1747, subsidies for cultivating indigo were offered to the farmers of the Carolinas, and a little later the indigo crop was recognized as a very important agricultural item in Georgia and North and South Carolina.

Soon after the close of the Revolutionary War, progressive British importers of Asiatic indigo introduced American processing methods at Bengal, India. Thus, in turn, Indian exportations increased until the indigo from the western hemisphere was almost completely driven from the British markets. Soon indigo processing establishments were set up on the plains of the Ganges River, in the Madras provinces, and at a later time, in Java and the Philippine Islands, but indigo produced anywhere else was secondary in quality and quantity to that of Bengal, largely because of the congeniality of both soil and climate to this dye-producing plant.

Navy Uniforms of Indigo Blue

From the time their color was adopted in the mid-18th century, indigo was used in large quantities to dye the uniforms of American and British sailors. Other navies had official uniforms long before the British, so in 1745 some British naval officers, meeting at Will's Coffee House in London, decided that they would petition the Admiralty for an official uniform in order to standardize it, as had other European navies of the day. These officers were directed to appear in person at the Admiralty each clothed in a uniform which was designed and colored in accordance with his individual ideas. Some wore gray with red facings, but one captain wore a blue uniform with white facings, and the latter was chosen by the Admiralty. The story goes that since King George II must make the final decision, the enterprising captain tactfully selected colors used in a special riding habit of the Duchess of Bedford, a favorite of the King and the wife of the First Lord of the Admiralty, who frequently rode in Rotten Row—that still fashionable ride in Hyde Park, London, named for "Route du Roi," or King's Road. These colors quickly gained His Majesty's approval, and blue has been the color of the naval uniforms since that day.

Notes, News, and Comment

Board of Managers. Edwin De T. Bechtel was elected to the Board of Managers on Sept. 30, to succeed Dr. D. T. MacDougal of Mt. Carmel, Calif., whose resignation became effective Sept. 4. Dr. MacDougal's association with the New York Botanical Garden began in 1899, when he was appointed Director of the Laboratory and First Assistant. In July 1904 he was made Assistant Director, continuing also in charge of the laboratory until he severed his connection with the Garden at the end of 1905. From 1929 until 1933, he was one of the Scientific Directors of the Garden. He was then elected to the Board of Managers on Jan. 8, 1934. Dr. MacDougal has been a member of the Corporation of the Garden since the beginning of 1930, and he remains a member of that body.

Professor. Dr. Bassett Maguire, who returned to New York the last of August after a summer spent exploring in the mountains of Utah and western Nevada, has been appointed non-resident professor of botany at the Utah State Agricultural College, where he taught for twelve years before accepting his new appointment as Curator at the New York Botanical Garden, in recognition of services rendered to the college. The announcement was made by President E. G. Peterson at a reception given in his and Mrs. Maguire's honor by the Sigma Xi chapter at Logan.

Movie in Mexico. The Garden's full-length motion picture in color was presented by Dr. W. H. Rickett on August 5 before the Mexico City Garden Club in the private theater of Mr. and Mrs. H. Bolling Wright. Later in the month Dr. Rickett showed the film before the Natural History Society in the hall of the College of Medicine in the National University of Mexico. This group is composed of scientists in all fields at the University, the Polytechnic Institute, and elsewhere, including the United States Bureau of Entomology and Plant Quarantine, which has a large laboratory in Mexico City. To describe the film, Dr. Rickett spoke in English, and Prof. M. Maldonado Koerdell of the Polytechnic Institute paraphrased in Spanish. A third showing of the film took place Sept. 7 in the Biblioteca Benjamin Franklin, which is an American library of books in English, chiefly for the English-speaking residents of the city. Dr. Rickett showed the film again Oct. 6 at the Instituto Politecnico to about 100 students and faculty of the Escuela de Ciencias Biológicas, this time speaking in Spanish.

Disease and Pest Control. A new volume entitled "Diseases and Pests of Ornamental Plants," prepared under the auspices of the New York Botanical Garden by B. O. Dodge and H. W. Rickett, came off the press the middle of August. It is a volume of more than 600 pages, illustrated with photographs and drawings, and it contains, besides an extensive discussion of the nature, causes and control of plant diseases and pests, an alphabetical treatment of the troubles of some 3,000 ornamental plants. The book will be reviewed in a forthcoming number of the Journal.

Not a Yucca. The photograph from Mexico which appeared on the cover of the Journal for last June does not represent a species of *Yucca,* according to E. J. Alexander, but is more likely either a species of *Nolina* or *Dasylirion.* There are tree forms in both genera, as there are also in *Yucca* and in the closely related genus *Beaucarnea.* However, the papery bracts which can be seen in the lower half of the flower stalk, also the small size of the flowers, definitely rule out both of these genera, he says, and place the subject in either *Nolina* or *Dasylirion*—probably the former.

Staff. Beginning October 1, Dr. E. E. Naylor has been named an Assistant Curator at the Garden. His work will be largely educational.

In the Tropics. Dr. W. H. Camp returned to New York in August after a year in Haiti with the Société Haitiano-Américaine pour le Dévelopement Agricole, and left a few weeks later for Central America to make some investigations into the culture of certain tropical economic plants.

At Geneva. Dr. A. B. Stout spent two weeks of September at Geneva, N. Y., working in co-operation with the Agricultural Experiment Station there in the development of hardy seedless grapes. Last winter, he reported, was a severe test for hardiness in all sorts of fruits, and the crop of grapes this year was consequently poor. While at Geneva he attended the 25th annual meeting of the New York State Fruit Testing Co-operative Association, at which one of the speakers was Dr. L. H. Bailey of Ithaca, N. Y., on "Fruit Varieties."

To Massachusetts. B. A. Krukoff and Arthur Cronquist spent the week-end of Aug. 7-9 at the Arnold Arboretum and Gray Herbarium, and Dr. Frances E. Wynne spent a few days there in early October.

Visitors. Dr. Lulu Gaiser, Professor of Botany at McMaster University, Hamilton, Ont., worked on the genus *Liatris* in the herbarium during the last week of August. Mrs. Elena S. Perak from Argentina, who is making a special study of the genetics of corn at the University of Missouri, visited the New York Botanical Garden late in September. Rupert C. Barneby, who in the past year has moved from California to Wappingers Falls, N. Y., did some work on *Astragalus* at the Garden during the middle of September. Dr. Matilde Bensaude Gotz, formerly of Portugal, came to consult with Dr. Wm. J. Robbins Oct. 1. K. D. Loose, W. E. Brownlee, H. G. Luther, and N. J. Cody of the Loose-Wiles Biscuit Co., held a conference concerning yeasts and molds with Dr. B. O. Dodge late in August. Mrs. E. R. Sansome, who is working on the effects of irradiation on the development of mutants in the fungus *Neurospora*, consulted with Dr. Robbins and Dr. Dodge Sept. 22.

Among other visitors of late summer and fall were J. Alcides Ocampo, Superintendent of the Commission for Flax Cultivation in Lima, Peru; Kenneth S. Dodds of Trinidad, British West Indies; R. B. Rogers of Coventry and E. J. Griffin of Oxfordshire, England; R. E. Currie of Honolulu; Myron Backus, Professor of Botany at the University of Wisconsin, formerly an assistant in Dr. Dodge's laboratory, and his brother, Edward Backus of the Lederle Laboratories; H. M. Fitzpatrick of Cornell; Donald D. Stevenson, Pennsylvania State College; Robert Cameron, Cambridge, Mass.; William H. Judd, Arnold Arboretum; W. Ormiston Roy, Montreal; Carl T. Ramsey, Dorset, Vt.; Hui-Lin Li, Arnold Arboretum; Harold J. Kersten, University of Cincinnati; Ilda McVeigh, Yale University; Dorothy Parker, Cincinnati; and F. G. Walsingham, of the Atkins Institution in Cuba, who has made several visits to the Botanical Garden while spending a few weeks in the United States.

Groups. A group of officers from the Chinese Army who are taking special training in the United States visited the Garden on Sept. 21. On Oct. 3, members of the Science Society of China held a Sunday afternoon meeting at the Garden.

Drs. H. C. Thompson and L. H. McDaniels of Cornell were speakers at a meeting held at the Garden September 21 by the Greater New York Victory Garden Council and the Emergency Food Commission of New York State. The care of harvested crops was the subject of the afternoon, and a motion picture was shown to illustrate particularly methods of storing vegetables.

A. A. A. S. Dr. William J. Robbins served as vice-chairman of the section on chemical growth promoters at the A. A. A. S. summer conference on chemical growth factors at Gibson Island, Md., Aug. 2-6, and on Aug. 5 he addressed the group on "Chemical Structure and Vitamin Activity for Plants."

Dr. F. J. Seaver Becomes Head Curator

ON October 1 Dr. H. A. Gleason relinquished his post as Head Curator at the New York Botanical Garden, retiring at his own request in order to devote himself more fully to his scientific work. He retains, however, the titles of Curator and Assistant Director. He had been Head Curator since June 1932, when he succeeded Dr. John K. Small.

Dr. Fred J. Seaver, who has been Curator in charge of the Cryptogamic Herbarium since October 1911, succeeds Dr. Gleason as Head Curator. For three years previous to 1911, Dr. Seaver was Director of the Laboratories.

Dr. C. Stuart Gager

THE Director of the Brooklyn Botanic Garden since its establishment in 1910, Dr. C. Stuart Gager, died at the Sisters Hospital in Waterville, Maine, Aug. 9, during a vacation he was spending at Belgrade Lakes. He was 70 years old. Dr. Gager had twice been on the staff of the New York Botanical Garden, as Laboratory Assistant for four months at the end of 1904, then as Director of the Laboratories from January 1906 until August 1908. From then until he was called to Brooklyn to head the new Botanic Garden there, he was Professor of Botany at the University of Missouri.

Born in Norwich, N. Y., in 1872, Dr. Gager was graduated from Syracuse University in 1895. He did graduate work at New York State Normal College, New York State College for Teachers, and Cornell and Harvard Universities, receiving the degrees of Ph.D. from Cornell in 1902, D.Sc. from Syracuse in 1920, and Doctor of Pedagogy from New York State Normal in 1921.

While he was with the New York Botanical Garden, he initiated one of the earliest investigations of the effect of radium on plants. A 278-page report of his work was published as a Memoir of the New York Botanical Garden in 1908, and shorter accounts were published in *Science, Torreya, The American Naturalist, Popular Science Monthly,* and in a later Memoir of the Garden, as well as in B. M. Duggar's book, "Biological Effects of Radiation" (1936).

Dr. Gager was the author of a large number of other papers and several books, among them "Fundamentals of Botany," "Laboratory Guide for General Botany," "Heredity and Evolution in Plants," "The Relation between Science and Theology," and "Errors in Science Teaching."

Dr. Gager had served as President of the Botanical Society of America, of the Torrey Botanical Club, of the National Institute of Social Sciences, and of the Twentieth Century Club of Brooklyn. He was a member also of Phi Beta Kappa and Sigma Xi, an honorary member of numerous other organizations, and an active participant in the work of the National Science Council, the Horticultural Society of New York, and, through the latter, the International Flower Show. In 1941 he received the Arthur Hoyt Scott Garden and Horticultural Award.

Successful Flower Shop Is Run By Mexico City Garden Club

REPORTS from south of the border, where Dr. H. W. Rickett, Dr. William J. Bonisteel, and Mr. Robert Simpson have all spoken at meetings of the Mexico City Garden Club, indicate that this organization is one of the most active garden clubs on the continent. One of its projects alone—a flower shop—nets around $1,200 a month (Mexican currency) for the Red Cross.

While the club's regular flower shows have been discontinued for the duration, at each monthly meeting the members compete for honors with exhibits of specimens of their own growing, and at the end of the year a cup is awarded to the member winning the most blue ribbons.

Many donations are made to charity, especially at Christmas time when baskets are distributed, but the club's chief activity at present is the flower shop, which is located on Paseo de la Reforma, in space which has been donated by a Mr. Pickard. All of the work is done by members, and most of the flowers are donated from their own gardens. The proceeds of the flower shop venture are divided between the Mexican Red Cross and the American Colony Committee, which is really a branch of the American Red Cross.

Active membership in the club is limited to forty persons, but there are also seven associate members and sixteen honorary. Dues in the club are $10 a year, Mexican currency.

The president of the club is Mrs. H. Bolling Wright; the secretary, Mrs. J. R. Woodul. Among the members is Mrs. Walter Douglas, who is a member of the Corporation and the Advisory Council of the New York Botanical Garden. The famed archeologist, Zelia Nuttall, who made a special study of the antiquities and the colonial history of Mexico, was a member of the club until her death in 1933.

New Course in Home Landscaping Offered This Year

TO respond to the increasing interest that has been shown in the development of home properties, the New York Botanical Garden has organized a new course in ***Home Landscaping***, the first lesson in which took place the evening of Oct. 4. The work is planned to occupy three terms of study, the first, in ***Planning the Home Grounds***, being under the instruction of Mr. Carl F. Wedell, landscape architect. Mr. Wedell is head of the department of horticulture at the New York Institute of Agriculture, Farmingdale, L. I., and during the past year he has also been Executive Secretary of the Greater New York Victory Garden Council. He introduced the course to the public by speaking on the Botanical Garden's radio program of Sept. 24.

Another term will consist of the course designated as 10A, ***Planting the Home Grounds***, which has been taught by Mr. P. J. van Melle. This will be repeated in the fall of 1944 as part of the Home Landscaping course.

The third term will be the course formerly known as 3A: ***Garden Construction***, taught by Mr. A. C. Pfander. This will be given again as 10C in the spring of 1944.

This year, for the first time, amateur gardeners are permitted to register for the ***Two-Year Science Course for Gardeners*** and to receive credit for the certificate that is offered at the end of the two years of study. Professional gardeners henceforth will be eligible for an additional certificate, to be awarded upon the successful completion of a two-day examination in the theory and practice of gardening.

The admission of non-professionals into the science courses this year has resulted in a registration of more than 30 students in each class. The work in ***General Botany I*** and ***Systematic Botany*** began Oct. 4. Because of the possibility of Dr. R. R. Stewart's returning soon to his post in India, some changes have since been made in the instructors and these two classes now are being taught by Dr. E. E. Naylor and Dr. Bassett Maguire with Dr. Frances E. Wynne assisting Dr. Maguire in Systematic Botany.

Starting Oct. 7, Mr. T. H. Everett opened the ***Two-Year Course in Practical Gardening*** with the first of the lectures on ***Fundamentals of Gardening.*** Approximately 40 are registered in this class.

The autumn course in ***Field Botany***, taught by Mr. G. L. Wittrock, has a record registration this year of nearly 25 students.

Details of these and of other new courses and subjects offered in 1943, '44 and '45 are contained in the latest edition of the Educational Program, copies of which are mailed free upon request.

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.)

History, Problems, Products and Aspects of Amazonia

THE AMAZON; The Life History of a Mighty River. Caryl P. Haskins. 415 pages, illustrated, indexed. Doubleday, Doran, New York. 1943. $4.

It is seldom that a popular account of such a vast subject as the history of the world's greatest river can be considered satisfactory; the present volume is a welcome surprise, therefore, in that the author's intention—to acquaint the reader with all the various facets of his tremendous subject—is realized. For this is a book which definitely should be read by all who are interested in South America, whether their interest is biological, historical, economic, or inclusive. Without too many concessions to the "popular" taste, it is a serious presentation, to compile which must have involved an extraordinary amount of research.

The first five chapters form a part entitled "World Primeval," in which a good semi-popular discussion of the geological history of the Amazon basin is given. Chapter V, "Mantle of the Land," will be of especial interest to botanically inclined readers, for in it the present-day vegetation is adequately discussed, beginning with the alpine zone and continuing downward through the temperate to the tropical. For a botanist who is not acquainted with the common plant names of the region, this chapter could have been made more interesting by the addition of scientific names, for the discussion of "ichu" grass, "llareta" scrub, "tola," "quinoa," etc., will mean nothing to most readers. In spite of popular prejudice against Latin names, surely one might expect them to be parenthetically used in such a detailed discussion as this.

Parts II and III deal with the human population and the exploration of the region. For many readers, Chapter XIII, on "Exploration," will be the most fascinating part of the book, and it is a welcome discovery to find that the author has not neglected the great contributions made by the scientific explorers, whose names are familiar to all botanists—Humboldt, Martius, Schomburgk, Castelnau, Wallace, Bates, and Spruce.

Of more concern to the reader interested in plants is Part IV, entitled "Storehouse Ajar." Here a lucid discussion of economically important plants will be found, and here again a freer use of scientific names would have been advisable. The greater part of this section deals, appropriately, with rubber, and the whole history of the industry in Amazonia is detailed in an accurate and instructive account.

The latter part of the book, considerably more than half of it, in fact, is devoted to a discussion of the history and contemporary status of the six nations partially drained by the Amazon and its tributaries. While this portion is largely historical, it is written in so fluent and readable a style that few readers, if they have any interest in South America, will care to set the volume down unfinished. The final section deals with contemporary problems in the relationships of the six nations to each other and to other countries.

If any popular book can adequately cover such a vast subject as the history of the Amazon, its geological and biological aspects, its human and economic problems, and its social and diplomatic development, "The Amazon" has done so.

A. C. Smith,
Arnold Arboretum,
Harvard University.

Subtle Beauty of the Soil

WARM EARTH. Dorothy Waugh. 43 pages, illustrated by the author. Oxford University Press, New York & London. 1943. $1.

If warmer feeling for the earth has ever been more subtly or beautifully expressed than in the drawings in Miss Waugh's little book, it has been kept hidden from our eyes. Where else can one see the rain seeping into the earth, every drop and every particle of soil magnified to many times its actual size; and see every dewdrop on a patch of grass and clover; a gigantic (actually a very tiny) ant crawling through a microscopic crack in the topsoil; and a bird sitting on a blossoming bough, this last to illustrate a paragraph on humus? Opposite the bird among the falling petals the paragraph which is headed "Humus," begins: "When leaves and petals fall, when fox-sparrows scratch them into the ground and earthworms carry them down into their holes at night, vegetable matter is added to the soil."

This is announced as a children's book. Grown people can justifiably envy the younger generation for whom such exquisite work is done.

Carol H. Woodward.

Boyhood in the Country

BOUNTY OF THE WAYSIDE. Walter Beebe Wilder. 256 pages, index. Doubleday, Doran & Co., New York. 1943. $2.50.

With a lovable old coot of a grandfather and an unusual gift as a storyteller, the author has pieced together, in a locale that is no longer found in this day of radios and rural deliveries, a loosely woven tale of an idyllic boyhood. Since the old grandfather has kept enough youthful zeal to lead him on from one escapade to another, it is no wonder that the boy is continually escaping from one foolishness only to be led into another.

At this season of rationing of food, the wealth of culinary ideas and recipes from the family retainer is most timely, and should furnish the coupon-haunted housewife with many inexpensive and health-giving menus.

This is a book for the adult who remembers a pleasant childhood and who likes to have it recalled through light and entertaining reading.

MRS. HARRY A. JENNISON.

Lands to the South

THE GOOD NEIGHBOR SERIES. Sydney Greenbie. 84 pages each, illustrated in color and black-and-white; pronouncing glossary. Row, Peterson & Co., Evanston, Ill. 1943. 56c each.

A nicely illustrated set of books with gay, pictorial paper covers, depicting the history and life of the people in the neighboring islands and countries to the south of us. They have been prepared under the direction of J. W. Studebaker, United States Commissioner of Education. The maps are picturesque and unusually helpful. The crops of the different lands play an important part in each story. The eight books cover Mexico, Three Island Nations (Cuba, Haiti, the Dominican Republic), Between Mountain and Sea (Chile), By Caribbean Shores (Panama, Colombia, Venezuela), Children of the Sun (Peru, Ecuador, Bolivia), The Central Five (Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica), Republics of the Pampas (Argentina, Paraguay, Uruguay), The Fertile Land (Brazil).

Trees and Their Uses

FORESTS AND MAN. Ralph S. Powers and Charlotte L Grant. 37 pages, mimeographed. Bureau of Educational Research in Science, Teachers College, Columbia University, New York. 1942.

Informative and interesting material compiled and well arranged for the use of teachers. It would seem to deserve something better than mimeograph reproduction.

For Boys and Girls

LET'S LOOK AT THE PLANT WORLD. David S. Marx. 158 pages, illustrated, indexed, spiral binding. The Botanic Publ. Co., Cincinnati. 1942. $3.

Ever since their introduction several years ago, the Marx books have been favorites with the children who have visited the Botanical Garden's library. This one contains pages on such topics as these, all picked at random: Hummingbird Flowers, Projectile Pods, Defense Fruits, Snowdrift Seeds, Unrolling Leaves, Trap and Trigger Flowers, Air-Cooled Leaves, Aromatic Plants—and more than a hundred others.

Gardening Primer

VERY FIRST GARDEN (for boys and girls). Dorothea Gould. 48 pages, with pictures by Elizabeth Ripley. Oxford University Press, New York & London. 1943. 50c.

The fundamentals told in terms for the very young to understand, in nice large type and in a surprisingly small space.

Some Scented Subjects

FRAGRANT HERBS. David S. Marx. 63 pages, illustrated, indexed. The Botanic Publishing Co., Cincinnati. 1943.

Leaf-prints of more than 50 plants whose leaves, roots, or seeds have a scent which may or may not have some practical use. Three lines of description given for each one.

Tire-less Philosopher

NOW THAT WE HAVE TO WALK. Raymond Tifft Fuller. 255 pages, bibliography. E. P. Dutton & Co., New York. 1943. $2.50.

Philosophy stands next to a planting plan for pines and spruces, and this is accompanied by a practical footnote about a borer which attacks them. Then, as the wind flicks over a dozen pages, we find a quotation from Walt Whitman, and on another page a paragraph which sounds like a steal (or an inspiration) from "The Skin of our Teeth." Then more philosophy. Mr. Fuller believes in the out-of-doors, and he wants every other man to believe in it and live in it too.

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.

MEMBERSHIP IN THE GARDEN

Established as a privately endowed institution, aided partially by City appropriations, The New York Botanical Garden is dependent for its progress largely upon benefactions and memberships. Through these means, though young as botanical gardens go, it has become the third largest institution of its kind, its library, herbarium, and horticultural collections ranking among the finest and most complete in any country.

Membership in The New York Botanical Garden, therefore, means promotion of scientific research in botany and the advancement of horticultural interests. Scientifically, the Garden is able to serve as a clearing-house of information for students and botanists all over the world; horticulturally, it often serves as a link between the plant explorer or breeder and the gardening public.

Through memberships and benefactions, provision is made at the Botanical Garden for the training of young scientists and student gardeners; hundreds of new books are added annually to the library, which is open daily to the public for research and reading; free exhibits are maintained in the museum, the greenhouses, and gardens, and lectures, courses, and free information in botany and gardening are given to the public.

Each individual member of the Garden receives:

(1) A copy of the Journal every month.

(2) A copy of Addisonia once a year, each number illustrated with eight colored plates of unusual plants, accompanied by descriptions.

(3) A share of surplus plant material of interesting or new varieties whenever it is distributed.

(4) Announcements of special floral displays, programs, lectures, and other events at the Garden.

(5) Credit to the amount of the membership fee paid, toward courses of study offered by the Garden.

(6) The privilege of borrowing lantern slides from the Garden's collection.

(7) Use of the Members' Room in the Museum Building.

A limited number of garden clubs are accepted as Affiliates. The privileges of affiliation are one lecture a year by a member of the staff, a share in the distribution of plants when they are available, a subscription to the Journal and to Addisonia, and announcements of special activities at the Botanical Garden. In addition, any member of an affiliated club may receive for the current year of membership a reduction of $5 in the fees paid for instruction. (This does not apply to the course for professional gardeners.) An Affiliate Garden Club may borrow lantern slides from the Garden's extensive collection, such loan being subject to the regulations for the use of lantern slides by individual members. Likewise, an affiliate club may engage without fee the Members' Room at the Garden for its meetings.

The classes of membership are as follows:

Annual Member	annual fee	$ 10
Sustaining Member	annual fee	25
Garden Club Affiliation	annual fee for club	25
Fellowship Member	annual fee	100
Member for Life	single contribution	250
Fellow for Life	single contribution	1,000
Patron	single contribution	5,000
Benefactor	single contribution	25,000

Fellowships or scholarships for practical student-training in horticulture or for botanical research may be established by bequest or other benefaction either in perpetuity or for a definite period.

Contributions to the Garden may be deducted from taxable incomes. The following is a legally approved form of bequest:

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

Conditional bequests may be made with income payable to 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, N. Y.

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

VOL. 44
No. 527

NOVEMBER
1943

PAGES
245-268

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

WESTERN EXPLORATION

STRETCHING from the state of Washington to Arizona and extending from the Rocky Mountains to the Cascade and Sierra Nevada ranges, there is a high intermountain region which comprises more than one-tenth of the total area of the United States. The last part of the country to be explored and settled and today still the most sparsely populated, this vast region is, botanically, the least satisfactorily known. In its reach of a thousand miles from north to south and six hundred at the widest part from east to west, there are still new plants to be discovered and many others the study of which will enrich botanical science and the life and industry of the region.

The first expedition on which plants were collected was John Charles Frémont's in 1842. At that time there was not a single white settlement in the entire Great Basin. Since then, numerous government-sponsored expeditions—army, railroad, and geological surveys—have been undertaken, and in recent years the forest and grazing services of the United States Department of Agriculture have contributed much to the botanical knowledge of the area. But in a region of more than 300,000 square miles where there are often no roads or trails through the mountains and where it is possible and sometimes necessary to be 100 miles away from a railroad, a detailed investigation of the flora has been difficult to execute

An organized study of the vegetation is now under way, however, with The New York Botanical Garden and Utah State College co-operating. Announcement of the plan was made in the Journal for September. The background, purpose, and importance of the work were explained at the Members' Day program November 3 by Dr. Bassett Maguire, who began exploration of the region while he was teaching in Utah.

Economically, the vegetation of this intermountain area is of enormous value for three purposes: (1) protection of watersheds with a plant cover which will conserve the moisture needed for agriculture in the valleys. (2) forage or grazing for livestock, an important industry of the region; and (3) the *mise en scène* for public recreation. For the proper administration of each of these functions, a thorough understanding of the plants is necessary. The program recently launched will provide important background for the interpretation of the flora It will not be the final word on the subject that will take more time. It will merely be the beginning of an essential scientific work with broad practical applications

Since its establishment, the New York Botanical Garden has played a major part in the study of the flora of every other region of continental United States. The sponsorship of a share of the work in the remaining one, the intermountain area, continues the contribution that the Garden has made in the past to an understanding of the flora of this country.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58. N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter, Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 44 NOVEMBER 1943 No. 527

The Fungus Gardens Of The Leaf-Cutting Ants

By Gerold Stahel

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ANTS originally were hunters living from insects and other small animals. Later, many of them became accustomed to other kinds of food, such as the excretions of plant lice, seeds, etc., food more easily available and in bigger quantities. This enabled them to build up bigger and more populous colonies. The highest evolution was reached when ants began to grow their own food by cultivating an edible fungus. They now use a great variety of leaves from trees, shrubs, and herbs, and from these the garden fungus concentrates the proteins and carbohydrates into an easily digestible and highly nutritious form.

These fungus-growing ants are known as the leaf-cutting ants or *Attinae*, a family limited to the American tropics and subtropics. They prefer the humid parts of these countries where an abundance of leaves enables them to build up immense compound fungus gardens and highly organized ant states. Only the genus *Moellerius* has adapted itself to the extreme conditions of the deserts, but, owing to the scarcity of leaves and the deep and extensive excavations necessary to reach the humid subsoil needed for the fungus cultures, the *Moellerius* colonies remain small.

The subterranean fungus gardens of a colony of the common leaf-cutting ant (*Atta cephalotes* and *A. sexdens*) have a weight of 150 to 300 pounds. They are scattered over 500 to 1,000 separate holes dug by the ants at one or many feet below the surface of the soil and connected one with the other by channels. In these separate garden units, the ants are able to stop a disease with much more success than in one big garden in a single subterranean hole. Infected garden units may be quickly removed by the ants to the big refuse-holes outside the garden area, and the channels may be filled up with soil to stop further spread of infection.

Sponge-like masses of fungus in the nests of the leaf-cutting ant, Atta cephalotes
(Photograph used by courtesy of the National Geographic Society)

Years ago, we made a big artificial fungus garden by filling nine basket with fungus gardens and ants collected in several nests in the field. Th baskets contained about 100 pounds of fungus gardens and were put clos together in one big subterranean hole. Every day plenty of fresh gree leaves were given to and eagerly used by the ants. They immediatel restored the broken gardens in the baskets, uniting them with the garden of the neighboring baskets into one immense coherent fungus garde After four weeks, however, the ants suddenly refused to cut the leave and by thousands they left the garden, which collapsed and formed on big soft rotten mass. This debacle the ants certainly could have prevente if the same garden mass had been scattered over about 100 separate hole only united by small channels.

Let us now observe a fungus garden of the lowland leaf-cutting an *Atta cephalotes.* The surface of such a nest commonly measures abo 20 by 30 feet. The fungus gardens of this ant are found from one to on and a half feet below the surface, and a half to one foot apart one fro the other. A garden unit looks like an old-fashioned bath sponge, an consists of thousands and thousands of small leaf pieces a little more tha one square millimeter in size, and held together only by minute thin-walle fungus threads. It is clear that such a structure must be very frail an easily broken when touched. The gardens are grayish, more dark in th upper part, more brownish below.

The ridges in the upper part are covered by thousands of minute whit points just visible to the naked eye. They consist of 200 to 300 minut globular fungus cells rich in protein and sugar. The little clumps a called kohlrabi heads, and are attached to the substratum by a few tin fungus threads only, so that the ants, even the smallest ones, are able t gather the heads without effort. They can easily be taken off with a platinu needle. These kohlrabi heads represent, as far as we know, the only foo these ants consume.

Day and night, during weeks, months, and years, the ants build up new ridges on the upper part of the garden and at the same time carry away the brown basal part, consisting of the oldest leaf pieces entirely exhausted by the fungus.

The size of the garden remains the same, but the mass of it is renewed continuously. The new leaf pieces planted on the upper ridges are covered within a few hours by new ones, and in this manner they gradually sink deeper and deeper into the mass of the garden.

Thus, our ants enjoy a continuous food production in their gardens much in contrast with our commercial mushroom growers, who have to work intermittently. After the manure is exhausted in a couple of months, it has to be cleaned away, the culture room has to be disinfected, and fresh manure and fresh spawn have to be brought in to start from the very beginning. Evidently our leaf-cutting ants are mushroom growers more able and skillful than man, but they have the advantage of an experience of thousands of years and of tools much finer and much more adequate for this work than ours.

For every mycologist who studies the fungus grown by these ants, it is a most surprising fact that the kohlrabi heads taken from new ant ridges of a fungus garden with the aid of a sterile platinum needle and transferred to nutrient agar, give rise, in by far the most cases, to pure cultures of this very slow-growing fungus. How the ants manage to make such clean

Subterranean fungus gardens in a colony of nests of Atta sexdens, one of the leaf-cutting ants. The whole structure measures about one meter (a little more than a yard) in height. (All photographs are by the author.)

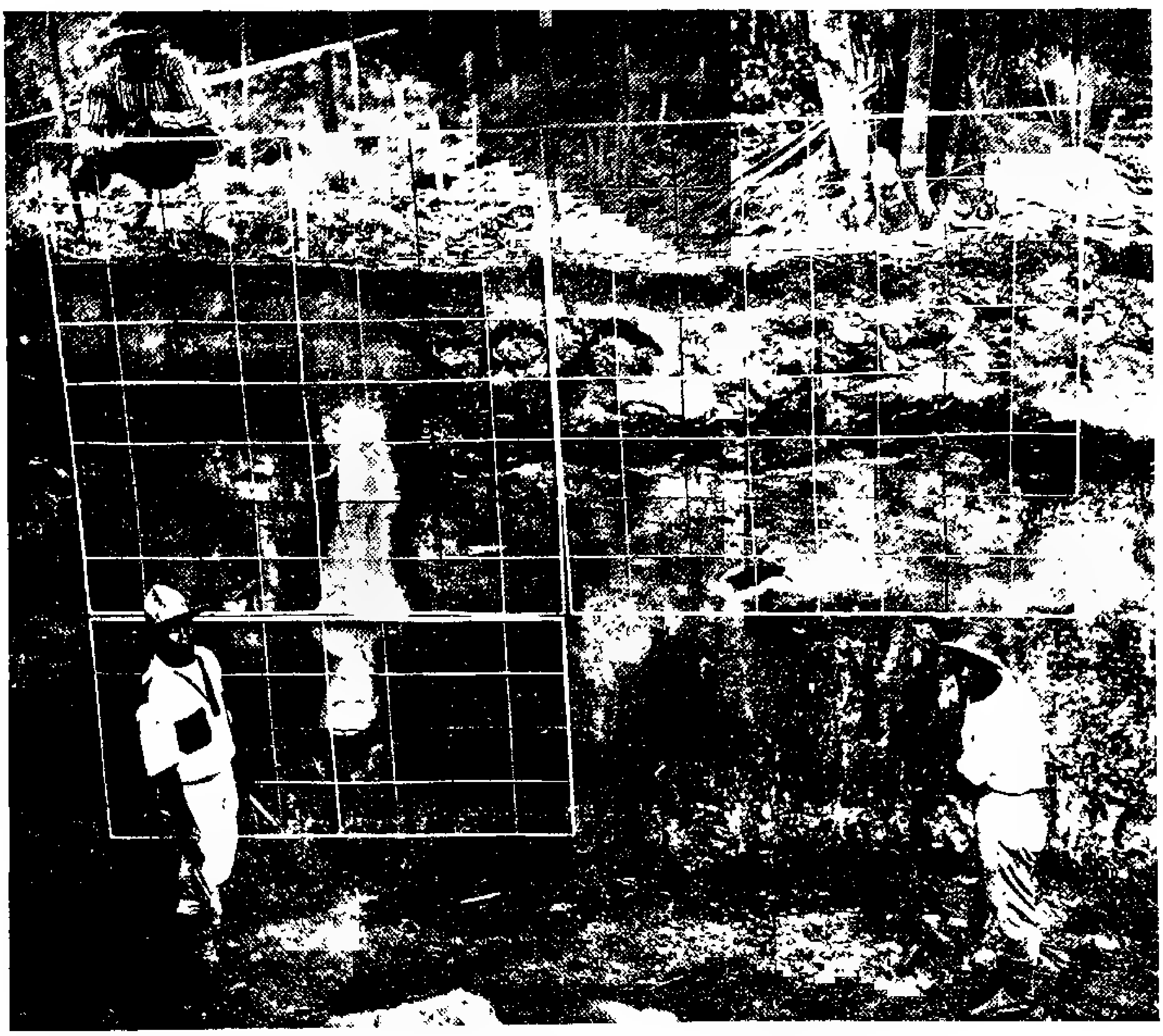
Workmen in Surinam cutting away a bank where the leaf-cutting ants have nested, preparatory to a study of the fungus gardens which the ants have developed
(Photograph used by courtesy of the National Geographic Society)

cultures in spite of the fact that leaf-cutters continuously come back into the nest after a walk of hours outside, is one of the most remarkable of the many striking facts we learn from these ants.

Long ago it was already well known that the leaf-cutters carry small workers as passengers on the leaves they bring to their subterranean fungus gardens. We counted as many as seven on one single leaflet. It was a mystery as to what these small ants were doing outside the nest, and one of the earlier observers supposed they might be sluggards and merry-makers at the expense of the heavily working carriers. We traced the path back to where the leaflets were coming from, and found our small passengers on the leaves which the ants were busy cutting. Slowly we saw them walking over the leaves, working continuously with their mouth parts, apparently cleaning the surface, which, in the humid tropics, is covered with a layer of fungus threads, yeasts, and bacteria, mostly invisible to the naked eye. That it really was cleaning work could easily be seen in our laboratory nest under a big bellglass. The humid inside of the clean bellglass covers itself with fine fungus threads after one day only. The threads are distinctly visible from outside with a magnifying glass. Immediately a number of small ants, laborers, the same as the passengers on the leaflets, begin to clean the inside surface of the glass. They swallow the fungus growth and make clean paths in the covering of fungus threads.

On a still larger scale this cleaning work goes on in the fungus garden itself. Let us see now what happens when the leaves arrive in the subterranean gardens. We can observe this in a big artificial laboratory nest. For three and one-half years we have had one nest in our laboratory, and it is still in excellent condition. When the leaf arrives in the nest, it is taken over by from one to three ants of the medium-size class, and held hanging down freely along the sidewalls or into one of the cavities of the garden. Six to twelve of the small cleaners climb on the leaf and assiduously begin to clean both surfaces for about two hours or more.

Then, one of the ants that held the leaf during this procedure starts



By means of these bars, which are in different colors, the sketching of the plan of the colony of Atta nests was facilitated. The scene is in Surinam, where the author, with Dr. D. C. Geijskes, has been making a thorough study of these curious ants and the fungi that they cultivate.

carving the margins of the leaf all around after the cleaners have left it. At every millimeter or at an even smaller distance, a deep carving is made with the aid of the strong mandibles, and at the same time glistening saliva is deposited on the carvings. The margin, treated in this way, generally discolors into dark green or black. After finishing this job, the ant still holds the leaflet, ready to be cut into still smaller pieces. Another ant of the medium class, that occasionally walks along, suddenly stops, and after a few seconds begins to cut a small roundish piece of a little more than one square millimeter from the leaf. Other ants come along and cut other pieces, and so on. Sometimes bigger pieces are cut, and these have to be divided in the same manner as the original leaf. For cleaning and cutting, eight to twelve hours are needed.

The freshly cut margins of the leaf pieces are carved and impregnated thoroughly as was done with the original leaf. After this work is finished, the ant walks to one of the ridges on the upper part of the garden, where it fixes the piece straight up. It puts it into this position by scraping loose fungus threads from nearby to the lower part of the piece. Now the job is done, and the ant goes on to look for another one. After its departure, one or two of the smallest garden ants, very tiny insects, and the only ones which never leave the gardens, appear on the freshly planted leaf-piece. In the neighborhood, they collect kohlrabi heads and plant them one beside the other on the free margin of the leaf-piece up to ten and more in one row. The work which started by cutting the leaflets on the tree fifteen to twenty hours before is now finished.

Not only the walls of the garden room and the leaflets are cleaned, but also the dirty carriers themselves. When the leaflet is taken over by other ants, the carrier undergoes a thorough brushing by the small cleaners. They climb on the carrier and assiduously clean every leg, the antennae, the mouthparts, and all other parts of the body. During all this time the carrier remains immobile. Only when the last cleaner has finished its job does it go on with its work.

It may be clear now that cleaning is one of the principal activities in the gardens of the leaf-cutting ants. But in spite of all this intensive cleaning, the garden is not free from foreign germs, not even the newly planted leaf pieces. I collected thirty-one of the pieces just before the planting of the kohlrabi heads, and brought them aseptically over to nutrient agar. During the first two days, there was no visible growth at all. After fourteen days, seven pieces showed fungus growth, fifteen showed bacteria and yeasts (*Sporobolomyces*), and only nine remained sterile or showed the nest fungus (two). The growth of the foreign germs was very slow during the first week, possibly retarded by the saliva with which the pieces were impregnated.

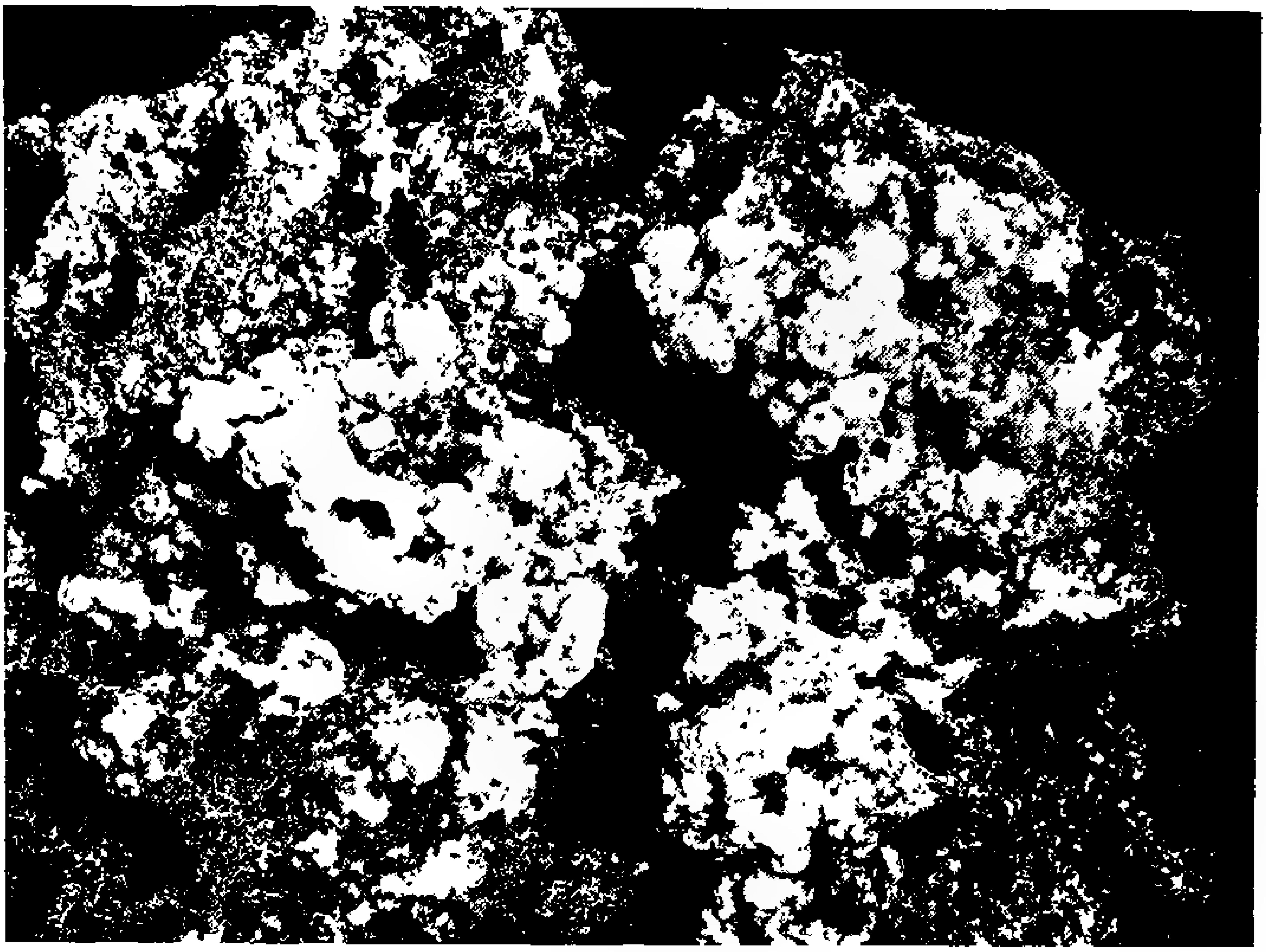
Besides the continuous fight of the cleaners against foreign contamination, other groups of ants have to watch and trim their own garden fungus.

The conidial form of the fungus cultivated by the leaf-cutting ants, developed in the laboratory. The ants are almost completely successful in preventing this phase of the fungus's life cycle from developing.

When a small piece of a fungus garden is transferred to a dish filled with moist sand and covered with a bellglass, the ants on this piece immediately begin to restore the broken parts and rebuild the sponge-like, well aerated microgarden. A few days later, they begin to cut fresh leaves and renew the garden just as in a normal one. If, with the aid of pincers, all the ants are picked out of the garden so that not a single one is left, within two or three days the garden covers itself with a wealthy, inch-high, white mold, which discolors after a few days into brown, and produces an immense quantity of brown conidia.

If, however, even a very few of the smallest garden ants, the ones we remember from the planting of the kohlrabi heads, are overlooked and left, the garden remains perfectly normal. The chief duty of these tiny insects is to prevent the growth of this conidial form, the greatest disaster that can overcome a garden. If that happens, the ants immediately leave the garden. In every garden these smallest garden ants can be noticed walking over the walls and ridges, weeding and scratching the surface and removing all the wild shoots.

A second form of the fungus is found in the ant nests during the dry season, when all available ants are very busy digging and deepening the waterwells to follow the dropping groundwater level, and carrying water



The crust which sometimes forms in an Atta fungus garden. The ants endeavor to keep this stage of growth from appearing.

to the thirsty gardens near the surface of the soil. It happens that during this time gardens may be found to be covered with a meaty, compact fungus tissue. From this crust eventually a mushroom may grow out, called *Rozites gongylophora.* The ants suppress these fruit-bodies with so much success that only by great exception is a mushroom formed. Even the crust may be carried away by ants of the medium-size class, as they normally do with the exhausted and useless parts of the garden. Some food that otherwise might be transformed into kohlrabi heads is lost in this manner.

The Old World termites are fungus growers too. On nest debris they cultivate the related *Volvaria* mushroom, but have not yet learned to suppress the forming of fruit-bodies as our American Attas do. Much useful food is spoilt in this way for the termites. The New World termites have not yet learned to cultivate fungi.

There is a striking difference in the behavior of the ants against the mushroom and the conidial form. In the first case, the ants remain in the garden and suppress the development of the fruit-bodies by taking the crusts away. In the second case, however, they shun anxiously from every contact with the disorganized garden and leave it without delay.

The leaf-cutting ants commonly use leaves from oranges, mangos, maniocs, etc., but also from most of the common vegetables such as Swiss chard, turnip greens, etc., on which to grow the garden fungus. During two years I fed a colony in my laboratory chiefly on leaves. From time to time, however, they like to have some variation, and got dried oranges, dried orange peels, dried tomatoes, and especially dried green sweet peppers.

While feeding only fresh leaves, I never saw the ants drink water, but two days after dried food was used exclusively, they went to drink by hundreds together, and only some days after the dried food was withheld did they stop drinking. It is only one single type of the smaller ant that comes to drink. It carries the water in its water stomach, just as honeybees do, to the nest and raises in this way the water content of the garden if it is too low.

Once I gave one of my laboratory nests finely cut dried fish. Greatly excited, the ants immediately hauled the pieces into the nests. But within the hour, the ants brought the pieces all around out of the nest to throw them over the margin of the pot into the waterpan. Apparently the testing for suitability of the fish as food for the garden fungus could be achieved in this short time only by the cleaners or the cutters, and not by the fungus itself.

* * *

In this article is given the mycological part of a study about the nests of the leaf-cutting ants which was carried out in collaboration with D. C. Geijskes, entomologist of the Surinam Agricultural Experiment Station. A full account of these studies about the construction of the Atta nests is published in three articles in the *Revista de Entomología,* Rio de Janeiro. and in Bulletin No. 56 of our Experiment Station.

For more than four years we have kept the ants in artificial nests in our laboratory and in a cellar. Especially *Atta cephalotes* is easy to rear. It produces wealthy fungus gardens, if one reckons carefully with some of the principal requirements of an Atta colony. In this case, there is no reason why these most interesting ants should not grow the same flourishing fungus gardens in the United States, if kept in an air-conditioned room at a constant temperature between 77° and 82° F. (25°—28° C.). Fecundated queens might be sent from here to Miami by plane.

If biological institutions would like to rear these ants, Dr. Geijskes and myself will try to send queens during the time they swarm and give directions for successful culture.

Sprouted Soy And Mungo Beans

By Sam F. Trelease and Helen M. Trelease
Department of Botany, Columbia University

AT a time when this country, along with the rest of the world, faces a severe shortage of meat, owing to wartime conditions, attention naturally turns to vegetable products that may be used to supplement the diminishing supply of animal proteins. Soybeans seem to meet nutritional requirements in providing a substitute for meat. Evidence of the high nutritive value of soybeans is seen in their record as the chief source of protein for millions of people in the Orient during the past 5,000 years. Modern research has shown that in nutritive efficiency the proteins of soybeans rival those of meat and are superior to those of wheat and of ordinary beans, such as navy and lima. Contrary to popular opinion, ordinary beans have little value as meat-protein substitutes, because of their deficiency in the amino acid cystine and their high starch content.

Soybeans contain about 40 per cent of proteins (mostly glycinin) that yield suitable proportions of all the ten essential amino acids required for the construction of the body tissues. They contain 20 per cent of high quality fat, and they are almost devoid of starch. For supplementing a deficiency of meat proteins, soybeans are far superior to the starchy cereals and ordinary beans. Soybeans are good sources of calcium, phosphorus, and iron, as well as of thiamin (vitamin B_1), riboflavin (vitamin B_2), and niacin, or nicotinic acid (also of the vitamin B group). Because of their many valuable qualities as a food, soybeans deserve a permanent place in our diet. About 30 million pounds of soybeans were used in this country in 1942 for direct human consumption. The total production in this country in 1943 for all purposes was about 500 million pounds, and it is estimated that the crop will be three times as large in 1944. The climatic and soil conditions of the Corn Belt are ideal for cultivation of soybeans.

Reasons for Sprouting the Beans

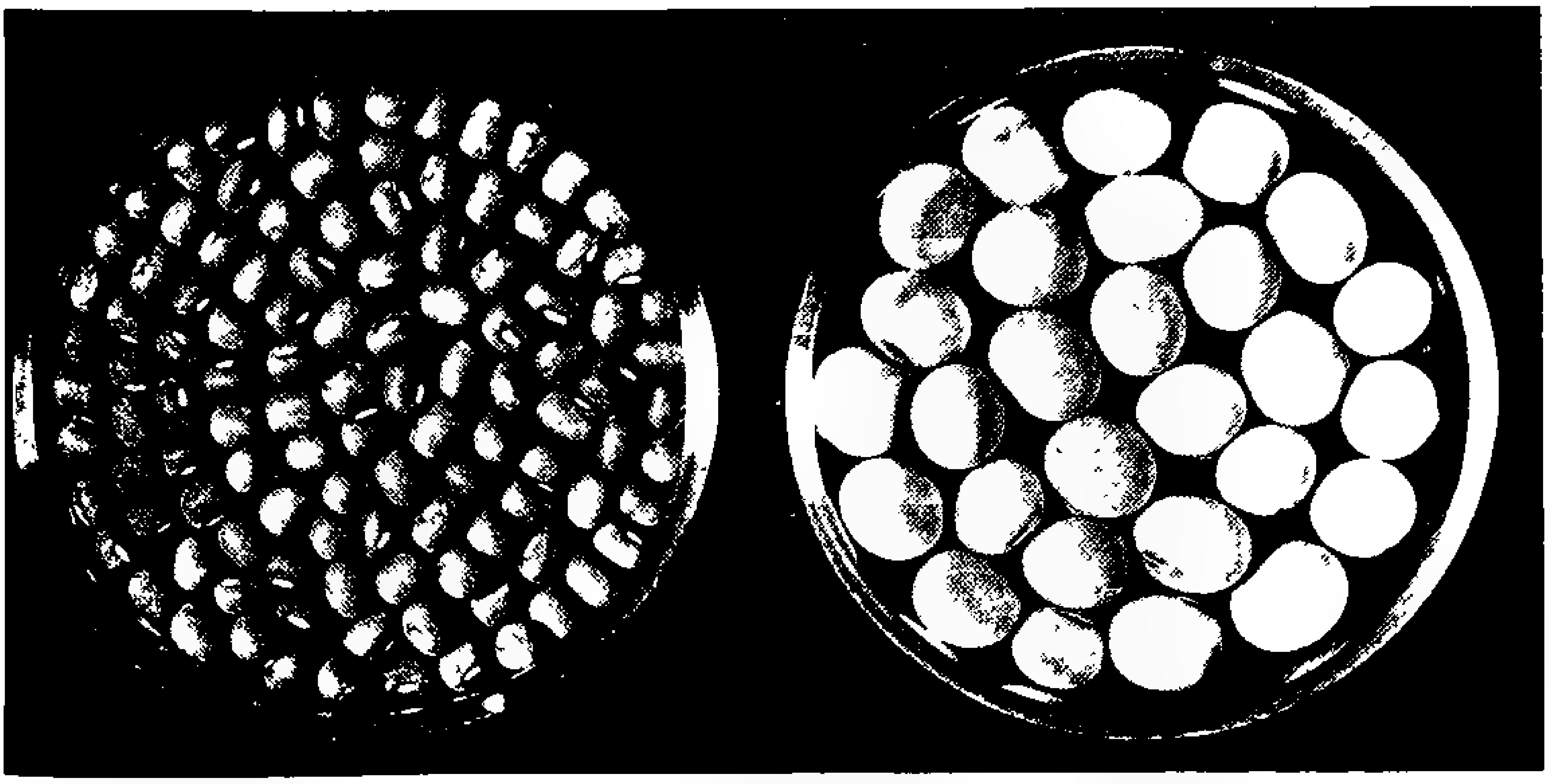
If, instead of simply cooking soybeans as we do other beans, we allow them to sprout first, they acquire added nutritional value and become a fresh vegetable, rich in vitamin C. In the sprouted form, soybeans are suitable for use in salads and other dishes in which they are different from ordinary cooked dried beans. By sprouting the beans, the cooking time is shortened from about 4 hours to 10 or 15 minutes—about the same as that for fresh garden peas.

Everyone who has eaten chow mein or chop suey has noticed the sprouted beans—perhaps the only component that even a botanist would attempt to identify. The Chinese custom of using sprouted beans goes back to ancient times and rests upon sound nutritional principles. While the bean seed is developing in the pod, it contains a considerable quantity of vitamin C; but by the time it has matured, dried, and entered the resting stage, it has lost all of this vitamin. When the seed germinates, however, its vitamin C content rapidly increases and soon equals that of the juice of orange, lemon, or tomato. Although cooking destroys some of the vitamin C, the cooked sprouts retain enough to make them a good source of this essential substance. Certain other vitamins, including biotin, riboflavin, and niacin, also increase during the germination of the seed.

Perhaps the immediate reason why many people have suddenly become interested in how to sprout soybeans is the natural curiosity we all have in something new. And all of us like to see things grow. Sprouting soybeans may provide many people with a form of year-round gardening that can be carried on in any kitchen and yields in four days a highly nutritious fresh vegetable.

Securing a Supply of Beans

A suitable supply of soybeans for sprouting may be bought in one-pound packages in grocery stores at about 12 cents a pound. Several thousand varieties are grown, with seed coats white, yellow, green, brown, or black. The edible soybeans available in the stores in New York City have a yellow coat. We have found them to give prompt, uniform germination of about 90 per cent. It is well to buy only one pound, and if this



Mungo beans (left) and soybeans (right), clean and perfect as they should be when ready for sprouting—shown natural size.

gives satisfactory germination, to go back and buy a larger supply from the same lot.

The favorite bean for sprouts used in the Chinese restaurants is not the soybean (*Glycine Max* L. (Merrill)) but the mungo bean (*Phaseolus aureus* Roxbg.), also known as mung bean, green gram, or little green bean. The mungo bean is thought to be a native of India, where it has been cultivated from time immemorial. The sprouts of the mungo bean are much smaller and more delicate in flavor and texture than those of the soy. Though mungo sprouts are still served in restaurants, reduced importation of the seeds during wartime makes them unavailable to the general consumer. Perhaps this is just as well during the period of meat shortage, because the soybeans are superior in the nutritive efficiency of their proteins, though the two are similar in content of vitamins and minerals.

How to Sprout the Beans

The chief problem in the sprouting of soy and mungo beans is to prevent the growth of mold which would render the seedlings unfit for use. Cleanliness is imperative. Shriveled, broken, or non-viable seeds serve as centers for the growth of mold. With seeds of high quality, little difficulty with mold is likely to be experienced if the seeds are washed several times a day with water or a dilute chlorine solution to remove the small amount of mold or bacterial growth that is certain to develop.

For the past fifteen years we have sprouted mungo beans at home by a relatively simple procedure. The beans (a cup or less) are washed and then soaked overnight in water, until they swell and absorb enough water to allow germination to start. They are then rinsed several times, drained of all but a surface film of water, and spread out in a two-quart baking dish, which is lightly covered to maintain a saturated atmosphere. If it is a glass dish, it is wrapped in paper to exclude light. Three times a day the seeds are rinsed thoroughly, and after each rinsing they are drained completely of excess moisture. Excellent, mold-free germination of mungo beans is obtained within three or four days.

Detailed directions for the sprouting of soybeans are given by Prof. C. M. McCay, of the Cornell University School of Nutrition, in a leaflet issued in September 1943, by the New York State Emergency Food Commission. They also appear in the *Reader's Digest,* September 1943, in an article by Leigh Mitchell Hodges condensed from the *American Miller,* August 1943. We have recently tested this method and we recommend it, with several modifications, as the one most likely to suit the convenience of those who may wish to sprout soy or mungo beans in the home. (Anyone who prefers to use a baking dish, rather than a fruit-jar, as a receptacle for the germinating beans, may easily make changes as necessary in the manipulations.)

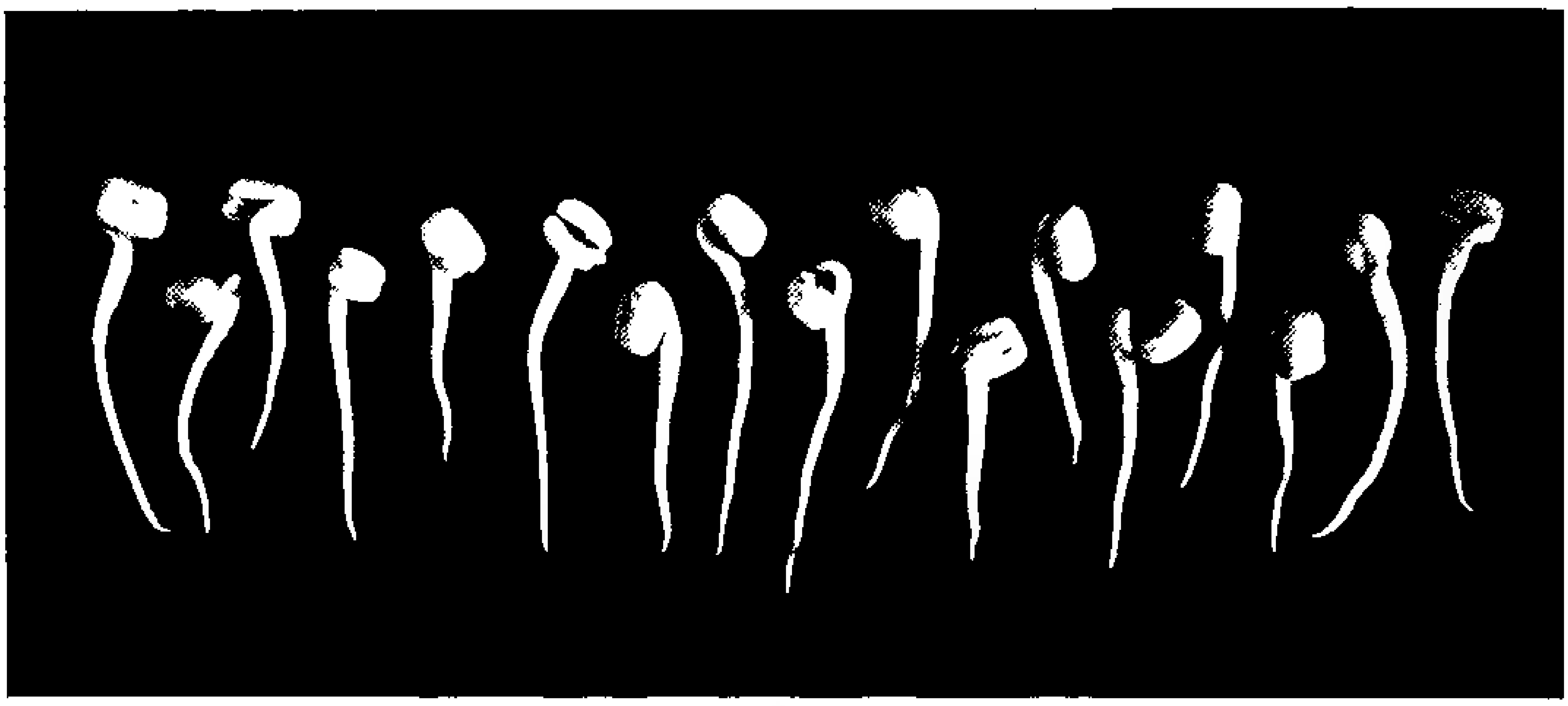
A simple, practical method for sprouting soybeans: A Mason jar tightly covered with cheesecloth and inverted on two small blocks of wood in a saucer, with the directions for covering, washing and rinsing, as given here, carefully followed. In four days' time the vitamin-packed sprouts are ready to use

Specific Directions

Spend a few minutes picking over the beans and discarding discolored, shriveled, and broken seeds, which would be likely to mold. Measure 2/3 of a cup of the good beans and put them into a saucepan. In order to remove mold spores and dust, wash the beans very thoroughly in running water, continuing the washing until the water is clear. Then drain the beans and transfer them to a 1-quart Mason fruit-jar.

Prepare a dilute chlorine solution, for use as a mold inhibiter, by putting 1 tablespoon of a 5 per cent solution of sodium hypochlorite* in a 1-gallon jug and filling the jug with water.

*A 5 per cent solution is sold for about 25 cents a quart at grocery stores under the trade names "Clorox," "Planet," and "Rose-X." Chlorinated lime, or calcium hypochlorite, may be used in the laboratory in a concentration of about 3.5 grams to 4 liters of water, and it allows somewhat more rapid growth of the seedlings than the "Clorox," etc.; but this powder is so highly corrosive and dangerous to store, smell, or handle that it is unsafe for use in the home, particularly within reach of children.



Mungo beans, two-thirds natural size, sprouted at home by the authors.

Fill the jar containing the beans with the dilute chlorine solution and let stand overnight.

In the morning rinse the beans in five changes of plain water, and pick out any broken beans that may have been overlooked in the first sorting. After the final draining, stretch a piece of cheesecloth† over the mouth of the jar and secure it with string or a rubber band. Then invert the jar on two blocks of wood about ¾ of an inch thick, in a saucer, to permit free drainage and access of air. Cover with a paper bag or cardboard box. If light reaches the seedlings, they turn green, owing to the formation of chlorophyll.‡ The temperature should be above 60° F., but high summer temperatures tend to promote the growth of mold.

Each evening remove the cheesecloth and rinse the beans with a quart of the chlorinated water; then drain this off, fasten a fresh piece of cheesecloth over the mouth of the jar, and invert the jar on the blocks in the saucer.

Every morning and noon, rinse the beans twice by filling the jar with plain water (without removing the cheesecloth) and pouring it out immediately; then invert the jar again on the blocks.

If the seeds are of good quality, they will sprout and be ready for use after three or four days at ordinary room temperatures. Soybean seedlings are likely to require four days for the sprouts to become a little over two inches long. Seedlings of mungo beans are best when about an inch and a half long, requiring about three days. Keep the sprouted beans in a refrigerator until you are ready to use them.

† Obtainable from a 10-cent store.

‡ A similar method has been used for many centuries in the Orient for germinating rice seeds before planting them in the nursery bed; a bamboo basket or cloth sack of soaked seeds is hung in the dark in a moist atmosphere.

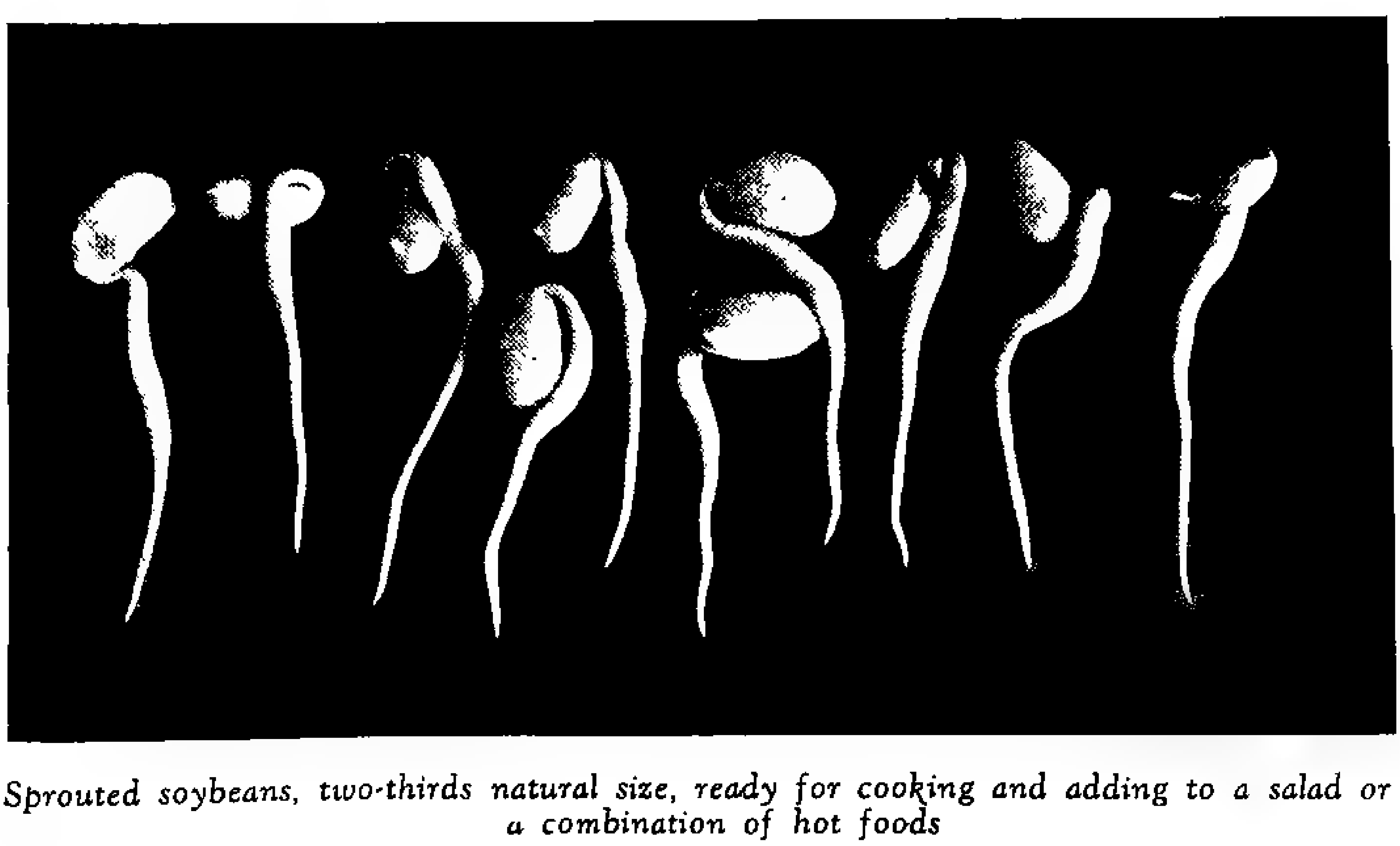
Commercial Sprout "Farms"

In the commercial establishments that supply New York's restaurants with sprouts, the beans are washed in lukewarm water and allowed to soak in large dishpans and are then transferred to 20-gallon galvanized iron cans, the bottoms of which have screened openings to drain off the excess water. Several times a day the beans are sprinkled with water. During the later stages of germination, cool water is used to remove the heat evolved in the respiration of the large mass of germinating beans. Half a dozen firms in Chinatown raise thousands of pounds of soy and mungo sprouts daily for the city's restaurants and markets. Mungo beans are preferred, and they are still available for restaurants because of stocks of seeds on hand at the beginning of the war. A single large restaurant may use an average of 100 pounds of bean sprouts a day in chow mein, chop suey, and other Chinese dishes. Packaged bean sprouts are beginning to appear in the chain grocery stores.

Cooking and Serving the Sprouts

Soybean sprouts are boiled 10 to 15 minutes, mungo sprouts only 3 to 5 minutes. The loosened seed coats may be removed from the soy sprouts before boiling; they rise to the surface of the water and may be skimmed off while the mungo sprouts are being cooked. Or, the seed coats may be left with the bean sprouts when they are served; they do not change the flavor, and they provide roughage in the diet. The boiled sprouts may be kept for a few hours in the refrigerator; but if the sprouts are to be kept several days, it is better to store them in the refrigerator in the fresh condition.

The cooked bean sprouts may be served in a variety of ways. One of the best is to mix them with mayonnaise and a little onion juice and serve



Sprouted soybeans, two-thirds natural size, ready for cooking and adding to a salad or a combination of hot foods them on lettuce or in various mixed salads or in coleslaw. Mungo sprouts are delicious when served in this manner. Soy sprouts, however, have a distinctive though mild flavor for which a taste may have to be acquired. While developing a fondness for soy sprouts, it is perhaps best to disguise their flavor by grinding them in a foodchopper and using them in the preparation of stews, meat loaves, meat balls, hash, stuffed peppers, chile con carne, curries with rice and Chinese noodles, scrambled eggs, omelets, or dishes containing fish, crab meat, cheese, or mushrooms. In this manner the soy sprouts not only serve as stretchers but carry their own share of nutritive value.

The soybean, as the source of raw materials for the industrial synthesis of many substances, is performing important services for the battle front. On the food front also it may play a vital part in the winning of the war.

RECIPES AVAILABLE

For three cents to cover postage (two cents in Manhattan and the Bronx), the New York Botanical Garden will send half a dozen recipes for the use of sprouted soybeans in casserole dishes, creole style, with eggs, with cheese, and in a salad. The recipes have been compiled by Dr. Ilda McVeigh of Yale University for distribution at her lecture at the Garden Nov. 27 on "Vitamins and Vegetables."

Penicillin Explained in Members' Day Address

PENICILLIN has become the wonder drug of the age. Possessing a thousand times the power of the sulfa drugs, which were making headlines up to two years ago, penicillin provides an effective inhibitor of the growth of some kinds of pathogenic bacteria when it is diluted with 30,000,000 parts of liquid.

The story of its discovery and of the search of botanists for similar substances that will duplicate or supplement penicillin was told by Dr. William J. Robbins at the first Members' Day program of the autumn season Oct. 6.

Penicillin, he explained, is produced by one of the blue-green molds, *Penicillium notatum*, a fungus which until a few years ago was of interest only to botanists as one of the more than 60 species of the genus. Of these many species, in fact, few have been given much attention; among these are *P. Roquefortì* and *P Camembertii*, which are responsible for two choice kinds of cheese. Others are principally noticed because they cover bread and lemons and other fruits with a characteristic greenish mold.

In 1929, Dr. Alexander Fleming, a London bacteriologist, was growing pathogenic bacteria belonging to the

Staphylococcus group in dishes containing agar, a jelly-like nutrient medium. A culture became contaminated with a blue-green mold which fell into the dish from the air, and he noticed that the bacteria did not grow in the culture in the vicinity of the mold. Fleming then grew the mold in a liquid medium, filtered off the liquid, and observed that it, too, would inhibit the growth of bacteria. He found further that the culture fluid on which the mold had grown was not injurious to animals, that it inhibited some kinds of bacteria but not others and suggested it might be of therapeutic importance. The contaminating mold responsible for the anti-bacterial action was identified as *Penicillium notatum*. Although Fleming's discovery is now recognized to be of tremendous importance, his observations passed unnoticed at the time by all but a few scientists.

During the next ten years Fleming and a few other investigators in England retained their interest in penicillin, studying its action on various bacteria and attempting to concentrate the active principle. There was, however, no general interest in *Penicillium notatum* and its products until about 1940 when the results of an investigation were published showing that penicillin was effective in curing various bacterial infections in mice. These results were sufficiently encouraging to suggest the wisdom of the next step, testing the action of penicillin on a human being. It is said that a London policeman, hopelessly ill with blood poison, agreed to have the new curative agent used on him. The improvement after the first injection was most marked, but, unfortunately, the quantity of material available was small, and the patient died before more could be prepared.

More penicillin was prepared and in 1941 a report was published on 10 patients, all of whom responded favorably to treatment. It appeared evident that an extraordinarily effective material for the treatment of certain types of infections had been discovered. The main problem was to produce enough of the material. Through the intermediary of the Rockefeller Foundation, two of the men who had been working with penicillin in England were brought to the United States to acquaint research laboratories and commercial drug companies with the characteristics of penicillin and methods for its production. Several companies with the encouragement and support of the United States Government entered into a large-scale program of research and production. In fact, several million dollars are now being spent for laboratories in which *Penicillium notatum* will be cultivated for its product, penicillin. At present almost all the material produced is allocated to the armed forces, and relatively little is available for civilian use, but that situation will be corrected in time.

It is important to note, Dr. Robbins pointed out, that not all the blue-green molds produce penicillin. In fact, *Penicillium notatum* alone seems to form this material in sufficient quantity to be of practical significance, and certain strains of this species are superior to others.

Up to the present, Dr. Robbins said, the chemical composition of penicillin is not definitely known. When it is—and numerous chemists in this country and in England are at work on the problem—it may be possible to produce it synthetically, but until then it can only be obtained by growing the fungus in huge laboratories under carefully controlled conditions.

A number of other bacteria and molds produce antibiotic substances but up to the present none of these has proved to be of much therapeutic importance. However, a search is now going on in many laboratories for organisms which may produce substances which will inhibit the growth of bacteria untouched by penicillin. Nearly 100 fungi have been tested at the New York Botanical Garden. The activity of one of these, a contaminant isolated at the New York Botanical Garden and tentatively identified as P_3, produces a substance which inhibits the growth of bacteria not affected by penicillin. However, the substance produced by P_3 is active in acid solution only, which probably eliminates its value in medical practice since the fluids of the body are neutral. To be of importance therapeutically, Dr. Robbins made clear, a substance must: (1) be active at great dilution, (2) be active in the fluids of the body, and (3) destroy bacteria without seriously injuring the host. Penicillin is the only antibiotic substance produced by bacteria or fungi yet discovered which meets these qualifications.

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.)

Delectable Fungi

COMMON EDIBLE MUSHROOMS. Clyde M. Christensen. 120 pages, illustrated in color and black-and-white, indexed. University of Minnesota Press, Minneapolis, 1943. $2.50.

Designed for the mycophagist (one who loves to eat mushrooms) rather than for the mycologist (who merely studies them), this excellent book gives the beginner the essential details of the poisonous and edible species. The descriptions of the different kinds are lucid and intriguing and the illustrations are excellent, especially the photographs, which show fine technical craftsmanship.

For the gourmet, the collection of recipes is a treasure trove. Think of it, forty-five species to add to our menus, all of them teeming with vitamins and minerals! Especially to be commended is the selection of the "fool-proof four" —morels, puffballs, sulphur shelf mushroom and shaggymanes. These can be learned in one lesson, and, as the author says, are eminently edible. Of course this selection eliminates the popular meadow mushroom, but perhaps that is just as well, for the button of the meadow mushroom closely resembles the button of the deadly amanita, and the latter has been known to pop up in shady lawns or on the edge of pastures.

MARGARET MCKENNY,
Olympia, Wash.

Economic Plants

USEFUL PLANTS OF THE WORLD. Willard N. Clute 219 pages. Willard N. Clute & Co., Indianapolis. Third edition. 1943. $3.75.

The third edition of Willard N. Clute's work on economic plants is an interesting, well written pocket-size reference book, the chief object of which is to give the common, scientific, and family names of our most important plants with a brief statement as to use. Unfortunately, there is no general index but the major economic groups such as food plants, condiments, perfumes, textiles, and drugs are treated as chapters with general remarks followed by a list of the most essential plants that serve as a source for the substances discussed.

The author gives two general regions of origin of our useful plants — the warmer parts of the Old World and the Indo-Malayan region. America's contribution is not apparently considered sufficiently important to cite as a third region of origin, though corn, potatoes, cocoa, pineapple, allspice, peanuts, squashes and pumpkins are discussed and rated by the author as extremely important. However, the book is excellent for quick reference to the important economic plants of the world.

G. L. WITTROCK.

The Gourmet's Garden

GARDENING FOR GOOD EATING. Helen Morgenthau Fox. 262 pages, illustrated, indexed. Macmillan, New York. 1943. $2.50.

If there has been a greater and more interesting variety of edible plants grown in home gardens this past season, and if these vegetables, herbs, fruits, and beverages have come to the table in unfamiliar and irresistible form, one good cause to look for is Mrs. Fox's book of last spring, "Gardening for Good Eating." It was fortunately published early enough in the season to enable home gardeners to follow its advice from the spading of the soil to the preserving and storing of the crops. Tempting recipes and menus intersperse the book and also form an effective concluding chapter.

The need for growing food plants which arose with the war prompted the writing of this book, as it has many others. But Mrs. Fox, instead of discussing cabbage and carrots and peas, happily followed her natural inclination to investigate the unusual. She had already grown many herbs in her garden at Foxden, Peekskill. "Herbs for Flavor and Fragrance," published by Macmillan in 1933, was the result of this successful experiment. She had made extensive studies of native American plants that could be eaten. "Edible Weeds of Wayside and Woods" in the Journal of the New York Botanical Garden in April 1942 came out of this. She had also grown and cooked and written about a number of what she calls "Forgotten Vegetables," and these form one of the most interesting of the chapters in her present book. One is convinced, after reading about lovage for rubbing the salad bowl, caraway roots as a vegetable, sweet cicely shoots on a plate of hors d'oeuvres, pods of the unicorn-plant for pickles, and roselle bolls for jams, that the gardener and cook who is chained by custom has been cheating herself and her family down through the centuries.

It is evident that Mrs. Fox's is a master hand at concocting salads. She knows which greens go best together, how to infuse herbs, which dressing blends most agreeably with each combination of greens, and, back of all this household wisdom, how a dozen salad plants can be grown. The young leaves of burnet, she says, mixed with lettuce or spinach, "are said to taste of cucumber, but to me have a faint, far-away flavor of roses, their distant relatives." Why shouldn't we grow burnet in the herb garden, to enjoy the flavor of its young leaves in the early part of the season and the beauty of its mature leaves and flowers later?

Mrs. Fox does not neglect the common vegetables. On the contrary, she glorifies them, and for each she gives a bit of historical background and at least one appetizing recipe.

Small fruits, herbs, and teas occupy other chapters, and greens for cooking, under the title "Spinach in Variety," another. Here one learns about borage, Good King Henry, Chinese mustard, orach, Swiss chard, beet and turnip tops, garden sorrel, cabbage greens, kale, collards, and more than a score of other plants the leaves of which are tasty when cooked.

Gardeners and gourmets who did not know of this book before they planned and planted their crops last spring will find new joys in gardening and eating if they have it to pore over during the winter months while the garden of 1944 is being evolved.

With its full-page illustrations and chapter headings drawn by Louise Mansfield and its cover and jacket in a gay chintz design, the book is good to look at as well as to read.

CAROL H. WOODWARD.

The Order of the Green Thumb

THE OLD DIRT DOBBER'S GARDEN BOOK. Thomas A Williams. 246 pages, illustrated, indexed. Robert M. McBride & Co., New York, 1943. $2.75.

Mr. Williams has written a very practical book that is easy to read and that is addressed, he says, to members of the Order of the Green Thumb. It should be of particular interest to the amateur, for it gives painstakingly clear explanations of just how each step in gardening should be taken; anyone willing to follow directions could not fail to succeed.

The book is divided into chapters treating the subjects of soil, shrubs, perennials, annuals, a vegetable garden, etc., with a particularly clear short chapter on sprays and fertilizers. "The Questions Most Frequently Asked" and their answers which follow each chapter give further information and add emphasis to the chapter itself.

Mr. Williams has done a remarkable job in making the information apply to all parts of the country.

ISABELLA M. LEFFERTS.

Disease-Control Manual

THE NATURE AND PREVENTION OF PLANT DISEASES. K. S. Chester. 584 pages, 207 figures, index. The Blakiston Company, Philadelphia. 1942. $4.50.

Although the expressed objective of "providing a work to which he [the student] may refer for detailed and specific directions on plant disease control" has not been achieved in all diseases discussed, Chester's book does reflect a more practical attitude toward plant pathology than other current texts on this subject.

The author is to be commended for the emphasis which he has placed on the relation between environment and disease and the importance of this relationship in formulating disease-control practices. The discussions of certain disease complexes and the chapter on virus diseases seem particularly well done. The treatment of the economic aspects of plant disease is realistic and well balanced.

The author has, however, condensed the introductory material on types of diseases and fungi almost beyond a satisfactory minimum. Likewise, the discussion of fungicides in the final chapter seems unduly brief, although additional information on fungicides may be found here and there in the discussions of specific diseases.

Unfortunately, confidence in the book is somewhat lessened by certain erroneous, equivocal or ambiguous statements which may be found. In discussing Verticillium wilts, for example, the author states (p. 165, 1. 8), "*V. albo-atrum* causes a discoloration of the xylem, similar to that due to *Fusarium* species." *V. albo-atrum* may cause no vascular discoloration in many of the herbaceous plants attacked. Relating to the control of blackspot of roses we find (p. 146, 1. 23), "In the greenhouse, a fungicide should be used and Selocide applied for red spider control—." Selocide was virtually abandoned as a spidercide about six or seven years ago. We find (p. 430, 1. 11) that "[agar] has the property of congealing to form a stiff jelly at room temperatures, and melting at temperatures not high enough to injure most organisms." This is misleading if not altogether incorrect.

A. W. DIMOCK,
Cornell University.

Textbook on Soils

FUNDAMENTALS OF SOIL SCIENCE. C. E. Millar & L. M. Turk. 462 pages, illustrations, glossary. John Wiley & Sons, New York, 1943. $3.75.

Soil science covers a large field and many sciences have contributed to its development. Research has made many important contributions in recent years. The literature is voluminous. It is, therefore, difficult to cover the subject comprehensively in one volume.

The authors have included important recent advances in soil science in addition to the older well established knowledge. Their presentation is by means of basic principles to which are related a wide range of significant facts. The approach to these principles is from the science involved. Applications to soil management are not attempted except in a few instances. For the most part the content is general rather than specific.

The book was written primarily to be used as a college text. It could be used most effectively by college students under the guidance of a good teacher. A great deal of difficulty would probably be experienced by an individual on reading it without having an adequate background of knowledge in the various sciences upon which soil science is based.

F. C. HERSMAN,
State Institute of Agriculture
Farmingdale, Long Island.

Primeval Forest Study

THE VIRGIN UPLAND FOREST OF CENTRAL NEW ENGLAND. A. C. Cline and S. H. Spurr. Harvard Forest Bulletin 21: 1-58, 1942, illustrated.

This is a technical study of the composition and structure of several fragmentary stands of the primeval forest with analyses of their successional status, forest type classification, and relationships to site and disturbances. Nichols' concept of physiographic climax is used as a modification of the Clementsian climatic climax. In addition to its excellent descriptive features, the value of the study lies largely in its silvicultural implications. Following the leadership of R. T. Fisher, the Harvard foresters have consistently endeavored to practice silviculture in harmony with the natural tendencies of vegetational development, and to counteract the prevalent "conifer plantation" concept of silviculture. It is for this reason that information concerning primeval forests is of such practical importance.

STANLEY A. CAIN,
University of Tennessee.

In the Laboratory

HANDBOOK OF PLANT TISSUE CULTURE. Philip R. White. 276 pages, illustrations, index, bibliography. Jacques Cattell Press, Lancaster, Pa. 1943. $3.75.

This volume is the first devoted primarily to a description of the history, methods, results, and prospects of plant tissue culture. Dr. White, who is himself a leader in the field, has prepared a book which will be of service to those who desire to use the technique either for its own sake or for the study of problems such as those in physiology, pathology, or morphogenesis to which the author points. The book commences with an interesting discussion of the history of tissue culture, a discussion in which, however, the original contributions and leading role of Dr. W. J. Robbins are not stressed. Detailed instructions for the execution of isolated root cultures and of callus cultures follow. These instructions include steps from the washing of dishes and the preparation of media to the set-up of experiments, measurement of growth, and the interpretation of results. The discussion of a few of the results achieved through the culture of plant tissues together with suggestions for future work conclude the volume.

JAMES BONNER,
California Institute of Technology
Pasadena, Calif.

Technicians' Guide

THE MICROSCOPE AND ITS USE. Frank J. Munoz & Harry A. Charipper. 334 pages, illustrated, indexed. Chemical Publishing Co., Inc. Brooklyn, 1943. $2.50.

This book is not intended as a scientific treatise but as a guide to aid technicians and students in the use of the microscope. The evolution, illumination, care, accessories, and uses of the microscope are discussed in a straightforward simple fashion. Whether the tool is the simplest dissecting microscope or the most delicate compound microscope, here are suggestions for using it to its fullest capacities.

FRANCES E. WYNNE.

Art in Flowers

HOW TO DRAW WILD FLOWERS. Vere Temple. 63 pages, illustrated. Studio Publications, Inc. New York. 1943. $1.

A pleasant little primer which tells something of the technique to use in drawing wild flowers and which shows some of their possibilities for design.

Notes Without Comment On a Variety of Books

If You Are Lost

ON YOUR OWN—How to Take Care of Yourself in Wild Country. Samuel A. Graham and Earl C. O'Roke. 150 pages, illustrated. University of Minn. Press, Minneapolis. 1943. $2.

Intended as a manual for field and service men "either outside or inside the continental United States," this small book attempts a lot in a few pages. Most of it is devoted to general advice and warnings when alone and lost; only eleven pages are concerned with wild plants that can be eaten—and these range from the wild rice of the north to the cabbage palmetto of Florida.

Needs of the Soil

ARTIFICIAL MANURES. Arthur B. Beaumont. 155 pages, illustrations, appendix, index, reference list. Orange-Judd Publishing Co., New York. 1943. $1.50.

A readable primer on soil and its needs and how they can be supplied with organic fertilizers (other than animal manures) such as leaves, straw, garden waste, lawn trimmings, and refuse from kitchen or cannery, also from cover crops that are planted for soil improvement.

Land and Mathematics

THE ECONOMICS OF SOIL CONSERVATION. A. C. Bunce. 227 pages, index, bibliographies. Iowa State College Press, Ames. 1942. $3.

A highly technical book containing mathematical equations to determine land values and costs of conservation, with emphasis on the necessity for long-term planning in the management of land and the consideration of society as well as the individual.

For Children

YOUNG AUDUBON, Boy Naturalist. Miriam E. Mason. 198 pages, illustrated. Bobbs-Merrill Co., Indianapolis. 1943. $1.50.

A biography for very young people, with silhouette illustrations.

Career Book

HOW TO BE A FOREST RANGER. E. M. Steele. 215 pages, illustrated. Robert M. McBride & Co., New York. 1943. $2.25.

"Some of the finest of today's career opportunities are to be found in forestry," says Earle H. Clapp in the introduction to this book, and the author makes each kind of forestry career appear as a glamorous and important one. In an appendix he lists the schools that give degrees in forestry and those that give courses in wildlife and range management.

Conservation

AMERICA'S NATURAL WEALTH. Richard Lieber. 245 pages, illustrations, appendix, index. Harper & Bros., New York. 1942. $2.50.

Chapters on scenery, land, and forests, as well as minerals and water, are presented to show the need for conserving the resources of the American continent. The author, who is on the Advisory Board of the National Park Service and is also Vice-President of the American Planning and Civic Association, says, in speakng of the work of the Civilian Conservation Corps, "We have now reached a point where we must all do our best to conserve the efforts of the conservators."

International Economy

WORLD TRADE IN AGRICULTURAL PRODUCTS. Henry C. and Anne Dewees Taylor. 286 pages, illustrated, indexed. The Macmillan Co., New York, 1943. $3.50.

A volume of 1,100 pages, which was prepared by two economists for the International Institute of Agriculture in Rome, has been used as the basis for the Taylors' book. War conditions prevented more than a few copies of the original (which was published in German) from reaching this country. The present book, which is illustrated with many charts and tables, has been undertaken with the aid of the Institute at Rome, the Rockefeller Foundation in New York, and the Farm Foundation in Chicago.

Trees in the Future

SHELTER TREES IN WAR AND PEACE. Ephraim Porter Felt. 320 pages, illustrated, indexed. Orange-Judd Publishing Co., New York. 1943. $2 50.

With the present war as a starting point, stressing the danger to trees and the importance of them, now and in the future, the author pleads for greater consideration of the welfare of the trees that we have and for the planting of wisely selected species for shelter and beauty in the years to come.

House Plants

A GARDEN IN THE HOUSE. Helen Van Pelt Wilson. 128 pages, illustrated, indexed, paper-covered. Sentinel Books, New York. 1943. 35c.

A reprint of a paper-covered book of nine years ago, concerned with the culture of house plants.

Camp Stunts

NATURE IN RECREATION. Marguerite Ickis. 114 pages, illustrated. Paper-covered. A. S. Barnes & Co., New York. 1943. $1.

A handbook for leaders at summer camps, with suggestions for inspiring a desire to learn about plants and animals, stars and shells, and other evidences of the natural world by bringing them into handcrafts, games, and artistic endeavors such as music and dramatics.

For More Pleasurable Living

LET'S ARRANGE FLOWERS. Hazel Peckinpaugh Dunlop. 162 pages, illustrated. Harper & Brothers, New York, 1943. $2.50.

Suggestions for flower arrangements that will be conducive to pleasurable living; also some practical advice for those who enter their compositions into the contests at flower shows; with 50 good photographs of arrangements by the author, each one briefly described.

Plants in Industry

PLASTICS FROM FARM AND FOREST. E. F. Lougee. 159 pages, illustrated. Plastics Institute, Chicago. 1943.

Brief chapters on the history and development of some of the industrial marvels of the day that are being derived from cotton and wood, walnut shells, corncobs, soybeans, and other unique raw materials.

Absentee Land Ownership

THE WISCONSIN PINE LANDS OF CORNELL UNIVERSITY. Paul Wallace Gates. 265 pages, illustrations, bibliography, index. Cornell University Press, Ithaca, N. Y. 1943. $3.50.

Subtitled "A Study of Land Policy and Absentee Ownership," this is a frankly written history of the half-million acres of white pine land acquired by Cornell University in 1874 from Ezra Cornell's bold speculative move of less than a decade earlier with land-scrip from the Agricultural-College Act of the Federal

Government. The lands gave the university officials plenty of headaches, but their eventual sale netted an endowment fund of five million dollars.

Mathematics of Wood

SOUTHERN PINE MANUAL OF STANDARD WOOD CONSTRUCTION. Southern Pine Association. 193 pages, illustrated with tables, indexed. Southern Pine Assn., New Orleans. 1942. $1.

A technical handbook of engineering data on timber design for engineers and architects. Properties of different types of southern pine construction, safe loads, figures on stresses and strains, board measure and logarithmic tables and innumerable charts are contained in this new edition.

Turf Troubles

DISEASES of BRITISH GRASSES and HERBAGE LEGUMES. Kathleen Sampson & J. H. Western. 85 pages, index, illustrations, references. Cambridge: The University Press. New York: The Macmillan Co. 1941. $1.50.

The result of 20 years' work at Aberystwyth, Wales, this paper-covered book gives, apparently, the complete story of the fungous and other diseases that attack turf lands in the British Isles. One of the many problems discussed is how to remedy the damage done by "fairy rings" of mushrooms.

Gardening

THE AMERICAN FAMILY GARDEN BOOK. Roy E. Biles. 160 pages, illustrated. Garden City Publ. Co., New York. 1943. $1.

Drawings, lists, and charts are crowded into a tall thin book that would seem to answer most of the beginning gardener's questions, although the experienced gardener would find occasional omissions.

A 16th Century Industry

SILK RAISING IN COLONIAL MEXICO. Woodrow Borah. 169 pages, illustrated, notes to chapters, bibliography. University of California Press, Berkeley. 1943. $2.

The history of an early American industry which goes back to the early years of the sixteenth century—during the period of Columbus's attempt to colonize the islands of his discovery. The work has been painstakingly prepared, and is presented as No. 20 of the Ibero-Americana series published in California by the University. More than 25 pages of notes accompany the text, besides 11 pages of bibliography.

Flowers and Feathers

ARRANGING FLOWERS. Margaret Watson. Illustrated. Studio Publication, Inc., New York. 1943. $1.

Twenty-six photographs, each faced by a brief description of the materials used in the arrangement. With lemons stuck on a wired stick, chicken feathers, a shell for a container, and other oddities, the author has to admit to a sense of humor now and then.

Trees, Mimeographed

OUR COMMON TREES—HOW TO KNOW THEM AND USE THEM. Hollis Howe. 98 pages, index, drawings by the author. Natural History Society of Maryland. Baltimore. 1942. 70c.

Outlines of leaves, twigs, and fruits, sometimes of the trees themselves, are reproduced on the mimeographed pages of this paper-covered book. Though published in Maryland, the book contains trees from other parts of the country, and includes the cultivated as well as the wild ones.

Notes, News, and Comment

Members' Day. The December program for Members' Day will take place the first day of the month at 3:30 p.m. in the Members' Room. The speaker will be Dr. George M. Hocking, Pharmacognosist for S. P. Penick & Co., manufacturing chemists of New York, and his subject is "Drug Plants and Plant Drugs —Their Place in the Modern World." Dr. Hocking is a member of the New York Botanical Garden.

Food Plants. The Garden Club of America used the subject of "Natural Resources of the United Nations" for its special exhibit this fall. Among the contributions of the New York Botanical Garden was the set of enlargements from which the photographs used in the Journal last May were selected, showing the cultivation of rice in ancient times in China.

The exhibit, which was chiefly concerned with food plants, opened in October at the Club's headquarters at 598 Madison Avenue, New York, and will continue through early December. The Garden also sent some living specimens of sorghum.

Lectures. Dr. F. J. Seaver spoke on Bermuda at the annual social of the Department of Natural History of the Brooklyn Institute of Arts and Sciences Oct. 5. G. L. Wittrock addressed the Morristown Garden Club, an Affiliate of the Botanical Garden, Nov. 4 on "Food and Drug Plants of the American Indian." The speaker the previous month was Frederick W. Raetz, who showed his hand-colored slides of English gardens at the Saturday lecture Oct. 30. T. H. Everett lectured before the Scarsdale Women's Club on "Wartime Gardening" Oct. 27; at the Darien Community Club on "Vegetable Gardening" Oct. 7; and before the Darien Garden Club Sept. 15 on "Harvesting and Storing." He also spoke on Oct. 13 at a meeting of the Dutchess County Horticultural Society.

Gardeners. Fraser MacCartney, who was the New York Botanical Garden's exchange student gardener with the Royal Botanical Gardens at Kew in 1938, and who went from there to Turkey, has recently left his position in the latter country and is now associated with L. R. Russell & Co., orchid growers in England. M. Truman Fossum, also a former exchange student gardener at Kew, who completed his formal training at the Botanical Garden in 1937 and who served last year as Associate Professor of Floriculture at the University of Maryland, joined the staff of Fred C. Gloeckner & Co., New York nurserymen, this fall.

Army. Florian Hines, a former student gardener who was made an assistant to Dr. Dodge in the work of disease and pest control, is now in the Army, located at Ft. Breckenridge, Ky.

War Job. Hugh O'Rourke, who had been employed by the Garden as a stenographer in the office of the Superintendent of Buildings and Grounds since 1927, left Sept. 15 for a war-industries job in a chemical plant at Bound Brook, N. J.

Stewart H. Burnham. Museum Aid at the New York Botanical Garden for a few years in the early part of the century, Stewart H. Burnham died at Hudson Falls, N. Y., the latter part of September at the age of 72. Up until 1930 he made frequent visits to the Garden, coming from Cornell, where he had been Assistant Curator in the herbarium.

Awards. For the two best papers presented before the American Society for Horticultural Science during the current year, one in the field of floriculture and one in vegetable crops, awards of $500 each will be made. Present expectations are that the offer will be repeated in 1944 and '45. To be known as the Vaughan Research Awards, these prizes are made possible through the generosity of Mr. L. H. Vaughan of Vaughan's Seed Stores, Chicago. Papers are to be judged on the basis of originality, soundness, accuracy, clearness and conciseness of presentation, and value of the work, especially in its practical applications.

Radio Programs

Dr. W. H. Camp, who has arrived again in New York after two months spent in Central America—this trip following a year in Haiti—will be the speaker on the New York Botanical Garden's radio program Friday, Dec. 3, at 3:30 p.m. over station WNYC. The program originally scheduled for that date has been cancelled because of Dr. Camp's return.

Four weeks later, on Dec. 31 at the same hour, a continuation of his topic will be given with Carol H. Woodward speaking on "Botany in Wartime Industry."

The intervening program, on Friday, Dec. 17, will be on "Winter Care of House Plants in the City." The speaker will be Dorothy H. Jenkins, who recently succeeded F. F. Rockwell as Garden Editor of The New York Times.

The two November programs in the Garden's bi-weekly series were "Looking Ahead to Next Year's Victory Garden" by Richard A. Sweet of New York City, one of the prize-winners in the Victory Garden Contest conducted by the RKO theaters in co-operation with the Civilian Defense Volunteer Office of New York, which was given Nov. 5, and "Tall Tales About Tropical Orchids" by Rodney Wilcox Jones of New Rochelle, President of the American Orchid Society and a member of the New York Botanical Garden.

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.

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.

Plants of the Vicinity of New York, by H. A. Gleason. 284 pages, illustrated. A handbook especially compiled for the beginner in plant identification. 1935. $1.65.

Flora of Bermuda, by Nathaniel Lord Britton and others. 585 pages with 494 figures, covering algae, fungi, mosses, ferns, flowering plants. 1918. $3.50

A Text-Book of General Lichenology, by Albert Schneider. 230 pages. 76 plates. 1897. $2.50.

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.

Plants of the Holy Scriptures by Eleanor King, illustrated, and accompanied by a list of Plants of the Bible with quotations, in the March 1941 Journal. 15 cents.

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.

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.

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.

An Herbal. First published by Richard Banckes in London. 1525. Edited and transcribed into modern English with an introduction by Sanford V. Larkey, M.D., and Thomas Pyles. 200 pages, including facsimile of original. Prepared by Scholars' Facsimiles and Reprints. 1941. Price to members of the Garden, $2.50; to others, $3.50.

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

The Victory Gardens of* 1942 *and* 1943 *at the New York Botanical Garden, with plans and suggestions for home growers, by T. H. Everett. 24 pages, illustrated, paper-covered. 1943. 10 cents.

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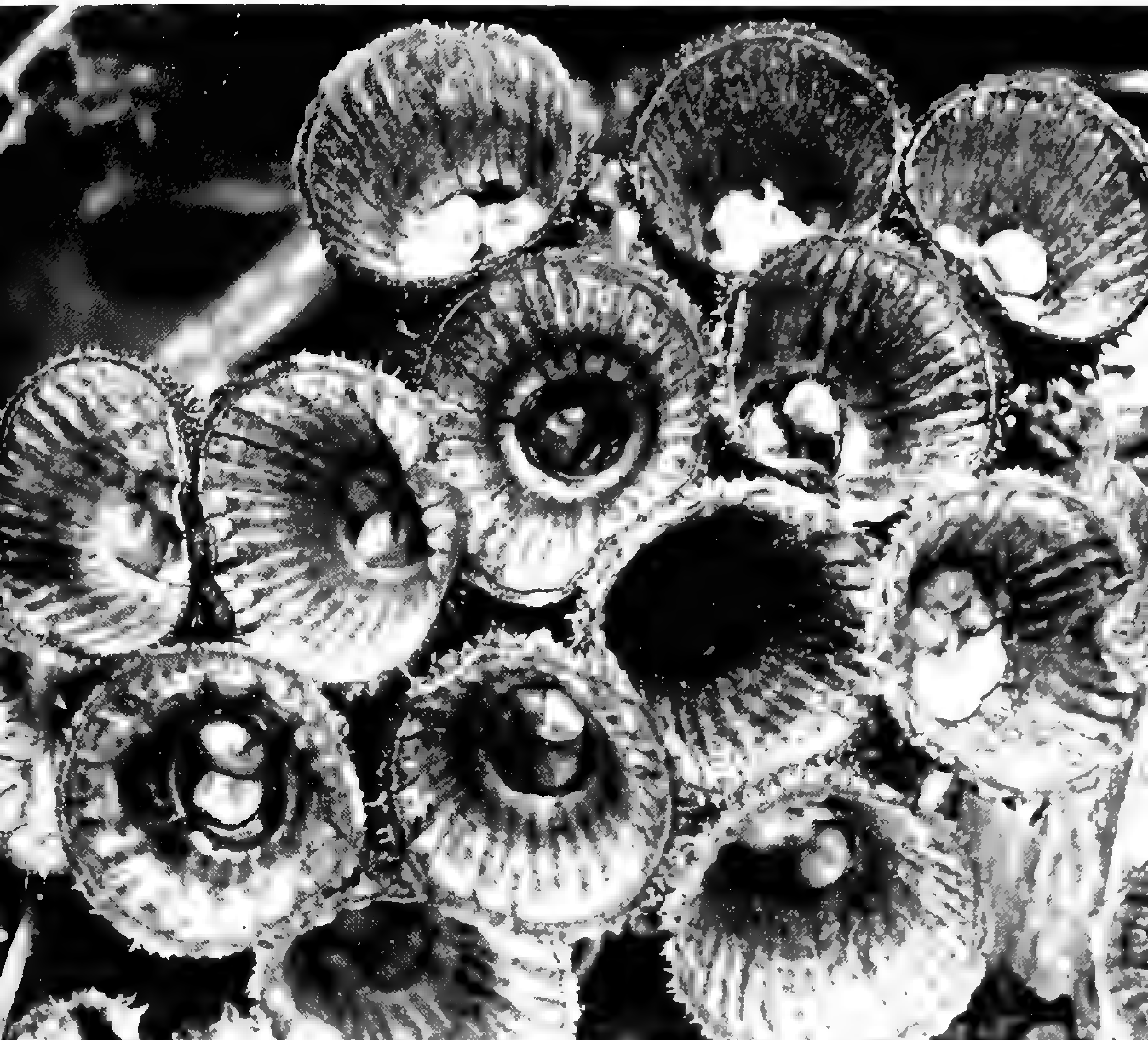
JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN



VOL. 44
No. 528

DECEMBER
1943

PAGES
269-300

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

FOR MEMBERS

IN the monthly Members' Day programs, initiated in the autumn of 1942, those public-spirited persons who, with their annual fees, are helping to further the work of the New York Botanical Garden have had the opportunity of becoming directly acquainted with the staff and with some of the work of the institution. They have learned about some of the problems that confront botanists and have witnessed some of the results of botanical research. On occasions, members themselves have done the talking, revealing their individual interests in things botanical or horticultural.

Regions where scientists on the staff have gone exploring for plants have been described in several of the programs—Fiji . . . Kashmir . . the Great Basin. In others, the practical aspects of botany have been explained through stories of how botanical knowledge has come to the rescue of certain industries hampered by the war; how it has helped to originate new products to replace former imports; and how it has figured in human diseases, both in their identification and in their treatment and cure.

Horticultural topics have been presented in the talks on early New York seedsmen and nurserymen, on the place of women in the profession of gardening (the Botanical Garden now employs seven women on its gardening staff), and on the means of eradicating plant pests and diseases when there is a scarcity of the usual preventives. One scientific aspect of horticulture was elucidated in a lecture on plant breeding. Another was brought out in a discussion of plant names and what they mean. Thus it became clear how the inseparable link that exists between botany and gardening is exemplified in much of the Botanical Garden's work.

In the new schedule being announced for the coming six months, members and friends of the Garden will share the rostrum with staff members in telling of their botanical interests and work and of their travels.

Commanding quite as much attention as the talk at each program has been the exhibit of plants from the grounds and greenhouses, each one labeled and nearly always accompanied by an illustrated description of the species.

These programs, with their exhibits and the social hour following, have served in a new way to cement a bond of friendship between the people who carry out the Garden's work and those who, as members, support it.

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The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered at the Post Office in New York, N. Y., as second-class matter, Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden
York Botanical Garden, Bronx Park, New York 58

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VOL. 44 DECEMBER 1943 No. 528

The Big Tree of Tule

By H. W. Rickett

THE CITY of Oaxaca in southern Mexico lies at the junction of broad valleys, which flow like rivers of good earth between the wasted slopes of high mountains. Near the confluence of the valleys is the hill which the Zapotecs (following more primitive tribes) made their religious center, crowning it with pyramids and temples, carving in it their burial chambers. From its height one may see many miles up and down the valley: the Río Atoyac coming from the north, receiving here the Río Grande from the east and flowing on to the Pacific in the south. The flat alluvial soil stretches as far as one can see northwards and southwards, tilled in small irregular fields, dotted with groves which conceal small villages. North is Mixtec country, south the land of the Zapotecs. To the northwest, behind the city, rises the Cerro de San Felipe, crowned by forests, for many years well and profitably searched by botanists.

Up the valley of the Río Grande—not a "gran río" by any means and indeed in most seasons, like the Atoyac, no more than a chain of nearly stagnant pools—up this valley is the little village of Tule, celebrated mainly as the home of one of the largest living things on earth.

The great cypress[1] in the churchyard of Santa María del Tule has been for northerners almost as inaccessible as Ultima Thule. To visit it one had to go by train from Mexico City to Oaxaca, thence by another train or by automobile over a rough road to Tule, where no hotel, no restaurant, not even a bottle of coca-cola alleviated one's aches and bruises. Now the new Pan-American highway is being built through the place; the traveler of the future will need only to stop his car by the roadside to see the big tree. Doubtless the vendors of "native crafts" will not be slow to interpose their wares.

* * *

Fittingly associated with the ancient tree is a venerable botanist. Professor Cassiano Conzatti[2] is now 81 years old, erect, clear-eyed, welcom-

[1] *Taxodium mucronatum.*
[2] See also Jour. N. Y. Bot. Gard. **38**: 118-121. May 1937.

ing visiting botanists with his charming smile, even accompanying them on motorized excursions into the country around. Naturally he has made many visits to the tree, El Gigante. At the request of the Dirección de Estudios Biológicos of Oaxaca, he conducted a thorough investigation into its botany, its ecology, its age, and its historical and literary associations. The results are published in a 54-page booklet entitled *Monografía del Arbol de Santa María del Tule.*[3]

The utterances of several would-be poets, confronted by this gigantic tree, are preserved in an album kept for such a purpose and are transcribed in Conzatti's paper. I shall not here attempt to rival their outpourings, or indeed to express the very real feelings of wonder and awe which are excited by the imminence of this enormous plant. The dominant impression is not of height but of bulk, of overwhelming mass. As one approaches, the tree seems monstrous, of a girth and sweep not natural to any plant. Standing beneath the hanging branches one sees a monstrous trunk, clearly disproportionate to the height; a trunk, moreover, built of narrow vertical flanges separated by deep vertical chasms. From these massive ribs arise

[3] Publ. Secr. Ed. Publ. [Oaxaca] **6**(4): 1-54. 1925.

Professor Conzatti at 81, photographed by the author in the summer of 1943 beside the trunk of the Big Tree of Tule—a monarch which he has been studying for nearly half his life. Is the tree one or several individuals grown together? The venerable Mexican botanist offers evidence for several theories in his monograph.

the main branches above, equally flattened, and tapering abruptly to shafts that lose themselves in a profusion of leafy twigs. In all this vastness, scarcely a dead branch is to be seen; the top is a mass of myriads of small flattened needles of vivid green.

* * *

The giant is not the only big cypress in Tule. A dozen other AHUEHUETES [4] grow nearby; imposing trees but dwarfed by the central figure. As one might expect, one has been dubbed "el hijo" (the son), another "el nieto" (the nephew). Curiosity is aroused by the presence of these usually water-loving trees in the dusty little village, at a distance of nearly half a mile from the diminutive Río Grande. Conzatti has shown that in all probability the river once ran where is now the village plaza; and a current native belief is that the site was once a swamp of bulrushes (TULES). There are plenty of signs in Mexico that rivers once ran fuller than they do today. Throughout the region wells are abundant and water exists only a few feet below the surface; which helps to account for the thrifty condition of the old patriarch, whose countless leaves must lose thousands of gallons of water annually.

* * *

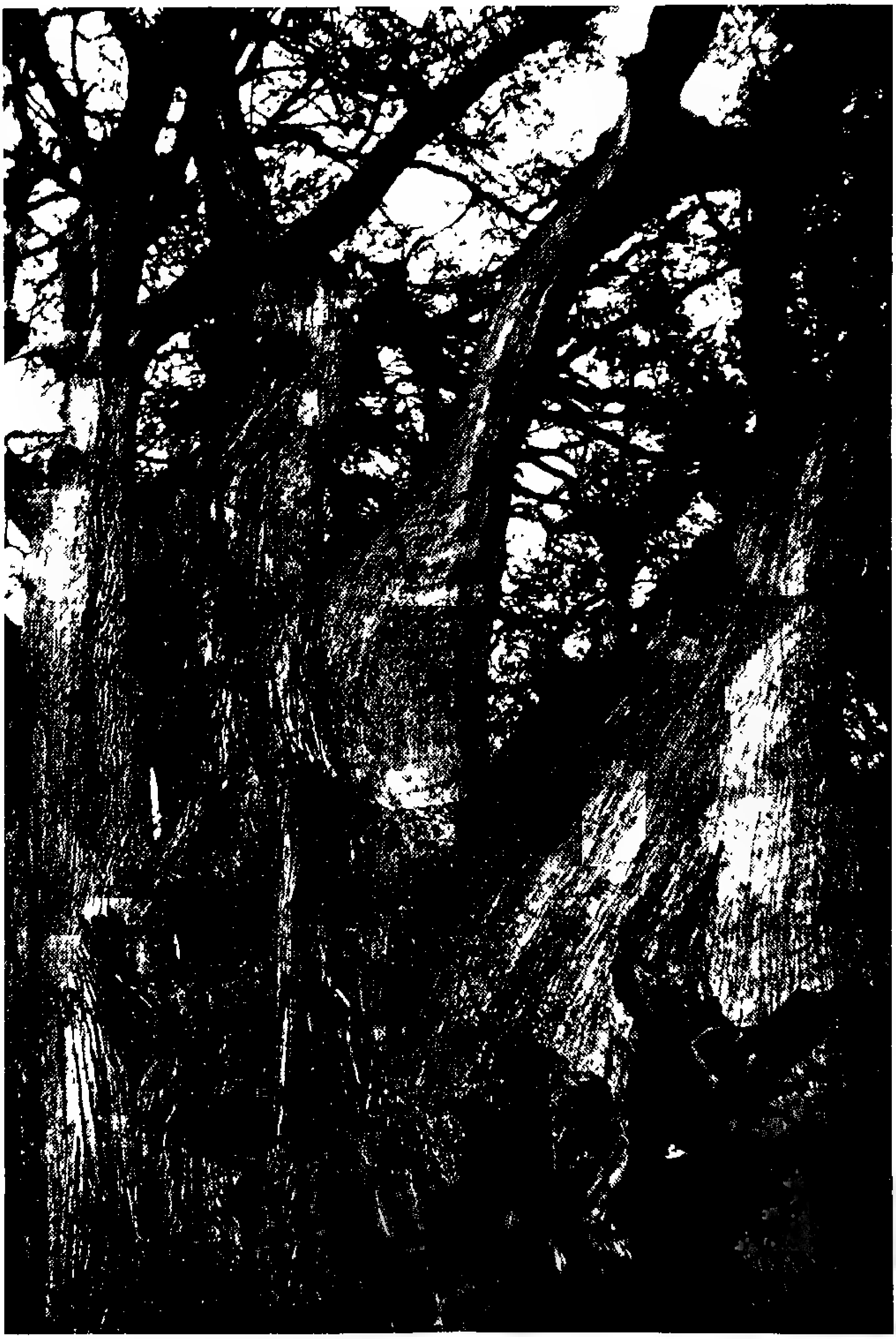
Most botanists know of the inscription on the tree, now almost obliterated by the growth of callus inward from its margins, which is attributed to Baron von Humboldt. Although little of the writing is now visible, it seems to Conzatti of a poetic character little in keeping with the writings of the great traveler. Moreover it is clearly of an age—to judge from the rate at which the bark is encroaching on it—much less than the years that have elapsed since Humboldt's travels in Mexico. Finally, it is incredible that Humboldt should have visited the tree and left no word about it in his published works. His name, still seen in the last line of the inscription, is to be interpreted as a reflection upon him by some romantic visitor rather than as a signature. It would not seem too difficult or dangerous for a properly qualified person to remove some of the bark which has covered the writing, and with it perhaps any lingering suspicion that the most celebrated explorer of Mexico was one of those who like to scratch their names on trunks of trees.

It is commonly said also that Hernán Cortés visited and admired the tree. Though plausible, this story is without foundation; it is, however, somewhat more credible than the celebrated yarn of the tears which he shed beneath another cypress, the night of his famous retreat from Mexico.

* * *

Of all questions that come to the mind of the visitor, the most insistent is "How old is it?" Since only a cross section can give a conclusive answer,

[4] A corruption of AHUEHUETL, the Aztec name meaning "tree by water."



Looking up into the sunlit mantle of green of the famous "Arbol de Santa María del Tule" the cypress tree which is recognized as one of the largest living things on earth. (Photograph by H. W. Rickett, 1943.)

the age of the giant must long remain what it has been so far: matter for speculation. Early estimates, which were little more than expressions of emotion, ranged from 4,000 to 6,000 years. Conzatti proceeded more cautiously on the basis of the known age of detached branches of neighboring cypresses, arriving at an estimate of not more than 2,000 years, perhaps as little as 1,500. The self-deception involved in more romantic estimates results from the feature of the trunk already mentioned. Its tremendous girth of over 150 feet is not a circle but a sinuous line following the narrow but deep ribs which compose so much of its bulk. The average diameter, upon which the above estimates of age are based, is 25 feet; a cylindrical trunk 150 feet around would have a diameter of nearly 50 feet.

The same peculiarity of its growth, which is shared to some extent by all the large ahuehuetes of Mexico, has given rise to a persistent theory that this giant tree is not one but several individuals joined together. The possibility of such a process is attested by the closing of narrow cavities and the fusion of their sides within the memory of modern observers. Several accounts cited in Conzatti's paper and there illustrated by photographs show narrow gaps which no longer exist between branches and portions of the trunk. Some writers have gone so far as to furnish imaginary cross sections showing three individual trunks which co-operated to form the monster. Though conclusive evidence must again be lacking, two considerations seem to favor such an interpretation. First, the individual ribs of the trunk are of about the same proportions as those of neighboring ahuehuetes, but more numerous. Second, and still more convincing, the height of the giant is not in proportion to its girth, but is about the same as that of its so-called son and nephew. Three trees of the size and proportions of the latter would indeed form one like the big tree. If this theory is ever proved to be fact, we shall have to revise our estimate of its age once more. The big tree of Tule would then turn out to be a mere sapling of 1,000 years or so.

* * *

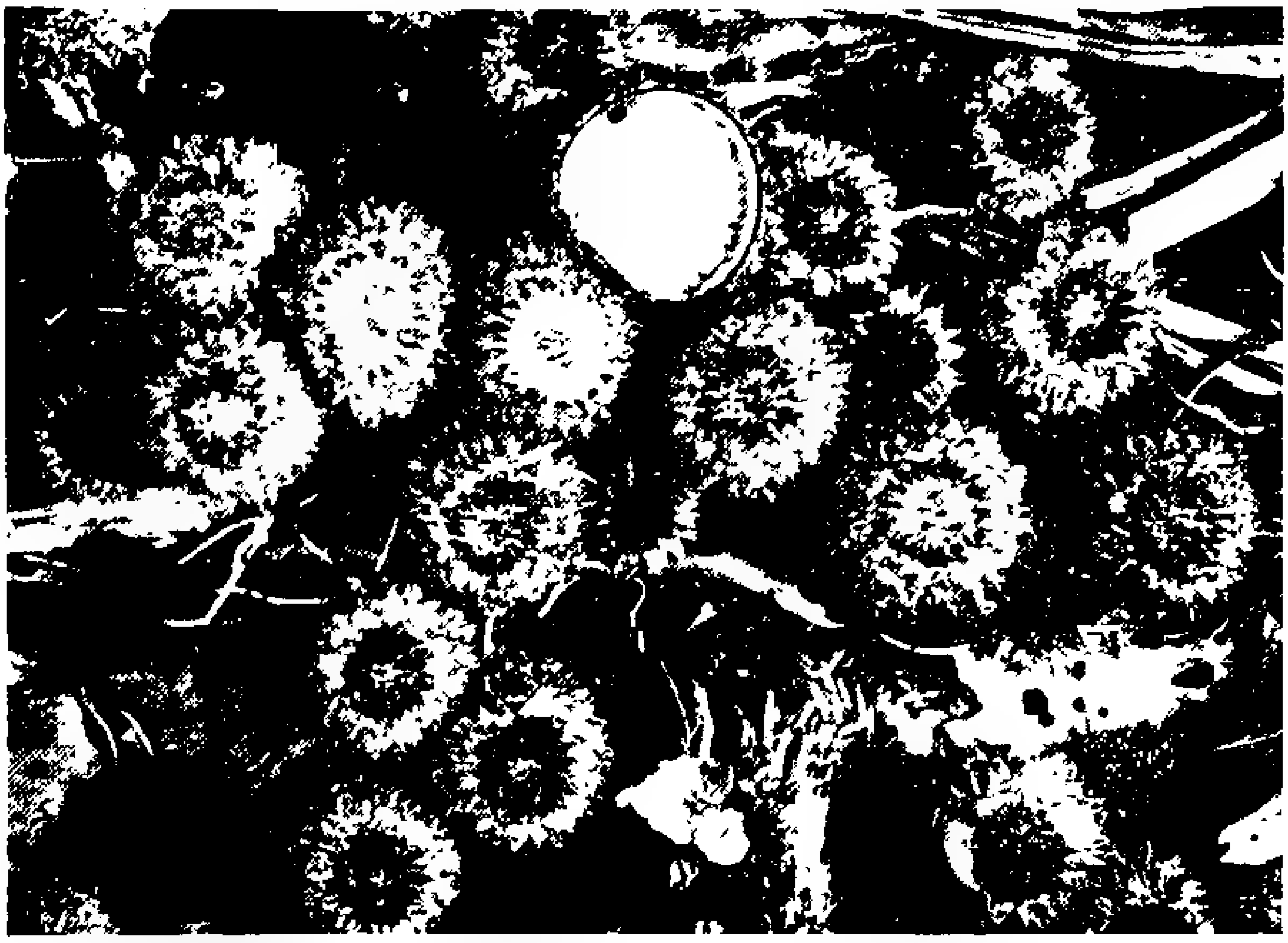
Whichever of its possible ages is the correct one, and whatever has been its true history, the massive Arbol de Santa María has stood long and quietly in its obscure corner; has doubtless seen the conquistadores clattering by, watched the austere priests on their more humane missions, observed cavalcades of finely dressed officers and their resplendent ladies, seen caravans of merchants with strings of laden mules . . . and always the brown-skinned men, patiently tilling the soil of their fathers.

EGG-THROWERS OF THE MUSHROOM WORLD

By Carol H. Woodward

With the co-operation of B. O. Dodge

THE fluted brown nests of this bird's-nest fungus (*Cyathus striatus*), which are shown here about natural size, may be found on the floor of the woods, carpeting a bed of long dead leaves or growing out of rotting wood, usually in the late summer or early fall. In an earlier stage of life, the nest (or peridium) appears as a shaggy, fur-coated bud; then when it opens it is



With the exception of the picture at the top of this page, all the accompanying photographs of the bird's-nest fungi were made by David B. Eisendrath, Jr., of the newspaper PM and are reproduced here by permission and through the courtesy of the paper. Copyright 1943 by Field Publications.

The drawings are taken from two of the plates appearing in the Annales des Sciences Naturelles in 1844 as part of the famous study of bird's-nest fungi made by the Tulasne brothers in France. The drawing at the left represents a portion of a peridium, with some of the sporangioles attached at the bottom, in the same manner as the photograph directly above it In the drawing at the right, some idea is given of the extent to which the funicular thread can be drawn out. The outer wall of the stalk, which at this stage has become the funicular sac, seems to disappear after the thread has been spun out from its interior.

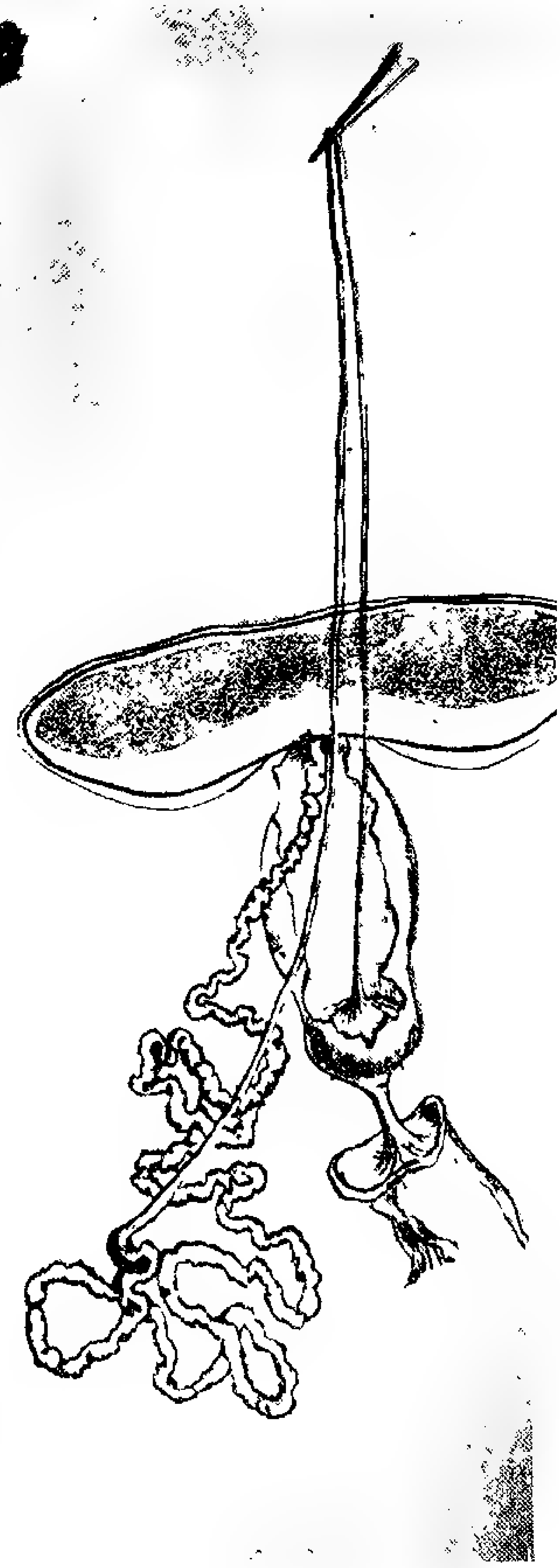
covered just below the rim with a tightly stretched parchment-like drumhead. This covering shows clearly in one of the specimens in the illustration directly above. It eventually tears away and exposes the eggs below.

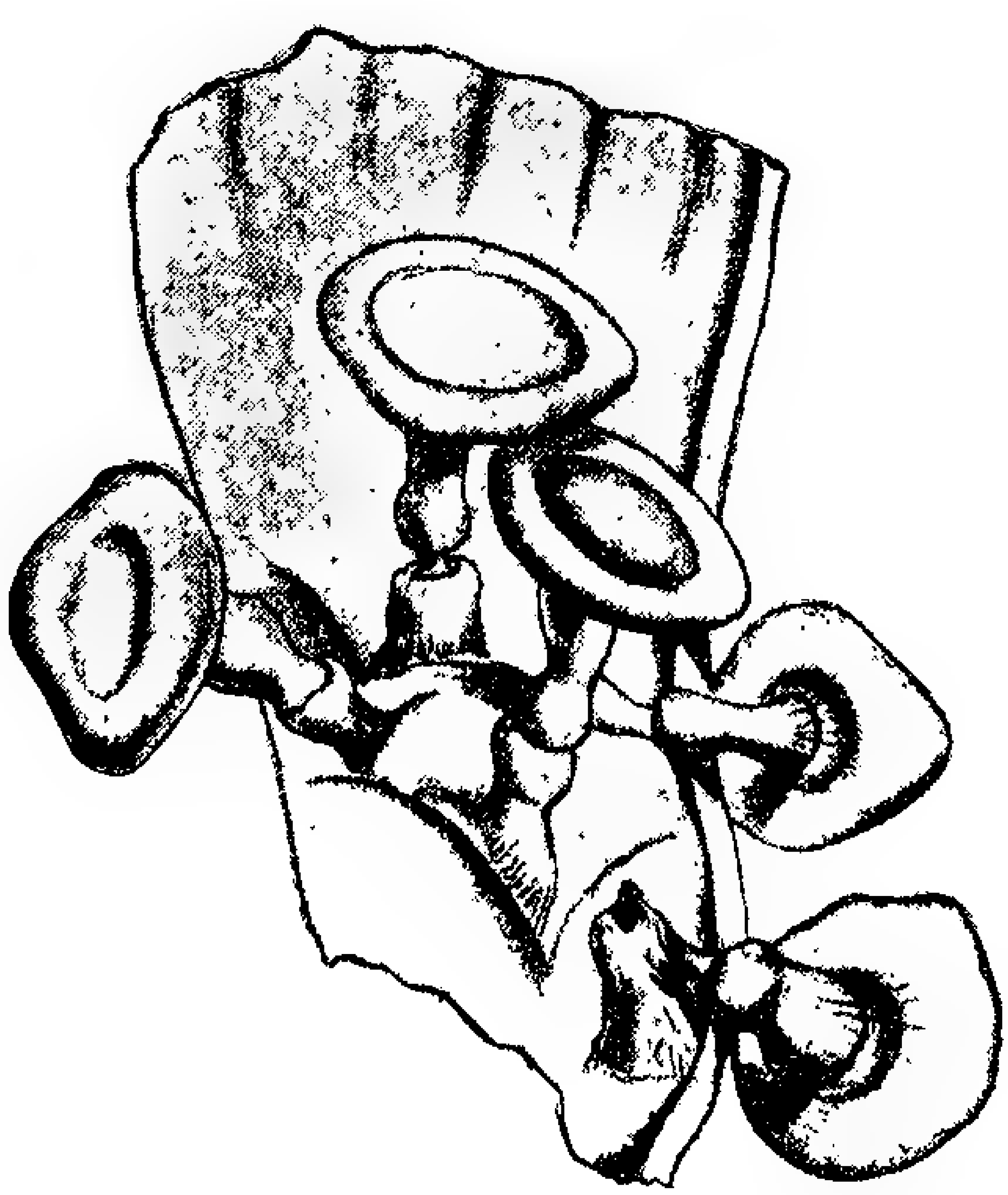
As many as fifteen tiny "eggs" (called peridioles or sporangioles) grow inside each nest, stacked in overlapping layers in the narrow basal portion of this funnel-shaped structure which surrounds and protects them.

The resemblance and relationship of these sporangioles to the sporophore of the common mushroom is revealed when one of them is gently removed from

For a description of these three illustrations, please refer to the preceding page.

please refer to the preceding page.

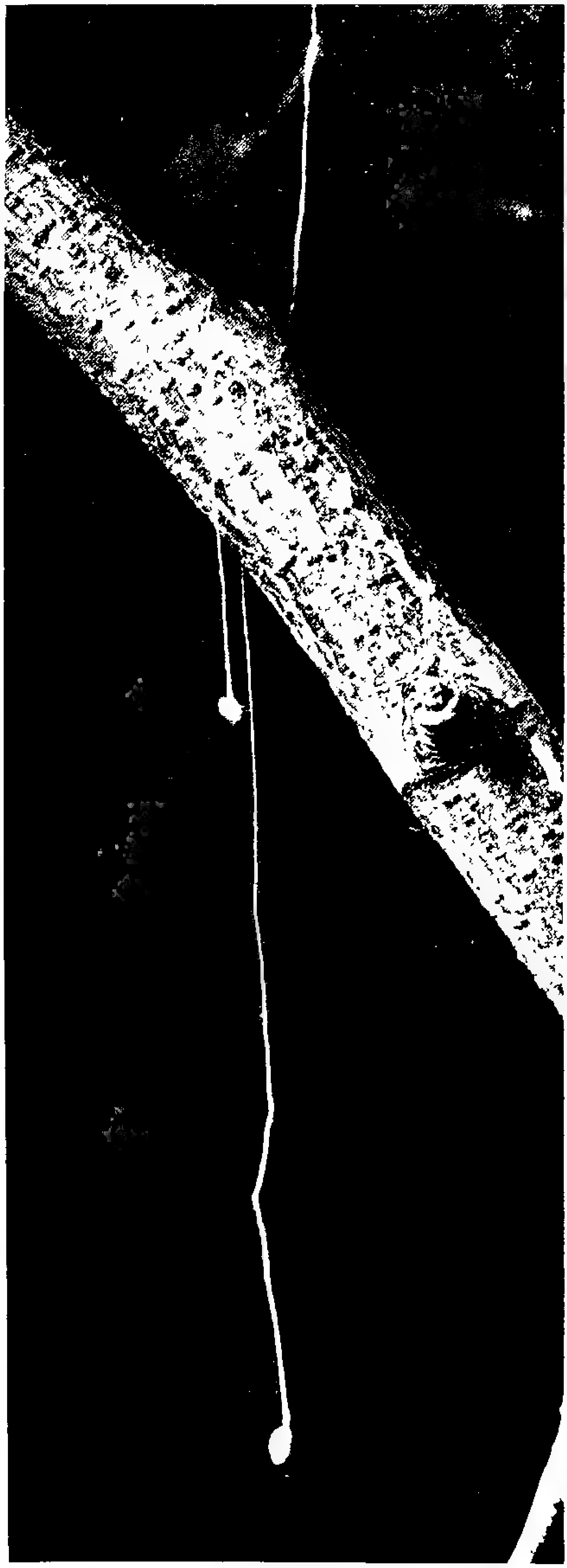




the nest with a pair of forceps. (On the preceding page is shown a segment of a peridium with three of the sporangioles exposed.) The "egg," it can be seen, is really the cap of the mushroom, sitting on top of the stalk, and this is attached by a sort of umbilical cord to the bottom of the nest.

This stalk is a wonderful structure. Neatly wound up inside of it at maturity, above the bulbous base, is a slender thread (the funiculus or funicular thread) which is capable of being pulled out without tangling to a length of from two to seven inches.

A raindrop, falling with great force from on high, has the power of splashing an egg from the nest with such momentum that it will fly two, three, five, ten -one record reports even thirteen—feet up into the air. As this tiny spore-producing body is jolted out of the nest, the funicular thread inside the stalk spins out, the stalk breaks away from its base inside the nest, and the egg goes hurtling through the air, trailing the thread behind



Note the way the funicular thread has been thrown around the branch.

thread has been thrown

it like a lifeline that has been shot from a lifesaving mortar. The bulbous base of the stalk often remains attached to it and follows along on the end of the funicular thread.

If this curious flying object strikes a leaf, the thread, which is slimy, will adhere to it and the egg will dangle down. If it strikes a slender branch, its momentum may serve to fling the thread around the twig, even tie it into a knot, and again the egg, which contains the reproductive spores of this fungus, hangs to await the time when its spores will be ready for dispersal.

Vitamins And Vegetables

*By Ilda McVeigh**

As presented in a lecture at the Garden November 27

WINNING the war depends among other things on adequate feeding of the armed forces and the civilian population. Our armed forces are on the whole well fed. Their food is purchased and their menus are planned with the advice of experts in nutrition. But recent investigations indicate that much remains to be accomplished in bringing up to acceptable standards the daily foods of our civilian population.

Surveys show that a high proportion of inadequate diets exists among industrial workers and also within professional groups and among families of the upper income brackets. In a dietary survey of 1,100 aircraft workers in southern California it has been found that 87% of these workers were living on diets definitely below the standards recommended by the Food and Nutrition Board. It is strange that here in a land of plenty so many of us are eating foods which are inadequate with respect to vitamins and other nutrients. Constructive measures, however, are being taken to improve the nutrition of workers, and current observations indicate a boost in our industrial effort—evidently the result of the new diet. It is hoped that this improved nutrition will remain long after the present crisis has passed, with consequent betterment of public health.

Although financial ability to purchase the proper foods must be recognized as one important factor in determining the diet, other surveys indicate that knowledge of nutrition facts on the part of the public is at least of equal importance. Results of a detailed questionnaire submitted to about 500 individuals in the upper income brackets show that 77% of these people who have sufficient money with which to buy good food had a deficient intake of the two vitamins, thiamine (B_1) and riboflavin (B_2). Ignorance concerning the nutritional values of food is common but there is also a lack of emphasis on the need for a proper diet, and also lack of self-discipline.

A recent investigation made for the Food and Nutrition Board indicates that the over-all per capita consumption of many foods was higher in 1940-41 than in 1936. This was the result of the combined influence of educational programs, increased power of consumers to buy, and more abundant food supplies. Gains were greatest in fruit and fresh vegetables. Consumption of fresh citrus fruits was more than one-third higher; other fruit and fresh vegetables 10 to 15 percent higher; consumption of meat and eggs 8 to 10 percent higher; milk products less than 5 percent higher. There was a slight decrease in consumption of grain products, potatoes,

* Dr. McVeigh is engaged in vitamin research at Yale University as assistant to Dr. P. R. Burkholder.

and sugar. These shifts have meant considerable increase in the consumption of protein, thiamine, and riboflavin. This survey indicates that the diets in this country meet the recommendations of the Food and Nutrition Board except in calcium and vitamins B_1 and B_2.

But now with the war going on and our country supplying food to so many people of other lands, it is necessary for us to change some of our food habits. These changes need not impose any hardships on us. In fact, they may actually improve our health. In our American dietary, animal sources have been relied upon for good quality proteins and for vitamins of the B complex. Present world events forebode a general scarcity of foods of animal origin, such as milk, cheese, eggs, and meat. In the future it will become necessary for us to rely more and more upon plant materials which possess a high protein content and which can be made to yield large crops within a single year. The vitamin content of these plant substitutes for meat is of great importance. Also we may find citrus fruits somewhat scarce. So in selecting our diets we must focus our attention on a source of good protein and on foods which supply adequate amounts of thiamin, riboflavin, niacin, ascorbic acid, and calcium. If we gain from our food sufficient amounts of these vitamins, very likely we will get sufficient quantities of the others.

Among the plentiful materials high in protein and B vitamins, which have not yet been utilized to more than a small fraction of their potentialities, are the seeds of cotton, peanut, and soybean. All three seeds are the basis of large industrial operations for vegetable oils. The residues from these industries yield large amounts of practically dehydrated, low fat concentrates which are rich in proteins and contain large stores of vitamins. When milled, these substances are particularly suitable for supplementing white flour. Used alone these flours would be poor in baking quality, as they are lacking in gluten. But added to cereal flour in proper proportions they improve nutritional value and render the final product highly desirable. Soybean flour is superior in protein quality, cottonseed flour in riboflavin content, and peanut flour in niacin value. As substitutes for both the proteins and vitamins of meat, a mixture of the three seed flours offers possibilities. Why not combine all three to make a new processed substitute for meat which would be palatable, nutritious, and inexpensive? This is being done to a limited extent, and we can now buy meatless steaks and choplets.

A large part of the soybeans grown in this country are to go into emergency rations for the half-starved people of the liberated lands. One use is the addition of 15% soy flour to the spaghetti and macaroni which is being sent to the Italians. Also the War Food Administration is learning to stretch the meat for lend-lease supplies by the addition of soy flour to sausage and other meat products. In this manner the protein content of sausage meat can be increased by as much as 27%—so says the War Food Administration.

What about our own civilian population? We are not being neglected. Last year an estimated 30 million pounds of soybean products were used in the United States for direct human consumption. The allotment this year, for civilian food purposes, is 362,500,000 pounds, an increase of more than 12 times. This really represents a relatively small share, *27%* to be exact, for the larger part of the soybean foods will be going to our fighting forces and overseas allies and to the civilian population in liberated lands.

What are some of these processed soy foods which can be bought on the market? Soy meat, soy spread, soy flour, soy grits, soy sausage, soy cereal, soy substitute for coffee, soy milk, soy cheese. One of the country's largest milk dealers has recently bought a large soy plant in the midwest where the company expects to turn out soy substitutes for dairy products. Who knows but that we will be drinking soy milk and liking it before the present milk shortage is over?

Another important source of protein and vitamins which has, up to the present time, been used to only a limited extent is yeast. In fact, one of the most rapid and efficient methods of obtaining valuable food from inexpensive carbohydrates and ammonia is by means of yeast growth. Perhaps you never thought of yeast as a vegetable, but at least yeasts are plants. The breweries of America, by saving their yeast by-products, on the basis of an output of 65 million barrels of beer annually, could supply about 200 million pounds of yeast, half of the dry matter being nutritious proteins high in the B-complex vitamins. Some of the progressive distilleries are now reinoculating their waste slops with efficient yeasts. The coarse material is screened out and dried rapidly in a rotary drum and sold for cattle feed. The fine material is spray-dried to yield a powdered product which will be used to enrich various foods. Many of the new yeast foods are attractive in flavor. Yeast bouillon seasoned with celery salt is nutritious and is easily made by dissolving the dry material in hot water. Yeast "meat" is being developed in England and it is claimed that this is one of the best and least expensive protein items which has been created under pressure of the war.

In the produce from our gardens, where are the most proteins and vitamins found? Again we turn to legumes, because their seeds and fruits—the peas and beans—are high in protein and also contain large stores of B_1, B_2, and niacin. Most of the soyas, or soybeans, used in flours and processed foods are the common field varieties. There are several edible kinds adapted to short growing seasons. ***Toku, Giant Green, Aoda, Mendota,*** and ***Bansei*** are edible varieties suitable for growing as far north as Connecticut. When planted in Connecticut the last week in May the green beans are ready for harvesting in late August. The pods should be blanched by parboiling for 5 minutes. Then they can be shelled easily. The beans can be cooked in a little boiling water for about 15 minutes and

SOME VITAMIN FACTORS IN VEGETABLES AND FLOURS

Comparative values in green and non-green parts

Beet tops	250 units B_2 per 100 gms.
Beet root	50 units B_2 per 100 gms.
Turnip tops	60 units B_1 per 100 gms.
Turnip root	30 units B_1 per 100 gms.
Turnip tops	300 units B_2 per 100 gms.
Turnip root	20 units B_2 per 100 gms.
Turnip tops	100 units C per 100 gms.
Turnip root	40 units C per 100 gms.
Lettuce (green)	4,000 units A per 100 gms.
Lettuce (bleached)	125 units A per 100 gms.
Lettuce (green)	50 units B_2 per 100 gms.
Lettuce (bleached)	25 units B_2 per 100 gms.
Dandelion (leaves)	25,000 units A per 100 gms.
Carrot (root)	5,500 units A per 100 gms.

Vitamin content of patent wheat flour compared with extracted soyflour.[1]

Factor	Vitamin	Patent Wheat flour (per lb.)	Extracted Soy flour (per lb.)	No. of times greater concentration in soy flour
Carotene	A	136 I.U.	340 I.U.	2.5
Thiamine	B_1	0.27 mg.	3.4 mg.	12.5
Riboflavin	B_2	0.41 mg.	1.82 mg.	4.4
Niacin	P.P.	4.5 mg.	27.2 mg.	6.0

Comparison of cottonseed flour with other substances.[2]

10% of 2500 calories supplied as	Weight gms.	Protein gms.	(B_1) Thiamin mgs.	(B_2) Riboflavin mgs.	Niacin mgs.
Milk	360	12.0	0.15	0.7	0.2
Whole wheat	60	6.7	0.33	0.11	3.8
Lean beef	125	25.0	0.08	0.45	11.0
Liver	195	40.0	0.35	5.0	25.0
Cottonseed flour	65	35.0	0.7	0.7	5.7

In tests with white rats, patent flour plus 15% soybean flour has resulted in a greater gain in weight over a six-week period than any lesser combination of soy with white wheat flour, and also greater than when whole wheat, peanut, or cottonseed flour was the only flour used. The gain with the 15% soy was almost five times as great as with patent flour alone. In addition to the flour, the same basal diet was fed to all of the rats.

[1] Hafner (1942) Baker's Digest **16**: 247.
[2] Zucker & Zucker (1943) Ind. & Eng. Chem. Ind. Ed. **35(8)**: 868-872.

served in any of the ways that baby lima beans are prepared. Or the green beans may be either canned or dehydrated. If the seeds are allowed to mature they may be used as navy beans, but they then require soaking for several hours and cooking for a long period of time.

That millions of Chinese have lived on a diet of rice and soybeans for five thousand years constitutes a great natural experiment from which much can be learned. Bean sprouts have been used by the Chinese for centuries, probably because they can be produced easily, require little fuel for cooking, have a pleasing flavor, and a high nutritive value. Sprouting the seeds is known to increase their provitamin A (carotene) and vitamin C content and to render their protein more readily available. (Remember—we may need to look for a new source of vitamin C this winter if citrus fruits are scarce, and here is one way we can increase the vitamin C supply right in our own homes.)* Recently at Yale we have made studies concerning the changes in B vitamins brought about by germinating many kinds of seeds. In general the thiamin (B_1) changes little, if any. But soya and mung bean sprouts were found to contain from two to eight times as much riboflavin (B_2) and niacin as were found in the dry seeds. Even sprouted cereals showed an increase in their B vitamins. In sprouted soybeans we have a vegetable which is available in all seasons, sprouts in 5 days or less, is rich in protein, minerals, and B vitamins, rivals tomatoes in vitamin C, has no waste in preparation, and can be cooked with as little fuel and as quickly as a pork chop. Also it is low in cost.

What about other vegetables? No doubt with all the Victory gardens last year and plans for the coming year, there are many questions. Which varieties are best to plant? Are there differences in vitamin content? What methods of processing are best? Should this vegetable be preserved by canning, freezing, or by the newer methods of dehydration so as best to conserve the vitamins? Many of these questions can't be answered yet. We have made some studies concerned with vitamins in different varieties of fresh and dehydrated vegetables. Some kinds of turnip greens are very high in riboflavin content, so don't throw away the leaves. Certain kinds of tomatoes contain seven times as much ascorbic acid as their relatives. Certain portions of a plant may store vitamins in larger amounts than other parts. We have found that the leaves of beets are richer in B vitamins than their roots. So don't throw the beet tops away. Others have reported that the leaves of broccoli contain four times as much carotene as do the flowers which we ordinarily eat. Green vegetables usually store provitamin A or carotene in the leaves, but the carrot stores it in the root. We eat carrots for the carotene content, while we grumble about the lowly dandelion growing on our lawns. Yet the dandelion leaves contain about 25,000 units of provitamin A in each one hundred

* See the Journal for November 1943 for directions for sprouting soybeans in the home.

grams, as compared to 5,500 for carrots. Peppers contain much ascorbic acid, some varieties more than others.

What about methods of processing? In the vegetables we have dehydrated there is little change in the thiamin, riboflavin, and niacin content. Vitamin C is destroyed. Vitamin C is easily oxidized when exposed to air and this destruction is hastened by heat. So in canning tomato juice, watch exposure to air and temperature. That is, keep the kettle covered and do not boil the juice any longer than absolutely necessary; also, do not use a pressure cooker on tomatoes.

In this changing world we may have to change our food habits but we don't need to worry about starving if we choose wisely. Right now our attention is focussed on vitamins but we must not lose sight of the fact that we must still have carbohydrates, fats, and proteins to supply us with our energy and building materials. Without the vitamins we cannot make use of the carbohydrates, fats, and proteins we consume, but the vitamins alone will not suffice. Don't be misled into thinking that a "coke" and vitamin pills will do the job of keeping us alive and full of energy.

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.)

Taxonomy and Evolutionary Processes

SYSTEMATICS AND THE ORIGIN OF SPECIES. Ernst Mayr. 334 pages, illustrated, indexed. Columbia University Press, New York, 1942. $4.

Dr. Ernst Mayr is an outstanding zoological systematist who has specialized on the taxonomy of birds, especially those of Oceania and Indonesia. He has considered the evidence from zoological taxonomy in its bearing on the course of evolutionary processes -that is, the origin of species. Although the book is documented chiefly by examples from the detailed studies on bird taxonomy, this in no way detracts from the value of this excellent work.

Taxonomy has undergone in recent years a marked change which is illustrated by the approach of the student to his material. In the "old" systematics the position of the species is of greatest importance; the species is defined from purely morphological concepts. In the "new" systematics the morphological species concept has made way for a more dynamic, biological concept which takes geographical, genetical, and other factors into account. Mayr has successfully utilized this latter concept in his approach to the problem of systematics and the origin of species.

This is a book which every biologist should read. The author, however, assumes a certain familiarity on the part of the reader with scientific disciplines other than taxonomy, and this book is not for the layman unless he has a clear understanding of the generalizations from the field of genetics, particularly.

Mayr's book is a member of the Columbia Biological Series, and is a worthy companion to Dobzhansky's "Genetics and the Origin of Species."

M. M. Rhoades,
Columbia University.

Genesis of the English School Of Landscape Gardening

HORACE WALPOLE: GARDENIST. Isabel Wakelin Urban Chase. 285 pages, illustrations, explanatory notes, bibliography, and index. Published by the Princeton University Press for the University of Cincinnati. 1943. $3.50.

Impatience of poets, philosophers, and artists with the classic forms in which even nature had to be symmetrical had a subtle but cogent influence on the gardeners (or "gardenists") of the 18th century, for it was largely through their works that the old formality was abandoned in garden design and the style which is still known as the English school of landscaping was created. A new appreciation of Alpine and Italian scenery and a current interest in things Chinese also served to prod the leading spirits of the day into developing as an art the naturalistic style of gardening.

Repton is usually given credit for originating this type of gardening, but Mrs. Chase gives greater credit to Horace Walpole.

"Pope, Mason and Shenstone," she says, "have received recognition for being gardeners as well as poets; but no attempt has as yet been made to give Walpole the credit due him for his designing of the grounds at Strawberry Hill, and his work in an advisory capacity on the estates of his friends . . . The part which Walpole played, along with others in the English landscape school, in the transformation of the principles of painting into what are today still regarded as the basic principles of modern landscape design of the naturalistic or park type was an important one."

The nucleus of the book is a new annotated edition of the 1782 edition of Walpole's "History of the Modern Art of Gardening." To these 40 pages are added nearly 40 more which give enlightening comments on the text. Then follow three sections which give, first, the background of Walpole's ideas on gardening, then, quotations from his own writings which show the development of his ideas, and finally descriptions of some of the famous gardens of Walpole's day, including his own place, Strawberry Hill, overlooking the Thames.

The author shows how the 18th century artist- and poet-gardeners, and the philosopher-gardeners too—Kent, Thomson, Pope, Shenstone, and others—plus the professional gardeners such as Brown and Bridgman, became the leading spirits, with Walpole, in creating and developing the new art of natural landscaping.

In conclusion, Mrs. Chase shows how the seeds of a new order in England were lying dormant in the romantic movement, which in itself had been conceived and bred in the cold formality of classicism. The Victorian era brought a devastating state of confusion to the harmonious "modern" landscaping of the preceding century. The English style, however, lived on in America—at Monticello, at Richard Stockton's Princeton place, and in the great estates developed along the Hudson in the 1840s by Andrew Jackson Downing. More recently, the influence of Walpole and his contemporaries, Mrs. Chase points out, has been revealed in the work of Frederick Law Olmsted, Charles Eliot, and Frank W. Waugh.

The creator of gardens and garden styles, like himself, Walpole said should be called a "gardenist" as distinct from the gardener who worked with the plants but not with their design. It is a word which might well be reconsidered today. We still have nothing quite so definitive to offer.

CAROL H. WOODWARD.

Lilac Guide

LILACS FOR AMERICA. Edited by John C. Wister, 65 pages, lists and classifications. The Committee on Horticultural Varieties of the American Association of Botanical Gardens and Arboretums. Published by Arthur Hoyt Scott Horticultural Foundation, Swarthmore, Pa. Revised edition, July 1943. $1.

Garden and public use of the lilac (*Syringa*), one of the most desirable shrubs because of its ease of culture, perfume and beauty, has been retarded by confusion in varieties. Bringing concise authoritative data up-to-date in the revised edition of this 65-page report on "Lilacs for America" should do much to relieve this situation.

The revision has been done very simply and effectively without altering the general form and context of the original issue. It is not too much to hope that this pattern and policy will be followed by the Committee on Horticultural Varieties in surveys of other large groups. Members of the committee have added to their own well founded knowledge the recommendations of many other persons familiar with lilacs in widely dispersed localities.

Of first importance is a list of preferred varieties which if commonly followed should give the tradesman increased sales and the gardener greater assurance in making purchases and greater pleasure in his garden. Admittedly, ratings and color classes are arbitrary and personally debatable, but at least they are indicative. Another valuable feature is the code of references to nurseries where most of these varieties may be obtained.

This finding list and guide should be commonly accepted by gardeners and nurserymen as well as institutional horticulturists. The layman should be told, however, that chapters on culture, pruning, and diseases were beyond the scope of this work, which is rather an annotated index to lilac varieties.

E. A. PIESTER,
Assistant Superintendent of Parks, Hartford, Connecticut.

Handbook for Tree Workers

TREE EXPERTS MANUAL. Richard R. Fenska. 192 pages, illustrated, indexed. De La Mare, New York, 1943. $4.50.

In about 185 pages of textual material, Richard R. Fenska, in his manual for tree workers, has attempted to cover a large and varied subject. Many phases of it are therefore, of necessity, treated rather incompletely. His material, however, is well organized and well planned. Each chapter is provided with references to other sources of information. Tables of tree diseases and their control, and a well organized chapter on spray formulae are the best features of the book. A chapter on shade tree laws is a valuable addition, seldom if ever encountered in tree books. The tables and references would make it a useful tool for the tree worker, but the rather high price asked for a book of its size will limit its circulation.

P. J. MCKENNA.

Producer of "Better Fruits And Fairer Flowers"

LUTHER BURBANK—Plant Magician. John Y. Beaty. 251 pages, indexed, illustrated by Luis M. Henderson. Julian Messner, New York. 1943. $2.50.

Although written for the young reader this is the best book about Burbank that has yet appeared. It repeats many of the exaggerated claims and misstatements common in all of the books about the California plant breeder but on the whole it gives much useful information and should be stimulating to many interested in plants and their improvement. There are lists of Burbank's most important plant productions and the plants worked with, a chronology of important dates in his career, and an index, all of which make the book valuable in the reference library.

Early in his career he met Agassiz who visited at the Burbank home in Lancaster, Mass. He also read Darwin's "The Variation of Animals and Plants under Domestication." Some of his inspiration was derived from these stimulating sources, the author points out.

Professional horticulturists would like to see a more critical comparison with other workers in the same field, many of whom have made more valuable and lasting contributions. The author quite appropriately uses the word magician in the title. Burbank's magic was of the side-show variety, mostly illusion. Horticulturists have generally agreed that the Shasta daisy is nothing more than a valuable selection from the European daisy, *Chrysanthemum maximum;* the plumcot is a variety of *Prunus salicina,* and the spineless cactus is a selection from among many spineless varieties that had long been known, none of which was particularly useful before and has not been found so since. The Empson pea, the example of a plant made to order, is no longer grown, and this is true of many other of his productions. The stoneless plum, the white blackberry and other plant novelties were known long before Burbank worked with them but are as seldom grown now as formerly.

Burbank's most valuable contribution to science, his *Rubus* hybrids that bred true, have been largely overlooked by geneticists. When these were first announced, Mendelian segregation was expected in all hybrids and his statements were not accepted. Now that amphidiploids are known to transmit without segregation, Burbank is not given the priority that he deserves for producing and putting these on record.

Burbank once said, "I shall be contented if because of me, there shall be better fruits and fairer flowers." This well expresses his life aim and accomplishment. He was a doer and not a thinker, an artist who reveled in the creation of new plants and had visions of their greater usefulness than others dared hope for. Successful in originating new forms, he cared little from whence they came or how they were produced. If Burbank has a place in the Hall of Fame, it will be because he *has* produced better fruits and fairer flowers and not for the contributions he has made to knowledge in the field of natural science.

DONALD F. JONES,
Connecticut Agricultural Experiment Station, New Haven.

Field Crops Management

FIELD CROPS MANAGEMENT. E. N. Fergus and Carsie Hammonds. 600 pages, illustrations, maps, charts, tables and graphs. J. B. Lippincott Co., New York, 1942. $2.40.

As indicated in the preface, "Field Crops Management" is designed primarily as a reference source for those engaged in or who expect to engage in the production of field crops.

The authors point out that crops grown in any area are chosen over a long period on a trial-and-error basis by farmers themselves. Those crops are continued in any locality when over a period of years they have proved their worth. Acreages of adopted crops may increase, and other crops not now grown may find their way into the agriculture of the region.

Corn, tobacco, small grains and hay crops particularly are discussed at considerable length as to their importance, principal areas of production and cultural practices followed. Numerous charts, tables and graphs help one to interpret and evaluate the subject matter of the text.

A chapter devoted to the principles of plant growth discusses, in some detail, the reproduction of crop plants, including the functions of the various plant parts. Pollination, fertilization, processes of germination and photosynthesis, less well understood than the ordinary plant functions, are particularly stressed.

Soils, in relation to crop growth and general tillage practices, are dealt with in the concluding chapters of the book.

"Field Crops Management" is not an elementary text in crop production. It should find its chief use in the hands of experienced farmers, plant breeders and advanced agricultural students. College professors, teachers of agriculture, and extension workers in the field of agriculture will find it a source of much up-to-the-minute information on modern crop production. The subject matter is well presented and is amplified by numerous tables, charts and graphs.

L. M. STEPHENS,
State Institute of Agriculture Farmingdale, N. Y.

Flaming Forests

BURNING AN EMPIRE. Stewart H. Holbrook. 229 pages, illustrated, indexed. Macmillan, New York, 1943. $2.50.

Mr. Holbrook writes both from personal experience with forest fires and from history in telling this dramatic story of the terrifying losses over the years in the forests of the United States. This is a tragic story, not a pleasant one to read, but an absorbing one, nevertheless.

He concludes (admitting that they have no factual bearing on the subject) with some ballads of forest fires.

CAROL H. WOODWARD.

Textbook on Fruit Growing

PRINCIPLES OF TREE AND SMALL FRUIT CULTURE. Victor W. Kelley. 170 pages, illustrated, paper-covered. Burgess Publishing Co., Minneapolis, 1943. $2.

A text-book by the Associate Professor of Horticulture, Extension Division, University of Illinois. It includes, according to the introduction, the "subject matter which the author has found by classroom experience to be adequate for a well rounded semester course for beginning students of fruit growing."

This book could prove valuable not only for beginning students but also for persons engaged in or contemplating fruit growing, either for home use or for commercial production. It should not be considered in the light of a complete guide to fruit growing—that is not the author's purpose; but the principles of fruit culture and much information pertaining thereto are laid down in detail, clearly, authoritatively, and scientifically.

EDWIN BECKETT.

The Art of Chinese Gardens

IN THE CHINESE GARDEN. Florence Lee Powell. 112 pages, 74 photographs, 2 plans of gardens. The John Day Company, New York, 1943. $2.75.

The excellent photographs in this book give one the feeling of walking through an actual garden. The two places described, Liu Yuan (LIU is the surname of the family, and YUAN means garden) and Shih Tzu Lin (SHIH TZU means lion or lions, and LIN forest), were two typical private gardens of the old days. They also represent the small public gardens of today, which have been converted from the private gardens of before the war. This book gives an unusual record of the beauty and charm of Chinese gardens, especially valuable since World War II has destroyed many beautiful spots of China.

ROBERTA MA.

Amaryllis Year Book

HERBERTIA. Volume 9. Edited by Hamilton P. Traub. 243 pages, illustrated. The American Amaryllis Society, Orlando, Florida, 1943.

Volume 9 of *Herbertia,* the Year Book for 1942 of the American Amaryllis Society, issued in May 1943, is designated an *Alstroemeria* edition and dedicated to Mr. Harry L. Stimson, who contributed several articles on the genus *Alstroemeria,* including discussions of classification, breeding possibilities, propagation, and culture. The volume also contains both popular and botanical articles on *Amaryllis, Crinum, Ixiolirion, Narcissus, Cyrtanthus,* and *Hemerocallis.* Two papers were contributed by Dr. A. B. Stout; one report is on the "Origin and Genetics of Some Classes of Red-Flowered Daylilies" and one is the description of the new species, *Hemerocallis altissima,* which was first mentioned by name in the Journal of the New York Botanical Garden, issue of October 1942.

. . . And Smoke and Sniff And Use in Medicine

PLANTS WE EAT AND WEAR. H. E. Jaques. 171 pages, illustrated, index. Published by the author, Mt. Pleasant, Ia. 1943. $1.50 in paper; $2.50 in boards

"Plants We Eat and Wear" by H. E. Jaques is a popular guide to the identification of our economic plants by means of simple keys and illustrations. Plants such as ylang-ylang, tobacco, sassafras, and the bay-rum tree are described and keyed in the text, but how can they be included to conform with the title of this book?

One would have to be a magician or be endowed with a rich imagination to be able to use this guide in a food market since all the parts of the plant necessary for identification by means of the keys are rarely included in a grocer's food display. To use the guide in an open country or in the tropics would be dangerous since one may key to a wild weed or stinging nettle, or even poison ivy, certainly not always to a useful plant. Apparently the only use of the book is to give the layman an impression by means of sketches what the whole plant looks like if he is interested in any particular species of economic plant.

The index contains a surprising novelty: all the scientific species names are divorced from their genera and included alphabetically, such as *acuminata, aestivum, edule, sativa, sativum, sativus;* what a waste of printing space!

Many of the general statements are not true. To say that "we could find only twenty-seven plants related in any important way to our clothing needs" is indeed most conservative. Another statement that "Man in his long experience with plants learned so few of them for his most essential needs" is an ambiguous assertion. The cream of the plant world has been known to man almost since prehistoric times. True, many wild plants are edible and were used by prehistoric man, but such plants are not always eatable; if they were, we would have been using them as staple articles long ago. Who would prefer skimmed milk to rich cream? And so with this book, its use is limited to a poorly illustrated definition of our economic plants.

G. L. WITTROCK.

Notes, News, and Comment

Advisory Council. Dr. William J. Robbins spoke on penicillin before the Advisory Council of the Botanical Garden at the annual meeting Dec. 1.

Conference. Dr. Fred J. Seaver spoke on "The Mycoflora of Bermuda" at the monthly conference of the scientific staff and registered students of the Garden Nov. 10.

Torrey Club. Dr. Bassett Maguire gave "A Report on the 1943 Field Summer in the Great Basin" at the meeting of the Torrey Botanical Club at the Botanical Garden Nov. 17, and Dr. H. W. Rickett is to present "Botanical Observations in Mexico" at the meeting Dec. 15 at the Garden. This meeting is being combined with the monthly conference of the staff and registered students of the Garden.

Lectures. Dr. R. R. Stewart spoke on the "Flora of Kashmir" at the Arboretum of the Barnes Foundation, Merion, Pa., Nov. 9. Elizabeth C. Hall addressed the Plainfield Garden Club, an Affiliate of the New York Botanical Garden, Nov. 10, on "The New Gardening Books." Otto Degener addressed an audience at the Arboretum of the Barnes Foundation on Nov. 23, speaking on his explorations in Fiji.

Honors. Dr. H. W. Rickett, who returned Nov. 1 from a four months' sojourn in Mexico, has been elected an honorary member of the Sociedad Botánica de Mexico, of which Prof. Maximino Martinez of the Instituto Politécnico in Mexico City is president. He has also been named an honorary member of the Eugene Field Society, in recognition of the "literary skill and craftsmanship" of his book "The Green Earth."

Washington. Dr. William J. Robbins was in Washington and Philadelphia from Nov. 19 to 23 for meetings of the National Academy of Sciences and the American Philosophical Society.

Groups. The Greater New York City branch of the National Association of Gardeners met at the New York Botanical Garden Oct. 20. Pharmacy students from Fordham University visited the Museum Oct. 14, and botany students from Hunter College studied the fossil collections Nov. 2. A taxonomy class from Swarthmore College in Pennsylvania made a special trip to the Garden Sept. 25.

Biology students from Hofstra College, Hempstead, N. Y., under Prof. Marcus C. Old, visited Range 1 Nov. 10.

Children from the fifth and sixth grades of Wartburg School, Mt. Vernon, who have been studying the Eastern Hemisphere and are now working on South America, visited the Main Conservatories and the outdoor plantings Oct. 21, giving special attention to the exotic plants they observed. Two sixth year classes from P.S. 67 in the Bronx studied the agricultural produce map on the stair landing in the Museum Building and visited the Main Conservatories Nov. 4.

Girl Scouts from P.S. 70 in the Bronx accompanied the opening tour of the autumn course in Field Botany Sept. 11.

Visitors. Autumn visitors to the Botanical Garden have included Enrique M. Sivoni from La Plata, Argentine Republic; Rev. A. Dutilly, Montreal; Dr. and Mrs. Andrew L. Winton, Wilton, Conn.; Alfred Bates, Newark; Charles Heimsch, Swarthmore; Ernst J. Schreiner, Philadelphia; William Favorite, Amherst; Dr. Shu Yi Chen from the Boyce Thompson Institute, and Bernice G. Schubert from the Gray Herbarium.

November visitors included Alfred Rehder from the Arnold Arboretum; E. J. Schreiner, Morris Arboretum; Capt. Henry Ives Baldwin of the U. S. Army Air Corps, formerly in the State Forestry Department of New Hampshire and Director of the Caroline A. Fox Research and Demonstration Forest at Hillsboro, N. H.; Mr. and Mrs. E. H. Casseres, Costa Rica; John D. Dwyer, Union College, Albany; and E. D. Merrill, Arnold Arboretum.

Member. The Little Gardens Club of New York City, with headquarters in Greenwich Village, has become an Affiliate Member of the New York Botanical Garden.

A DEADLY MUSHROOM DRAPED IN A MOLD

The death-cup, Amanita phalloides, one of the most poisonous of all fungi, is shown here covered with a veil of Sporodinia grandis, a fungus which customarily grows as a parasite on other fungi. Photograph made by Margaret McKenny, who until recently was a resident of New York and a member of the New York Botanical Garden. Miss McKenny, who has lectured at the Garden, is now on the West Coast conducting a series of radio programs in nature study for children, under the auspices of the Washington State Progress Commission.

Winter Events at the Garden

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Members' Day Programs

Given at 3:30 p.m. in the Members' Room the first Wednesday of each month.

Jan. 5 ***The Power of Plants*** *E. E. Naylor*

Feb. 2 ***Impressions of a Botanist in Mexico*** *H. W. Rickett*

Mar. 1 ***Winter Pods and Buds*** *Rutherford Platt*

Apr. 5 ***Travels Through South America*** *Mrs. Robert H. Fife*

May 3 ***Behind the Scenes***—Some Maintenance Problems at the Botanical Garden *A. C. Pfander*

June 7 ***Textiles from Plant Sources*** *M. D. C. Crawford*

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Saturday Afternoon Lectures

The free series of lectures given on Saturday afternoons will be resumed on Jan. 8 with a showing of the Botanical Garden's natural-color motion picture in the lecture hall at 3 p.m. The complete program for the winter will be announced in next month's Journal.

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Radio Programs

The broadcasts which have been given by the New York Botanical Garden over station WNYC every other Friday will be continued after the first of the year, beginning the afternoon of Jan. 14 at 3:30. The schedule will be announced as soon as completed. Late in December, cards will be mailed to members and to others requesting them listing the titles and dates of the broadcasts, as well as of the Saturday afternoon lectures.

* * *

Courses

Classes in the Two-Year Science Course for Gardeners will be resumed the evening of Jan 3 with Dr. Bassett Maguire, assisted by Dr. Frances E. Wynne, instructing in ***Systematic Botany Laboratory***, and Dr. H. W. Rickett teaching ***General Botany II.***

Outdoor Flower Gardening is the subject being offered for the winter term in the Two-Year Course in Practical Gardening. The class will meet on alternate Thursdays for two hours each night, beginning Jan. 6 at 8 p.m. Mr. Arthur King will be the instructor.

Vegetable Gardening will be taught on six successive Monday evenings beginning Feb. 21, with Mr. James B. Jack and Mr. Arthur King sharing the teaching.

The first term in the Botanical Garden's new course in ***Plant Propagation*** will begin Feb. 26. The instruction will be given on three alternate Saturdays from 2 to 4 p.m., by Dr. E. E. Naylor. This winter term of classroom study will be followed in the spring with demonstrations and practice in the propagation of plants, both vegetatively and by seed.

Also included in the Garden's courses announced for the winter months is the ***Three-Day Short Course in Vegetable Gardening,*** to be offered Mar. 27-29, with morning and afternoon sessions taught by a corps of six instructors.

Detailed announcements of these and of other courses offered by the Garden will be sent free upon request.

BROADCAST

IN the Garden's radio program given Dec. 3 over station WNYC, Dr. W. H. Camp spoke on some of the problems that the United States has to face in the production of rubber, vegetable oils, fibers, and drugs for immediate and post-war needs. Some excerpts from his talk are given here.

ONE who has never been in a tropical forest finds it difficult to visualize what it is like. Actually, there is less so-called jungle in much of the tropics than one might suppose. However, one must admit that the jungle is what the traveler usually sees, for, in general, the jungle is associated with man. By that I mean that the jungle which forms the basis of some of our popular literature is to be found in those areas where man has entered and cut down the original forest. Following this disturbance of the natural vegetation, a lot of weeds have sprung up—but not the sort of weeds we have in our victory gardens here at home in temperate regions. These tropical weeds are mostly rapidly growing trees and vines, which, because of their tangled nature, make up what we call a jungle. In undisturbed areas in the tropics, the trees often form a majestic forest, cathedral-like when viewed from below, and with so dense a shade that but few plants can gain a foothold underneath.

The tropical jungle and tropical forest are two quite different types of vegetation; and tropical forests differ also from our northern forests by the great variety of trees that they contain. For example: In the temperate zone, a forest may be made up predominantly of one species of tree, such as beech; another forest may consist mostly of oak; and farther north it might be of pine or spruce exclusively. But not so in the tropics. In general, the tropical forest is likely to consist of a large number of different species, with the individuals of any particular species relatively few in number in a given area. And that should explain one of the problems we are facing in getting out the natural rubber from the forests of South America. The wild rubber trees are so far apart that finding and tapping these trees is a major task; and, it might be added, a costly one. Transportation, except along streams, is almost non-existent through most of the region where wild rubber is abundant. Also, the problem of adequate labor—trained to gather rubber—must be surmounted. Taken all in all, the problem of making our native rubber supply available has presented us with a number of difficulties.

* * *

Today we can scarcely open a newspaper without seeing pictures of our men fighting in the Pacific area . . . and almost without exception, these pictures show large numbers of coconut palms. Now, these palm trees are by no means just a part of the natural scenery of the area. For the most part, they are on plantations, and were the source of copra, which, in turn, was the basis of a considerable portion of our supply of vegetable oil. The Japanese strategists were wise enough, for by taking over almost all of the Pacific islands in the beginning, they not only got excellent sites for bases, but they also cut off much of our supply of vegetable oil for the manufacture, not only of food and soap, but, what is more important, one of the best for the manufacture of high explosives. The coconut palm may have supplied a lot of romantic scenery in the Pacific islands, but it also supplied a lot of our strategic material.

To increase our immediate supply of vegetable oils, we are working on increased production of rapidly maturing plants; but even this is slow, for we must not forget one thing: It takes time to grow a plant. One can not just push a button and have a new crop planted and ready for harvest. An adequate supply of seed must first be grown; new sites suitable for its culture must be found; the whole economics of the crop must be worked out; and methods of cultivating the plant and handling the crop must be learned by the growers—most of whom have probably never seen the plant before. And all of this takes time. That is why the American housewife, meanwhile, must save all her waste fats and turn them over to the Government.

* * *

Fibers also are certainly scarce . . . and essential. Even cotton, which we think of largely as cloth, is an important ingredient of certain high explosives. But I am thinking primarily of those which are grown in the real tropics . . . fibers such as sisal (which comes from a relative of the century plant) and manila hemp, or abacá (a close relative of the banana). Now, sisal is native in Mexico, and it requires a particular type of soil and climate. Abacá is a native of the Philippines, and it, too, has rather definite requirements as to where it will grow. Our supply of sisal in this hemisphere was scarcely adequate for our peacetime needs; and abacá was almost unknown in tropical America. Yet, here are probably the two best types of fibers for the manufacture of cord, rope, and hawsers. If we were to consider merely the vast amount of rope needed by our greatly increased Navy and Merchant Marine, it would take but little imagination to envision the problem of stretching our present supplies until the new plantations of just these two essential fiber plants can come into production. But I can assure you that, somewhere in the American tropics, men today are sweating on plantations to produce an adequate supply of fibers for our future needs.

Much the same problems have to be confronted with drugs and other essential plant materials.

* * *

In answer to the question of why so many of these vital plants that are native in the American tropics have not been grown on a commercial scale in this hemisphere, I will mention only one factor. Plantation workmen in the American tropics have been better paid than those in other tropical regions. And that has meant that American plantation owners could not compete with those of other regions in the same crops. Their operational costs were too high. For example, I have recently analyzed the cost of a certain vital war item now being grown for the first time in this hemisphere. It costs the plantation owner in tropical America, with labor at only 30 cents a day, almost twice as much as the oriental grower to produce the same article. The post-war fate of this newly developed tropical American agricultural industry is easy to envision unless steps are taken to reorganize its basic economy so that oriental competition can be met.

* * *

In the face of our present emergencies, it would seem logical that, until we are certain that war is forever abolished, we should always have carefully located plantations of all vital tropical plant materials; if need be, financed by government subsidy. An alternative—and this I sincerely hope may be realized — is a permanent world-wide peace structure, so planned that each portion of the world may contribute its share according to its climate, soils, and available supply of labor . . a world community of peoples living together in peace and for the betterment of all.

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An asterisk following a subject or a page number indicates an illustration or an illustrated article. The letter "R" preceding a page number refers to the Annual Report, which was issued as Section Two of the June Journal and paged separately. Except for activities of staff members, items appearing in Notes, News, and Comment and in the Current Literature column are not indexed. Book reviews are listed separately at the end of the general index, and are arranged alphabetically by authors' names.

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BOOK REVIEWS

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
Mrs. George Arents, Jr.
George Arents, Jr.
Vincent Astor
E. C. Auchter
Dr. Raymond F. Bacon
Prof. L. H. Bailey
Stephen Baker
Henry de Forest Baldwin
Sherman Baldwin
Charles W. Ballard
Mrs. James Barnes
William Felton Barrett
Mrs. William Felton Barrett
Prof. Charles P. Berkey
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Prof William J. Bonisteel
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Harry Harkness Flagler
Mrs. Mortimer J. Fox
Childs Frick
Robert I. Gannon, S.J.
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Mrs. Frederick A. Godley
Mrs. George McM. Godley
Prof. R. A. Harper
Mrs. William F. Hencken
Mrs. A. Barton Hepburn
Capt. Henry B. Heylman
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Mrs. Clement Houghton
Archer M. Huntington
Pierre Jay
Mrs. Walter Jennings
Mrs. Alfred G. Kay
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John L. Merrill
Roswell Miller, Jr.
Mrs Roswell Miller, Jr.
Mrs. Roswell Miller, Sr.
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H. de la Montagne
Col. Robert H. Montgomery
Mrs. Robert H. Montgomery
Barrington Moore
Mrs. William H. Moore
Dr. Robert T. Morris
B. Y Morrison
Mrs. Augustus G. Paine
Mrs. James R. Parsons
Rufus L. Patterson
Mrs. Wheeler H. Peckham
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Francis E. Powell, Jr.
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