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CAROL H. WOODWARD

EDITOR

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

MORE ON ANTI-MALARIALS

(Continued from the preceding issue)

Fifth in a series of editorials designed to show the unique and specialized services that are furnished to the public without cost by the New York Botanical Garden

A native of the island of Cyprus, now a naturalized citizen of the United States. remembered from his boyhood a plant which had long been used as a febrifuge and anti-malarial in his homeland. Its name was unknown to him, and his description of it was fragmentary and imperfect. Some years before the outbreak of the war, he said, Germans had bought up all of the plant available in Cyprus, and he was convinced that this was because of its medicinal properties. He was prepared to fly to Cyprus to bring back seeds of it for cultivation in this country.

Some questions on the part of a member of our taxonomic staff and a visit to our library, where a publication on the flora of Cyprus was available, led to the suggestion that the plant concerned was *Citrullus Colocynthis*, the colocynth. Herbarium specimens gave the final confirmation and in some thirty minutes the unknown had become the known. Native to the eastern Mediterranean, *Citrullus Colocynthis* has an intensely bitter fruit and has probably been used for centuries as a home remedy.

Unfortunately, according to the best information available, it is ineffective as a cure for malaria. No trip to Cyprus was made for seeds.

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Sedge Boats in the Andes

*By Alan A. Beetle**

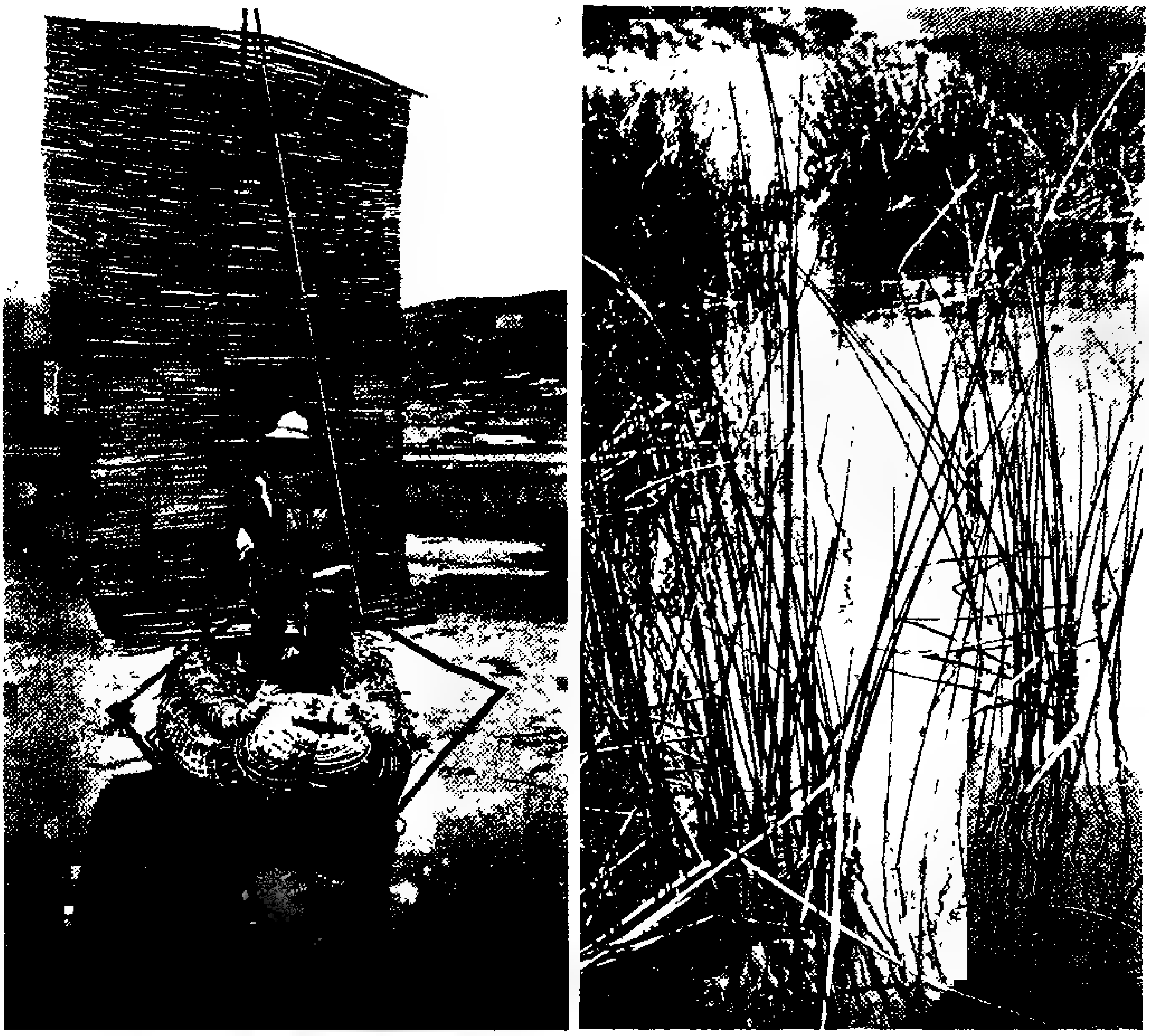
TO build a boat entirely of the stems of sedges seems like a fantastic notion to a resident of a well forested country; but in the high altitudes of the Andes where at 12,500 feet there is navigable water but where no trees exist, necessity steps in, as is her custom, and becomes the mother of invention in the manufacture of boats out of native materials. Sedges are the sturdiest and the most abundant plant of the region, and so the Indians make their sailing craft of them. Yet, so improbable does this seem that when mentioned incidentally in a paper of the author a reviewer commented: "This statement is nonsense. Something else was evidently intended."

However, these "balsas," so-called, are a common sight on Lake Titicaca. They are not made of balsa logs, like those of Ecuador, but the boats are fashioned from the long straight, leafless culms of *Scirpus tatora,* a bulrush growing in quantity and to a height of three meters on the shores of the lake.

But this region is not the only one in the Western Hemisphere where reed-like plants have been used for boat building. In the November 1944 issue of *Desert Plant Life* is an illustration of a boat of similar construction from Tiburon Island in the Gulf of Mexico, labeled "A rare photograph of the last native carrizal reed balsa made by the Seris in 1922." Carrizal reed is the familiar tall marsh grass, *Phragmites communis,* which is distributed over much of the world and is as familiar to New Jersey commuters taking the train each morning across the meadows into New York as it is to the natives of Tiburon.

The sedge that is generally used for the balsas of Lake Titicaca is endemic to the high altitudes around the lake, which is part of the boundary

*Dr. Beetle is in the Division of Agronomy at the University of California in Davis, and during the summer of 1944 he spent a month on a scholarship at the New York Botanical Garden working on the genus *Scirpus.*



At the left is one of the reed boats equipped with a reed sail, made of Scirpus tatora and used on Lake Titicaca in the Andes. Right is a closely related species of Scirpus, S. californicus, found throughout the Americas and also used occasionally for boats. This photograph was made near Puno, Peru, on Lake Titicaca by César Vargas C. of University of the Cuzco, who did taxonomic research at the New York Botanical Garden during the summer of 1941.

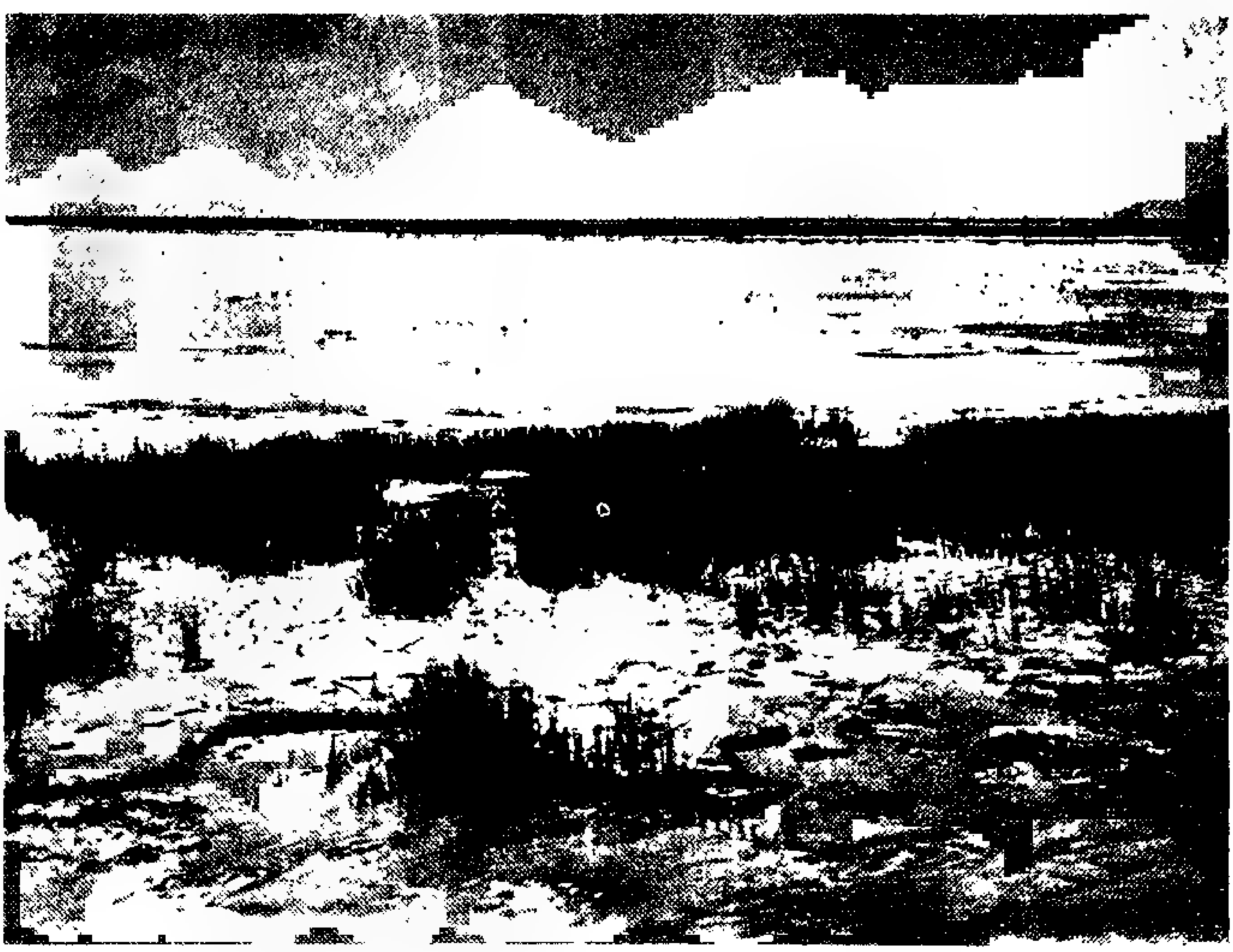
between Peru and Bolivia. Although it is similar in habit to the familiar bulrushes, *Scirpus validus* and *S. acutus* in this country, its only close relative here is *S. californicus,* a species common to all the Americas. *S. tatora* is distinguished by its strikingly yellow-green culms which are largely sterile.

Scirpus californicus itself has been used in boats ethnologically similar by the Pehuelches on Lago Nahuel-Huapi far to the south. Nearby too, the Indians at Lake Huanache have employed in addition a species of cattail. However the Cymara tribe at Lake Titicaca has used mainly the native TOTORA. Where the shores are covered they are privately owned and considered a source of wealth.

After the green culms are cut they are thoroughly dried. The pulpy stems with large airspaces are then very buoyant. They are tied in large bundles with rope made of the stems of native grasses (*Stipa* and *Festuca* species). Two large bundles usually form the bottom of the boat and additional smaller rolls form a railing. The largest of the boats carry five or six people. Near the shore and around the numerous narrows of the lake the boats are paddled canoe-fashion. In the center of the lake sails, which are mats made of *Scirpus* stems, are suspended on a double mast. The two poles, evidently made of material brought up from the lowlands, are tied above, and one is stuck in each side of the boat.

The balsa is used mainly for fishing. The author has in his possession a small model made to scale and of the same materials. It was sold by an Indian boy at the boat dock near Puno, Peru. There is another model in the boat collection in the Smithsonian Museum in Washington, D. C.

At best Lake Titicaca is an out-of-the-way corner, now known as the highest navigable water in the world. The lake is used as a mountain pass by an English steamship line whose boats ply an overnight run between



Species of Scirpus growing on bars in Lake Titicaca near Puno, Peru. The many birds which dot the surface of the water are the flightless grebes which are indigenous to this lake.

The bleak, treeless shore of Lake Titicaca, with the reed, Scirpus californicus, growing out of the water.

Puno, Peru, and Guaqui, Bolivia. Here, to come upon swarthy Indians speaking an Inca tongue and complacently sailing their own boats, the while dressed in bowler hats and brightly colored ponchos, is a sight to be remembered.

Jujube, The Chinese Date

(No. 14 of a series of articles on Chinese Vegetable Foods in New York)

By Willard M. Porterfield, Jr.

ONE of the dried fruits stocked in glass jars in the Chinatown food shops is the so-called Chinese date, or TSAO, better known in foreign quarters as the jujube. Its popularity with the Chinese can be judged by the fact that it has been designated in the classics as one of the five principal fruits of China and that it has been eaten there for 4,000 years.

Tsao fruits are sweet to the taste and are eaten fresh, dried (like raisins or litchees), preserved in sugar, stewed, or smoked.[1] The meat is firm and

[1] Meyer, F. N. Agricultural explorations in the fruit and nut orchards of China. U.S.D.A., B.P.I. Bul. 204: 35-40, March 25, 1911.

when fresh the fruit is plump. A light mahogany-colored fruit sold on the streets of Sian-fu in the province of Shensi under the name of TSEN TSAO [2] is eaten fresh. This one has only a medium sweet taste not suited to drying or candying. Most varieties of the fruits have seeds, but a few are seedless.

The species commonly seen here is *Zizyphus jujuba* Mill., which comes from a spiny shrub of tree-like proportions. In China, however, the species most commonly cultivated is called *Z. sativa* Gaertn. (*Z. vulgaris* Lam.). This is less tree-like and inclines to thornlessness under cultivation. Its fruit, which ripens from March to June, is smaller than that of the other (½ to ¾ of an inch in length in its wrinkled dried state), and it is short-stalked, ovoid to oblong, and reddish to black in color.

In other countries species of *Zizyphus* have quite different uses. One in Brazil, *Zizyphus Joazeiro,* is used as a fodder. *Z. Lotus* is said by some to have produced the lotus fruits of antiquity, and of *Z. Spina-Christi* it is said that its branches furnished the crown of thorns.

The jujube is an important fruit of North China and grows in all sections where winter temperatures are not extremely low. The fruits grown in Shantung Province are considered among the best. Factors favorable to growth are light rainfall and a dry cold winter.[3] The trees are hardy and do not need much care. They are equally productive on open land, even if strongly alkaline, or in an inner courtyard where the ground has been tramped down. In western China [4] they grow on loess or in arid valleys. A report from Peiping [5] calls the jujube a "bad weed that easily overruns dry plains." It is also said to have overgrown much of the Peiping city wall.

The trees grow singly or in groves, or they are cultivated in orchards. When planted in rows 5 to 10 feet apart they produce the largest quantity of fine fruit. To increase the crop the farmers ring their trees every year. Cultivation around the roots is not necessary. Propagation is by seeds and by suckers springing from the base of the trees. Varieties planted by seed do not breed true, so propagation by suckers is the best method. Root cuttings can also be made, but these cannot be counted on. The Chinese sometimes successfully graft cultivated scions on wild stock, but this is accomplished only by a few who have had considerable experience. Some trees near Pinchow, Shensi, have been observed, which have reached 1½ feet in diameter.[6] These trees seem to be free of "bunch disease" although infected wild plants stood nearby.

It is reported that not less than a hundred varieties [7] of the Chinese

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[2] Meyer, F. N. In U.S.D.A., B.P.I. Plant Immigrants 108: 875. 1915.
[3] Meyer, F. N. 1911. in loc. cit.
[4] Wilson, E. H. A naturalist in western China. 2: 30. 1913.
[5] U.S.D.A., B.P.I. Plant Immigrants 106: Item No. 17892. 1906.
[6] U.S.D.A., B.P.I. Plant Immigrants 108: 876. 1915.
[7] Meyer, F. N. 1911. in loc. cit.

date, or tsao, have been under cultivation. There are marked differences in the appearance and quality of many of them. The Chinese edible varieties from different sections listed by Meyer are as follows:

1. Ming Tsao—Peiping and Jehol. Fruit oblong, sweet.
2. Ya Tsao—Jehol. Large, tapering, not very sweet.
3. Mu Shing Hong Tsao—Shansi. Oblong, tapering toward apex.
4. Hu Ping Tsao—"Bottle" jujube. Shansi. Locally thought the best.
5. Tsui Ling Tsao—Shansi. Oblong, spineless.
6. Lang Tsao—Shansi. Small, mellow, sweet.
7. Yuen Ling Tsao—Shantung. Fruit round. Smoked and exported.
8. Wu Hu Tsao—Laoling, Shantung. Nearly seedless, kernels soft. Fruits small, very sweet.
9. Chin Sze Tsao—Shantung. Small but sweet. Best for the manufacture of the honey jujubes.
10. Tun Ku Yu Tsao—Tsinanfu, Shantung. Flat, sweet, best to eat fresh.
11. Twen Ku Lu Tsao—Chinchowfu. Flat, medium large, sweet. Does not keep long.
12. Mi Tsao—Celebrated honey jujube. Looks like Persian date. Small, sweet.

The fruit of the WU HU TSAO (No. 8) is excellent boiled with rice or millet, or a delicious stewed compote can be made with it. Also, it may be eaten dried with peanuts, the same as raisins and almonds. The HSIAO TSAO from the same district in Shantung is prepared for eating in the same way. The MI TSAO, or honey jujube, is boiled in sugared water and dried. It is then slashed with a knife and given another boiling and dried.

The jujube is also known as the Indian fig because it is widely grown in India. From there it has spread to Australia and Africa. In most tropical countries including South America, where it is now cultivated, its chief use is ornamental. Secondarily the jujube is grown widely in India for use as a host to lac insects [8] which, placed on the branches of the plant, bore small holes in the bark. The gum lac which exudes from these holes is bright red and from it is made a lac dye highly esteemed in India by many dye users.

By analogy with other fruits and because of its ordinarily black color, the jujube has been called the "ink date" or "ink berry." In Germany where the fruits once appeared in markets, they were designated as "Tintendatteln." Historical records, however, fail to show that they have ever been used in the preparation of ink. On the other hand, tannin is present in the bark, particularly in the root bark, of the tree. It imparts a yellowish-red tinge to leather, but owing to the low tannin content, it is considered unimportant commercially.

An analysis [9] of the fruit yields the following results:

	Water	Protein	Cane Sugar	Reducing Sugar	Ash	Undetermined
Original material	13.44	2.93	13.06	42.19	1.73	26.65
Water-free material....	....	3.39	15.09	48.74	2.00	30.78

[8] Mell, C. D. Dyes and Tans from Zizyphus jujuba. Textile Colorist 54 (635): 125-126. February 1932.

[9] Blasdale, W. C. A description of some Chinese vegetable food materials. U.S.D.A., O.E.S. Bul. *68*: 43. 1899.

Tsao, the Chinese date, or jujube (Zizyphus jujuba), which has been a favored fruit in the Orient for at least 4,000 years.

The food value of the Chinese date has been investigated and several reports have been published. The carotene, pro-vitamin A, content was found to be 0.70 mg. per gram of fruit pulp.[10] It has also been discovered that the tsao has a fair amount of vitamin C.[11] The ascorbic acid content is shown in mg. per gram in the following table:

	Iodine titration value	Dye titration value	Vitamin C
Chinese date (Tsao), fresh	0.9996	0.0871	+
Small jujube, dried	0.2865	0.1330	+

Medicinally[12] the fruits of the wild jujube are considered cooling, anodyne and tonic. The kernels of the seeds are reported to have a sedative effect. If eaten frequently, they are said to increase the flesh and strength. They are recommended also to those who are subject to sleeplessness. The cultivated fruits are considered nourishing, beneficial and laxative. They

[10] De, N. D., Majumdar, B. M., and Sundararajan, A. R. The vitamin A activity of some vegetable foods. Part II. The carotene content of some vegetable foodstuffs. Indian Jour. Med. Res. 26 (2): 437-440. October 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. September 1938.
[12] Stuart, G. A. Chinese materia medica. Shanghai. 19928. p. 466.

are thought to be an antidote to aconite and are recommended in nausea and vomiting, also abdominal pain in pregnancy. They are used also externally in poultices and applications on wounds. The leaves of the tree are regarded as a diaphoretic and are prescribed in the typhoid fever of children. A decoction of the heartwood of the tree is said to have a beneficial action on the blood. The root is used in fevers of children and to promote growth of hair. The bark is used in a decoction together with mulberry bark as a wash for inflamed eyes.

Finally the wood has its commercial use. Though not plentiful, the old trees are sought for the manufacture of combs and for all sorts of turnery.

Base Camp in Ecuador

THE eastern slopes of the lofty Andes which run through western Ecuador have been the principal hunting ground for Dr. W. H. Camp, who, on a Government project, has been searching for stands of cinchona trees for quinine production for about a year. Part of his work has been in the area from where quinine and its source were first reported to Europeans. In a letter dated from Cuenca and written Christmas day to Dr. H. W. Rickett, he gives a glimpse of a few hours of life in a base camp.

"It might interest you to know," he says, "that the proof of the *Vaccinium* opus was delivered to me by Jivaro runner at the base camp inside the central ranges of the Cutucú. I doubt if proof for *Britonnia* ever was delivered to a more out-of-the-way place on the face of the earth. Our camp was just above the junction of the rivers Itzintza and Chiviaza (not on any map except ours). . . . We had made camp on the only level space we could find, and the night after the runner got in it began pouring buckets -and the next morning the lovely Itzintza — usually a mountain torrent only—was a roaring chute of water and tumbling trees. The water came up to within 8 inches of the bottom of the split palm-wood floor built into the base-camp shelter, and I had visions of trying to cart the duffle up the nearly precipitous slopes back of us (not impossible but a damned unpleasant job in the rain). So all that day (Nov. 26) I sat on the edge of one duffle box and worked over the proofs with one eye on the little sticks I had pegged into the ground just beyond my feet so that I might know whether the river was upping or downing. It did both from time to time, but never got higher than the blessed 8 inches from the toes of my boots."

Gardening Course Arranged By New York Times

T. H. EVERETT will be the New York Botanical Garden's representative in the series of four free lectures on gardening to be given by the New York *Times* with the co-operation of four public institutions of the New York area. On Jan. 30 he will present the opening lecture, which will be entitled "Why Not Grow Flowers Too?" The series will continue on successive Tuesday afternoons and evenings at 2:30 and 8 o'clock.

The subsequent lectures, to be on lawns, vegetables, and fruits, will be given by Dr. George H. Avery, Jr., Director of the Brooklyn Botanic Garden; C. H. Nissley of the New Jersey State College of Agriculture; and Norman H. Foote of the State Institute of Agriculture on Long Island.

Admission to the series of lectures, which will be given in New York Times Hall, 240 West 44th St., will be by ticket available from Dorothy H. Jenkins, Garden Editor of the New York Times, 229 West 43rd St., New York 18.

The program is the outgrowth of the series of lectures on vegetable gardening given as a contribution to the war effort during 1942, 1943, and 1944 by the New York Times with the New York Botanical Garden alone co-operating.

Blueprint of the Jungle

As Depicted by the Altitude of Growth of the Bromeliads—With Notes on the Culture of Certain Tropical Epiphytes

*By Mulford B. Foster**

FOR hours we had been cutting our way through a dry, brambly jungle out in Mato Grosso and at last we had found a haven for rest. Suddenly, we looked up into the forest "penthouse" above us. A rustle of leaves and vigorous swaying of branches focused our attention on a spry Capuchin monkey; something was wrong in his world! Without asking we had intruded into his domain, had entered his dining-room to eat our lunch. He wasn't too certain what to do about it. He leaped down three flights, from "floor to floor" of his jungle home to investigate these visitors more thoroughly. As we watched him we were reminded, as we had been many times before, of the structural character of the Brazilian jungle. While the jungle forests seem endlessly varied, always they seem patterned or blueprinted in the form of a great building with one, two, three, or even four "stories" of growth.

In the great CERRADO or CATINGA (scrub lands) only the first floor of vegetation occurs, but in the great primeval forests in various mountain ranges, such as the Serra das Aymores, the Serra do Mar, or the Serra da Mantiqueira, we always observed three or four distinct stories, with even a "penthouse" above. The strata of plant growth are more or less comparable to strata of rock formation, and it is singularly interesting to note how strictly the plants which grow in the trees keep to their own strata. Seldom do you find a given plant growing in more than one of these areas.

The ground floor of course is always more easily observed than any of the others. For the most part the plants on the first floor of the big forest are lush, the leaves are broad, of more tender and rapid growth, and the plants are naturally shade-loving. They are likely to be a tangled mass of ferns, calatheas, tradescantias, heliconias, pipers or bromeliads. As I am especially interested in the bromeliads, I am naturally more aware of the strata in which these particular plants grow, though they follow a pattern of habitat similar to that of other epiphytic forms such as orchids, cacti, ferns, and pipers. In fact, my own blueprint of the jungle growth is based mainly on the habitats of bromeliads.

Neoregelia, *Nidularium* and *Canistrum* are three bromeliaceous genera which can be found on the first floor of growth, since they like the moisture

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* Co-author, with Mrs. Foster, of "Air Gardens of Brazil" soon to be published by the Jaques Cattell Press.

and shade of the lowest parts. Seldom do they ever venture high above the ground, but actually the ground is often so crowded with verdant growth of other plants that they do seek the low trunks, stumps, or low-slung lianas. And strangely, the vegetative growth of these particular bromeliads is more luxuriant and showy, while the flowers and fruits of these plants are less spectacular than on those that grow higher up. The conditions in the shadows of the rain forests make these plants well adaptable for corners and neglected places of the greenhouse or conservatory and shaded parts of a home. I generally place most of my nidulariums, canistrums or neoregelias under slat benches or under other foliage plants in my greenhouse for they are much less inclined to grow out of form and shape than plants which strive harder to reach the light.

The ground floor in the jungle, of course, acts also as a starting point or foothold for climbing plants which sometimes go on up to the roof.

Although many of the luxuriantly growing plants of the first floor covering have the ability to outgrow and overshadow other growth in almost complete shade, in horticultural use they generally are less adaptable to sudden changes in temperature and light than those in the upper strata. These first floor plants of the jungle, such as nidulariums, calatheas, ferns and others, require, as a rule, more constant conditions. On the other hand, some of the plants, like the aroids and other climbers which have their feet on the first floor, adjust themselves to various levels. They defy any of the other growth to outdo them, so they get off the ground and take to the spaciousness of the trees. Thus, because of this resourcefulness to rise above their conditions, they often become more adaptable under artificial conditions as house plants. They are prepared in nature for a transition to the cave-dweller conditions of a home. So, we continuously search for plants that can stand shade and the heated room, and that have the ability to stay with people whom it is often difficult to understand.*

In many jungles the foliage of the cacaos and other low-branched trees makes the roof covering of the first floor. In practically every jungle area in Brazil the willowy cecropias serve as the roof of the first and second story of the growth. They are usually on the edge of the dense jungle and seem to act as nurses who stand in readiness to protect the tender growth below them, should anything happen to the dense, high "roof" proper. The great, broad palmate leaves of these rapidly growing cecropias protect the young seedlings of other plants until they are able to take care of themselves.

* The desire of human beings to be with plants is basic, even though a complete understanding of them may be dormant. The so-called "love" of plants on the part of many persons is based on appearance. People look principally at the outward beauty and glamour of the plants, but if they had the welfare of the plant more in mind, they would strive to take an understanding care of it. Instead, if unsuccessful, they usually blame the plant for dying.

Among the bromeliads, species of *Billbergia, Vriesia,* many of *Aechmea* and some of *Tillandsia* have taken residence on the second floor. Occasionally a *Quesnelia, Hohenbergia* or a *Streptocalyx* also may have chosen this area. These plants are a bit more independent of moist conditions and enjoy more light than their first floor cousins. Consequently, they are inclined to be more showy in form and flower. The tree-tops of this level are more open and enough light filters through to create a situation that will harbor plants, especially bromeliads, which are favorable to greenhouse, sunporch or patio conditions. They do not need quite so much moist atmosphere or diligent attention as those growing lower down.

Here in the more open second floor we find many of the climbing and vine-like palms, and the tree-like species of *Opuntia.* These cacti which stand with their feet in the acid leaf-mold and enjoy the forest shade are only just beginning, in the course of their evolution, to show the typical succulent pads of their desert relatives.

The layman thinks of cacti as being almost exclusively residents of the desert, and while this may be more or less true in Mexico and our Southwest, it is not entirely so in Brazil. South American jungles must have been the original home of that great family for we still find a predominance of the earlier leafy forms of cacti there. *Rhipsalis, Hatiora, Zygocactus* and other genera of epiphytic cacti abound in most jungle areas of Brazil, being habitués of the second floor along with *Aechmea, Billbergia* and *Vriesia* of the bromeliads. The well known *Zygocactus* (Christmas cactus) grows happily on the first and second floor in the moist shade of the coolest jungles.

On the third floor of any given Brazilian jungle, will be found a predominance of *Aechmea,* a stiffer and sterner type of bromeliad which is seeking more light and more air currents. Of course, *Vriesia* and *Tillandsia* will be found here also, on the "mezzanine" between second and third floor, as it were, made up of the lower limbs of the giant trees whose leaf heads form the roof and penthouse areas above.

Some of our most interesting discoveries were found in this third floor stratum, the structure of which is made up of great limbs of the towering forest trees which throw out their far-reaching branches, filtering the light for trees and vegetation below. Here in these giant trees we find giant bromeliads; in size some of them are so immense that one wonders why they have not taken to the ground instead. It was in southern Bahia in a great primeval forest back from Ilheos, when we discovered the two new species, *Aechmea conifera* and *Aechmea depressa,* that we had our first experience in seeing really giant plants completely at ease fastened securely in their high, lofty positions on limbs almost as large as ordinary trees, 80 feet up from the ground. The trees in which they live are often eight to ten feet in diameter. To reach these air plants we had to do as the monkey

SCENES FROM BRAZIL'S JUNGLE GARDENS OF BROMELIADS

Plants which cling to trees instead of thrusting heir roots in the soil have many problems ndependent of the earth below them. (This photograph is from "Air Gardens of Brazil" to be published early this year by the Jaques Cattell Press, and is used by permission of the publisher.)

Footpath through the den jungle at Alto da Serra in t State of São Paulo, raini spot in all Brazil. Epiphy plants predominate here fr the "ground floor" up.

Collecting epiphytic plan on cut-down trees is the ea est way of climbing specimens. The collector fortunate, who arrives ju after the woodsmen ha used the axe over a wide

By Mulford B. Foster

overcrowded arboreal apartment on the "second . where Vriesia guttata rooms side by side with great masses of orchids.

The giant bromeliad Chevaliera sphaerocephala dominates this air garden alone.

On his way up to the "third floor" of the jungle garden, the author makes a few camera shots from the second story.

does. First we climbed into the trees of the first and second floors, their branches intermeshed with the taller trees of the second and third floors. From limb to limb with the help of great swinging vines we finally reached the third floor, or the lower branches of the largest trees. It is no easy job; in fact, sometimes it takes from one to two hours to successfully reach those plants and loosen them from their secure quarters. Lowering them with ropes and bringing them to earth, we finally realized their immense size. *Aechmea conifera* had a cone-like flower head which, when fully developed, was eighteen inches long and weighed twelve pounds. One of these plants with its several side shoots and its partly cast off previous growth may weigh 100 to 125 pounds. And right in this one mass of plant life there is plenty of interest in other forms of life for the ranologist, herpetologist, entomologist and botanist, because frogs, snakes, and beetles, as well as aquatic mosses and algae, make up the great variety of life in the little universe in the series of pools within the leaf cups of one great epiphyte. These giant air plants, in spite of the animals and the one or two gallons of water they hold, hang on securely with their wire-like roots in a perfect balancing act.

The character of the fourth story is more open and thereby more sparsely inhabited by bromeliads. The higher the area the stiffer and more rugged the bromeliad. If the plant holds water in its basal leaf-cups, the leaves may have more spines; but if the plants (like the xerophytic tillandsias) do not hold water between their leaves, then their bodies will be covered with countless peltate scales. These scales serve both as an insulation against sun and wind and act also as sponge cups to soak up moisture from the cool, dewy air. Naturally these higher stratum air plants are the most independent of all the plants. That is, they are independent of what we generally term as favorable conditions. As house plants they are, however, quite susceptible to excessive coddling, often succumbing quickly to too much moisture, for they have developed their xerophytic qualities on a parallel with desert dwellers and cannot stand a "soft" life. For example, *Tillandsia recurvata* (ball moss), has become so conditioned and hardened that it could be called a xerophytic or saxicolous plant as well as an epiphytic one, finding lodging on desert cacti or among rocks quite as comfortably as on trees in temperate or tropical zones. This tillandsia has probably the greatest adaptability of any plant in the Western Hemisphere.

Many of the tropical plants, especially those growing at some elevation in the mountains, are what we would call coolhouse plants, for at home they have heat only in the middle of the day. I often wish that more growers, especially those who are confined to greenhouses in the north, could personally experience these jungles and feel the many conditions under which the plants live. And, since many of the epiphytes love cool nights, they seem quite remarkable in their adaptability to withstand the

MONKEY BUSINESS

The author plays Tarzan in the jungles of Brazil as he leaps from one tree to another in his search for bromeliads in the upper stories of vegetation. (From "Air Gardens of Brazil" by Mulford and Racine Foster, soon to be published by the Jaques Cattell Press.)

hothouse treatment day and night that they receive when confined far from their native arboreal air gardens. They like more air than we are inclined to give them, and more variation in temperature. Plants which are fastened in one position throughout their life must have plenty of exercise.

How can a plant have exercise? By the raising and lowering of temperature, by alternating drying out and watering periods; these changes, mixed with good, pure ventilation will keep a plant active and in vigorous health. There are often conditions even in the forest which are detrimental to some of the plants some of the time. The vitality of certain ones is lowered and we find scale and other insects there, but where the plants have the proper exercise and ventilation with their natural source of food you find them endowed with a much greater resistance and fewer insect enemies than you find when they are confined in a glasshouse.

Unfortunately, bromeliads and orchids as greenhouse or house plants cannot always get the rain water which means so much to them and often must get along on chemically treated water which has the very life taken out of it. That many of them hold up remarkably well under this deficiency in their diet demands our great admiration. One caution is important: bromeliads and orchids cannot thrive very long with excessively alkaline water.

I believe also, that epiphytic plants in the greenhouse should have the association of other kinds of plant growth around them. Human beings cannot live without plants, neither can plants live without other plants, but we are quite sure that plants can live without human beings. Little do we know of the beneficial gaseous atmosphere that is given out by the various plants. Some plants may give off ethylene (a gas in wood smoke) which has been proved to have an action on bromeliads in that it forces them to bloom out of season.** What gases are given off and what their resultant actions are present a vast field for investigation.

But I digress too far from the jungle "apartment" structure.

When one thoughtfully surveys the different stories of the jungle growth, its inhabitants, and its living conditions from the perspective of the first "floor" one realizes that the great mass of epiphytic life clinging to the trunks and overhanging branches forms a garden quite removed from the earth, a garden "in suspension."

The successive strata or stories of vegetation, in which different types of epiphytic plants make their homes give the jungle its blueprint, or pattern.

** See National Horticultural Magazine, Oct. 1943, "A Step Ahead of Mother Nature" by M. B. Foster.

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.)

Guide for Microscopists

PHOTOMICROGRAPHY, Theory & Practice. Charles P. Shillaber. 773 pages, illustrations, glossary, index. John Wiley & Sons, Inc., New York. 1944. $10.

The ideal method of appraising any really complete reference book would likely be to wait five years and secure detailed opinions from fifty workers in that field and construct a consensus report.

Mr. Shillaber has obviously anticipated this method by very wide research amongst workers and texts, plus his own vast experience. Certainly every laboratory library should include this text.

Assuming, in the United States, 50,000 professional microscopists, including 5,000 photomicrographers, again including, say, fifty experts, plus untold thousands of amateurs, it is startling to consider the improvement in general technique if every one of the total 50,000 would faithfully absorb the first 400 pages (especially Chapters 1 and 2) and Chapter 7 (Mounting Media, Stains, Reagents and Solvents).

Visits to many industrial and health laboratories disclose that a good proportion of general microscopists have never known even the important functional difference between field diaphragms and aperture diaphragms, and the need for both.

As for the specialized photographic sections, consultation with a few acknowledged photomicrographers turns up hearty and sincere praise for the scope and thoroughness, with special praise of the author's intent and success in setting forth not one but several solutions of individual problems of a controversial nature.

The extreme generosity of technical illustration and the exemplary index, with references both to definitions in the full glossary and to textual discussions, give the reader a sense of combined completeness and simplicity. The rarity of typographical error (such as inversion of Fig. 63, with drop of mercury at top, against the law of gravity) spells near-perfection of compilation.

Paul L. Rittenhouse,
Vice-President, New York Microscopical Society.

400 *Native Fresh-Water Plants*

AQUATIC PLANTS OF THE UNITED STATES. Walter Conrad Muenscher. 374 pages, illustrations, maps, glossary, index. Comstock Publishing Co., Ithaca, N. Y. 1944. $5.

Because they are frequently both inconspicuous and difficult to collect, prepare properly, and identify, aquatic plants are neglected by many botanists. Not so Dr. Muenscher! For over thirty years he has studied aquatics in the field and herbarium, and he has collected them in every state in the union. It can safely be said that no one is better qualified to write a comprehensive treatment of the aquatic plants of the United States.

The book is no mere compilation; it is a labor of love, built on a solid foundation of study and understanding. Some 400 species of aquatic pteridophytes and spermatophytes are treated, the lower plants not being considered. The author may have leaned over backward in trying to include borderline aquatics, but this is all to the good.

There are descriptions of the families and genera, and short workable keys to these and the species. Each species is provided with a distribution map, a statement of habitat, and nearly always a line-drawing illustration. The international rules of nomenclature are followed. The taxonomy is moderately conservative. Environmental forms, so common among the aquatics, are discussed but generally not dignified with nomenclatural status. The work cannot be monographic, and those having special knowledge of certain groups will doubtless find points to criticize, but anyone having to deal with aquatic plants will find this book an indispensable aid and companion.

ARTHUR CRONQUIST.

Salt-Water Botanizing

THE MARINE ALGAE OF THE GULF OF CALIFORNIA. Elmer Yale Dawson. 454 pages, tables, 47 plates. University of Southern California Press, Los Angeles. 1944.

The trip which Lieutenant Dawson described in his article in the June 1944 Journal, "Botanizing in an Open Boat," was made for the purpose of completing, at a different season, some of the exploring done on one of the Alan Hancock Pacific Expeditions in which he had taken part in January 1940.

In "The Marine Algae of the Gulf of California" he now describes the algae collected on this trip, which was one of ten such annual expeditions, beginning in 1932 and carrying various scientists off the coasts of Mexico, Central America, South America, and the Galapagos Islands. Lieutenant Dawson, who is now located with the Scripps Institution of Oceanography, describes 273 species found in the Gulf. Five have previously been known only from the western edge of the Pacific and one only from the Mediterranean. His was the first investigation of the seasonal alternation of floras in the region—a study which, at one station alone (Turner's Island), brought results calling for further research.

CAROL H. WOODWARD.

Phenomena of Cell Division

MITOSIS. Franz Schrader. 110 pages, illustrated, indexed. Columbia University Press, N. Y. 1944. $2.

This volume of 86 pages of text and 18 pages of bibliography presents a critical evaluation (1) of the knowledge regarding the structures involved in the mitotic movements of chromosomes during nuclear duplication, (2) of the theories regarding the forces concerned with the properties and movements of the various structures, and (3) of certain related phenomena.

The average textbook treatment of mitosis is chiefly confined to didactic statements of what happens during mitosis and what is accomplished. Dr. Schrader's critical evaluations are concerned with how and why the various activities take place. He views mitosis as a "great complex of different mechanisms" rather than an expression of a single force.

A. B. STOUT.

Measuring a Cell's Activities

MANOMETRIC METHODS. Malcolm Dixon. 2nd edition, 157 pages, illustrated, indexed. Macmillan, New York. 1943. $1.75.

This handbook, in its second edition, gives information required by research workers on the use of manometric methods in measuring cell respiration or photosynthesis, oxidation-reduction systems, enzyme action, or other processes in which a gas is either absorbed or evolved. The most refined methods permit exchanges of gas by cell suspensions, slices of tissue, or small seedlings to be measured with an accuracy of the order of one-millionth of a cubic centimeter.

SAM F. TRELEASE,
Columbia University.

Virginia's Pteridophytes

THE FERNS AND FERN ALLIES OF VIRGINIA. A. B. Massey. 110 pages, illustrated Virginia Polytechnic Institute, Blacksburg. 1944.

An advantage to the beginner in fern study in the book recently issued on the ferns of Virginia is the way that some distinguishing characteristic is pointed out on the drawing of each species. A momentary disadvantage is the failure to indicate the difference in size of the ferns that are illustrated together, as on the page showing several species of *Botrychium*. However, the relative measurements are given in the text describing each.

More than a hundred ferns are treated besides the fern allies that are found in the state. Many drawings and photographs enliven the text, some of them taken from this Journal and from the booklet on "Hardy Ferns and Their Culture" published by the New York Botanical Garden. A ten-page key aids in identification.

CAROL H. WOODWARD.

Current Literature At a Glance*

Sporeling Study. A 17-page paper by Margaret Fulford on "Sporelings and Vegetative Reproduction in the Genus *Ceratolejeunea*" appeared in the *Bulletin of the Torrey Botanical Club* for November. The work was made possible through the Marshall A. Howe Memorial Fellowship given by Mrs. Elon Huntington Hooker to the New York Botanical Garden, for the summer of 1943. In the paper, which is illustrated with 72 figures by the author, sporelings of 12 species of *Ceratolejeunea* are identified and compared, and vegetative reproduction in the genus is discussed for the first time in detail.

Rose Society. The December *Bulletin of the Georgia Rose Society* describes briefly the New York Botanical Garden, the Rose Garden, and a Members' Day program which was attended by the editor, Mrs. Joel Hunter of New York and Washington, D. C.

Begonian. The November number of *The Begonian* features the gardens of eastern begonia growers, in an article by A. E. Nelson of Arcadia, Calif., President of the American Begonia Society. One of the illustrations shows Mr. Nelson in the begonia house in the New York Botanical Garden's conservatories.

Willows. A. B. Massey of Virginia Polytechnic Institute, who is also Botanist for the Virginia Cooperative Wildlife Research Unit, is co-author with Carleton R. Ball of the U.S.D.A. of a 31-page booklet, "The Willows of Virginia" published by the Polytechnic Institute at Blacksburg, Va.

Children's Work. Two more booklets have been issued by the Brooklyn Botanic Garden to describe the work carried on there for boys and girls in gardening and science: "The Children's Greenhouse" and "Our Boys and Girls Club."

Microscopes. In the autumn number of *The Educational Focus* published by Bausch & Lomb Optical Co., types of microscopes in use today are described and illustrated.

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

Landscape Architecture. Persons interested in landscape architecture as a career will find information about its possibilities and requirements in Occupational Abstract No. 9: Landscape Architect, issued by the Occupational Index, Inc., at New York University. Single copies of this leaflet may be obtained for 25 cents.

Rafinesque. In publishing "A Life of Travels" by C. S. Rafinesque in *Chronica Botanica* (spring 1944), the editor presents for the first time since the original edition of 1836 a "verbatim and literatim reprint" of the report of this unique genius of American botany. E. D. Merrill, in a foreword, points to the fact that Rafinesque in 1832 forecast the general principles of organic evolution in a published statement. There is a critical index by Francis W. Pennell with explanatory comments at the end of the reprint. Several portraits illustrate the work.

Transplanting. A booklet that will be useful beyond its immediate purpose has been prepared by the National Shade Tree Conference and the National Arborist Association on "Transplanting of Trees and Shrubs in the Northeastern and North Central United States" for the U. S. Army Camouflage Branch Engineer Board. The 76 pages of detailed directions are illustrated with photographs, diagrams, and drawings.

Semi-Centennial. To honor Alice Eastwood, who, at the age of 85, is still the active head of the botany department of the California Academy of Sciences, where she has served for 50 years, the Academy has issued in the fourth series of its Proceedings, the Alice Eastwood Semi-Centennial Publications. Starting with a revision of the genus *Fuchsia* by Philip A. Munz, published in December 1943, the series contains papers on a wide variety of botanical topics, including one on the genus *Astragalus* by Rupert C. Barneby, who has done considerable research in the New York Botanical Garden's herbarium.

Boron. Deficiencies caused by lack of boron in the soil are described and illustrated, partly in color, in a booklet issued by the Pacific Coast Borax Co. under the title of "Boron in Agriculture." A revised edition appeared in 1944.

Alaska. Dr. Hugh M. Raup of the Arnold Arboretum, who is lecturing at the New York Botanical Garden Feb. 10 on plant life from the Alaska Highway to the Aleutians, reports on his 1943 expedition along the Alaska Highway in the January number of the *Geographical Review.*

Food for Great Britain. How Great Britain has succeeded in feeding herself in the past few years is told in a booklet on "Farming in Wartime Britain" recently issued by the British Information Services. With double the number of allotments, and with 5,000,000 private gardens devoted to vegetables, as against 3,000,000 before the war, Great Britain has increased its vegetable acreage by more than 50%, grains by about 80%, and potatoes by 100%. The net increased production of foods from these areas is 70%, measured in calories.

Herbs. Quotations from a dozen recent books on herbs are included in the illustrated catalog of herb products issued by the Tooles of Garry-Nee-Dule, Baraboo, Wisc. Recipes and suggestions for herb uses also are given.

Corn. The table use of corn on the cob and in cans is so small as compared with the use of corn as livestock feed, that in a chart in "Corn Facts and Figures," published by the Corn Industries Research Foundation, it is lumped in the category "Industrial and other uses: 12.1%." Yet there is a list of 250 industrial uses of corn in addition to nearly as many uses in food, pharmaceuticals and cosmetics. America's record corn crop of 1943 is given a total value of nearly three and a half million dollars.

Timber. In view of the statement recently heard that the timber cut in the United States for war purposes would make a clear swath a mile wide across the entire northern part of the country, the leaflet recently issued by the U. S. Forest Service, "Some Plain Facts About Forests," is exceptionally timely. There it points out that timber cut or destroyed during 1943 was 50 percent greater than growth. The leaflet (Miscellaneous Publication No. 543) answers questions on the future of our forests, their ownership, their management, and their significance to the people.

BROADCAST

By HARVEY K. MURER

WHEREVER *food is concerned, bacteria are important, because their life activities, as they subsist upon what we wish to eat, may render our food not only unpalatable but often highly poisonous to us. On the other hand, that same activity, in certain kinds of bacteria, may be beneficial. Harvey K. Murer, who is Director of the Biochemistry Section of Central Laboratories, General Foods Corporation, told about the relation of bacteriology to food in the radio program given by the New York Botanical Garden over WNYC Oct. 20. Some of his remarks, including his introduction on what bacteria are, appear below.*

BACTERIA are very minute, single-celled forms of life. Whether they are plants or animals can scarcely be determined, for they have characteristics of both. Some idea of their size can be gathered by the fact that as many as ten trillion of them could occupy the level volume of a teaspoon without being crowded.

In spite of their minute size, under proper magnification they can be seen to have definite shape and form, just as any other living organism. They may be spheres or small rods and they may be found in clusters or groups or chains or existing individually. Some of them have a means of locomotion and appear to be swimming around in the liquid in which they live.

The vast majority are not harmful; we are mainly concerned about a few bad actors. Fortunately, most of these have been discovered and studied, and means of controlling them are known.

Since bacteria are living organisms, they naturally engage in many of the same activities as higher forms of animal and plant life. That is, they eat, grow, and reproduce. Actually, their effect on foods is due mainly to the fact that they feed upon whatever materials they are growing on, and thus cause it to change in composition. The resulting substances produced by some bacteria are actually harmful. Most of them, however, are merely objectionable because they change our food so that it is no longer pleasing to us. On the other hand, they may give rise to very desirable changes, for example, in curing cheese and in making vinegar.

An Age-Old Problem

Since the earliest times, our problem in handling food has been to kill the harmful bacteria present or to treat the food in such a way that bacterial activity will be reduced. Long before our knowledge of bacteria as living organisms, man was confronted with the problem of keeping food from a period of abundance for use in a period of scarcity.

Methods in Common Use

Like other living organisms, bacteria cannot survive being boiled very long. Therefore, the simple process of cooking is one of the main means of control.

Drying is another practical way of preventing bacterial growth, for, in order to carry on their life processes, bacteria require moisture. If the material is dry enough, the organisms, although not necessarily killed, will be kept from multiplying and carrying on their activities. This is probably the oldest of all methods of food preservation. During the war we have heard a great deal about home dehydration, but it is not a new principle in the preservation of foods. We are merely trying to adapt an ancient practice to other foods. Actually, our cereals are preserved by drying. Man learned long ago to allow the grain to ripen and dry out in the field before it is harvested and stored.

Freezing is equally effective, because at low temperatures bacteria are not active. They may be retarded or even destroyed by freezing. Low temperatures not only make it too uncomfortable for the bacteria to grow, but also help to preserve the food in its most palatable and nutritious condition.

Enzymatic Changes

There are many changes that take place in moist food materials that are not due to bacterial action. These changes are spoken of as *enzymatic* and represent a continuation of the normal life processes of the food material. Thus, the wilting of vegetables, the changing of flavor of meats upon storage, the decrease in vitamin content or the onset of some forms of rancidity may be due to these causes and not at all due to the effect of bacteria. These usually take place previous to bacterial action in such things as meats and vegetables, and so the retarding of these enzymatic actions, even by simple home refrigeration, is a highly desirable thing whether or not we are confronted with the necessity of preventing bacterial spoilage.

Fruits, Fresh and Preserved

Most fruits are themselves fairly well protected against bacterial spoilage in that they have a protective outer coating or skin, and if they are kept at fairly low temperatures, can be preserved fresh for some time. Spoilage usually takes place when the fruit has been bruised or the outer skin broken, thus allowing the organisms to enter the moist tissues of the fruit. The acid nature of fruits also helps to preserve them and makes it possible to store them for long periods of time—provided the refrigeration is adequate.

Materials of a very high sugar content are not tolerated by the bacteria. The making of jams and jellies offers a typical example of the preservation of food by this principle. The recipes provide for a syrup or jelly containing about 60-65% of sugar, and this concentration is enough to prevent bacterial growth. That the sugar itself is effective is illustrated by the fact that preserves do not spoil upon standing after opening or partial use. One may, at times, however, have difficulty with molds growing on leftover portions of jams or jellies, particularly if they are kept in the icebox. This is because when a cold container is removed from the icebox to a warm room, moisture from the air tends to condense upon it and upon the surface of the product in the container. When these materials are then further stored, this thin film of water on the surface of the jelly or jam has so diluted the sugar content at the surface that the molds have a chance to start growing. The same difficulty is sometimes encountered in partially used table syrups in which moisture condenses in the upper portion of the bottle, thus giving a dilute syrup on the surface where the organism can thrive.

Salt and Vinegar

In pickles you get a combination of the effect of acid and salt in which bacteria do not thrive. In some instances the bacteria themselves are used to develop the eventual preserving agent. The fermentation used to preserve cabbage in the form of sauerkraut is a typical example in which the organisms have been allowed to grow and develop a high acid content. They are inhibited and limited from further growth by the fact that the acid that they themselves have produced becomes so strong that they no longer can multiply. A high concentration of salt is also used in the preserving of meats and fish.

Bacterial Spores

Non-acid foods, such as vegetables and meats, have to be processed in a pressure cooker in order to be safe, whereas tomatoes merely have to be boiled in an open kettle before being put into the sterilized jars. That is because we are concerned not only with the bacteria themselves, but also with the spores which are one form of the life cycle of certain of these organisms. These little reproductive bodies are even smaller than the bacteria, and have about them a protective or capsule-like membrane. They are, therefore, more resistant to heat treatment or to freezing than the usual form of the organism. In order to be sure that all spores are destroyed, it is necessary not only to raise the temperature to boiling, but to obtain even higher temperatures by means of heating under pressure. Such a process is, of course, used in commercial canning almost universally, and is very carefully controlled. In home canning, however, where an open kettle or ordinary atmospheric pressure cooking is used, all of the spores may not be destroyed. It is mainly because of this fact that some home-canned products have later caused food poisoning.

This used to be commonly known and sometimes is still referred to, as ptomaine poisoning. It is now recognized that this type of food poisoning is due to the toxin produced by a specific bacterium known as *Clostridium botulinum*, which grows only in the absence of air. The toxin may be so violent where the product has been badly contaminated, that even tasting of the material before recooking may be dangerous. In commercially canned foods, however, this difficulty is avoided by adequate pressure cooking. Since this organism does not thrive well in acid foods, such as, for example, fruits, these may be safely processed with the so-called open kettle method and used without the necessity of reheating. Thorough cooking of all home canned vegetables and meat before serving is therefore always recommended. In any home-canned product, however, one should always take the precaution to examine the material and the container to make sure that spoilage has not taken place.

Since we should not taste home-canned vegetables to determine whether or not they are all right before preparing them for the table, probably the best criterion we have for food spoilage is the smell. "Your nose knows best" is a pretty good rule to follow.

Notes, News, and Comment

Bahama Book. The remaining copies of "The Bahama Flora" by Nathaniel Lord Britton and Charles Frederick Millspaugh, published by the authors in 1920, have been put on sale at the New York Botanical Garden. The book contains 695 pages, of which 460 are devoted to descriptions of Angiosperms, with keys; three pages to Gymnosperms (one pine, one juniper, and four cycads); and the remaining pages, exclusive of notes on explorations and collections, biblography (prepared with the co-operation of John Hendley Barnhart), and index, to the ferns, liverworts, mosses, lichens, algae (contributed by Marshall A. Howe), diatoms (Charles S. Boyer), and fungi (by Fred J. Seaver). The book sells for $6.25.

In Canada. Dr. William J. Robbins showed the New York Botanical Garden's motion picture film under the title of "Plant Life in a Botanical Garden" before an audience of 1,200 in Toronto, Canada, the evening of Dec. 9. The occasion was arranged by the Royal Canadian Institute, of which Dr. E. S. Moore of the University of Toronto is President. The picture was shown in Convocation Hall at the University, and was part of the annual program for the 96th session of the Institute. Dr. Robbins was accompanied by Mrs. Robbins, and they were entertained at a coffee party after the lecture. The following Monday was spent at the Montreal Botanical Garden.

Southampton Club. At the home of Mrs. Nicholas Murray Butler in New York Dec. 12, Dr. William J. Robbins showed the Garden's motion picture before the members of the Southampton (Long Island) Garden Club.

Correspondent. Dr. Harold N. Moldenke has been elected to corresponding membership in the Sociedad Botánica de México and in the Centro de Estudiantes del Doctorado en Ciencias Naturales in Buenos Aires.

Groups. The City Gardens Club of New York made a tour of the Main Conservatories and convened for tea in the Members' Room the afternoon of Nov. 18. Twenty-nine pupils from the public school at Emerson, N. J., visited the greenhouses Nov. 17. Two classes from P.S. 47 in the Bronx viewed the conservatory displays and museum exhibits Dec. 13. During the earlier weeks of the fall, groups from Public Schools 46 and 114 made special trips to the Garden; 30 students from Panzer College of Physical Education and Hygiene at East Orange, N. J., and two groups of 60 each from the New York Color Slide Club also inspected the indoor and outdoor plantings.

Conference. Plans for the development of the New York Botanical Garden were presented briefly by Dr. William J. Robbins at the conference of the scientific staff and registered students of the Garden Dec. 15.

Princeton. Dr. F. J. Seaver was at Princeton University Dec. 6, inspecting the herbarium.

Returned. Dr. John Hendley Barnhart has returned to New York for the winter and to his desk at the New York Botanical Garden.

Rensselaer. Dr. William J. Robbins visited Rensselaer, N. Y., Nov. 27, where he conferred with the research staff of the Winthrop Chemical Co.

Visitors. Dr. Horace T. Herrick, Director of the Northern Regional Research Laboratory at Peoria, Ill., and Dr. B. M. Duggar of Lederle Laboratories were visitors in Dr. Robbins' laboratory Dec. 15. The following day Dr. Harold Raistrick of the London Institute of Hygiene and Tropical Medicine, who is in the United States studying penicillin, spent considerable time there, and on Dec. 18 Dr. Ralph R. Mellon, Director of Infectious Disease Researches at the Mellon Institute in Pittsburgh, came to the Garden to consult with Dr. Robbins and Dr. B. O. Dodge. Dr. W. H. Sheldon, who has recently retired from the Cornell Medical Center, and Mrs. Sheldon also were visitors that day.

Others who have been at the Garden in recent weeks include E. J. Schreiner of the U. S. Forest Service in Philadelphia; George L. Slate of the Experiment Station at Geneva; Richard H. Goodwin of Connecticut College; John D. Dwyer, Albany College of Pharmacy; Ray F. Dawson, Princeton University, Lt. John B. Routien, who was formerly mycologist at the University of Missouri; Genevieve Dawson of Argentina, currently of Cambridge, Mass., and Caroline K. Allen of the Arnold Arboretum.

Volunteer. Judith Embury, who worked as a volunteer under Dr. B. O. Dodge last summer, has returned to the Garden for two or three weeks of laboratory work, assisting Dr. Dodge again in his cultures of boxwood parasites.

WINTER EVENTS AT THE GARDEN

Members' Day Programs

First Wednesday of each month, 3:30 p.m. in the Members' Room

Jan. 3 *Early American Botanist*—A Portrait of José Mociño *By H. W. Rickett*

Feb. 7 *Growth and Flowering*—Lapsed-time Photographs of Some Native Plants *By Walter E. Thwing*

Mar. 7 *Exploring Kaieteur and Table Mountain in the Guianas*—A Report *By Bassett Maquire*

Saturday Afternoon Programs

Weekly at 3 p.m. in the Lecture Hall

Jan. 13 *Motion Picture in Color*
SCENES AND SERVICES THROUGH THE YEAR
Produced by the New York Botanical Garden

Followed by a series of six illustrated talks on
Plants of the Regions Where Our Men and Women Are Serving

Jan.	20	*Food Plants of the Tropics*	*Otto Degener*
Jan.	27	*Flora of the Islands of the Pacific*	*Otto Degener*
Feb.	3	*Vegetation of India and Burma*	*Otto Degener*
Feb.	10	*From the Alaskan Highway to the Aleutians*	*Hugh M. Raup*
Feb.	17	*Plant Life of the Mediterranean Region*	*Rupert C. Barneby*
Feb.	24	*Strategic Plants at the New York Botanical Garden*	*E. E. Naylor*

Mar. 3 *Time-lapse Motion Pictures*
NATURAL GROWTH OF PLANTS AND RESPONSES TO GROWTH SUBSTANCES
Produced by the Boyce Thompson Institute for Plant Research, with Dr. P. W. Zimmerman as Commentator

Radio Programs

Alternate Fridays, 3:30 p.m. WNYC (830 on the dial)

Jan. 12 *Streamlining the Age-Old Soybean*
Edward Jerome Dies, Author of "Soybeans: Gold from the Soil"

Jan. 26 *Selecting the Best From the New Seed Catalogs*
Paul F. Frese, Editor of "The Flower Grower"

Feb. 9 *Fitting the Garden into the Family's Life*
E. L. D. Seymour, Horticultural Editor, "The American Home"

Feb. 23 *Winter Nature Study in New York*
E. Laurence Palmer, Professor of Rural Education, Cornell 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.

Membership in

THE NEW YORK BOTANICAL GARDEN

and what it means

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

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

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

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* * * *

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

* * * *

Classes of membership in the New York Botanical Garden are:

	Annual Fee		*Single Contribution*
Annual Member	$ 10	Member for Life	$ 250
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Contributions to the Garden may be deducted from taxable incomes.

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

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

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

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

LIVING MONUMENTS
FOR ALL OUR BOYS
By Millicent Easter

Marine

In memory of me, please don't erect
A dreary stone that would reflect—
No thought of joy or living things,
Or hope, for which the whole world sings.

I ask that you go plant a tree
To cast a shadow, cool, for me.
A tree to bless the weary earth,
Or any monument of vital worth!

Soldier

In haunting memory, on marble cold,
I want no story of my valor told.
Forlorn and desolate, they stand for years,
Despair they bring, and lonely tears.

Instead, I beg you plan a place—
A playground—where children race,
Where laughter rings, and children sing,
And mothers, there, their babies bring.

Sailor

I want a woodland—dark and deep—
Where ferns, like sea-weed shadows creep,
A little lake—a bathing beach—
A happy place—in easy reach.

For city children, denied the joy
That I once knew, as a bare-foot boy.
Or (of man-made ice) a skating rink—
Are among the worth-while things, I think.

Flyer

For all the boys—on sea or land—
For all the Flyers—who victory planned—
From the Spirit World—We unite our pleas—
For playgrounds—pools—and glorious trees!

No futile piles of stone to mar
The landscape view, both near and far!
Dead monuments are but idle toys—
Give living things for our noble boys!

(*Reprinted by courtesy of The Matrix*)

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JOURNAL

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SEEDS OF ANTIQUITY

STORIES of wheat that has sprouted after centuries of burial in the darkness of an ancient Egyptian tomb and of peas that have been grown in gardens recently from seeds that had been stored beside a mummy long before the Christian era are perennially appearing in print. In the past year particularly several accounts have been published of peas which had been taken directly from a container sealed within the tomb of Tut-ankh-amen 3,300 years ago, and which germinated and grew.

No one today is a greater authority of the length of time that seeds may be expected to live than William Crocker, Director of the Boyce Thompson Institute for Plant Research, Inc., in Yonkers. To answer the many questions that have been sent to the New York Botanical Garden lately regarding the veracity of these repeated tales, Dr. Crocker has generously consented to write the accompanying article on the life-span of seeds, presenting the facts as they have been revealed through his own research and that of others here and abroad.

It will be seen very shortly that wheat that has been stored ten years will germinate almost 100 per cent; but if 15 years are added to this period, the rate of germination is reduced to a negligible figure. A long way, this, from the hundreds, possibly thousands, of years of storage in Egyptian tombs!

Seeds of the same kind of lotus (*Nelumbium*) that was cultivated in the waters of the Nile have germinated after they have been in storage 250 years, and buried seeds of lotus from a lake bed in Manchuria, where they had lain for perhaps two to four hundred years, have also sprouted successfully.

Members of the Pea family, which, like the lotus, are apt to have hard, impervious seed-coats, also rank among the seeds of long life duration. Some of these have been found to be viable after about 150 years and might be viable even longer. But scientific tests remain to be made on seed 500, 1,000, and 3,000 years old.

Dr. Crocker's statements should put an end to future speculation on mummy wheat, at least, if not on the garden peas from Tut-ankh-amen's tomb; but, as others have also predicted, these tales will without doubt be perpetually revived.—C. H. W.

Longevity of Seeds[1]

By William Crocker

PROFESSOR EWART, in his booklet "On the Longevity of Seeds," 1908, says in part: " . . . such fables as the supposed germination of mummy wheat have long since been exploded." He was evidently too optimistic about the ease of disposing permanently of the mummy wheat fable, for it has been repeatedly revived and exploded since 1908 and will probably recurrently revive and be exploded in the future.

Seeds of farm and garden plants are not long-lived. It is rare except under very special storage conditions that any seeds of these crops will remain viable more than 25 years.

Seeds of Short Life Duration

Seeds of a number of species of plants remain alive for relatively short periods (days, weeks, or months) when exposed to drying or other detrimental factors of the atmosphere. Among such seeds are spring-fruiting maples of this region, Indian or wild rice, chestnuts, hickory nuts, walnuts and other nuts, acorns, poplar, willow, citrus, sugar cane, *Hevea,* elm, and others.

In the river maple (*Acer saccharinum*) and Indian rice (*Zizania aquatica*) the main and perhaps the sole injurious effect of the air is drying. In the former the seeds bear about 58 per cent water when they fall from the tree and are killed when the water falls to 30 to 34 per cent, regardless of speed and temperature of drying. In nature, the seeds fall with the radical pointing downward and many germinate immediately, thus avoiding drying. These seeds retained full vitality for 102 days when stored at 0° C. in a way to prevent drying and accumulation of carbon dioxide. This was the duration of the experiment so there is little doubt

[1] Practically all facts and conclusions in this paper are based on two papers (2, 3) written on this subject by the author: "Life-Span of Seeds" in the *Botanical Review* 4: 235-274, 1938, and a chapter, "Life Span of Seeds," in *Book of Boyce Thompson Institute,* to be published soon. Both of these papers are fully documented, consequently few additional citations are called for in this article. For these few citations, referred to by numbers in parenthesis, see the end of the article.

that they will retain their vitality much longer than this under these conditions.

Indian rice stored in air also seems to be killed by drying. In nature the seeds generally fall in water and remain in the cold water until spring, when they germinate. These seeds can be stored in water at or a little above the freezing point until spring. In this condition they after-ripen as well as retain their vitality and are ready to grow in the spring.

Willow seeds endure thorough drying if the drying occurs rapidly and at a low temperature as is the case when they are sealed with a desiccating agent and placed in an ice-chest. Poplar seeds retain their vitality for 22 months if sealed in a vacuum and stored at a low temperature. American elm seeds lose their vitality almost completely in 6 months in open air, but retain full vitality for more than 5 years when kept in sealed storage at 5° to -5° C. with a water content of 2 to 7 per cent.

The two articles on life span of seeds on which this paper is based describe experiments on several other short-lived seeds showing the atmospheric factors that kill the seeds and the conditions necessary for prolonging the lives of the seeds.

Seeds of Medium Life Duration

Seeds of most of our farm and vegetable garden plants still retain a low percentage of viability after a few to possibly as much as 25 years in some cases when stored in the manner of common practice. Vilmorin, the well known seed and horticultural firm of France, kept many records of the life span of seeds. According to these records, oats and barley had an average life of 3 years and timothy and flax 2 years, and the extreme limit of seeds were maize 4 years, lettuce 9 years, onion 7 years, crucifers (cabbage, turnips, rape, and radish) 10 years, and cucurbits (watermelon, muskmelon, pumpkin, etc.) and beets 10+ years. The climate of France is evidently unfavorable for retention of viability of seeds, for the records of the life span of the same kinds of seeds by other workers is much greater than the Vilmorin records.

Robertson and Lute (5) of Colorado determined the percentage germination of several varieties of wheat, barley, oats, Rosen rye, Wisconsin Black soybean, and one variety of corn after various years of storage in the Colorado climate. The following shows the percentage germination after the periods of storage mentioned: varieties of wheat 89.8 to 98.4 per cent; varieties of barley 68.1 to 100 per cent; and varieties of oats 81.8 to 91.9 per cent (all after 10 years of storage); rye 52 per cent after 9 years of storage; soybeans 48.1 per cent after 8 years; Black Amber sorghum 97.9 per cent after 6 years; and corn 79 per cent after 9 years. At the beginning all the seeds gave 100 per cent germination except corn, which gave 92 per cent.

Dillman and Toole found that flax stored in the dry climate of Mandan, N. D., gave 58 per cent germination after 18 years of storage, and Goff of Geneva, N. Y., found that rutabaga gave 50 per cent germination and muskmelon 56 per cent after 14 years of storage; cucumber 14 per cent after 19 years; beet 24 per cent after 15 years; and tomato 56 per cent after 16 years.

Sifton of Ottawa, Canada, got 2 per cent germination for 17-year-old wheat, 41 per cent for 19-year oats, 10 per cent for 12-year timothy; Karper and Jones (Texas) got 4 per cent for 18-year and 0.4 per cent for 19-year-old sorghum. Finally, Percival of England got 16 per cent germination in 25-year-old wheat that was especially dried and sealed in a bottle.

All of the workers show that the life span given by Vilmorin is too short for the same seeds stored in more favorable climates, but none of them indicate that the life span is likely to exceed greatly 25 years for ordinary storage. Sifton's (6) results are especially significant on the last point, for his curves show that once the vitality drops 10 to 20 per cent the fall is rapid thereafter. Oats may be a partial exception, for the vitality in oats had not dropped 20 per cent until after more than 15 years and still gave 40 per cent germination after 19 years. In Sifton's curves there is a tendency for the curves to flatten out somewhat again after the viability reaches a low value, indicating that there are a few seeds in each batch that are rather persistent. Still, the mummy wheat fable gets no support from these data.

Good Storage Conditions Increase Greatly the Life Span of Seeds

Table I shows how much improved but not optimum storage conditions lengthen the vitality of relatively short-lived delphinium seeds. These seeds were kept in a heated laboratory from harvest until December, when they were put into storage. Judging from our records of the water content of various kinds of seeds in the laboratory during each month of the year and from the fact that these seeds are fatty, they probably bore about 6 per cent water when put into storage.

The annual delphinium seeds stored open in the laboratory fell continuously in percentage germination with duration of storage and were all dead after 46 months. In these, of course, both the water content and the temperature fluctuated with the season.

Contrast with these the seeds sealed and stored at 8° and 5° C. These had not fallen in percentage germination after 143 months and still gave more than half of the original germination after 193 months, or more than 16 years of storage. These seeds were kept constant both as to moisture and temperature. They gave about the same percentage germination after 193 months of storage as those open in the laboratory gave after

TABLE I

Viability of Delphinium Seeds Stored under Various Conditions

Seed	*Storage conditions*	*Germination percentages after months of storage*								
		11	22	46	69	111	123	143	168	193
Annual, 72% germinated when stored	Open room temp.	57	44	0	0	—	—	—	—	—
	Sealed room temp.	75	80	50	15	0	0	—	—	—
	Open 8° C.*	50	41	31	5	0	0	—	—	—
	Sealed 8° C.*	70	67	66	80	76	71	71	48	43
Perennial, 43% germinated when stored	Open room temp.	11	0	0	—	—	—	—	—	—
	Sealed room temp.	35	21	0	0	—	—	—	—	—
	Open -15° C.**	44	45	37	27	8	6	8	3	—
	Sealed -15° C.**	42	53	57	44	49	50	45	45	33

* After 7 years the temperature was changed to 5° C.

** After 7 years the temperature was changed to -5° C.

22 months. Those sealed at room temperature and those stored open at 8° and 5° C. were intermediate in life span. The first had constant moisture with higher and fluctuating temperature and the latter constant temperature with changing moisture content.

For the perennial delphinium seeds, open and sealed storage at room temperature were both unfavorable with the former more so. Sealed storage at -15° and -5° C. was very favorable while open storage at sub-freezing temperatures was considerably less favorable. In the 193 months of storage sealed at the low temperature these seeds had lost only one-third of their original germination capacity.

Both the annual and perennial seeds were stored at the 8° and 5° C. and at the -15° and -5° C. combinations. The annuals retained their viability best at 8° and 5° C., and the perennials best at -15° and -5°. Probably with more thorough drying the lower temperature would also have been more favorable for the annuals since freezing does not generally injure seeds that are dried sufficiently. Judging from this table, sealed storage at low temperature in contrast to open storage at room temperature lengthened the life span of annual delphinium seeds about 9-fold and of perennial delphinium seeds more than 17-fold. If even such short-lived seeds as delphinium were stored under optimum conditions, it might take a lifetime to watch over their slow complete demise.

Extensive seed storage studies by investigators at this laboratory and by many investigators elsewhere show that for seeds that endure considerable artificial desiccation there are three factors that increase their longevity: low and constant moisture content, low temperatures, and absence of oxygen. Changing one of these factors modifies the effect of the other two; seeds with low constant moisture content are less injured by high or low temperatures or oxygen pressure than those with high moisture.

Different kinds of seeds vary greatly in the degree of desiccation they will endure without injury; we have seen above that certain seeds are killed by very moderate drying, certain pines are injured if dried much below 3 per cent moisture, while radish seeds are apparently not injured by complete withdrawal of the water. It would be of value to know the lowest water content to which one could dry each kind of commercial seed without injury, for that is probably the best water content for storage of any particular kind of seed. It would also be fine to know the optimum temperature for storing of each sort of seed when it was dried to the optimum moisture content for storage. It may be that absolute zero is the optimum temperature for storage of seeds that stand thorough desiccation. We do know that seeds that stand thorough desiccation keep well and probably best in total absence of oxygen. It is interesting to speculate how long the last seed of batches of oats, rutabaga, cucumber, beet, or tomato would stay alive if stored at the optimum constant water content and optimum temperature in absence of oxygen. No doubt the period would be long.

Seeds of Long Life Duration

There are several records of seeds that remained alive after being kept in seed cupboards or herbaria for a long time. The most interesting record of this sort is that of Becquerel because of the great life duration of some of the seeds he studied. He had access to a batch of old seeds in a storage room in the National Museum of Paris. The time of collection of these seeds varied from 1819 to 1853. He ran germination tests on these seeds in 1906 and again in 1934. For the 1934 test, Humbert and Metman furnished him about 20 seeds of *Cassia multijuga* which were collected in 1776. These seeds were all hard-coated, so they demanded special treatment. They were sterilized, the coats broken, and put to germinate in tubes

TABLE II

Becquerel's Record of Old Seeds

Macrobiotic species	*Date collected*	*Seeds growing in 1906*	*Seeds growing in 1934*	*Determined longevity*	*Probable longevity*
Mimosa glomerata Forsk.	1853	5 out of 10	5 out of 10	81 years	221 years
Melilotus lutea Gueld	1851	3 " " 10	0 " " 10	55 "	—
Astragalus massiliensis Lam.	1848	0 " " 10	1 " " 10	86 "	100 years
Cytisus austriacus Linn.	1843	1 " " 10	0 " " 10	63 "	—
Lavatera Pseudo-olbia Desf.	1842	2 " " 10	0 " " 10	64 "	—
Dioclea pauciflora Rusby	1841	1 " " 10	2 " " 10	93 "	121 years
Ervum Lens Linn.	1841	1 " " 10	0 " " 10	65 "	—
Trifolium arvense Linn.	1838	2 " " 10	0 " " 10	68 "	—
Leucaena leucocephala Linn.	1835	2 " " 10	3 " " 10	99 "	155 years
Stachys nepetifolia Desf.	1829	1 " " 10	0 " " 10	77 "	—
Cytisus biflorus L'Hérit.	1822	2 " " 10	0 " " 10	84 "	—
Cassia bicapsularis Linn.	1819	3 " " 10	4 " " 10	115 "	199 years
Cassia multijuga Rich.	1776	—	2 " " 2	158 "	—

under sterile conditions at 28° C. The seed stock was considered so precious that only ten of each sort were used for the test. Of *Cassia multijuga* only two seeds were used. Table II shows the results obtained for the 13 kinds, showing germination in either the 1906 or the 1934 test. In the last column Becquerel estimates the probable life span of several of the seeds, based on the data for the two tests.

All these seeds are Leguminosae, except those of *Lavatera* (Malvaceae) and *Stachys* (Labiatae). The seeds of *Cassia multijuga* germinated after 158 years of storage. This exceeds the former records of Robert Brown for *Nelumbium speciosum*[2] from the British Museum, which were 150 years; also the records of Ewart for *Goodia lotifolia* and *Hovea heterophylla,* which were 105 years. Becquerel believes the long life span in all these seeds is made possible by impermeability of the coats, which prevents any exchange of gases or water between the embryo and endosperm and the outside atmosphere, and by the high degree of desiccation, 2 to 5 per cent moisture, and absence of oxygen in which the embryos exist within the hard coats.

Later work shows that hard seeds of *Albizzia julibrissin* in the British Museum (4) were alive after 149 years and seeds of *Nelumbium* (Robert Brown's collection) after 250 years of storage.

It is interesting that the seeds that remained alive so long in seed cupboards and herbaria had hard coats which give to the living parts of the seeds two conditions which we have mentioned as good storage conditions for long life span, namely, low constant moisture and low oxygen pressure. Perhaps neither of these was at the optimum and of course these seeds did not have the advantage of low constant temperatures.

Life Span of Seeds in Soil

There is little doubt of Ohga's claim of great age of the *Nelumbo nucifera* seeds excavated from a naturally drained lake bed in Manchuria. The seeds were buried about 1.5 meters deep in a layer of gray mud covered in turn by a layer of peat and a layer of loess. The eroding river which drained the lake has now cut a channel through the lake bed about 13 meters deep. Since there were no *Nelumbo* plants growing in the region, and the seeds were buried so deep, Ohga concludes that the seeds were from plants growing in the lake before it was drained. Judging from the rate at which the river is eroding its bed, the age of the trees growing on the land since drainage of the lake, and the records of a family that has been farming the drained lake bed for several generations, Ohga concludes that the seeds have been buried for at least 120 years and more likely for 200 to 400 years. These seeds are hard-coated and those that were

[2] *Nelumbium speciosum* and *Nelumbo nucifera* are synonyms, and both are synonymous with *Nelumbium Nelumbo* Karst.

excavated had not absorbed water. They gave 100 per cent germination when the coats were broken so the seeds could swell.

Since these seeds did not swell naturally, the retention of vitality in the soil was not unlike that of hard seeds in herbaria and seed cupboards except for lower and more nearly constant temperature which was provided by deep burial. This condition would of course favor longevity. We noted above that *Nelumbo* seeds in the British Museum retained their viability for 250 years. On the other hand, the hard coats in moist soil are more subject to attack by bacteria and fungi. Indeed, Ohga noted that the epidermis and the outer portion of the palisade layer in these old seeds were eaten away. As soon as the corrosion reaches the "light line" of the palisade layer (this is the inner limit of impermeability) these seeds swell, germinate, and the seedlings perish due to the deep burial. It is likely that this had been occurring with many of the seeds through the centuries so that only those with more resistant coats were left in the seed bed.

Some seeds that absorb water remain in the soil intact and viable for many years. In 1879 Dr. Beal of East Lansing, Michigan, buried 20 sets of seeds as follows: 50 seeds each of 20 kinds of plants were mixed with sand and placed in pint bottles, and the 20 uncorked bottles were buried in sandy soil 20 inches deep with the mouths tilted downward to avoid

TABLE III

Beal's Buried Seeds -Results of All Germination Tests to Date

Plus Sign Indicates Germination

Name of species tested	*5th* yr. 1884	*10th* yr. 1889	*15th* yr. 1894	*20th* yr. 1899	*25th* yr. 1904	*30th* yr. 1909	*35th* yr. 1914	*40th* yr. 1920	*50th* yr. 1930	*60th* yr. 1940
Amaranthus retroflexus	+	+	+	+	+	+	0	+	0	0
Ambrosia elatior	0	0	0	0	0	0	0	+	0	0
Brassica nigra	0	+	+	+	+	+	+	+	+	0
Bromus secalinus	0	0	0	0	0	0	0	0	0	0
Bursa Bursa-pastoris	+	0	+	+	+	+	+	0	0	0
Erechtites hieracifolia	0	0	0	0	0	0	0	0	0	0
Chamaesyce maculata	0	0	0	0	0	0	0	0	0	0
Lepidium virginicum	+	+	+	+	+	+	+	+	0	0
Agrostemma Githago	0	0	0	0	0	0	0	0	0	0
Anthemis Cotula	+	+	+	0	+	0	?	0	0	0
Malva rotundifolia	+	0	0	+	0	0	0	0	0	0
Oenothera biennis	+	+	+	+	+	+	0	+	+	+
Plantago maior	0	0	+	0	0	0	0	+	0	0
Polygonum Hydropiper	0	+	+	+	+	?	0	0	+	0
Portulaca oleracea	0	+	+	+	+	0	0	+	0	0
Rumex crispus	+	?	+	+	+	+	+	+	+	+
Chaetochloa lutescens	+	+	+	0	+	+	0	0	0	0
Alsine media	+	+	+	+	+	+	0	0	0	0
Trifolium repens	0	0	0	0	0	0	0	0	0	0
Verbascum Thapsus	+	?	+	+	0	0	+	0	0	0
Verbascum Blattaria									+	+

TABLE IV

Seeds Alive After 60 Years' Burial

Name of plant	Number of individuals 1930	1940	Percentage of germination 1930	1940
Rumex crispus	26	2	52	4
Oenothera biennis	19	12	38	24
Verbascum Blattaria	31	34	62	68

Percentage of all seeds buried still germinating: 4.8%.

filling with water. It was originally planned to take up a bottle every 5 years for vitality tests so that the experiment would extend over a period of 100 years. So many seeds were still alive at the 40-year period that it was decided to test the other 12 samples at 10-year periods, thus extending the experiment over a total period of 160 years. Table III shows the seeds some of which were alive at each period of test, and Table IV lists the three kinds of seeds that had lived 60 years in the soil, along with the percentage still intact and alive.

In 1902 the U. S. D. A. buried many replicates of seeds of 107 different kinds of plants, wild and cultivated. The seeds were planted in soil in flower pots and triplicate pots buried at three different depths in the soil. The last report published was for the 20-year period and for that period the results confirm the findings of Beal for weed seeds. Seeds of many of the cultivated plants, such as cereals and vegetable garden plants, were dead before 20 years of burial with most of them dying within 1 year, probably due to lack of dormancy and prompt germination. A percentage of seeds of certain cultivated plants—timothy, Kentucky blue grass, clovers, beet, tobacco, celery, and black locust—were alive after 20 years' burial. Depth of burial had little effect on longevity.

Seeds with Greater Longevity in Soil than in Air Storage

As we have seen above, seeds of most cultivated plants remain intact and alive much longer in dry storage than in moist soil. According to the records, this is true of seeds of some wild plants. On the other hand, it has been shown for seeds of a number of wild plants that they live much longer in soil outside than they do in dry storage inside. Table V shows this relation for 13 different kinds of seeds. Recorded life span of these seeds in seed cupboards is compared with the recorded life span in the buried seed experiments of Beal and the U. S. Department of Agriculture.

Very recent work by Kjaer confirms this conclusion. In 5-year tests he found that the seeds of the following retained their vitality in soil better than in dry storage: *Polygonum tomentosum,* 20 vs. 0 per cent; *Thlaspi arvense,* 87 vs. 1 per cent; *Vicia hirsuta,* 50 vs. 5 per cent; *Daucus carota,*

TABLE V

Comparative Life Span of Certain Seeds in Dry Storage and in Soil

Species of seeds	*Life span in dry storage according to Ewart*	*Life span in soil and per cent germination according to Beal and U.S.D.A.*
Amaranthus graecizans	7 spp., less than 15 yrs.	Beal, 40 yrs., 66%
Apium graveolens	Less than 10 yrs.	U.S.D.A., 20 yrs., 10.5%
Chenopodium album	Less than 20 yrs.	U.S.D.A., 20 yrs., 65.5%
Datura Stramonium	Less than 15 yrs.	U.S.D.A., 20 yrs., 78%
Nicotiana tabacum	6 spp., less than 10 yrs.	U.S.D.A., 20 yrs., 56%
Oenothera biennis	Less than 15 yrs.	Beal, 50 yrs., 38%; U.S.D.A., 20 yrs., 87.5%
Plantago major	Less than 10 yrs.	Beal, 40 yrs., 10%; U.S.D.A., 20 yrs., 83.5%
Poa pratensis	5 spp., less than 12 yrs.	U.S.D.A., 20 yrs., 18.5%
Polygonum Hydropiper / *Polygonum persicaria*	15 spp., less than 15 yrs.	Beal, 50 yrs., 4% / U.S.D.A., 20 yrs., 55%
Portulaca oleracea	Less than 15 yrs.	Beal, 40 yrs., 2%; U.S.D.A., 20 yrs. 38%
Verbascum Blattaria	Less than 15 yrs.	Beal, 50 yrs., 62%
Verbascum Thapsus	Less than 15 yrs.	U.S.D.A., 20 yrs., 92.5%

43 vs. 10 per cent; *Plantago major*, 30 vs. 0 per cent; *Cirsium arvense*, 55 vs. 0 per cent. He reports Dorph-Petersen's results with seeds of *Sinapis arvensis* buried 10 years 87 per cent germination, dry stored 21 per cent; buried 18 years 17 per cent, dry stored 0 per cent. Avery and Blakeslee (1) state that *Datura* seeds stored in the laboratory are all dead after 9 or 10 years but *Datura* seeds buried in the soil outside (U. S. D. A. buried seeds) still show 97.5 per cent germination after 39 years.

The fact that seeds of some wild plants remain in the soil for long periods in a dormant viable condition means that the soil is always well stocked with seeds which are capable of germination when the soil is disturbed. This assures the persistence of the species. It also makes the task of the farmer and gardener in fighting weeds difficult, for when the soil is once well stocked with seeds it takes years of cultivation for the complete germination and final destruction of the weeds. While the old imbibed seeds in the soil are of necessity dormant, or they would have germinated, the dormancy in the main is due to a rather delicate equilibrium that is overcome by exposure to light, by fluctuating temperatures of the top soil, or even by mechanical disturbance or better oxygen supply. Disturbing dormant weed seeds in soil starts them to germinate. Many of the seeds just mentioned as living longer in soil than in dry storage absorb water. Imbibed seeds of course respire so there is danger of exhaustion of stored foods. Barton, for seeds, and Denny, for gladiolus corms, have shown that in the soil these dormant organs curtail respiration greatly. This reduces the rate of exhaustion of stored foods and thus may enable them to live much longer.

Why Do Seeds in Storage Finally Die?

We have seen that some seeds in air storage are killed by moderate desiccation. It is probable that many seeds in the soil that swell up and remain dormant die because the stored foods are used up in respiration. Several explanations have been offered for the final death of seeds in dry storage. Among these are exhaustion of stored foods or enzymes. These explanations are doubtful for foods are little exhausted in dry storage though they may be denatured to a degree and dry seeds are poor in enzymes—the enzymes are largely formed by the embryo or living tissue after germination starts. A number of other explanations have been offered. The one that seems most likely is that the delicate mitotic mechanism of the embryo cells degenerates so that normal cell division and growth can no longer occur. Avery and Blakeslee (1) noted that *Datura* seeds degenerate much faster in dry storage than in the soil. They also show a much higher mutation rate in dry storage. The changes in the nuclei that lead to mutations may be the changes that lead to death if they go far enough. If space permitted, other evidence could be furnished for this explanation of age-degeneration of seeds.

Summary

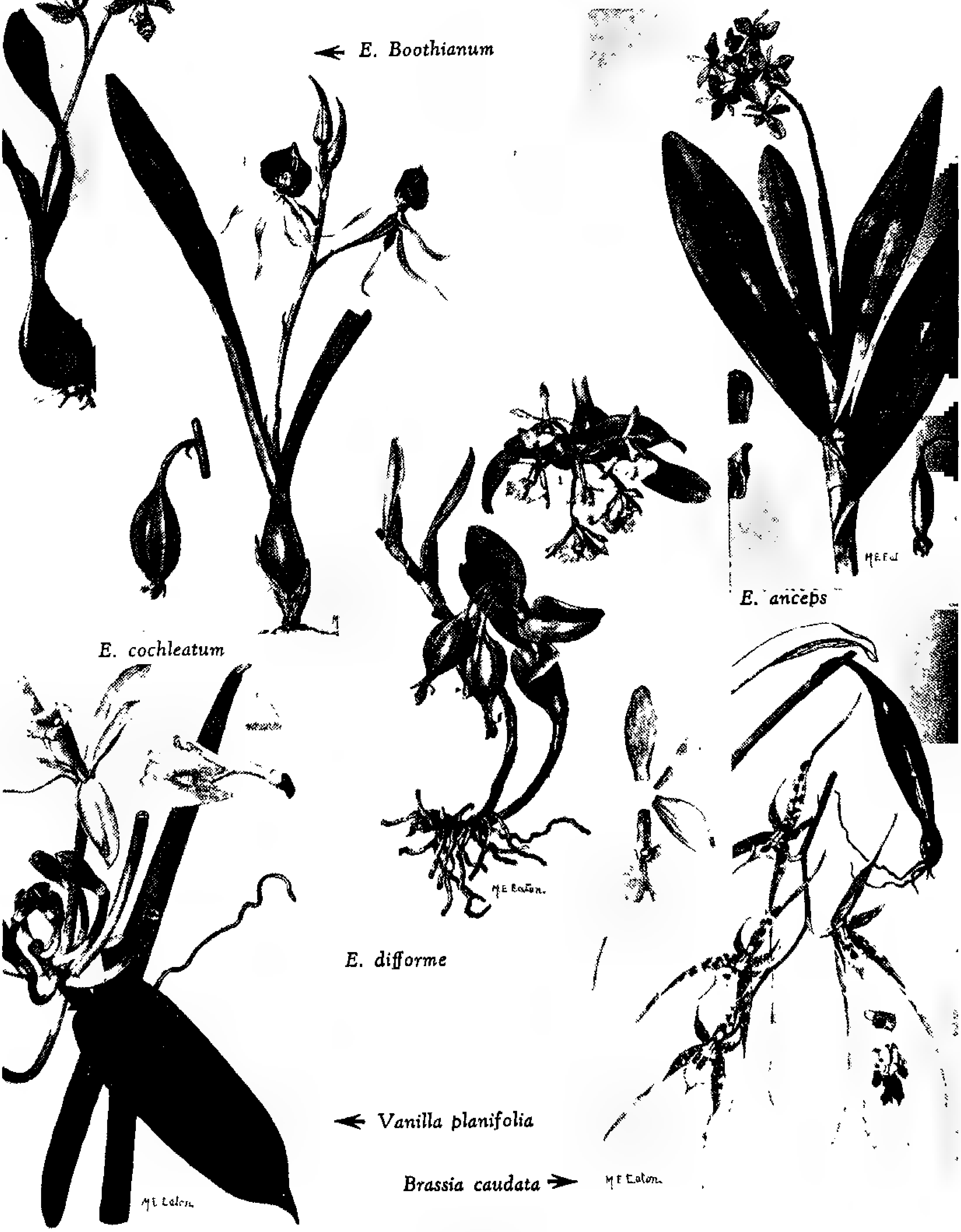
We have seen that some seeds live for only a few hours or days when exposed to the air, while others live for much more than a century under the same conditions. Cereals and seed of many other farm and garden plants do not live beyond 25 years in ordinary air storage. This disposes of the mummy wheat fable. The life span of seeds of medium life duration can be greatly lengthened by proper storage conditions. For longest life, seeds that will withstand drying should be dried to as low a water content as possible without injury and kept in sealed storage at a low temperature in absence of oxygen. Hard-coated seeds which do not permit an exchange of air or water with the atmosphere and bear little water have been known to live well over a century in seed closets—*Nelumbium* 250 years in a herbarium. Hard-coated seeds live in the soil for long periods or until the coats become pervious to water. Some weed seeds that swell readily remain in the soil dormant and viable for more than 60 years. A number of weed seeds live much longer in the moist soil in nature than they do in dry storage. It has been suggested that age-degeneration of dry seeds is due to gradual degeneration of the nuclear mechanism which leads to mutation in the earlier stages and later to death of the seeds.

For references to the literature cited in this article, see page 48.

ORCHIDS OF FLORIDA

* * *

SOME OF THE EPIDENDRUMS AND OTHER EPIPHYTES



All illustrations used in this and the accompanying plate have en taken from paintings made for Addisonia, where four ve already appeared as Plates 234, 273, 437 and 607.

E. nocturnum

Oncidium guttatum

Oncidium floridanum

← *E. tampense*

The Epiphytic Orchids of Florida

By Alex D. Hawkes

IN the Florida peninsula, more than a third of the native orchids live in the trees. They do not exist on trees as parasites, as many people think, but rather they *perch* there like strange and colorful birds and live as epiphytes, or plants upon plants. Instead of drawing their sustenance from the ground, as do the terrestrial or earth-dwelling orchids, these epiphytes simply sit on the trees and secure most of their nourishment from the air and rain. Their thick, white, spongy roots fasten the plants securely to the tree and absorb minerals from the water which pours on them from above and from the debris which usually lodges near their bases.

Epiphytic orchids have highly specialized organs and are able to exist for long periods under the most adverse conditions. Besides developing fleshy roots adapted to procuring water for the plant, orchids usually have thick leathery leaves capable of storing large amounts of liquid, thus enabling them to survive during prolonged dry seasons. Many of the epiphytic species, in addition, have specially thickened stems, called pseudobulbs, which also store water for the plant.

Some of the tropical species grow attached to hard rocks, fully exposed to the blazing sun and torrential rains, and thus furnish an excellent example of the fact that these plants are epiphytes, not parasites. If these orchids were parasitic and therefore required the absorption of food from a living host, those which live on stones would certainly have long since died.

Most of the orchids in tropical countries grow either in trees or on rocks as epiphytes. Florida, however, the most tropical state in the union, has only a scant 29 species of its orchid flora living in this way. The remaining 65% of the 84 native species are either terrestrials or saprophytes. Occasionally, a stray plant of the epiphytic group finds its way to a congenial spot on the ground and continues to thrive there, and some of the terrestrials get up into the trees, but these will be mentioned later in this paper.

Most of the 14 genera of epiphytic orchids found in Florida are represented only by a single species, but *Epidendrum*, *Oncidium*, and *Vanilla* all have several different plants indigenous to the area. The first genus has a total of 10 native species, and is therefore the third largest group of Florida orchids, the first being the terrestrial genus *Spiranthes*, with 15 native species and varieties, and the second another ground-dwelling group, *Habenaria*, which has 12 Floridan representatives.

The two most widely distributed species of *Epidendrum* in the state are the Florida butterfly orchid, *E. tampense*, and *E. conopseum*, which has no widely used common name. On the mainland the butterfly orchid is restricted to this one state, but it occurs in more robust phases off the coast in the Bahamas and Cuba. *Epidendrum conopseum*, which is more northern in its distribution, is the only epiphytic orchid found outside of Florida in the entire country. Very common in the central and much of the northern part of the state, it has also been found in Alabama, Georgia, Louisiana, North Carolina, and South Carolina.

While looking for orchids in the jungles of central Florida, I have found specimens of this plant as much as five feet long and four feet wide, almost covering the trunks of huge old oak trees. When these plants are in flower, there are absolutely thousands of blossoms, and they perfume the jungle for some distance with their distinctive honey odor. Quite frequently these large plants are impossible to collect, because of the hordes of large ferocious ants which build their nests under the roots and rhizomes of the orchid. The insects protect the orchid from marauders and in turn receive shelter from the rain and sun.

Since epiphytic orchids in general are lovers of the tropics, the majority of those that dwell naturally in Florida are to be found in the southern, warmer portion of the peninsula. In addition to the previously noted pair, the following species of *Epidendrum* are to be seen in the lower part of the state: *E. anceps, E. Boothianum, E. cochleatum* var. *triandrum* (which is found only in southern Florida and no place else in the world), *E. difforme, E. nocturnum, E. pygmaeum, E. rigidum,* and *E. strobiliferum.*

These plants usually grow on large trees in rather shady woods, where they frequently form huge clusters, several species often being found intermingled. Many of them have beautiful and interesting flowers, and several, such as *E. tampense, E. difforme,* and *E. nocturnum,* emit a delightful perfume, especially at night.

Very few people realize that the vanilla extract of the kitchen shelf is the product of an orchid, *Vanilla planifolia,* made by crushing the seed capsules after they have been cured. Florida is fortunate enough to have this interesting vanilla-producing species growing wild in the extreme southern tip of the peninsula, though it is very rare there. The plant forms a rather long fleshy vine which clambers over low shrubs and up trees in the swamps and jungles.

In addition to the widely known commercial one, three other species of this genus are known from southern Florida. *Vanilla Eggersii, V. phaeantha,* and *V. articulata* have also been reported, but, except for *V. Eggersii,* they are all extremely rare. The rather large and very beautiful flowers of *V. Eggersii* last less than a single day.

The genus *Oncidium* is also represented by four species in the Florida orchid flora: *O. carthaginense, O. floridanum, O. guttatum,* and *O. variegatum.* The second species is one of the few members of the Orchid family which is found only in Florida and not any place else. It is a fairly showy plant, usually found growing in rich moist earth or on rotting logs, but sometimes on trees, expanding its medium-sized yellow and brown flowers on tall, arching spikes. *Oncidium carthaginense* and *O. guttatum* are both commonly known as "mule ears," because of the large, erect, leathery leaves. Both species bear very long, usually arching spikes of rather small brownish or purplish flowers which are so numerous as to make these two among the showiest of our native epiphytic orchids.

For the average person it is frequently extremely difficult to believe that a certain insignificant weedy-looking plant is a member of the famed and exotic Orchid family. The two native species of the genus *Campylocentrum* are particularly good examples of this class. These tiny orchids to the uninitiated certainly do not even resemble anything in the vegetable kingdom known to the ordinary flower grower, but would seem to make better bait for fish than plants worthy of cultivation.

Both species consist of a tangled mass of fleshy greenish-grey roots sprawling over small twigs and branches of relatively smooth-barked trees. In *C. porrectum* there springs from the approximate center of this pile of Medusa-like roots a tiny irregular spike bearing two or three minute greenish flowers which even when in full bloom seem to be mere buds. If one looks at one of these wee blossoms under a lens, however, the "bud" resolves itself into a perfect little orchid of very interesting structure.

The other Florida species in this fascinating and unusual genus is *Campylocentrum pachyrrhizum*. When measured side by side, the name is sometimes almost as long as the plant itself. The inflorescence is shorter than that of *C. porrectum*, although the plant itself is considerably larger, and bears a zigzag bunch of tiny, somewhat bell-shaped, green flowers.

The remaining nine indigenous genera all consist of a solitary species in Florida, but all of them have several or many more species found outside of this area. Of these nine plants, one of the most interesting is the totally leafless *Polyrrhiza Lindenii*, a species which greatly resembles a large *Campylocentrum* in vegetative habit. In addition to being a leafless species, it bears the distinction of having the largest flowers of all the native orchids, including both epiphytes and terrestrials. These blossoms, which are green and white and very fragrant, are borne singly on long, jointed spikes which arise from the center of the cluster of roots. In large specimens the flowers measure up to nine inches long and about four inches across. They are of very peculiar structure and on first glance seem to belong to the animal rather than the vegetable kingdom.

One of the commonest of all epiphytic orchids in many parts of southern Florida is *Polystachya luteola*, a medium-sized plant with branching spikes of very small, fragrant, yellowish-green flowers. This species is of particular interest to botanists because it has probably the largest distribution of any orchid. The plant ranges from southern Florida over most of

FOUR OF FLORIDA'S TREE-DWELLING ORCHIDS

Ionopsis utricularioides

Bletia tuberosa (*B. purpurea*)

Polystachya luteola (*P. minuta*)

Macradenia lutescens

tropical America, and is also found in several localities in the eastern tropics, notably the Mascarene Islands, Ceylon, and the Philippines.

Of all the native epiphytic orchid plants, *Cyrtopodium punctatum* attains the largest size. The pseudobulbs are massive and sometimes attain a length of three feet and a thickness of four inches. These huge bulbs earn for the plant two of its vernacular names of "cigar orchid" and "cow's-horn orchid," but the name of "big fish orchid" comes from the sharp points which remain attached to the bulbs when the leaves fall, and "bee-swarm orchid" refers to the inflorescence. The yellow flowers, spotted with red-brown, are rather large and are borne profusely on long branched scapes which reach a height of about three feet. This species usually grows in cypress swamps, which are often called "hammocks" here in Florida, where it frequently forms huge masses, generally growing near the tops of the trees.

The Orchid family is divided into a great many groups which include genera and, in turn, species of fairly close relationship. Of these sections, one of the largest and most complex is the strictly neotropical sub-tribe *Pleurothallidinae*. In our Florida orchid flora two species of this group, representing two different genera, are very rarely found in the extreme southern part of the peninsula. *Pleurothallis gelida,* the commoner of the two, is a rather large plant bearing long arching racemes of tiny bell-shaped yellowish flowers. The racemes arise from the base of a single large fleshy paddle-shaped leaf at the top of a slender stem.

The other native species of this group, *Lepanthopsis melanantha,* is an exceedingly rare and very small plant with tiny red-purple flowers. It has been found mostly in the Big Cypress Swamp, where so many of our rare and little-known orchids live.

Sometimes on trees or vines in southern Florida, one will find an unusual fleshy-leaved orchid with its myriads of slender white roots tightly wrapped around the branch to which it clings. Perhaps this plant will be in flower; a rather tall spike waves in the breeze, at the top of which are arranged a large number of somewhat triangular-shaped, white blossoms, that are frequently marked with light or dark purple on the lip. This is *Ionopsis utricularioides,* one of the most beautiful of all our native epiphytes, but now unfortunately a rather rare plant. This is another species with a large distribution, but since it is confined to this hemisphere, it does not approach *Polystachya luteola* in the immensity of its range.

Deep in the heart of the Everglades there are localities in which this beautiful epiphyte covers huge grapevine lianas from top to bottom and carpets the adjoining trees with great masses of plants. It must be a beautiful sight to see an area like this during the blooming season, with thousands of the white flowers scattered through the dense jungle growth.

Although not even in the same sub-tribe with it, the genus *Macradenia* is fairly closely related to *Ionopsis.* Our native species, *M. lutescens,* is a medium-sized plant with a generally pendent raceme of yellowish flowers spotted on the inside with dull brown or purple. It seems to be excessively rare, but has been found in the Big Cypress Swamp and other localities in the extreme southern part of the state.

One of the most spectacular and beautiful of our native epiphytic orchids is the very variable spider orchid, *Brassia caudata*. In the phase which is found in southern Florida, where it is very rare, the plant is large, with big flattened pseudobulbs and long spikes of spidery yellow flowers that are spotted with brown and that have a foetid odor. The blossoms last several weeks in perfection.

Even with our native orchids, we occasionally find a species that is very difficult to grow under artificial conditions. Such a plant is the rare *Maxillaria crassifolia;* it is usually found in the Big Cypress Swamp, where it frequently grows as a terrestrial plant. Under cultivation it usually grows much better if treated in this way instead of as an epiphyte.

At first glance this species certainly does not resemble an orchid, but looks much more like a small iris, if out of flower. The plant consists of irregular fans of fleshy leaves without any visible pseudobulbs. The blossoms appear singly on short stems near the base of the plant, are yellow in color, and do not open completely. It is not a particularly beautiful plant, but the flowers are very interesting if studied closely.

Several of the so-called "terrestrial" species occasionally exceed their territory and get up into the trees, thus becoming epiphytic or semi-epiphytic in habit. Usually these plants are found in cavities or crevices that have filled with humus or other debris which gives them all the nourishment they need. Chief among the species of this class, intermediate between the terrestrials and the epiphytes, are *Liparis elata* and *Bletia tuberosa*. Many more of the normally ground-dwelling species, however, have been found growing in this manner.

And now we have finished with the epiphytic orchids of Florida—or should I say "finished"? For these interesting air-plants may be studied for years and years without learning everything about them. Orchids are perhaps the most famed and yet most misunderstood of all plants, and if one delves into their history a little, a fascinating subject is revealed. We have the material for this study in our own country, growing wild in the southernmost state of Florida, where strange and beautiful orchids flourish in the tropical jungles and hammocks, for all to see and admire. These are orchids at their best—wild ones at home.

Unfortunately many of the more showy species of our native orchids are rapidly being brought perilously close to the point of extinction, and since orchids take so very long to reproduce themselves from seed, a great deal of temperance in orchid collecting must be observed. Otherwise our Florida epiphytic orchids will go the way of so many of the beautiful wild plants of this nation.

Current Literature At a Glance*

New Cactus Genus. In the December number of the *Cactus and Succulent Journal,* E. J. Alexander describes a new genus in the Cactaceae, from a plant collected in 1939 by Thomas MacDougall, with whom he is now exploring in Mexico. *Lobeira* is the new genus and *MacDougallii* the specific name accorded to the novelty, which somewhat resembled an epiphyllum until it bloomed with large silky flowers of mallow-purple. Mr. Alexander named the genus for Señora Lobeira (pronounced lo-*ray*-rah) who was growing the plant in her garden from material brought to her by a native from nearby Cerro Hueitepec.

Araliads and Umbellifers. The latest issue of *North American Flora,* Part 1 of Vol. 28B, contains the Araliaceae by Albert C. Smith and part of the treatment of the Umbelliferae by Mildred E. Mathias and Lincoln Constance.

Brittonia. The two numbers of *Brittonia* which appeared in September (Nos. 1 and 2 of Vol. 5) contain studies in and of the genera *Schinus, Lotus, Cornus, Erigeron, Carex, Scirpus, Strychnos, Sedum, Phlox,* and others, in addition to miscellaneous papers by E. D. Merrill, Charles L. Gilly, Rogers McVaugh, Otto Degener, John D. Dwyer, and Arthur Cronquist.

Western Nature Studies. Margaret McKenny is the author of a loose-leaf book of Washington Nature Notes published by the Washington Book Society in Olympia, where she has been engaged in presenting nature study radio programs for children. Trees, flowers, mushrooms, birds, and animals are treated and all are illustrated, many of them with her own photographs.

Notebooks and Checklists. Published a generation and more ago, the numerous notebooks and checklists of plants and animals issued by the Slingerland-Comstock Co. in Ithaca, N. Y., are still being made available to nature-study groups and individuals. Included in these pocket-size booklets are simple guides to mosses, trees, wild flowers, and ferns. There is also a plant notebook, containing questions with spaces for their answers and some drawings to be filled in, and a pocket-size folio of outline drawings of 98 wild flowers on watercolor paper.

Day-Length for Beans. Whether the days are long or short may affect the form of the plant or the flowering and fruiting of beans and other legumes, according to studies by H. A. Allard and W. J. Zaumeyer, published as Technical Bulletin No. 867 of the U. S. Department of Agriculture. While the majority of beans grown in the vegetable garden are day-neutral, these investigators found, the semi-pole varieties would become bushy on short photoperiods and twining on the longer ones. Plants belonging to other leguminous genera exhibited different reactions, and species of *Phaseolus* native to the equatorial zone refused to flower under the longer midsummer days at Washington, D. C.

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

Notes, News, and Comment

Surinam Visitors. Lieutenant Lisa Stahel, who is the wife of Dr. Gerold Stahel, Director of the Agricultural Experiment Station in Paramaribo, Surinam, and the author of several articles that have appeared in this Journal, brought some of her group of 20 Surinam girls to the New York Botanical Garden Dec. 29, to see the conservatory displays and to view some of the kodachrome pictures taken by Dr. Bassett Maguire in Surinam last year. Mrs. Stahel, who is commanding officer in Paramaribo for the Netherlands West Indian Woman's Army Auxiliary Corps, was in New York for about two weeks on her way to the Far East. The score of young women accompanying her had all volunteered for service with the Netherlands Army Medical Corps in Asia.

Annual Meeting. New Corporation members elected at the annual meeting of the New York Botanical Garden Jan. 16 in the office of President Joseph R. Swan are William H. Bell, President of the American Cyanamid Company; Mrs. Melvin Sawin, who became a member of the Garden's Advisory Council last year;

Manfred Wahl, retired industrialist of Philadelphia and a sustaining member of the Garden; and Alain C. White of Litchfield, Conn., also a sustaining member and the author of several notable books on succulent plants.

All officers were re-elected, and the seven board members whose terms were expiring were re-elected for another three-year period. They are Arthur M. Anderson, Pierre Jay, Clarence McK. Lewis, E. D. Merrill, Henry de la Montagne, Francis E. Powell, Jr., and William J. Robbins.

New committee appointments made were William Felton Barrett on the City Relations committee with Henry de Forest Baldwin and Mrs. Harold I. Pratt, and Francis E. Powell, Jr., on the Finance committee with Pierre Jay and H. Hobart Porter.

Mrs. Robert H. Fife read the annual report of the Advisory Council.

Among the out-of-town members of the Board and Corporation who came to New York for the meeting were E. C. Auchter, Research Administrator, U.S.D.A. Agricultural Research Administration, of Washington, D. C., and E. D. Merrill, Administrator of Botanical Collections, Harvard University. H. R. Kunhardt, Jr., of Caracas, Venezuela, also attended the meeting.

Dr. Robbins interrupted the reading of his annual report with a demonstration of the significance of herbarium specimens, showing examples of several "lost" plants that have lately been rediscovered and giving the history of several specimens taken from the herbarium, some of them gathered in the early part of the 19th century. The report in full will be published in the spring as a supplement to the Journal.

Robert T. Morris. Hailed as "one of America's first great modern surgeons," Dr. Robert T. Morris died at Stamford, Conn., Jan. 9 at the age of 87. He had been a member of the Corporation of the New York Botanical Garden for 20 years, and from his home, Merribrook Farm, in Stamford, he had written many letters of comment and query to the Garden.

Dr. Morris was the author of noteworthy scientific and popular books chiefly dealing with medicine, one of the last of which was "Fifty Years a Surgeon," published in 1934. Nut-growing was one of his occupations on his 430-acre farm, which was also a wild-life sanctuary and arboretum, and he wrote a book on this subject in 1921.

He is credited with bringing many modern ideas into the practice of surgery, championing antiseptic methods and initiating techniques which greatly reduced the death rate in operations.

One of the four books he published in 1918 was "Microbes and Men" in which he attempted to "diagnose" famous writers from their works.

Conference. Dr. H. A. Gleason spoke on "A Collection of Melastomes from Colombia" at the monthly conference of the staff and registered students of the Garden Jan. 18, and Dr. A. B. Stout on "Intra-specific Incompatibilities in Relation to Populations" the same day. The melastome collection consists of some 300 specimens sent from Colombia by José Quatrecasas.

Lectures. Two Garden Club Affiliates hearing talks by members of the Botanical Garden's staff last month were the Little Gardens Club of Greenwich Village, where Elizabeth C. Hall spoke on "The Literature of Gardening" Jan. 8 and the Garden Club of Mamaroneck, N. Y., where Dr. H. W. Rickett spoke Jan. 29 on "Gardens of Cloister and Castle."

Orchids. H. R. Kunhardt, Jr., who is a member of the Corporation, returned last month from Venezuela bringing the Garden a collection of 50 or more orchid plants which he had gathered in the wild.

Visitors. Dr. Harold St. John, Professor of Botany in the University of Hawaii, who is returning from two years of cinchona exploration in Colombia, was at the Garden Jan. 22. Dr. Sterling Hendricks of the Division of Soils and Fertilizers, Division of Fruit and Vegetable Diseases, of the U. S. Department of Agriculture, came to the Garden Dec. 28 to consult with Dr. William J. Robbins on hormones and growth substances. Among other visitors of recent weeks have been C. K. Tseng of the Scripps Institution of Oceanography, La Jolla, Calif.; C. L. Huskins of McGill University, Montreal; Jack Ziffer, head of the department of zymomycology for Schenley Research Institute, Lawrenceburg, Ind.; S. H. Hutner of Haskins Laboratories; Cecil Yampolsky of New

York City; and Harvey Bassler of the American Museum of Natural History.

Dean. Prof. E. W. Sinnott, who was a member of the Board of Managers of the New York Botanical Garden for seven years, until he left Columbia University in 1940 to go to Yale as Sterling Professor of Botany and Director of the Osborn Botanical Laboratories, has been appointed Dean of the Sheffield Scientific School at Yale, to succeed Prof. C. H. Warren upon his retirement at the end of the current academic year. Dr. Sinnott was the author, with Robert Bloch, of an article entitled "Luffa Sponges, A New Crop for the Americas," which appeared in this Journal in June 1943.

Thomas Little. Superintendent of the estate of Col. Robert H. Montgomery at Cos Cob, Conn., Thomas Little died Jan. 19. For the past five years he had been an instructor in several of the courses in practical gardening given by the New York Botanical Garden, beginning with the Three-Day Short Course offered in the spring of 1941. Two years later he also was one of the six instructors on the roster for the new Three-Day Short Course in Vegetable Gardening. He was likewise one of the lecturers in the six-weeks' course in vegetable gardening presented by R. H. Macy & Co. under the supervision of the New York Botanical Garden in 1943, and in the afternoon and evening series of gardening lectures organized early in 1941 by the New York Times in co-operation with the New York Botanical Garden. In April 1944 Mr. Little gave one of the Garden's Saturday afternoon lectures, speaking on "Late Spring Work in the Vegetable Garden."

On the Montgomery estate, where he had been superintendent for about 15 years, Mr. Little had worked extensively in building up the collection of evergreens, for which the property was famous. He also won acclaim for his successful culture of many other kinds of plants, both outdoors and in the greenhouse.

Trophy. George H. Gillies, Head Gardener for the Marshall Field estate and an instructor at the Botanical Garden, was awarded the silver trophy for 1944 by the Horticultural Society of New York. He had competed in all shows and monthly meetings during the year.

Anti-biotics. Jeane Onslow of the Institute of Pathology of Western Pennsylvania Hospital in Pittsburgh has come to the Botanical Garden to work for a month or two in the laboratory of Dr. William J. Robbins, to become acquainted with methods used in studying antibiotic substances produced by molds.

H. H. Whetzel. For 43 years a member of the Department of Botany at Cornell University, Prof. H. H. Whetzel died after a long illness Nov. 30 at the age of 67. He was head of the department there from 1906 to 1922. A plant pathologist, he worked particularly on *Botrytis* and on *Sclerotinia* and its related genera, studying their taxonomy as well as the diseases they caused. Until the last few years he had been a frequent visitor to the New York Botanical Garden. In October 1942 he contributed an article to the Journal on his leading hobby of growing wild flowers from seed. He also contributed many papers to *Mycologia* and had worked on *Sclerotinia* for *North American Flora*, but this work was never finished. He was one of the founders of the Mycological Society of America.

William T. Davis. An entomologist who had been a lifelong friend of Drs. N. L. Britton and Arthur Hollick, particularly in the early days when they were making some of their first botanical collections, died in the Staten Island Hospital Jan. 22 at the age of 87. He was William Thompson Davis. Though his primary interest was the cicadas of North America, he did considerable work on the local flora, and in years gone by was well known around the New York Botanical Garden. He published about 25 papers on native plants.

Scirpus tatora. According to a letter received from Alan A. Beetle too late for making corrections in the January Journal, all species of *Scirpus* illustrated in his article, "Sedge Boats in the Andes," are *S. tatora*, the narrowly endemic sedge of the shores of Lake Titicaca. *S. californicus*, Dr. Beetle says, is a more common, low-elevation relative.

Lecturer. Rupert C. Barneby is giving the Saturday afternoon lecture Feb. 17 on "Plant Life of the Mediterranean Region." Mr. Barneby, who is a graduate

RED CROSS EXHIBIT IN CONSERVATORIES

TO aid the Red Cross in its spring campaign, the New York Botanical Garden is staging in the conservatories in March a huge red cross of a newly patented blood-red azalea which has been named for Lambertus C. Bobbink. The background of the cross will be made of plants of a hardy white azalea named "Snow."

There will also be a typical field dressing station of the Red Cross, designed after the stations that are being set up in the Philippines and other islands of the Far East, directly back of the battle lines. Plants that are native to these islands will be used for the surroundings of the station, and Red Cross nurses, with their customary field equipment, will be in attendance.

The Bronx County Red Cross 1945 War Fund office is co-operating in arranging the exhibit.

A special ceremony Sunday afternoon, March 4, will precede the opening of the display to the public.

of Cambridge University, England, has done botanical exploring in the area. Frank E. Egler, who was originally scheduled for this program, was at last report at Camp Pickett in Virginia and said he was headed for southern Texas.

Tropical Fruits. To illustrate the three talks given by Otto Degener in the current Saturday afternoon series on "Plants of the Regions Where our Men and Women are Serving," tropical fruits of many varieties were displayed on the stage of the lecture hall. The Garden is indebted for these to Dr. David Fairchild of Coconut Grove, Florida, to Edwin A. Menninger of Stuart, Florida, and to Dr. George D. Ruehle of the Agricultural Experiment Station of the University at Homestead, Florida.

Dancer. East Indian hand positions and movements which illustrate flowers, trees, vines, and other forms of plant life were demonstrated by Juana of the Ethnologic Dance Center in New York at the lecture on "Vegetation of India and Burma" given by Otto Degener at the Garden Feb. 3. A brief talk on the form and symbolism of the Hindu dance preceded the demonstration. The program was concluded with a Burmese dance representing a flower swaying in the wind.

Radio. The first broadcast in the New York Botanical Garden's next series over WNYC will have Mrs. Elizabeth Williams, a Red Cross overseas worker who has recently returned from two years of service in the South Pacific, as the speaker. The program will be given March 9 at 3:30 p.m.

Saturday Programs. The spring series of Saturday afternoon programs at the Garden will deal with "The Great Groups of Plants—How They Live from Year to Year." Speakers will be members of the staff. Starting March 17, the series will be preceded on March 10 and followed April 28 by a motion picture.

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Appearing on pages 25-35

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2. Crocker, William. Life-span of seeds. Bot. Review **4**: 235-274. 1938.
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5. Robertson, D. W., and Anna M. Lute. Germination of the seed of farm crops in Colorado after storage for various periods of years. Jour. Agric. Res. **46**: 455-462. 1933.
6. Sifton, H. B. Longevity of the seeds of cereals, clovers, and timothy. Amer. Jour. Bot. **7**: 243-251. 1920.

New Term Announced for Teachers' Course

A SECOND term of study in the course for New York City public school teachers, inaugurated last September at the New York Botanical Garden in co-operation with the Board of Education, will begin Feb. 21. While none of the work will duplicate that of the autumn term, neither series of talks and demonstrations is considered a prerequisite for the other.

As before, the course will be in charge of Dr. E. E. Naylor, with the co-operation of Marvin M. Brooks, Director of School Gardens for the New York City Board of Education, and the majority of the sessions will be directed by them. In addition, one lecture each will be given by Dr. B. O. Dodge, T. H. Everett, and Elizabeth C. Hall of the Botanical Garden's staff.

The course will occupy 15 successive Wednesday afternoons with the omission of April 4, meeting in the Museum Building from 4 to 6. It will comprise 30 hours of work, applicable toward alertness credit awarded to teachers by the Board of Education. Below is the tentative schedule of subjects.

Feb. 21.	Registration at Museum Building. 4 o'clock Trip to the Conservatories.	*Dr. Naylor*
28.	Garden Publications, Journals, Catalogues.	*Miss Hall*
Mar. 7.	Tender Plants from Bulbs. Greenhouse Studies.	*Dr. Naylor*
14.	Soil Study and Weather.	*Mr. Brooks*
21.	Foliage Plants for the Class Room. Observations in the Greenhouses.	*Dr. Naylor*
28.	Cuttings & Problems of Propagation. Studies in the Propagating Houses.	*Dr. Naylor*
Apr. 11.	Planning the Vegetable Garden.	*Mr. Everett*
18.	Science in the Garden.	*Mr. Brooks*
25.	Early Spring Garden Plants. Seeds, Planting, Watering and Care.	*Dr. Naylor*
May 2.	School Garden Management & Vandalism.	*Mr. Brooks*
9.	Later Garden Plantings.	*Dr. Naylor*
16.	Animal Life in the Garden.	*Mr. Brooks*
23.	Insect Pests & Diseases of Garden Plants.	*Dr. Dodge*
June 6.	Garden Tour. Transplanting, Thinning, etc.	*Dr. Naylor*
13.	Note Books and Examinations.	*Mrs. Thomson* *Dr. Naylor*

The fee for New York City teachers is $2.

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.

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

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

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

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.

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

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

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.

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

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

Periodicals

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

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1 a year; single copies 15 cents. Free to members of the Garden. Now in its 45th volume.

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

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

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 100 parts now issued. Not offered in exchange. Prices of the separate parts on request.

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

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

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OF

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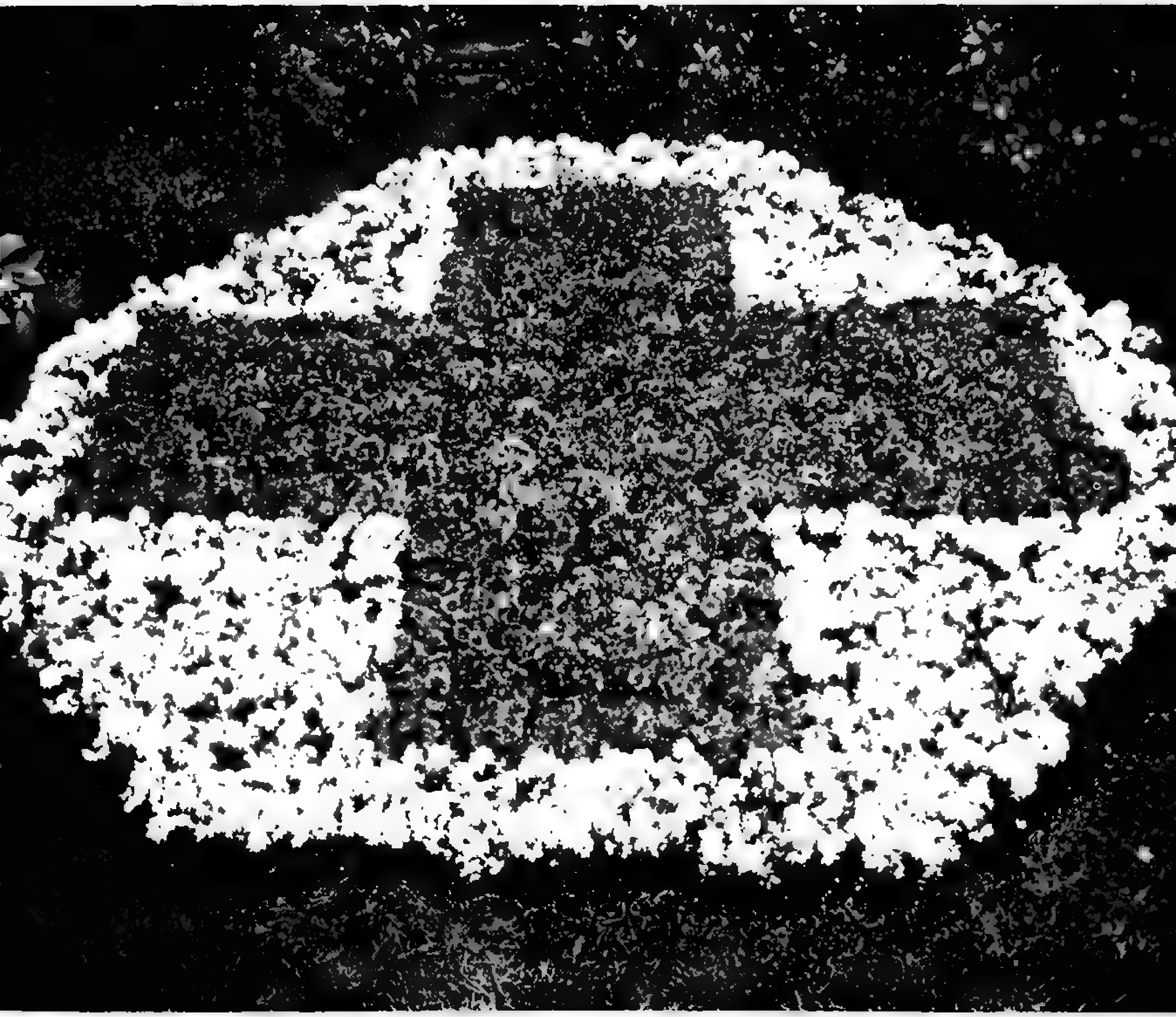

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

MEMORIALS THAT LIVE

WHEN the present war is over we may expect, as after every conflict, a mass movement for the erection of monuments. The men and women who have served their country must be honored for their heroic deeds and sacrifices.

As we look back on the monuments bequeathed to this generation from earlier wars, we are faced with the realization that, though well intended, they are often monstrous things, scarcely a credit to the taste or intelligence of the donors.

A memorial should be a thing of permanent beauty. At the close of the last world war a few inspired individuals strove for this ideal by having trees planted as memorials to the men who had given their lives, and these today, *where they have been given proper care,* have grown into magnificent avenues or parks. But there are not enough of them, and there are far too many guns and cannon-balls and crudely fashioned figures of inanimate metal or stone.

Type of memorials that can become a source—as they are the result—of inspiration and a means for pleasanter living are suggested in the poem by Millicent Easter published on this page last month. In the few words: "For all the Flyers . . . glorious trees!" there lies the germ of any number of memorial projects, which might with equal suitability be carried out with dogwoods or with oaks, with lilacs or roses or evergreens, or with flowers such as chrysanthemums or annuals planted and cared for in a public place.

A memorial created with living plants can serve as a model for the community, to show the effect of well planted trees and shrubs and flowers, while at the same time it helps to keep perpetually alive the brave, youthful spirits of our men and women who have served and sacrificed. For years extending far into the future, a living memorial can enhance community or countryside and exalt the spirit of the people.

However, it will give such long-lasting pleasure only if kept at its best from year to year. No garden flowers can be expected to perpetuate themselves without a skilled hand to care for them, and few trees can be expected to thrive without attention to their yearly needs.

Those groups of citizens who are planning war memorials will need to think in positive terms about the future. If they are giving consideration to a "monument" of living plants, which is the ideal memorial, they must provide for the permanent upkeep of those plants, either by a special endowment or by arrangements with reliable authorities.

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A Note on the Vegetation of the Mediterranean Littoral

By Rupert C. Barneby

THE casual visitor to the Mediterranean, whatever his means of travel, is apt to return home with the impression that the entire basin, whose shores are lapped by the sparkling and seemingly tideless waters of the Inland Sea, delights the year round in sunshine and the perfect resort climate. This is a fallacy propagated by travel agencies and holiday literature, and is as much a fiction as the old story that it never rains in Miami or Hollywood. The native, and also the traveler who visits the Mediterranean out of season, has a different story to tell. He will have experienced the searching and bitter blast of the BORA (the Boreas of the ancients), and the noxious vapors of the SIROCCO, the duststorms of Algeria and the violence of the MISTRAL, the searing desert heat of southeastern Spain and the chill winters of Athens. He will know that between the Pillars of Hercules and the shores of Palestine, a distance of some 2,000 miles, there lies a diversified and broken region, embracing such contrasts as the fertile VEGAS of Andalusia, the harsh, snowcapped peaks of the Appenines and Asia Minor, the deserts of Murcia, where three years may pass without a single shower, and the precipitous Adriatic coast where the rainfall may exceed in a year that of watery London.

This is the first of a series of articles to appear in this Journal covering the Saturday lectures given during the winter of 1945 at the New York Botanical Garden on the plants of the regions where our men and women are serving. Another will deal with the plant life of Alaska, "From the Alaska Highway to the Aleutians." This will be done by Hugh M. Raup of the Arnold Arboretum, who spoke at the Garden February 10. A series of three descriptive articles by Otto Degener will cover briefly some of the most common plants that are found in the tropics around the world.

But in spite of diversity in detail there is also a broad uniformity. The Mediterranean climate, a term which has come to be applied to equable climates throughout the world, does exist; for the moderating influence of the sea provides insurance against those extremes of temperature experienced on the great continental land-masses of the temperate zones. The general maritime influence is felt everywhere, even though accidents of terrain and exposure may vastly modify the normal balance. Since climate is everywhere the chief factor determining the character and density of vegetation, so in the Mediterranean basin the plant cover presents a broadly uniform aspect, modified here and there by physiographic accident. In this short note it will be impossible to examine the exceptional and the extreme, and only a brief sketch of the prevailing vegetation can be attempted.

In general, the vegetation of the Mediterranean is that of a dry region. Even where abundant rainfall occurs in the fall and winter months, the summers are hot and dry, and the few native deciduous trees are found only along watercourses, in irrigated land, or in sheltered valleys. Arboreal vegetation of any importance is entirely composed of Coniferae—pine, cypress and juniper—and of evergreen oaks. In the days when the Phoenicians were opening trade-routes into the west, the bays and promontories which they skirted, even those along the now bare shores of Africa, were clothed in green forests of Aleppo pine and ilex. But these exist today only as remnants, in remote, sparsely settled regions or on private estates from which the wood-cutter and the goat, that omnipresent and omnivorous scourge of the Mediterranean, have been excluded. Sod-forming grasses are rare or non-existent, true meadows occurring only under irrigation or occasionally on saline flats along the immediate coast. But perennial bunch-grasses, such as *Andropogon* species, with harsh dry culms and of little nutrient value, as well as innumerable annual species, mostly of extremely ephemeral duration, are everywhere apparent; while *Arundo Donax*, a tall, bamboo-like grass, the stems and leaves of which are utilized as fishing-rods and for thatching the cabins of fishermen, is characteristic of ditches near the coast.

Plant Inhabitants of the Maquis

Except for the relatively restricted areas of desert, the dominant natural vegetation of the Mediterranean littoral is MAQUIS. This term, originally applied to the especially abundant and luxuriant type of shrubbery which is found on the island of Corsica, has been extended to cover the similar association wherever it occurs, though the different peoples have their own local names, such as MACCHIE in Italy or PHRYGANA (a slightly different thing) in Greece. It may be compared with, and very closely corresponds to, the CHAPARRAL of our southwestern states. In essence it is an association of evergreen shrubs marked by the small, inrolled, varnished or densely pubescent leaves, the thick, dry bark, and the tough, sometimes spinescent twigs of the xerophyte. The component species of the maquis, its density and average height, largely depend on the exposure and the composition of the soil, and vary also in the different provinces of the Mediterranean. But maquis in some form is always present, either as a pseudoclimax between the primeval woodland and the cultures, or as a true climax on soils unsuitable for pines or ilex. Among characteristic species belonging to the maquis may be noted the numerous kinds of rock-rose, *Cistus,* with their handsome white or pink roselike flowers; the dwarfer rock-roses (*Helianthemum*), which are also known as sun-roses; *Rhus Cotinus,* similar to our native smoketrees; the mastic tree, *Pistacia Lentiscus*; the various shrubs of *Phillyrea*; scrub-oak (*Quercus Cerris*); myrtle, jasmine, bay (*Laurus nobilis*); the wild olive, probably introduced by man, at least in the west; the magnificent heathers (*Erica*); the strawberry-trees (*Arbutus Unedo* and *Andrachne*); species of sagebrush (*Artemisia*); rosemary, lavender, and the kitchen sage. In the western basin the brooms and gorses (*Ulex, Cytisus* and *Spartium*) are especially highly developed, and in spring clothe the hillsides in brilliant gold. Over large areas of the Balkan Peninsula, in very impoverished soil, the maquis is reduced to a low scrub, a foot high or so, composed largely of thyme and other suffruticose mints. Many of the maquis shrubs, which form impenetrable thickets or, perhaps more often, are spaced out and intermingled with herbaceous plants or a scattering of live-oaks or pines, are glandular and resinous, and the scent arising from them after rain embalms the air, and when the wind is favorable can be smelt many miles out at sea. To this zone of vegetation belongs the palmetto (*Chamaerops humilis*), a dwarf palm with scarcely any trunk and a tuft of fan-shaped leaves, most characteristic of rocky pastures near the coast.

In clearings or intervals in the maquis there luxuriates a varied herbaceous flora, sometimes of great brilliance. Already in late winter the first bulbous plants asphodels, grape-hyacinths, squills, crocus, jonquils and the delicate tazzetta narcissi are in bloom, while the buttercups and the scarlet or multi-colored anemones, the cyclamens, and the charlocks with their countless relatives of the Cabbage family, begin to decorate the hillsides and valley-floors. In spring and early summer these are joined and replaced by the leguminous weeds—vetches, trefoils, medicks and rest-harrows (*Ononis*); by the terresrrial orchids, by the parsleys (Umbelliferae) which have supplied our table with many a succulent vegetable and flavor—fennel and coriander, dill, cumin, carrot, parsnip and opopanax; by the humble but already gaudy ancestors of our garden flowers, the carnation (*Dianthus*); also larkspur, stock, and snapdragon; and by Compositae in many species and genera. But by July the flowers have retreated to the mountains, and little is left on the lower slopes but a few thistles and robust mulleins (*Verbascum*), their leaves coated in white dust.

Flora of the Sands and Rocks

Along the immediate shore of the Mediterranean, particularly where the land rises at a gentle incline from the sea, there often lie extensive sand-dunes with a specialized vegetation of their own. Here are found thickets of the white broom (*Retama monosperma*), planted as an ornamental in California, and here and there occur open parklike groves of arborescent junipers. In their shade, as well as in the open sand, partly stabilized perhaps by the running roots of a maritime grass, one comes upon colonies of the little annual Crucifer, *Matthiola maritima*, which under cultivation has become the "Virginia Stock"; and one also sees the white-felted bushes of a rayless daisy (*Diotis candidissima*), the sea eryngo (*Eryngium maritimum*), and the stately amaryllidaceous bulb, *Pancratium maritimum*, with its umbels of white daffodil-like flowers. Back of the beach itself the dune-flora merges insensibly with the maquis, or, where low-lying land permits water to collect and form a partially saline lagoon, into an estuarine vegetation dominated by fleshy-leaved *Salicornia* and a bewildering miscellany of sea-lavenders (*Limonium*).

The Mediterranean littoral is to a very large extent built of sedimentary rocks, the commonest being a hard white limestone which weathers into bold bluffs and terraces, into box-canyons, cliffs and GARRIGUES, which lend the landscape a character of its own, and at the same time afford foothold to many plants which without cultivation will grow nowhere but in the crevices of virgin rock. It is to the cliffs that one must turn to find the many species of *Campanula*, such as the favorite old pot-plant *C. pyramidalis*, the sweet sultans (*Centaurea*, of the same genus as the annual cornflower) with their handsome dissected leaves, the scabiosas, and the rock cabbages, probable ancestors of all our domestic cabbages, cauliflowers and broccoli. Almost every family of seed-plants at all highly developed in the Mediterranean region has at least one member found only on calcareous cliffs, where, protected from browsing animals, it lives isolated and secure, becoming, like all hermits, vastly modified in the process.

The Mediterranean People and Their Crops

But this is the natural vegetation, the covering of wild and waste places, and a quite small fraction of the whole. The Mediterranean basin supports a dense and ancient human population which for uncounted centuries has been busy changing, by culture and depredation, the natural face of the earth. To gain an approximate idea of the primitive state of a Mediterranean shore, it is necessary to travel to some remote cape on Sardinia, Crete or the Peloponnesus, and even here the charcoal-burner and the goatherd have gone before. To an enormous extent the vegetation and landscape have been shaped and determined by the hand of man.

The peoples of the Mediterranean are frugal; they have to be, because of the relative poverty of the natural resources. The areas which would appear suitable for cultivation to an American farmer are small, few and far apart. They are confined, in fact, to valleys where a river or stream debouching from the mountains in the interior has carried down a sediment of silt and soil and at the same time provides water for irrigation. The Sahel of Algeria, the valleys of the Guadalquivir, the Rhone and the Nile (though this is in reality a long oasis cut through pure desert) and of the lesser streams, often mere torrent beds in summer, along the Italian and Balkan coasts, offer these conditions and are intensively cultivated with alfalfa, cereals, oranges, or vegetables similar to those grown in the subtropical regions of the United States.

Outside these favored and fertile spots the earth is dry and stony, the water supply meager and uncertain, and agriculture is an arduous profession. Centuries of deforestation and consequent erosion have denuded the hills of their natural flesh and everywhere the bare bones of the earth show through. The problem of growing anything on these barren slopes has been solved by terrace cultivation, a process which more than anything else has moulded the landscape of the Mediterranean region. Throughout the littoral, and far inland, stone walls, following the contours of the hills, have been built up in tiers along the hillsides, providing flat terraces which catch and retain both soil and moisture and provide level ground for cultivation. Each loose rock turned up by the plow or mattock is laid aside and incorporated in the walls, and as these grow higher the pocket of earth behind grows deeper.

Here it is possible to raise cereals and stone fruits such as the peach, apricot, and almond; or, where water can be led by ACEQUIA along the hillside, citrus and herbaceous vegetable will flourish. In the south of France acres of terraced land are planted with roses, violets and lavender, from which are distilled the essences used in perfumery. But by far the greater area is devoted to those two staple crops, on which depends the entire agricultural economy of the Mediterranean—the olive and the vine. Indeed, so ubiquitous are the olive groves and vineyards that one might truly claim that they form, even though artificially maintained and ever prone to slip back into wasteland and eventually maquis, the commonest and most characteristic type of vegetation in the Mediterranean basin.

Weeds that Flower Among the Crops

Associated with the cultures and existing side by side or intermingled with the crops, there exists an extensive weed-flora. Many of the component species are natives which find in the annually disturbed soil and in the absence of shrubbery, which would normally limit and control their numbers, an ideal environment. Some are annuals appearing in early spring and ripening with the cereals, while others have tough roots or bulbs, tenacious of life and impossible to eradicate. Among these are the annual species of *Veronica,* toadflax (*Linaria*) of many sorts, poppies, mallows (*Malva* and *Lavatera*), garlics (*Allium*), vetches (*Vicia, Lathyrus* and *Ervum*), and borages (*Anchusa* and *Borago*). All luxuriate on cultivated ground, in the light shade of the olives or among the budding vines, and occur in such quantity as to impart color and verdure to the landscape. A few are immigrants, such as the yellow sorrel (*Oxalis cernua*) from South Africa, which has found an equally agreeable home in the citrus groves of California, and is there similarly spectacular and pernicious. Two of the very few weeds originating in the New World are the century-plant (*Agave americana*) and the prickly-pear (*Opuntia Ficus-indica*), planted in the first place for ornament or in the form of hedges, but now firmly established and abundant along roadsides and in fallow fields. On the whole, however, the Mediterranean has given to America, in vegetation as in other ways, far more than it has received. There is no parallel to the invasion of western North America by the filaree (*Erodium cicutarium*), an annual weed only moderately abundant around the Mediterranean but today, in point of number of individuals, California's commonest single species of seed-plant.

This short glance at the vegetation of the Mediterraneous littoral would be far from complete without some reference to the desert regions, tracts of coast where one looks in vain for the characteristic interplay of maquis, ilex groves and vineyards. In southwestern Spain and along the African coast from Tunisia, where an arm of the Sahara reaches up to the sea, through northern Egypt to Palestine, the rainfall, by physiographic accident, is far lower than elsewhere, a fact inevitably reflected in the vegetation. Native trees, except for an occasional tamarisk, which here plays the role of the juniper, become very rare or are wholly absent, and salsolaceous shrubs with small fleshy leaves become abundant. In the Spanish province of Valencia the date palm is cultivated as successfully as in the Saharan oases, while certain shrubs and herbs, otherwise confined to the deserts south of the Atlas Mountains, have isolated stations. It is significant that two Stapeliads (*Stapelia* and *Caralluma* species), belonging to a family of succulents which simulate the Cactaceae of the New World, are found on the desert shores of Spain. But these regions, although lying within the Mediterranean basin in a geographic sense, have comparatively little kinship with the Mediterranean floral province, strictly defined, and are largely extraneous to the subject of the present notes. So also are the mountains which encircle the Inland Sea or which rise as islands out of the lowlands of the basin and which, cooler and wetter than the coastal region, support every type of vegetation, from the chestnut forests of Corsica through the arid, elevated steppes of Castile and the Atlas, to the lush meadows of the Alpes Maritimes, the volcanic screes of Mount Etna and the alpine peaks of the Bithynian Olympus. These and many others, which include some of the marvels and delights of the Mediterranean, must await consideration elsewhere.

Air Plants and Their Problems of Survival

How Specialized Roots and Leaves Help Them Live Above the Ground

By E. E. Naylor

EXPLORATIONS into tropical regions abound with tales concerning the finding of rare and beautiful orchids growing high on the branches of jungle trees. Many members of the Orchidaceae, Bromeliaceae, Araceae, and nearly a dozen other families of plants [1] may be found in such lofty places, and for this reason are oftentimes called "air plants."

Because they live upon other plants does not mean that they are parasitic. On the contrary, these are green plants that are capable of manufacturing their own food just the same as green plants that live on the ground. These are true epiphytes,[2] growing upon other plants without any structural connection, hence they have no means of exchange of water or foods, such as parasites have. The requirements for the continued growth of epiphytes do not differ in any marked way from those of plants that have their roots in the earth. When they are supplied with water, carbon dioxide from the air, the essential mineral elements, and sunlight, they make their own foods and build up their own bodies. The chief problem is for these plants to obtain the necessary materials in the peculiar places they inhabit.

"Air plants" obtain their materials for growth essentially from the atmosphere, and because of this fact, many interesting and important questions arise. For instance, how do they secure the water which makes up some 80 to 90 percent of their total green weight? And what is the source of the iron, potassium, magnesium, phosphorus, and other mineral elements vital to the construction of their bodies?

Spanish-moss, *Tillandsia* (or *Dendropogon*) *usneoides,* is perhaps one of the best examples to illustrate this epiphytic condition. In our southern states it thrives upon the live oaks and upon certain cypress trees, hanging in long twisted strands and forming a conspicuous part of the vegetation. In fact, many people think that the presence of the Spanish-moss gives the common name to the live oak, but the name comes instead from the fact that the leaves of *Quercus virginiana* are green the year around. Spanish-moss also occasionally grows upon dead branches of trees, and even on

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[1] It is not uncommon to find mosses, lichens, liverworts, ferns, and selaginellas growing on the same tree. Several members of the Cactus family also grow upon other plants.

[2] Epí means on, or upon, in Greek; PHYTÓN means plant.

telegraph wires and fences, but it does not kill the trees on which it grows, except by occasionally cutting off the light from the leaves to such an extent that the leaves can no longer function in the manufacture of food to maintain the tree's growth.

Water Absorption

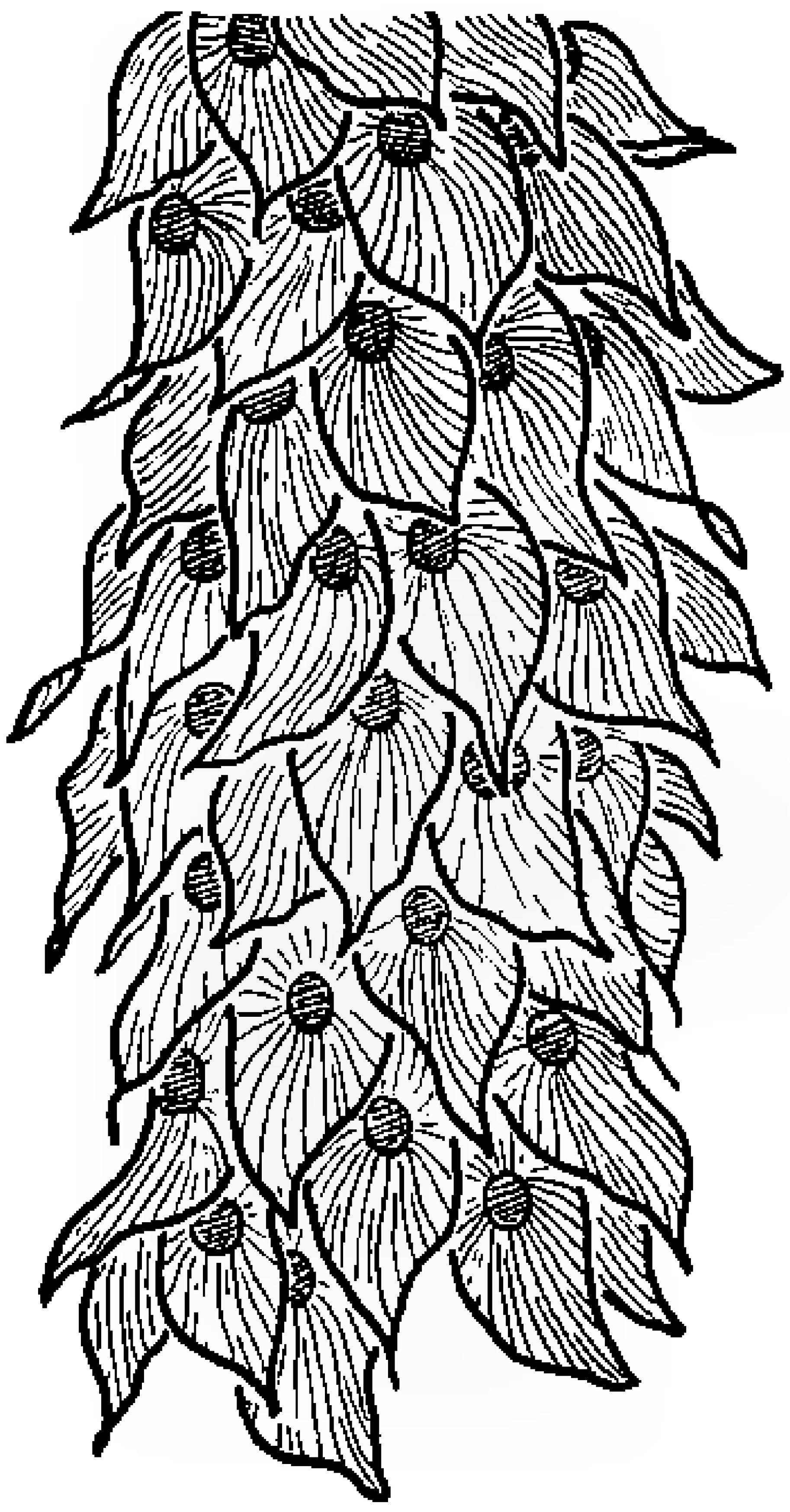
Ground-dwelling plants normally absorb water and dissolved minerals for nourishment through their roots; but Spanish-moss, which has no roots at all, is capable of absorbing the water which falls upon it by the action of numerous scale-like structures which completely cover the leaves and stems. When the plants are relatively dry, these scales separate from each other and curve upward along their edges, giving the plant its whitish appearance. When they are wet, the scales adhere closely to each other and the underlying chlorophyll layers show through. Each scale is attached near its center to a group of living cells known as the STALK CELLS. These stalk cells are embedded within the tissues of the leaf and when the plants

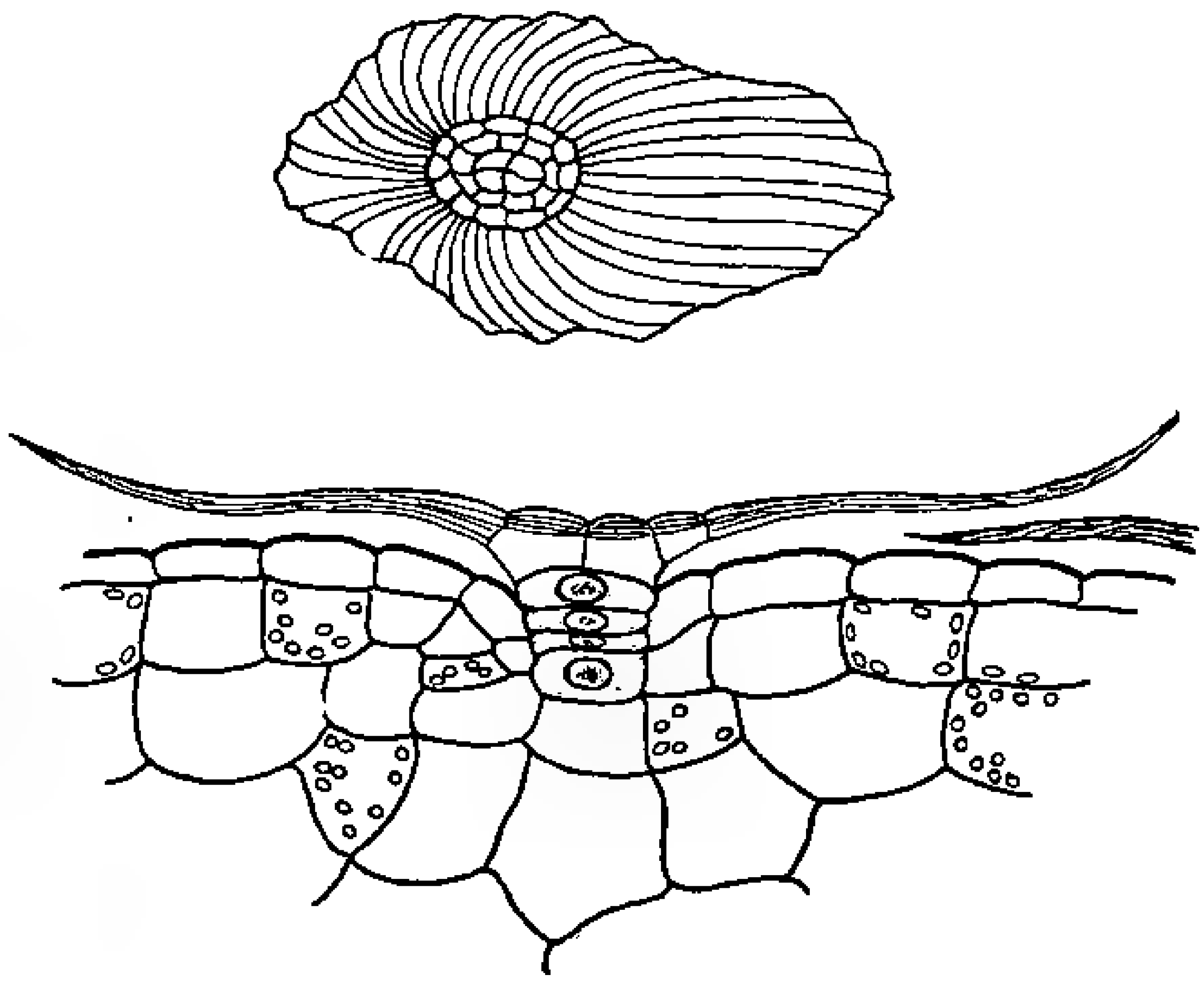
Spanish moss, Tillandsia usneoides, covering a tree in Florida.

Tillandsia fasciculata, one of the bromeliads known as "wild pines," growing on a tree of Spondias lutea in Cuba.

are covered with rain or dew, the scales hold the water by capillary action while the living stalk cells underneath slowly absorb it. When the storage cells within the leaf become completely filled with water the plants can exist for days, or even weeks, without an additional water supply. Under experimental conditions they have been subjected to as much as two months of rainless exposure without injury. Since showers and heavy dews are frequent in tropical regions, it is possible for Spanish-moss to secure enough water through these foliar structures to enable it to grow hanging to whatever support may be at hand.

This plant belongs to a large family of flowering plants called the Bromeliaceae, and it is related not to the mosses but to the cultivated pineapple. In contrast to the delicate structure of Spanish-moss, many members of this group have long sharp-pointed leaves which become very tough and leathery. Several of these species are common to the Everglades of Florida where they are called "wild pines." These plants belong likewise to the genus *Tillandsia,* and they are also covered with countless scales





Enlarged portions of Spanish moss. At the left, the overlapping, water-absorbing scales which cover the stems. Above, a single scale enlarged, and a section through a scale (after Billings, Botanical Gazette, 1904), showing the basal stalk cells which function in water absorption.

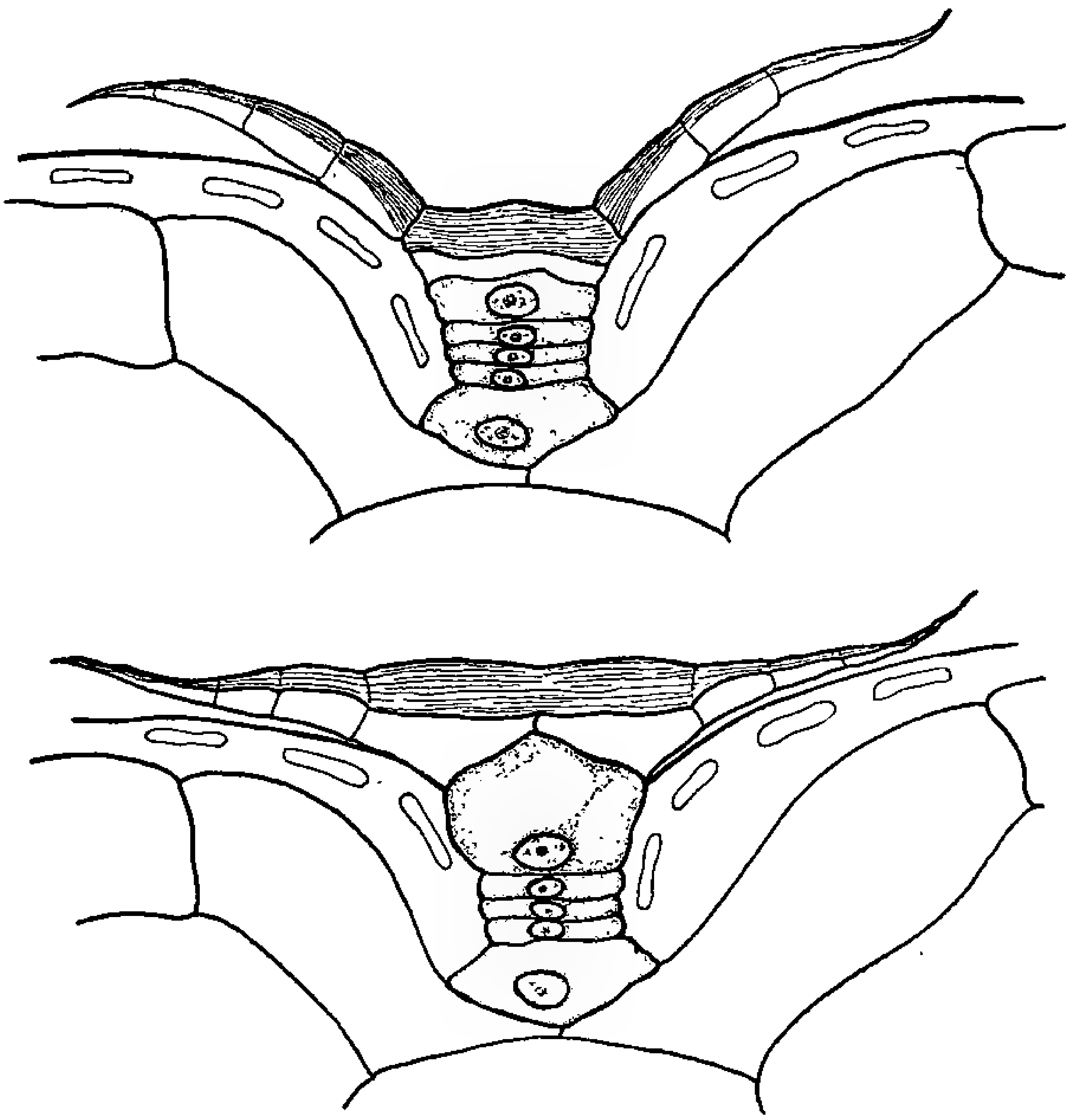
which act like microscopic sponges in soaking up water. Some of these Florida epiphytes are found occasionally in the dime stores of cities, where they are sold as "air plants."

One of the giant bromeliads of Brazil, known as *Vriesia*, has very interesting water-absorbing scales on its large leaves. Each scale has a foot portion consisting of one to several cells, and a funnel-shaped stalk part, which is sunk below the level of the epidermis. This stalk is surmounted by a disc which is very thin around the margin and thick in the center. When the air is dry, the thin outer part is turned upward, and the central part is pulled down so that it completely covers the absorbing stalk cells like a tight-fitting lid. When moistened, the lateral parts expand, the lid is raised, and the stalk cells have access to the water held under the scale. The whole apparatus functions as a beautiful device which serves as an absorbing organ during wet spells and prevents the escape of water during drought.

Another type of leaf modification which is found in many of the larger bromeliads, such as *Aechmea* and *Billbergia*, is perhaps best described as a water reservoir. In these plants the leaf bases are enlarged to form spoon-shaped structures which overlap each other in such a fashion that they hold water. During a shower the water falling on the leaves drains down into these pockets where it is slowly absorbed through the soft tissues of the leaf base. These reservoirs serve as a continuous source of water, and also as small aquaria for certain algae and aquatic mosses—even for small members of the animal kingdom. As much as a gallon of water [3] may be obtained from some of these tropical specimens when they are turned upside down and allowed to drain.

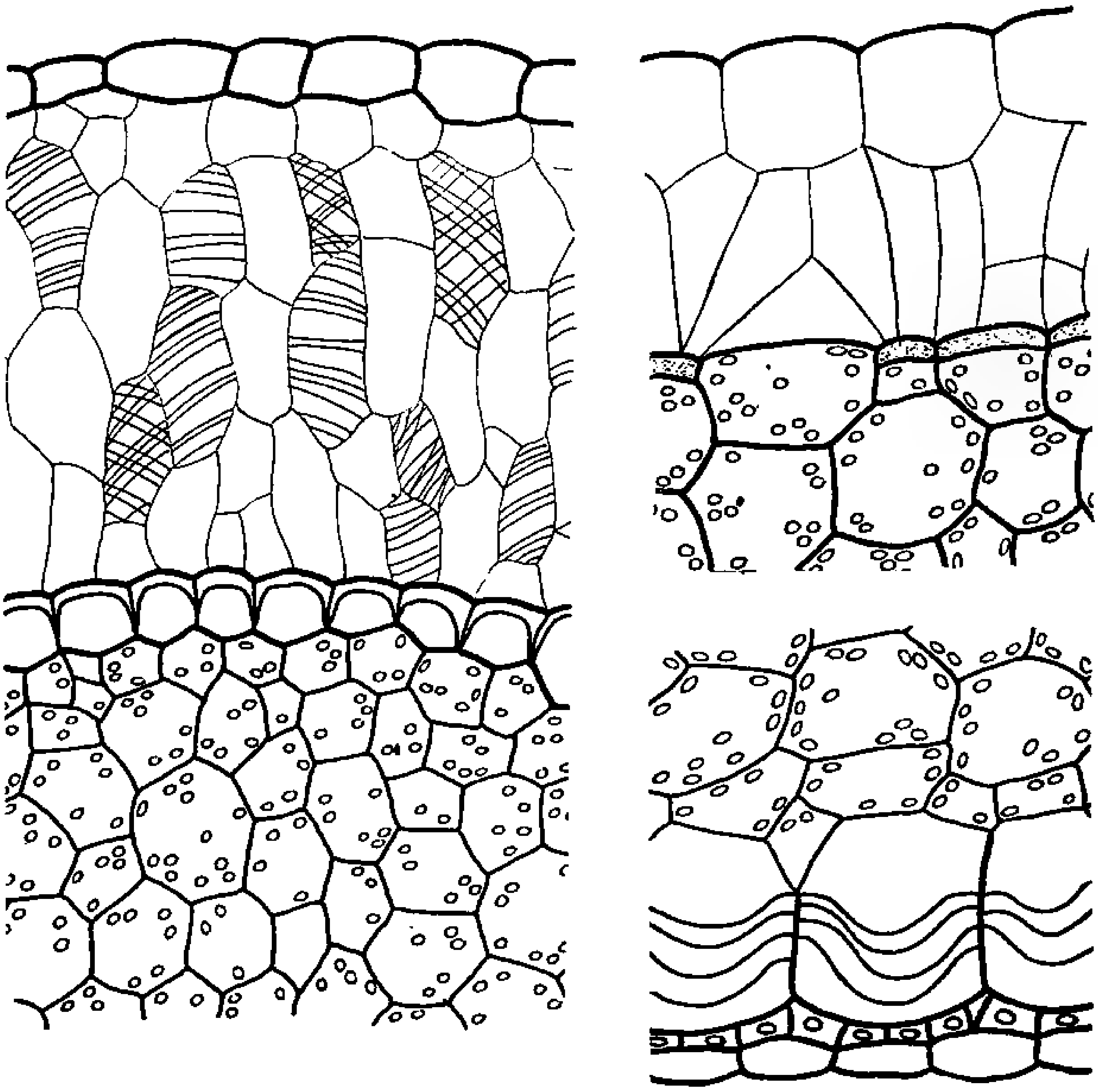
The epiphytic orchids,[4] so well known for their beautiful flowers, and also some of the aroids, are quite well adapted for the absorption of water from the air. Instead of having roots like ground-dwelling plants, the majority of the tropical orchids produce large aerial roots which cling to the bark of trees upon which they are growing, or simply hang suspended in the air. These odd-looking structures take up water by means of a special

[3] See "Blueprint of the Jungle" by Mulford B. Foster in the January issue of this Journal.
[4] See "Epiphytic Orchids of Florida" by Alex D. Hawkes in last month's issue.



SCALES OF VRIESIA IN THE DRY AND WET CONDITIONS

Above, when dry, the scale is pulled downward to cover the absorbing cells like a tight-fitting lid. Below, when wet, the lid is raised to give the absorbing cells access to the water that is available. (After Haberlandt).



CELL STRUCTURE OF THE VELAMEN OF ORCHIDS

Left (after Gager), the orchid velamen is shown to be the outer, dead part of an orchid root, which acts like blotting paper in absorbing moisture from the air. Right (after Goebel), on the sides of the orchid root next to the bark, in Phalaenopsis Schilleriana, the velamen is shown above to be fully developed into a spongy tissue, while on the outer side (below), it is reduced to a point where its chief function is to prevent drying out.

layer called the VELAMEN. This tissue covers the roots and acts like a piece of blotting paper in absorbing and holding water.

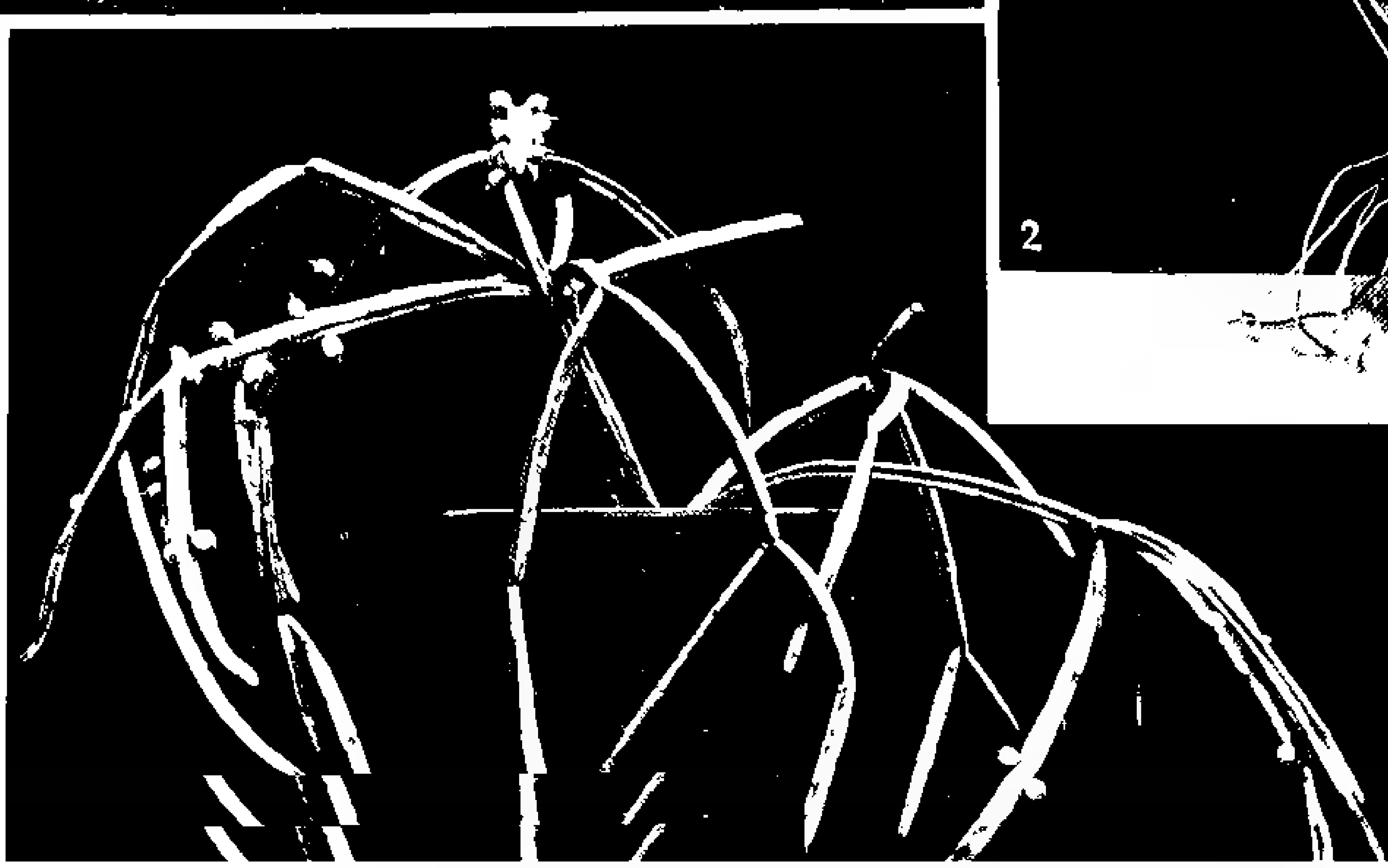
The velamen consists of a silvery parchment-like sheath of cells which has lost all living contents and has become filled with air. The walls of many of the cells are strengthened in a great variety of ways, but most often by means of spiral thickening fibers. This cellular envelope takes up water by capillary action and is to be regarded as the true absorbing tissue of these aerial roots.

After the water is absorbed by the velamen it passes inward through thin-walled living cells, known as "passage cells" to the central portion of the root. Here it enters the specialized conducting strands (vascular bundles) and moves upward through these definite channels to the leaves where some of it is used in photosynthesis and the remainder is evaporated into the air. When aerial roots of orchids are wet by a shower they change in color from papery white to a pale green, revealing green tissues underneath. These tissues contain chlorophyll and may therefore perform the work of photosynthesis, a function not usually associated with the roots of plants.

Water vapor also can be absorbed by the velamen. Experimental results show that certain orchids, when transferred from very dry air to very moist air, will absorb from 8 to 11 percent of their weight in moisture within 24 hours. After a thorough wetting by a tropical shower the velamen may absorb enough water to supply the plant for several days.

Some orchids show further peculiarities of structure of the roots to insure maximum absorption and minimum evaporation of water. In

EPIPHYTIC PLANTS
OF THREE FAMILIES



1. Vriesia carinata of the Bromeliaceae. 2. Dendrobium nobile of the Orchidaceae. 3. A species of Rhipsalis of the Cactaceae.

Phalaenopsis Schilleriana the roots are flattened and lie close to the bark of the tree. Absorption of water takes place largely on the side next to the bark, while the other side is so constructed that it protects the roots against drying out. Structurally, the roots have a two-layered velamen on both sides, but on the upper side it is reduced, while on the lower side it is fully developed, very spongy in texture, and with a high capacity for absorbing water.

Root hairs are seldom, if ever, found on the free hanging roots of orchids. Some of the epiphytic ferns, however, such as the giant staghorn ferns of Australia, produce modified types of hairs which are not sensitive to dryness and which therefore may exist for a long period of time. These peculiar brown hairs, which are exposed to the air, serve to hold water by capillarity and act as a sort of root sponge, probably like the velamen of orchids, absorbing vapor as well as actual drops of water from the air.

In addition to water-absorbing leaf scales, leaf reservoirs, the velamen of air roots, and the root hairs of certain ferns, there are other adaptations which further enable epiphytes to survive above the ground. Most epiphytes develop a very thick cuticle over their stems and leaves which lessens water loss. Some are covered with waxy scales or possess hairy coverings which likewise function in slowing down evaporation. Sometimes, as in Spanish-moss, the leaves are reduced in size, or, as in certain of the epiphytic cacti, they are nothing more than spines. Occasionally orchids drop the expanded part of the leaf during dry periods and only the bulb-like lower portion remains as a water and food storage organ.

Mineral Nutrition

The source of mineral elements for epiphytes has long been a subject for discussion. Ash analyses of Spanish-moss show that it contains compounds of sodium, phosphorus, potassium, magnesium, chlorine, calcium, iron, sulfur, and silica. The amounts of sulfur, chlorine, and silica are higher than in many other plants, and the ferric oxide content is much higher. Obviously these minerals are not supplied through a root system from the soil solution as is true for such common plants as sunflowers and soybeans.

It has been argued that the scales of Spanish-moss play the important role of catching and holding dust particles which supply the inorganic materials necessary for growth. To test this hypothesis, scientific studies were conducted by the Bureau of Chemistry of the U. S. Department of Agriculture, and their findings do not give substantial evidence to this

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The originals of the photographs reproduced on the opposite page were made in 1902 by the German botanist E. Ule, who spent the greater part of his life exploring in Brazil. These pictures are part of a small collection of Ule's which have been deposited in the library of the New York Botanical Garden.

1. *The bromeliad, Nidularium eleutheropetalum, shares the upper branches of a Brazilian tree with a large-leaved aroid.* 2. *The staghorn fern, Platycerium andinum, and a tropical polypody, Polypodium Ulei, live side by side as epiphytes on a jungle tree.* 3. *The bushy rosette of narrow leaves belongs to the bromeliad, Streptocalyx angustifolius.* 4. *A spineless, tree-dwelly rosette of narrow leaves belongs to the n here*

theory. These investigators were unable to find visible evidence of quartz grains, which are prominent in ordinary dust, when superficial portions of the plants were rubbed off and examined under a polarizing microscope. Washings from the plants also failed to show appreciable amounts of mineral substances.

Additional tests were made by comparing ash analyses of plants which had previously been washed with distilled water with unwashed specimens. Final tabulations showed some minor differences between washed and unwashed plants, but the differences were not systematic, and did not exceed variations expected in the sampling of materials. No change in the percentage of total ash was found, and also no differences in the amounts of silica or ferric oxide as would be expected if loosely adherent dust particles were washed away.

The general conclusion was reached that, since dust can not be demonstrated in appreciable quantities on the plants or in the washings from them, Spanish-moss does *not* obtain its mineral elements from dust caught between the scales. This places considerably less emphasis on the importance of the scales as dust traps, and more upon their role as water-absorbing organs.

It might also be added that the Spanish-mosses, and many other epiphytes, grow in tropical forests where the air is kept rather free from dust by frequent showers. In addition, it seems reasonable to believe that rain is more likely to wash dust away than to deposit it on a plant hanging in air.

Further investigations, especially by Edgar T. Wherry and his associates, point to the possibility that air plants obtain their minerals chiefly from constituents already dissolved in rain water as it falls on the plants. We usually think that rain water is pure, but this is not necessarily true. A chemical analysis of rain water samples, taken near the coast of British Guiana, revealed that it contained minute quantities of iron, aluminum, calcium, magnesium, potassium, sodium, and chlorine. Sulfates, carbonates, silicates, and small amounts of ammonia also were present. The elements sodium and chlorine were found to be most abundant, and are accounted for by ocean spray which is carried to high levels by wind action.

The source of mineral elements in rain water is traced ultimately to dust particles. As water vapor condenses and falls through the air it comes in contact with dust carried by air currents, and minute amounts of minerals are thus dissolved in this water by the time it falls on the earth. These minerals are not in the same proportions as found in the living plants, but it is well known that plants are capable of extracting relatively large amounts of such substances from very dilute solutions. Frequent showers are therefore most important to the growth of epiphytes since they supply both the necessary moisture and a continuous supply of very dilute mineral elements.

Under natural conditions most epiphytes are subjected to the water which drips from other plants, especially from the bark of branches of the plants supporting them. This would afford an additional source of inorganic substances with every shower.

When epiphytes are grown indoors under artificial conditions they do not have the benefit of rain water, yet they may live successfully for a long time. Spanish-moss has been growing here at the New York Botanical Garden in the Rain Forest house for many years. It is sprayed several times each day with the regular city water, and the fact that it grows and produces flowers indicates that it is obtaining the necessary building materials. Some of the minerals are supplied from the city water, some perhaps from the canopy of dead branches above, and some from the washings from other plants. Carefully controlled experiments on the mineral nutrition of this plant might yield some interesting and important facts.

Orchids have additional sources of minerals from the considerable vegetable detritus which ultimately collects about the base of long established plants. This may be composed of decaying leaves, bits of bark, and sometimes lichens and mosses. After some lapse of time the epiphyte may have a small amount of soil at its disposal. This condition is found in the staghorn ferns, as well as in many orchids.

Certain orchids also produce aerial roots which are negatively geotropic, and as they grow outward from the plant they form a thick basket-like tangle of roots which sometimes become a foot or more in diameter. These entangled masses are called "nest roots" and serve the important function of holding decaying plant materials which gradually accumulate. Enough humus may become lodged to serve as a source of both moisture and minerals. These "nest roots" are found in certain species of *Oncidium* and *Cymbidium,* as well as in some members of the Aroid family.

Two important factors concerning the growth of epiphytes have been considered—the source of water, and the source of mineral elements. In addition, they must also have sunlight because it furnishes the energy for the process of food manufacture in all green plants. This problem has been met most successfully by epiphytes. By adapting themselves to aerial habitats they have raised themselves off the shaded forest floor and thus have access to enough sunlight each day to maintain growth and reproduction.

Although "air plants," or epiphytes, have no roots in contact with the soil, they can absorb enough water and enough minerals that are dissolved in this water to grow and flourish in competition with hosts of other plants. They constitute a diverse and remarkable group, in which we find a high degree of specialization in the peculiar water-absorbing structures that make their very existence possible.

Spring Programs at the Garden

Members' Day Programs

Wednesdays at 3:30 P.M.

Apr. 4 ***Daffodils in Your Garden***
James G. Esson, Editor, Gardeners' Chronicle of America

May 2 ***Pleasures of Rock Gardening in Westchester County***
Harold Epstein, Member of the New York Botanical Garden

June 13 ***Rose Growers' Day—***
In co-operation with the New York section of the American Rose Society *All-day program to be announced*

Two Motion Pictures with Sound

Saturdays at 3 o'clock in the Museum Building

Mar. 17 ***Our Neighbors Down the Road—***
A scenic trip along the Pan-American Highway, produced by the Co-ordinator of Inter-American Affairs.

Apr. 28 ***New York State Parks—*** Presented by *C. R. Blakelock,* Secretary, Long Island State Park Commission.

Six Illustrated Lectures by Members of the Botanical Garden's Staff on

THE GREAT GROUPS OF PLANTS

How They Live From Year to Year

Saturdays at 3 o'clock in the Museum Building

Mar. 10	***Flowering Plants, From Grass to Orchids***	*Frances E. Wynne*
Mar. 24	***More Flowers: Pussy-Willows to Chrysanthemums***	*Frances E. Wynne*
Mar. 31	***Trees That Bear Cones***	*H. W. Rickett*
Apr. 7	***Ferns of Forest and Field***	*H. W. Rickett*
Apr. 14	***Green Plants in Miniature—*** The Mosses and Liverworts	*Frances E. Wynne*
Apr. 21	***Plants Without Roots, Stems, or Leaves—*** The Fungi and Algae	*F. J. Seaver*

RADIO PROGRAMS

Alternate Fridays, 3:30 p.m. WNYC (830 on the dial)

Mar. 9 ***Two Years in the South Pacific***
Mrs. Elizabeth Williams, Red Cross Overseas Worker

Mar. 23 ***Favorite Flowering Shrubs of Spring***
P. J. van Melle, Nurseryman, Poughkeepsie, N. Y., and Instructor, New York Botanical Garden

Apr. 6 ***How Finer Garden Flowers are Developed***
A. B. Stout, Curator of Education and Laboratories, New York Botanical Garden

Apr. 20 ***Spring at The N. Y. Botanical Garden***
Mrs. Robert H. Fife, Chairman of Advisory Council, New York Botanical Garden

BROADCAST

By W. D. TURNER

PLASTIC *ash-trays, bottle-caps, handles, containers of various sorts, and colorful tees for a golfer to use were exhibited on the studio table when Dr. W. D. Turner was interviewed during the Garden's broadcast Nov. 17 over WNYC on "Plastics from Plant Materials." Dr. Turner is Professor of Chemical Engineering at Columbia University and is also Eastern Technical Director of the Plastics Industries Technical Institute in New York. Excerpts from his talk are given here.*

PLANTS provide a large percentage of the plastic materials that are now being manufactured, and in the light of present research I can see a vast increase in the use of plants—particularly waste materials from the farm, such as corncobs and nutshells, also cornstalks, oat hulls, and many other products that formerly were a total loss to the producer of farm crops.

At present, however, the most important plant used for plastics is cotton. The fibers—the same as are used for weaving cloth—are used for the plastics, but there again, the waste cotton can be used, for when the fibers are too short for spinning, they can be combined with chemicals and turned into plastics.

Celluloid, you know, was the first plastic ever made, and it was created out of cotton linters, bits of wood that were ground into a pulp, nitric acid, and camphor. An Albany printer named Hyatt first made it in 1869, and he gave the world the start of an industry with infinite possibilities and with a future which now, 75 years later, is really just beginning.

Waste material from lumbering, as well as waste material from farm crops, can be used in the making of plastics. And more than that, some very important by-products come from the use of wood waste in making plastics. The best-smelling factory in the world is probably the one in Wisconsin where about a quarter of all packaging paper used in the United States is manufactured. As a by-product of the sulphite wood pulp that is used for the paper, vanillin[1] is made. This is the flavoring most used by bakeries and candy and dessert manufacturers, and it is, of course, much cheaper than the extract prepared from the beans of the vanilla orchid from the tropics.

You ask how a flavoring like vanillin was ever discovered in sulphite wood waste.

Well, years ago, all such wastes were dumped into rivers with the result that fish died and many people complained. Eventually laws were passed to prevent this pollution, so the mills had to find some other means of disposing of their refuse. The story is briefly told in a little book put out by the Plastics Institute.[2] Mr. Lougee, the author, says, in describing the work of a chemical engineer for one of the big paper companies:

"He began by treating waste liquors with lime in a precipitation process, which separates lignin from the residue. Lignin is further cooked with acid into what is called a sulphite lignin base. Treated in one way this base becomes vanillin. Treated another way, it is processed into lignin plastics. A number of chemical products such as calcium, sodium, magnesium, and other salts are recovered and disposed of at a profit. Hardly anything remains except the water that was originally added to wash and float the pulp."

Oat hulls are used as a base for many plastics, in that furfural is processed from them—also from corn cobs; and furfural is the chemical base of some of our most important plastics. To explain what furfural is without going into the chemistry of it, I would say that furfural is a colorless oily liquid which has wide use in the manufacture of rubber, glue, disinfectants, lacquers, and dyes, as well as certain plastics.

Oat hulls and corn cobs are also used occasionally, as soybeans are, for making plastic articles directly, but the soybeans seldom are used by themselves. It is customary to blend the soybean plastic with other materials. The best and most extensive soybean application has been

1. Pronounced with the accent on the first syllable.
2. Reviewed in this Journal in November, 1943.

made by Henry Ford. He purifies the soybean meal to remove all oils and then blends the protein part and the fibre part, which are left over, with a composition similar to bakelite. This blend makes strong and beautiful parts for automobile trim especially.

Nutshells, a few years ago, started out to have tremendous possibilities for plastics manufacturing, and they are still used to a considerable extent. They figure in the manufacture of certain small parts for airplanes and are used for dies for casting; but since they were first developed in 1935, other waste products have outstripped them. They are now used chiefly as filler for plastics that are made from other materials.

A promising new industry for Brazil is the production of bottle caps and such items made from coffee beans.[3]

The plastics industry should become a great boon to farmers and producers of this and other countries. It is always dangerous to make predictions, but I believe that if corncobs or cornstalks or other light-weight materials are to find wide use in production of plastics, it will be necessary to use small portable plastic manufacturing plants which can be sent into farm districts. This is because these materials are so bulky that it will be more economical to carry the processing plant into the area than to transport the farm wastes by rail to distant centers for processing.

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.)

Four Who Opened a Continent

SOUTH AMERICA CALLED THEM. Victor Wolfgang von Hagen. 311 pages, illustrations, bibliography, index. Alfred A Knopf, New York. 1945. $3.75.

"South America Called Them" by Victor von Hagen stands out like a peak in the Andes among the plethora of books on South America. The author gives vivid accounts of the expeditions of four great naturalist-explorers, La Condamine, Humboldt, Darwin, and Spruce, each of them a pioneer in his field, two of them supreme in their achievement. Their travels covered a century and a half. La Condamine came to Quito in 1735, Darwin published "The Origin of Species" in 1859, the year of Humboldt's death. During this period South America emerged as a free and independent continent, thanks to the leadership of Bolivar.

La Condamine's purpose in going to Ecuador was to find out if Newton's theory that the earth is a globe flattened at the poles and bulging at the equator was correct. He proved it by nine years of laborious measurements in the Andes. While he was doing this La Condamine was shown the first map that had been made of the Amazon by a Jesuit Padre. This aroused that "curiosité ardente" which Voltaire found so characteristic of him. He immediately planned to return to France by way of the Amazon and to make an accurate chart of that river which no Frenchman had ever seen. On this journey he unknowingly became the first rubber manufacturer for he made himself a pouch of rubber for his quadrant. Rubber was of course known to all the explorers since Cortez, who had seen the Aztecs play a game with solid rubber balls.

Next in line was one of the greatest naturalist of all times—Baron von Humboldt, the friend of Goethe, and possibly (as Dr. von Hagen ingeniously suggests) the inspirer of Bolivar. From 1799 to 1804 Humboldt and Bonpland, the botanist, explored Colombia, Venezuela, Ecuador and Peru and established the connection between the Amazon and the Orinoco which La Condamine had heard of fifty years earlier. In Venezuela Humboldt found coffee and chocolate

3. Exhibited at the Members' Day program at the Botanical Garden, October 4.

growing. Arab traders had brought coffee out of Ethiopia into Spain, from where it had reached the New World in 1720. Cacao, which when roasted and ground becomes chocolate, had been developed by the Incas under the name of Kakua and had reached Mexico before Cortez. Linnaeus had named the cacao tree "Theobroma Cacao" but it was Humboldt who described its cultivation and growth. Bonpland, returning to France, was made superintendent of her gardens at Malmaison by the Empress Josephine, the beautiful Creole who adored flowers.

Baron von Humboldt was the first modern geographer who became a great traveler; he was a human geographer, a field in which he was the originator. His influence in his way was as great in the world of thought as Napoleon's in the world of action. Animals, trees, plants, rivers, cities, streets, and currents bear his honored name. Thomas Jefferson invited him to come to North America and they spent three weeks together at Monticello. There Jefferson communicated to Humboldt an extraordinary project for the future division of the continent of America into three great republics into which were to be incorporated Mexico and the South American countries. Humboldt's comment on his visit to North America was "that the institution of slavery was the only cloud."

He returned to Europe with a mighty corpus of knowledge which filled many volumes and was eagerly read. Humboldt's words and deeds fired the mind of the young Englishman, Charles Darwin, and he grasped the first opportunity of going to South America. Captain Fitzroy needed a naturalist aboard the *Beagle* which was to make a survey of both coasts of South America. Darwin accepted the post. This was the only journey he ever made but it fertilized his thought the way guano fertilized the dry coastal land of Peru. And from the observations and deductions he made on the Galapagos Islands, the "Origin of Species" was born and zoology in its modern phase began.

The last but not unworthy successor of these great naturalists was Richard Spruce, a self-taught and painstaking botanist from Yorkshire. For seventeen years he explored the Amazon basin, sending home thousands of specimens to the museums of Europe. Kew alone received thirty thousand. He sent Cinchona to India. He made a careful study of rubber-yielding trees, and passed this information on to Kew, at that time the British government's adviser on rubber. Twenty years later, thanks to this information, another Englishman, Henry Wickham, made his famous—or rather, we might say infamous—"seed snatch" through which a whole industry was taken bodily from Amazonia to India and Malaya. Spruce had never intended this to happen.

The pioneer age of South American exploration comes to a close with him. He is the last link between the Colonial and Industrial eras. Much remains to be explored; the author enumerates many of the things that are still waiting to be done. He ends with a trumpet call—"South America is Calling."

Note: It seems almost invidious to single out for special mention any part of this superb book, but the 14th chapter stands out for its sympathetic interpretation of an important question, that confront one everywhere in the Andes—the problem of the Indian since the Conquest.

AMY SPINGARN.

Crop-Plants of Georgia And Nearby States

SOUTHERN HORTICULTURE. H. P. Stuckey. 688 pages, illustrated, indexed. Turner E. Smith and Co., Atlanta, Georgia. $2.56.

"Dedicated to the Farmers of Tomorrow," this book is a school book, and the material is so clearly and simply presented that even grade school students could understand it.

In the preface, Paul Chapman, Editor, affirms that the nation's trend in agriculture is towards fruit and vegetables and away from field crops, and that the South is largely responsible for providing said fruit and vegetables, especially in winter.

The author follows this lead and features orchards, groves, berry acreage, and other food-producing land, for commercial purposes and also for home use. Peaches have the spot-light, naturally, for Dr. Stuckey is a loyal Georgian, the Director of the Georgia Experiment Station. Apples, pecans, figs, the several berries, melons and vegetables—all are given detailed attention from planting to marketing, not forgetting to brush off insects and ward off diseases. Questions for class discussion, references for further study, and many maps add to the value of the text. In conclusion, space is given to the home vegetable garden, and the beautifying of home grounds, which makes the happy ending.

However, some southern horticulturists will look in vain for cotton and tobacco, and those who live across the Florida line will not find oranges in the index, but only okra and onions under "O"; likewise, no grapefruit under "G", but only garlic and grapes.

The title of the book covers a large territory, but from the Georgian viewpoint, the great sub-tropical crops fade out in the distance.

"Southern Horticulture" gives a very practical discussion of the subjects chosen from the wealth of plant material of the southern states.

EVA NOBLE,
Jacksonville, Fla.

Guide for Successful Fruit-Growing

FRUITS FOR THE HOME GARDEN. U. P. Hedrick. 171 pages, illustrated, indexed. Oxford University Press, New York, 1944. $3.

Here is an excellent book on fruit growing, designed particularly for the person who is entering this field but none the less valuable to the fruit grower in general. Its main point of distinction lies in the concise and easily understood manner in which directions are given, instruction which the amateur may readily grasp and put to practical use.

Commencing with the essentials of soil, site and climate selection, the author goes on to describe the various fundamental practices necessary to assure a successful outcome. It is evident that the information dispensed is the culmination of many years of close observation and association with this work.

The chapter on propagating fruits will no doubt be especially intriguing to the novice, as too the spraying calendar, both of which are clearly set forth without over-much confusing detail.

Separate chapters are devoted to each of the main fruits or fruit groups, giving detailed information of their care together with a selection of varieties, many of which are of recent introduction, in their order of ripening.

The illustrations add much to the value of this work.

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

Orchids of a Distant Land

THE ORCHIDS OF NEW SOUTH WALES. H. M. R. Rupp. 152 pages, illustrated, indexed. Australasian Medical Publishing Co. Ltd., N.S.W. 1943.

The first volume in a projected new Flora of New South Wales, issued by the National Herbarium, has been prepared by an honorary member of the staff who has made the study of the native flora a major interest during half a century. For the past 20 years the Rev. Rupp has specialized in the orchids of that part of Australia.

Twenty-three plates illustrate characteristic plants of different types. The addendum includes five newly discovered species of *Diuris*, described and named by Mrs. Pearl R. Messmer.

While the book is technical and complete enough for the taxonomist, its style is such that, with the help of the introduction and glossary, botanically untrained persons should be able to use it too.

CAROL H. WOODWARD.

Far Western Plants, Continued

ILLUSTRATED FLORA OF THE PACIFIC STATES, Vol. II. Le Roy Abrams. 635 pages, illustrated, indexed. Stanford University Press, Calif. 1944. $7.50.

Plant lovers who for years have been waiting for the second volume of Professor Le Roy Abrams' Illustrated Flora of the Pacific States will be gratified to know that it has appeared and that there will apparently be a relatively short delay in the publication of the third volume. The book covers the flora from the Buckwheat Family to the Krameria Family, inclusive, and offers descriptions and illustrations of 1,663 species.

The style of the book has been conspicuously changed. Instead of a separate cut for each species, the illustrations have been assembled into plates, mostly full page and dealing with nine species each. The book will certainly be extremely useful to all botanists, whether professional or amateur, who are interested in western plants.

H. A. GLEASON.

Science in Retrospect

A SHORTER HISTORY OF SCIENCE. Sir William Cecil Dampier. 189 pages, illustrated, indexed. Macmillan, New York. 1944. $2.

Some years ago, Sir William Cecil Dampier of Cambridge University wrote a rather extensive history of science which considered the philosophic as well as the chronological and more tangible aspects of the subject. In referring to that volume, Sir William has written: "Some, however, have found the philosophic part difficult to read, and have asked for a straightforward story of the growth of science reduced to its simplest terms." The present pocket-sized volume is a result of that thought, and the author, in preparing it, had in mind primarily two groups of people, the general reader and the scientifically inclined schoolboy who needs to look at his subject, as he says, "from a humanist standpoint."

E. H. FULLING.

Monograph on Cellulose

CELLULOSE and CELLULOSE DERIVATIVES (High Polymers, Volume 5). Emil Ott, Editor. 1,176 pages. Author and subject index. Interscience Publishers, Inc., New York, 1943. $15.

In the words of the Editor, this is "a thorough introduction for work on any cellulose problem by any person with reasonably wide general technical training."

After a short introduction on the occurrence of cellulose, comprehensive monographs which do not presuppose an understanding of a later section deal with the fundamental properties of cellulose, structure and properties of cellulose fibers, carbohydrates normally associated with cellulose in nature, lignin and other noncarbohydrates, preparation and purification of cellulose, derivatives of cellulose, physical properties of cellulose and its derivatives, and a summary of technical application.

This compilation is written by a number of experts thoroughly conversant with their respective fields. However, a more extensive study of the work, for example of Bose or Falck and others, should have prevented the editor from publishing statements as occur on page 152 with reference to enzymatic degradations.

F. F. NORD,
Fordham University.

Garden Photography

ALL ABOUT PHOTOS IN THE GARDEN AND YOUR CAMERA. R. M. Fanstone. 58 pages, illustrated. Transatlantic Arts, New York. 1941. 50c.

Reading Mr. Fanstone's book on photos in the garden gave me pleasure, and friends who borrowed the book agreed with my own opinion that it is interesting and instructive, and that it discusses the various problems one encounters in garden photography. The only criticism we had to make concerned the illustrations, which were either cropped too much or taken too close to the subject, with the result that portions of anatomy are missing. For example, the five pictures by H. Gorny are clear and sharp only in parts, and look as though they were prints taken out of the heart of the original negative.

FREDERICK W. RAETZ.

Negro Biography

DR. GEORGE WASHINGTON CARVER, Scientist. Shirley Graham and George D. Lipscomb. Illustrated by Elton C. Fax. 248 pages, appendix, index. Julian Messner, Inc., 1944. $2.50.

Two people of his own race have written about the great Negro scientist in a documented but somewhat fictionized biography, and a third has illustrated the work. Enlivened with conversation, the book develops the character of Dr. Carver in an easy manner, showing him chiefly in his relations with other people, but not neglecting his contributions to agricultural economy.

CAROL H. WOODWARD.

Notes, News, and Comment

Red Cross Display. When the doors were opened to the public after the ceremony for the unveiling of the Garden's Red Cross display in the conservatories the afternoon of Sunday, March 4, there were 15,000 people waiting on the paths outside and in the adjacent houses, to view the floral red cross (pictured on the cover) and the Philippine jungle scene with the Red Cross recreation hut erected among the trees. A description of the display and a report of the program will be given in next month's Journal.

Conference. F. L. Arland of White Plains, a member of the Botanical Garden, who has worked for many years on the culture and breeding of *Epigaea repens,* the trailing arbutus or mayflower, spoke on his experiences with these plants at the conference of the staff and registered students of the Garden Feb. 16. The second half of the program was given by Arthur Cronquist, who described some of his recent taxonomic studies in the Sapotaceae.

Addresses. Dr. William J. Robbins, after attending a board meeting of the Biological Stain Commission at the Cornell Medical College in New York on Feb. 17, left for Providence where he gave an address that evening at Brown University on "Growth Substance Deficiencies of the Fungi." The evening of Feb. 21 he addressed an audience at the Brooklyn Botanic Garden on "Penicillin and Similar Substances." This was the third lecture in a course being given there on "Recent Discoveries in Plant Science." On March 2 Dr. Robbins attended a meeting of the National Science Fund in Boston, where, as chairman, he accepted a fund of $50,000 from the National Sugar Research Foundation to be distributed as prizes for research on new uses for cane sugar.

Dr. A. B. Stout spoke on "Hemerocallis, Old and New" Feb. 5 in the course in floriculture given by the Horticultural Society of New York. On March 6 he addressed the Bronxville Woman's Club, an Affiliate of the Garden, on the same subject.

Elizabeth C. Hall addressed the Rye Garden Club, an Affiliate, Feb. 6 on "What Makes the Library of the New York Botanical Garden Unique." On Feb. 21 she spoke before the North Atlantic group of the American Rock Garden Society on "A Five-Foot Shelf for Rock Gardeners."

Dr. Roberta Ma spoke at Adelphi College in Garden City Feb. 12 on "Chinese Women in Science and their Opportunities."

Visitors. Dow V. Baxter of the University of Michigan spent two days at the Garden, Feb. 26 and 27, working on the fungi of Puerto Rico. While here he showed the staff his motion pictures taken during a recent trip to the West Indies. Josiah L. Lowe of the College of Forestry at Syracuse, René Pomereau of the College of Forestry in Quebec, and J. M. Waterston of Bermuda, currently of Cornell, were other February visitors in the mycological herbarium.

Among other visitors of the month were Helena Azevedo, Librarian in the National Museum of Brazil in Rio de Janeiro; Margarita Silva, mycologist in the School of Tropical Medicine at San Juan, Puerto Rico; Oscar P. Chiesa, of the Botanical Garden in Buenos Aires; José G. Rivas of the Department of Education in Buenos Aires; George W. Irving, Biochemist in charge of biologically active compounds for the U.S.D.A. at Beltsville, Md., who came to discuss research problems and visit Dr. Robbins's laboratory; Dr. Walter Carter of the University of Hawaii, who is working on pineapple wilt caused by insects, and who came to confer with Drs. Robbins and Dodge.

Groups. School and Scout groups which have toured the Garden in recent weeks under the guidance of staff members include a nature study class from the Spence Girls' School, classes from Bronx Public Schools Nos. 27 and 114, and a Zionist Scout troop.

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

CAROL H. WOODWARD, Editor

SPRING COMES TO THE NEW YORK BOTANICAL GARDEN

By Suzanne Gayne

FEW are the steps—
a few as the robin flies—
from shining rails that wind past murky house fronts
to the simple granite gate
of a vast green quietude—
acres and acres of greenness and paths and skies .

Spring and the morning beckon to a bench,
humble in the mellow coat of weather and time;
yet fittingly,
as newness would not have been—
where boxhedge-framed a cherry snow
lies, like mirage, on trees;
and still among the evergreen
the little fires of azalea glow . .
Cascades of flute cadenzas—
delicate, passionate as the bloom of spring—
form harmonies
with the gentle purr of a little wind
that teases burnished baby leaves of birch
in silver stockings like a corps de ballet.

No longer raucous with complexity and haste,
now human voices gentler seem;
the children's laughter ripples
like a Maytime stream . . .

And lilacs — lilacs riot everywhere!
The western white, the purple plumes,
the lacy Chinese, the Persian blooms,
are opening to the golden light
a beauty, unbelievable to sight;
and, freely pouring their delirious scent,
lave nostril nerves, long abstinent.

Now let us wander on, but softly, softly—
these are forest walks—
what sound! The lordly hemlocks bid us hush
to hear the bacchanal of spring—
the echo plays accompaniment -
and listen — serenely from this altar stone
petrified history talks . .

How long we dreamed? Time would not tell
For exquisite the dreaming here, O wonderland!
Yet must it, must it be farewell,
though heart and feet are lingering . . .

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GARDEN WEEK

May 14—20, 1945

TO celebrate its fiftieth anniversary, the New York Botanical Garden is sponsoring a Garden Week, May 14 to 20. The public is invited to participate in the tours of grounds and buildings, the exhibits, and the programs which will take place morning and afternoon each day. The complete schedule of events will be announced early in May.

A short motion picture of the Botanical Garden will be shown every afternoon in the museum building, and a talk will be given by a member of the staff on some phase of the Garden's activities. Flower arrangements by recent prize-winners at flower shows will be staged in the rotunda, and visitors will be invited to vote on their favorite composition. The tours that are scheduled will take the Garden's guests around the grounds, through the main conservatories, and through the museum building, where they will visit the laboratories, library, herbarium, and some of the exhibits.

Other plans call for a children's day with special entertainment, an international day, outdoor folk dancing, and additional features. Special programs are being arranged for the week-end.

The lawns around the Museum Building will be given over to guests who bring picnic lunches in order to spend the day.

Mrs. Robert H. Fife, Chairman of the Garden's Advisory Council, is heading the committee on arrangements for Garden Week.

Tropical Plants the World Around

By Otto Degener

I.

This is the second in the series of articles being presented by the Journal of the New York Botanical Garden on the general topic of the winter series of Saturday afternoon lectures: "Plants of the Regions Where Our Men and Women Are Serving." In this article, the first of several prepared by Otto Degener, who has lived for many years in Hawaii and has explored the tropics and near-tropics of other parts of the world, plants that are commonly seen in most of the tropical regions are described and illustrated. The majority of the drawings have been adapted from the originals made for his "Flora Hawaiiensis" or "New Illustrated Flora of the Hawaiian Islands."

LYCHEE

IN THE FORM of welcome Christmas gifts proffered by Chinese tradesmen, the lychee "nut," or fruit, long has been familiar to Americans. Though the lychee tree (*Litchi chinensis*, Soapberry family) is unknown in the wild state, we suspect it is native originally to southern China. Since it can stand only a few degrees of frost, it could never have grown any considerable distance north. Its closest relative grows in the Philippines.

The lychee is a slow-growing, spreading tree with many shiny pinnate leaves. Its small greenish flowers, borne in clusters sometimes up to a foot long, are not worth looking at so far as beauty is concerned. But the fruit is a lovely sight when it ripens to a brilliant pale crimson and hangs in generous clusters. It consists almost entirely of seed—the only part of the fruit that is not seed being the tessellated, brittle, papery shell. In the ordinary type of seed, the young plantlet, or embryo, is surrounded first by a delicate seed-coat, termed the tegmen. Outside of that lies the hard, protective coat, or testa. The lychee, like the nutmeg with its mace, is peculiar in that it possesses a third seed coat, known as the aril. This grows out from around the base of the seed, in irregular, finger-

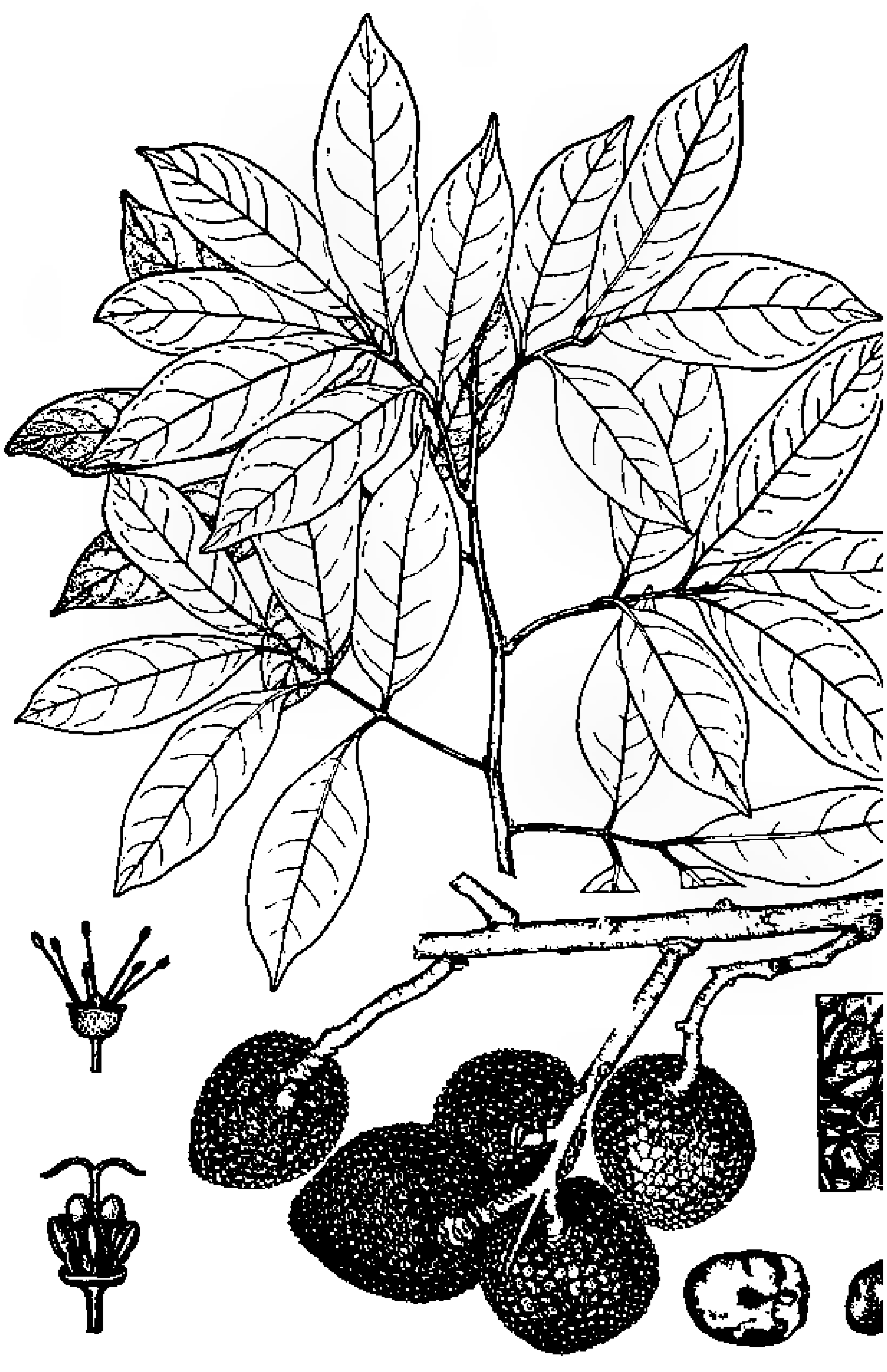
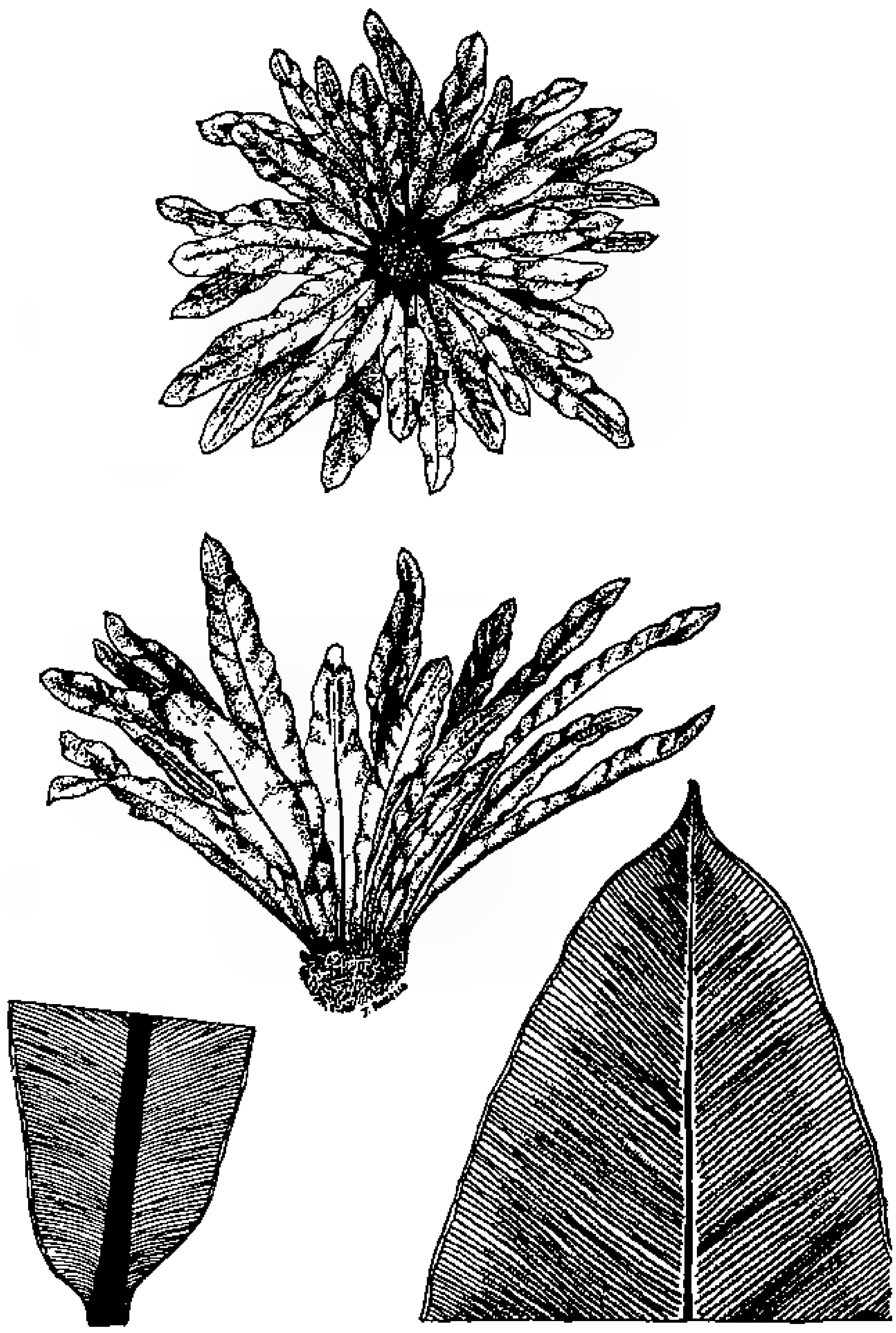


Illustration partly after E. H. Walker.

like extensions which crowd firmly together in the confining shell. These do not grow together and amalgamate where they meet, but can be readily pulled asunder. In the fresh lychee fruit, this remarkably developed aril is white-translucent, juicy, and sweet—somewhat like a muscat grape in texture and flavor. It is this third coat which comprises the edible portion of the plant.

The meat of the dried lychee is dark, reddish brown, sticky, shrunken, and sweeter than the fresh fruit. It differs in appearance and taste from the fresh fruit somewhat as a raisin differs from a grape. The fresh fruit is marketed by simply breaking off the branches bearing the fruit clusters. Even so, the fruit quickly loses its attractive bright color and begins to turn brown. The Chinese ordinarily postpone this about two weeks by sprinkling the cluster with weak salt water and packing it in bamboo joints plugged with clay. Lately, however, refrigeration or submergence in distilled water has been adopted. The fresh fruit nowadays is occasionally canned in syrup and is considered a great delicacy. The tree is rare outside the Orient, but is beginning to be planted more and more in warm and tropical countries. Reasoner Brothers introduced the lychee from Saharanpur, India, into Florida about 1886, and from there into southern California about 1897. It had been planted in the Hawaiian Islands by the Chinese long before.



BIRD'S-NEST FERN

THE BIRD'S-NEST FERN (*Neottopteris nidus,* Fern family) is a huge plant closely related to the spleenworts and by some botanists included in that group. With its varieties, it is native to Australia, Madagascar, tropical Asia, and to most warm islands of the Pacific. It grows perched, as its name suggests, like a bird's nest, usually in the crotch of some venerable tree or rarely in a rock crevice. Being such an oddly ornamental fern, the bird's-nest is prized for growing in hanging baskets and in tubs in the tropics, and under glass in temperate and cold regions.

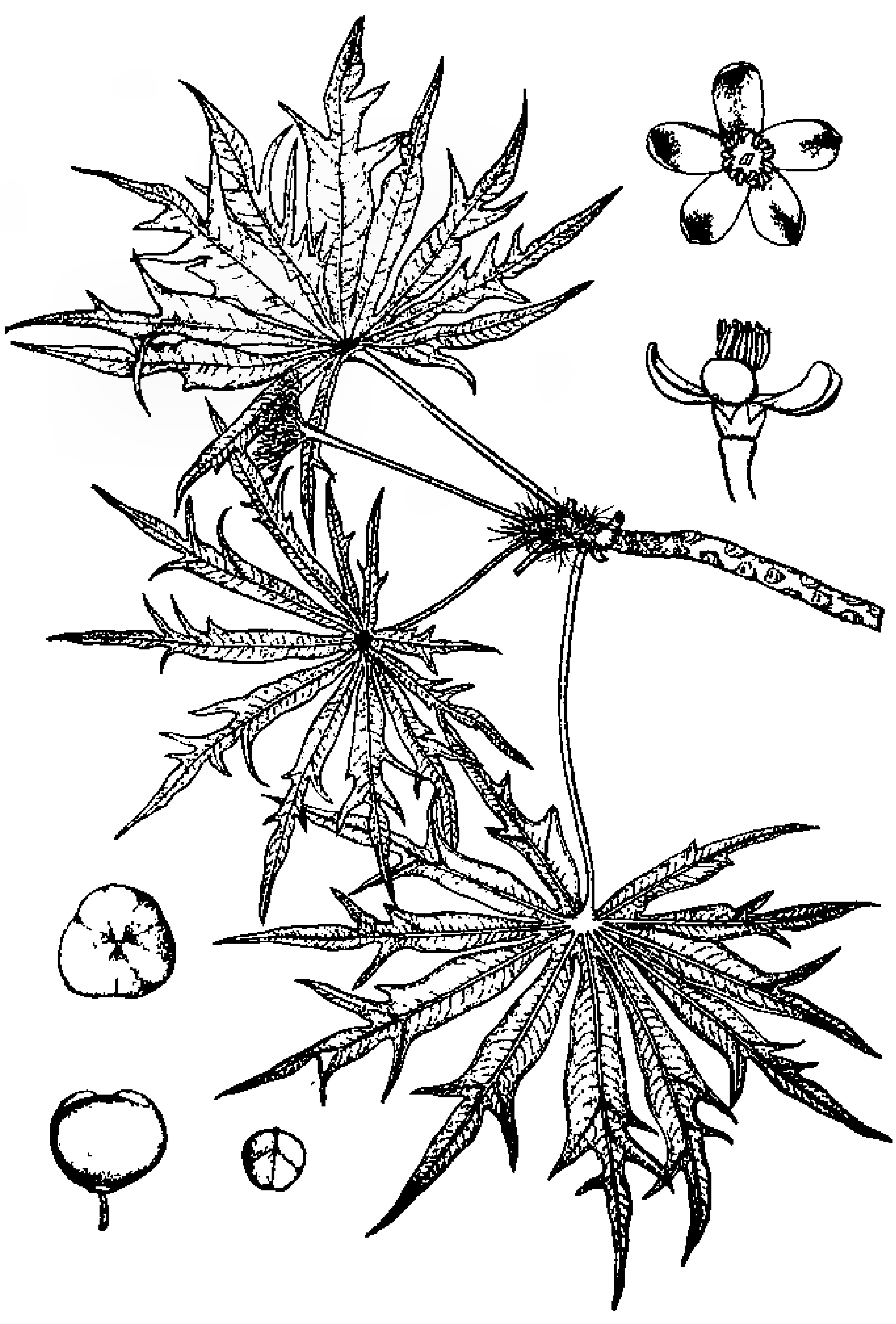
The bird's-nest fern consists essentially of a mass of fibrous, rich brown, spongy roots; an erect stem that is almost non-existent; and many shiny, smooth, stiff fronds growing to the surprising length of five feet. These fronds are shallowly trough-shaped, and thus catch dust, falling leaves, and other organic debris. They also catch rain, which washes the accumulated humus down to the mass of spongy roots. These, many of which grow upward, act as a reservoir to tide the fern over periods of dry weather.

After the Hawaiians had selected and cut a tree to hollow its trunk into a canoe, they covered the stump with the fronds of this fern before continuing their work. Because of the fanciful shape of these fronds, they gave the bird's-nest fern a name meaning "the paddle of the demigod Maui." This fern has figured in the mythology of many other Pacific islanders as well.

CORAL-BUSH

THE CORAL-BUSH shown here (*Jatropha multifida*, Spurge family) is one of three closely related and similar plants that have been extensively grown in tropical countries, both for commercial use and as ornamentals—though as rather dangerous ornamentals because of the poisonous quality of their seeds. The other two are the physic-nut, or Barbados nut (*Jatropha curcas*), and the gout-plant (*Jatropha podagrica*), also called Tartogo nut, and distinguishable by its "gouty" stem which is swollen for a short distance above the root.

These three species of *Jatropha* bear 3-celled, yellow to red capsules, enclosing about three large seeds, or NUCES PURGANTES, about the size of a peanut or larger. They taste delicious—and here, states Dr. Harry Arnold,* lies a grave danger, for whoever tastes one will instinctively eat more of them. "These seeds contain from 29 to 40 per cent of a yellow fixed oil, the specific gravity of which is 0.929, which is known variously as Hell oil, Pinhoen oil, Oleum infernale and Oleum ricini majoris. It consists of the glyceride of a characteristic acid belonging to the same group as ricinoleic and crotonoleic acids, but not identical with either. Its activity is greater than that of castor oil and less than that of croton oil. The purgative dose is 0.3 to 0.6 cc. The oil is much used in commerce for illuminating purposes, the making of soaps, adulteration of olive oil, and so on. It is also used as a lubricant."



Now that science has found superior substitutes for the seeds of the coral-bush and its ilk, there is no excuse for growing these plants any longer, even though they are very odd ornamentals. Their danger to the ever-inquisitive child is too immediate. The substances concentrated in these seeds are almost incredibly powerful poisons when injected or otherwise introduced into the circulation, as through a cut, for example. They resemble snake venom in their action, and in the city of Honolulu alone these seeds have been a frequent cause of more or less serious illness. Elimination by vomiting and purging usually seems automatic and, of course, must not be checked. Meanwhile, a physician should be rushed to the patient.

The coral-bush itself is native to dry parts of tropical America, but precisely where has not yet been established. It is a coarse, few-branched shrub about 5 feet high, which under exceptionally favorable conditions may become a 12-foot tree. Its leaves are circular in outline, but deeply split into many radiating, few-toothed segments. These are green above and white with a bloom below. The stipules (appendages on each side of the base of the leaf stalk) are split so finely as to be almost thread-like. The flat-topped flower clusters consist of coral-red stalks, as the common name implies, and scarlet flowers. These are of two kinds; the many staminate, or male, flowers irregularly surrounding the few pistillate, or female ones

* Arnold, H. L. Poisonous Plants of Hawaii, 1944.

· MANGROVE

THE COMMON MANGROVE (*Rhizophora mangle,* Mangrove family) is, like many of its relatives, admirably adapted for growth in salt marshes and mud flats. Native along the Atlantic from Bermuda, the West Indies, and Florida south to Rio de Janeiro, it has been introduced into the Pacific in Hawaii, where it is now completely naturalized.

Growing usually about 30 feet high, on rare occasions it has been known to reach twice that size. The leaves are thick and leathery. The few flowers produced are clustered in the axils of the leaves. Their sepals, which persist even after the germination of the seed, are waxy and yellow; while the narrow petals, which function but a day, are lighter in color and furnished with cobwebby hairs.

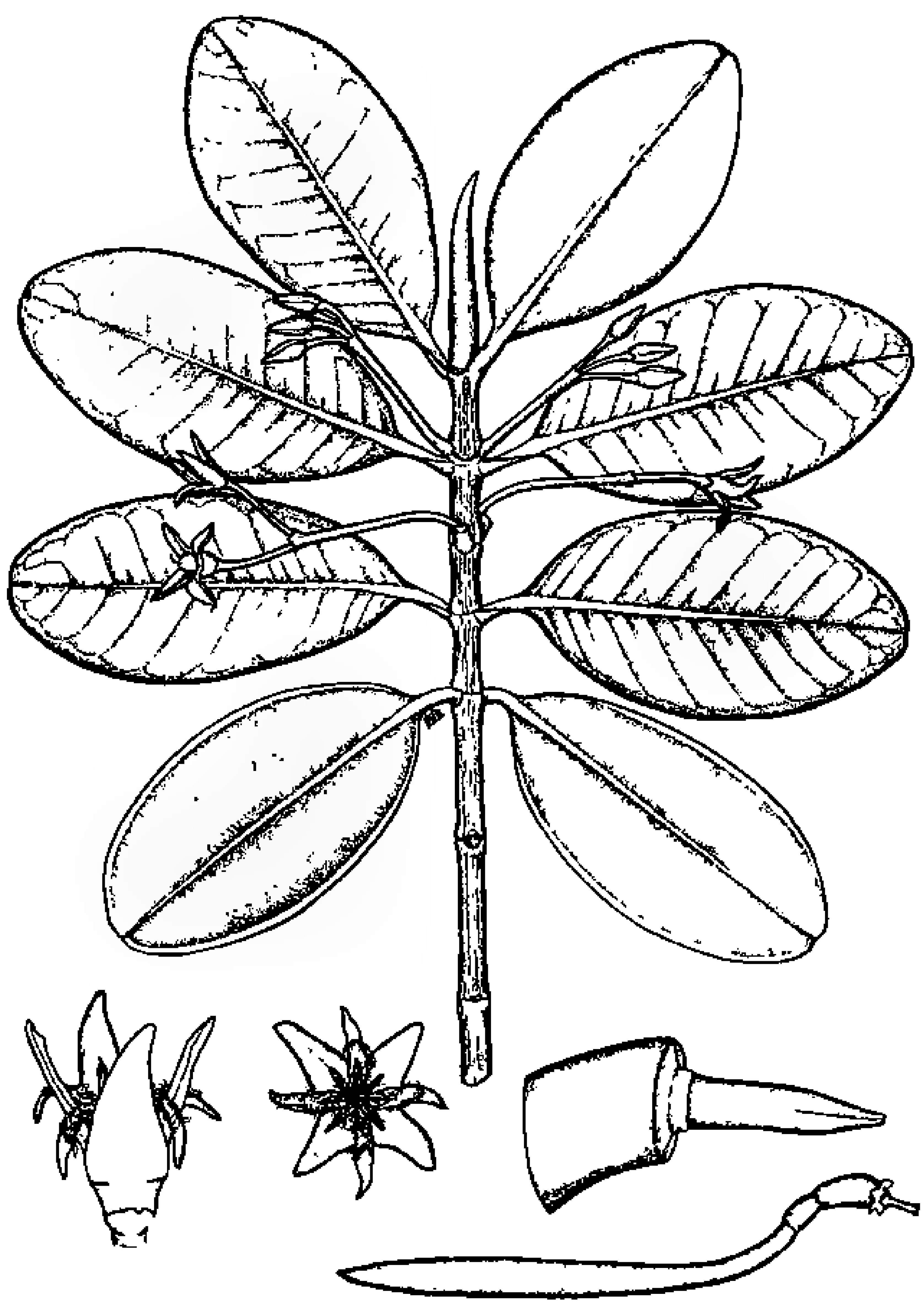
Mangroves have long been famous for their so-called "viviparous" seeds and for their peculiar root development. The leathery fruit is greenish brown, about an inch long, and roundish. Instead of dropping off the tree when it becomes ripe, it stubbornly hangs on for weeks and even months, while the impatient seed within it germinates *in situ.* There it produces a single root, which grows to the incredible length of four to ten inches. This root is narrowly club-shaped but the end is pointed. As the seedling finally falls loose from the fruit, which is still attached to the parent tree, it plummets like an arrow down into the mud, there to anchor the now independent plant.

On the mature mangrove the roots are of two kinds: prop roots growing downward, not from the base of the plant but from the branches; and air roots, or pneumatophores, growing upward from the muck. As the long slender prop roots arch downward, they divide several times like a bursting Fourth of July rocket, and finally sink into the tidal mud. These roots eventually grow into sizable trunks and tend to "walk" the tree ever seaward.

Because the mud flats are mostly devoid of oxygen in available form for the plant's use, the mangrove produces great numbers of pneumatophores, which are spongy, subterranean roots which seek the surface. When the mud flats lie exposed at low tide, an exchange of gases can thus take place between the open air and the gases imprisoned in the parts of the plant buried deep in the mud and otherwise prone to suffocation.

The tangle of branches, prop roots, and pneumatophores catches mud and, at high tide, flotsam and jetsam. Thus, while the older part of the mangrove swamp gradually becomes dry land from the accumulation of debris, the young fringe continues its forward advance. The mangrove is therefore very useful in protecting and reclaiming land from the ocean.

The trunk of the mangrove has several uses, for the wood is much esteemed for charcoal, and the bark, which contains from 20 to 30 percent tannin, is used in tanning hides. Twigs, used in place of



toothbrushes in the Bahamas, are said to be effective because of the tannin content.

Though the reddish, fine-grained, hard wood is so heavy that it sinks in water, the unanchored seedling mangrove, if it has not struck ground in falling from the fruit, merrily floats about in ocean currents to begin the growth of new colonies, perchance on distant shores.

PEPPER

FOUR KINDS of true pepper are used rather extensively by man. All belong to the botanical group *Piper* (Pepper family) which is in no way related to the red or bell peppers of vegetable gardens.

The common pepper (*Piper nigrum*), found reposing beside the salt shaker, is native to the hotter parts of India but is now cultivated in most tropical regions where the rainfall is heavy. It is a coarse climber, at times reaching a height of 20 to 30 feet, with heart-shaped leaves. Its minute flowers are borne in a narrow rat-tail of a spike 4 to 6 inches long. This spike finally produces the stalkless peppercorns, about fifty in number, so well known to us for their pungent flavor. These at first are green but soon change to red and then finally fade to orange.

Curiously enough, both black and white pepper are derived from the same plant. For black pepper, the peppercorns, or berries, are gathered while yet unripe. They are spread on mats in the sun, and when thoroughly dried, are ground. On the other hand, for white pepper, as it is manufactured in the Orient, the berries are gathered when ripe and fleshy and left to soak in water for about a week. When the pulp has sufficiently decayed, barefoot laborers squash it off by repeated trampling. The peppercorns are then washed, dried, and ground. This unappetizing procedure is not followed on modern plantations, mostly located in the New World. There the pepper is freed of its outer covering by machinery.

Theophrastus mentioned the use of pepper as a spice in the Fourth Century B. C. Before the use of modern refrigeration, pepper and other condiments were far more prized than today. Pepper retarded the spoiling of food, and made food already tainted and highly odorous, easier to stomach. The high regard in which this spice was held is shown by Attila, who demanded three thousand pounds of pepper as part ransom for the city of Rome.

A related plant, likewise a climber and likewise a native of India, is the cubeb pepper (*P cubeba*). This is very unusual in bearing stalked berries on its spikes. These berries, called cubebs, are harvested when unripe. Because of the presence of ethereal oils, these berries are employed as a kidney stimulant and, put up in the form of cigarets, are also used in catarrhal conditions.

Wherever splotches of red saliva stain the walks, there one will find the betel pepper (*P. betle*) or some of its varieties. This plant is a climber bearing stalkless berries similar to those of the common pepper. It is native to Ceylon and Malaya but is widely cultivated in the Orient and, where East Indians have settled, elsewhere. The leaf of this pepper and the seed of the betel palm (*Areca cathecu*) are the chief ingredients necessary for the ugly but relatively harmless habit of betel chewing. This custom is indulged in by some two hundred million men and women inhabiting an area extending from Reunion and Zanzibar to India, Ceylon, and southeastern China, and in the Pacific as far east as the island of Yap in the Carolines. It is estimated that the addicts chew over fifty thousand tons of palm seeds yearly.

Betel chewing was first described in 340 B. C. by Herodotus. The method is complicated and varies according to the whim of the chewer. In general, fresh pepper leaves are smeared with quicklime and cutch (a gum derived from *Acacia catechu* or some other plant). Slices of the seed, or "nut," of the betel palm at any stage of maturity are placed on the leaf. Some connoisseurs may add a pinch of tobacco, clove, tamarind or other flavoring. The whole cud is then placed in the mouth, and the mildly narcotic effect soon follows.

Though betel chewing is helpful in preventing hyperacidity, it blackens the teeth and turns the chewer's saliva blood-red. Also, it greatly stimulates the flow of saliva.

The fourth pepper, here illustrated, is a stocky, non-climbing bush rarely over five feet high. This is the kava pepper (*P. methysticum*), which resembles so closely all the other kinds of *Piper* found in the Old World tropics, that one should be able to recognize a *Piper* wherever he sees one.

The precise home of the kava pepper is not known. It has been cultivated from earliest times by the Polynesian and some Melanesian peoples as their national beverage throughout the Pacific beyond the betel-chewing belt. The plant, as well as the drink, is known as AWA by the Hawaiians, Samoans, and Tahitians; KAWA by the Tongans; and YANGONA by the Fijians. This plant furnishes a mild narcotic tonic. Until I began drinking kava day after day in Fiji, I was under the impression from reading early missionary accounts that this habit was a pernicious one. I erred. In moderation, the drink is refreshing and cleansing, leaving an after-taste akin to that left by a poor quality peppermint toothpaste.

In Fiji, the drink is prepared by pounding the swollen roots and basal stems, either fresh or dried, between two stones. The sawdust-like result is then placed in a clean bowl and mixed with water. The bast fibers of a hibiscus relative (*Pariti tiliaceum*) are next employed with graceful movements to strain the liquid. This has the appearance of a weak mixture of coffee and milk. It is drunk only by men. Its taste is not particularly pleasant to many, but this is outbalanced by its refreshing after-effect. The preparation and drinking of kava are accompanied by much religious ceremony and pomp, and for a white man to ignore the etiquette followed at a party would be considered the height of ill-breeding. He would quickly lose social standing.

In other island groups — Hawaii, Samoa, and Tonga, for example—kava is—or was in the past—prepared in a less sanitary manner, the method varying somewhat in the different archipelagos. In Hawaii the chiefs were wont to choose the prettiest young girls to prepare their drink. These, with rosy lips and pearly teeth, sat cross-legged upon mats around a large calabash. They chewed the kava, often until fatigued, until it was reduced to a pulp. When of the proper consistency, they spat the juicy mess into the calabash. After a sufficient quantity of kava balls had been produced, water was added, and the infusion was well kneaded and stirred. Then, after undergoing further straining and the addition of more water, it was passed to the waiting chiefs. In an experiment years ago, W. T. Brigham furnished some Hawaiians with kava and water. He weighed each carefully before the preparation of the drink and weighed the drink on its completion. Though nothing had been added, the weight of the ingredients used and the weight of the product did not coincide. The increment came from the chewers with rosy lips and pearly teeth. Kava, as its process of manufacture shows, is non-alcoholic and is not a result of fermentation, notwithstanding recently published statements to the contrary.

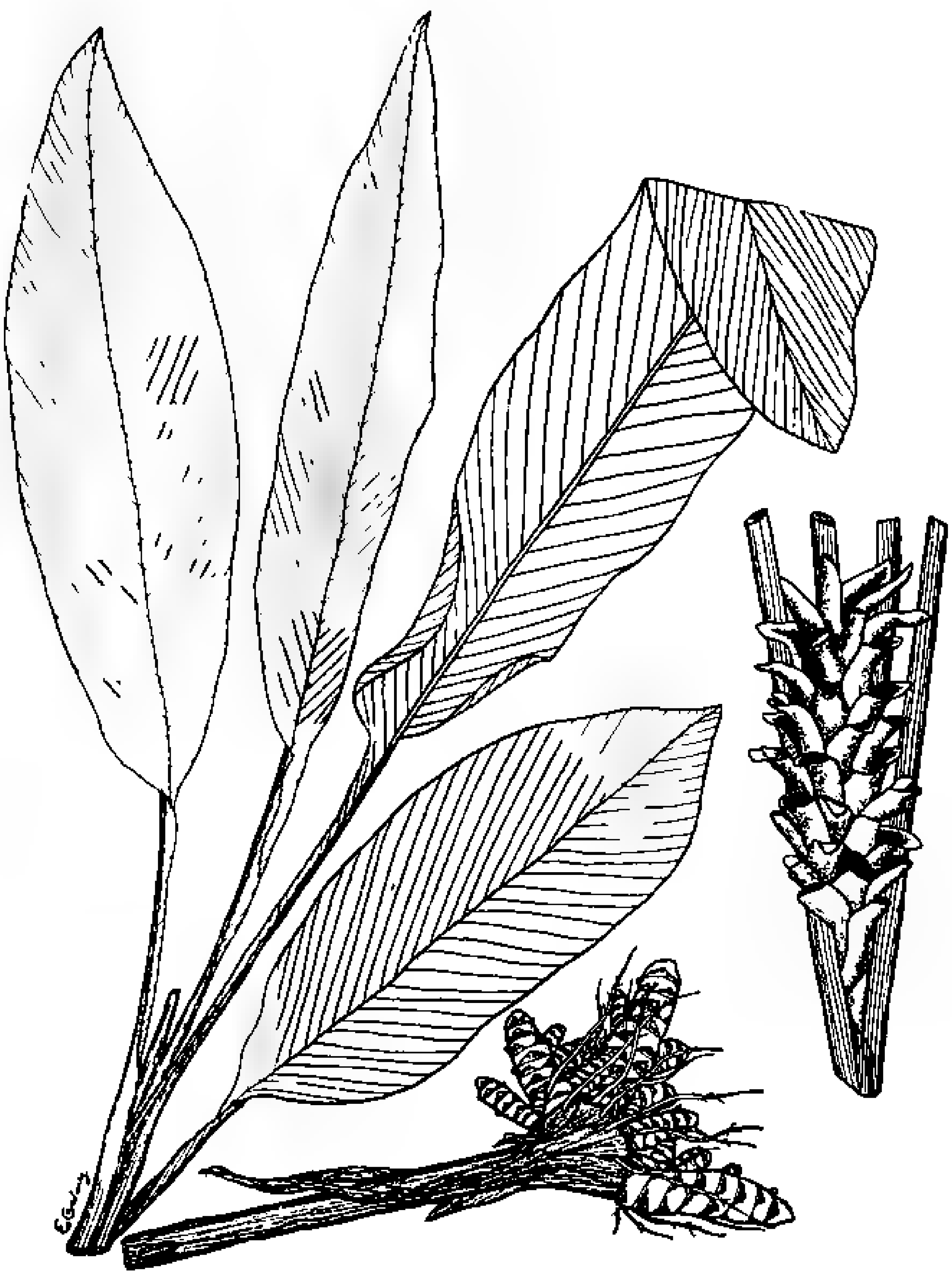


Illustration partly after C. Judd.

TURMERIC

THE TURMERIC PLANT (*Curcuma longa*, Ginger family) is a coarse herb, two to three feet in length, with a thick rhizome similar to that of its relative, the common ginger, but deep golden in color and somewhat waxy to the touch. The plant is not known in the wild state anywhere. From time immemorial it has been cultivated by the peoples of the Orient. As it evidently bears no seeds, cuttings must have been carried by the Polynesians to Hawaii and to other Pacific Islands during their canoe voyages—voyages that surpassed in distance and daring the exploits of the Vikings. To these islanders turmeric was more than a food; it was used in medicine and in many religious rites.

The turmeric plant is grown particularly in Bengal, Java, Formosa, and China for its rhizomes. These are able to withstand considerable abuse without dying; and so long as they are alive, their cells, with a "will to live," tenaciously retain their water from evaporation. Thus, the rhizomes may even grow and produce leaves while packed away in storage. To prevent the resultant loss to the harvest, these rhizomes are killed with scalding water. Dead, the cells readily give up their moisture, and the rhizomes soon dry, shrivel, and are prime for shipment to market.

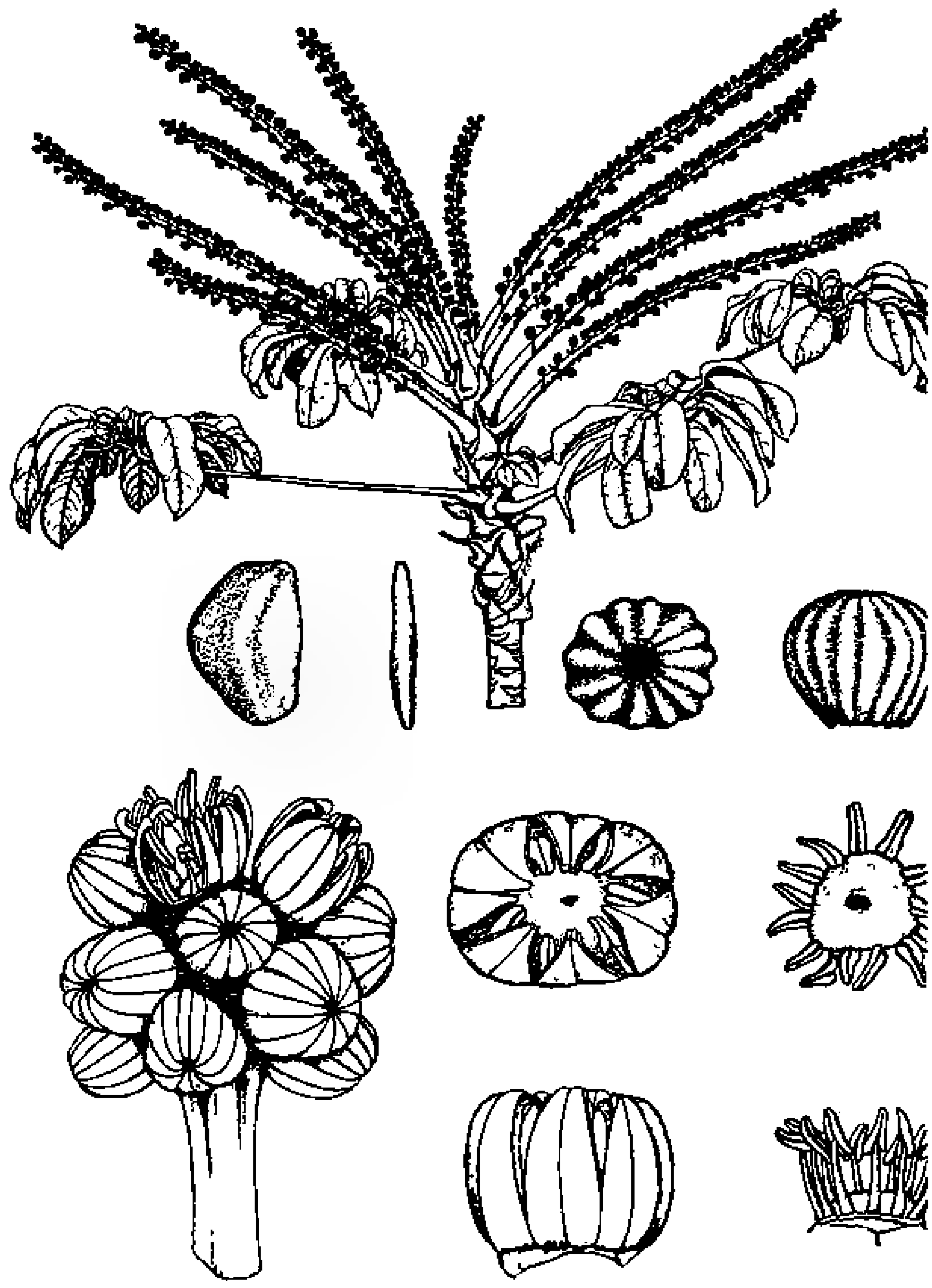
The mature, so-called "round" rhizomes furnish the turmeric of commerce—a condiment characterized by a peculiar, feebly aromatic odor, and a bitter, pungent taste. It colors the saliva yellow. In India it is an essential ingredient of curry powders. Besides turmeric, these contain chiefly curry leaves, garlic, pepper, ginger, and various other strong spices. Turmeric is sometimes used to impart a yellow color to ointments and other pharmaceutical preparations. It has been found also as a common adulterant in prepared mustard to give the product a more attractive color. The other type of rhizome, which is young, pale, and described as "long," furnishes a kind of arrowroot.

WORMSEED

MEXICAN-TEA (*Chenopodium ambrosioides*, Goosefoot family) is a widely distributed, unattractive, weedy, perennial plant, growing about 2 feet high. The under side of each leaf is minutely spotted with yellow dots containing oil, which, no doubt, accounts for the plant's strong aromatic qualities. The greenish flowers are tiny and very numerous, indicating that the Mexican-tea depends on the wind, rather than on insects, to effect cross-pollination and aid in seed production. Such plants must always be suspected as potential hayfever producers.

Though Mexican-tea is native to Mexico, it may be found naturalized in many different forms from Maine and Ontario to California, as well as in southern Europe, Asia, and many islands of the Pacific. It is apt to thrive in pastures because cattle, disliking its pungent, minty flavor, are apt to reject it in favor of its more palatable neighbors. Thus, it is aided in its struggle for

"Lebensraum" at the expense of competing plants. The Mexicans, who know the plant as APAZOTL, cook and eat it or brew it into a tea. It was popular as a tea in Germany as early as the middle of the eighteenth century, and it is still cultivated in the Philippines. Its fruiting heads and leaves furnish an oil used as a remedy against hookworm and other intestinal parasites, hence another common name for the Mexican-tea is wormseed.



UMBRELLA-TREE

THE UMBRELLA-TREE (*Brassaia actinophylla,* Aralia family), native to Queensland, Australia, is a coarse tree of few branches, growing generally 10 to 20 feet high. Its large leaves are borne toward the ends of the branches, and each one consists of a number of thick, shiny leaflets arranged radiately like a pin-wheel or the ribs of an umbrella. The tree itself attracts no particular attention until it produces at the ends of its massive erect branches a dozen or more radiating flower clusters, which are 3 to 4 feet long and of the brightest crimson. It is a novel and beautiful sight, although a bit suggestive of the spreading tentacles of a devilfish.

The umbrella-tree has found its way into many tropical gardens, but is as yet by no means common.

PRIDE-OF-INDIA

THE PRIDE-OF-INDIA (*Melia azedarach,* Mahogany family) is a tree often reaching a height of 50 to 65 feet, with a trunk 6 or more feet in diameter. It has very large leaves that are broken up into numerous small leaflets, and, in a roundabout way, this fact is responsible for its scientific name. Because its leaves bear a superficial resemblance to those of the ash, Linnaeus gave the pride-of-India the Greek name for ash, which was *Melia.*

Though our tree is native to southeastern Asia, it is widely planted for the sake of its beauty, and becomes naturalized in most tropical countries. It can withstand considerable seasonal drought, shedding its leaves at that time to reduce excessive evaporation.

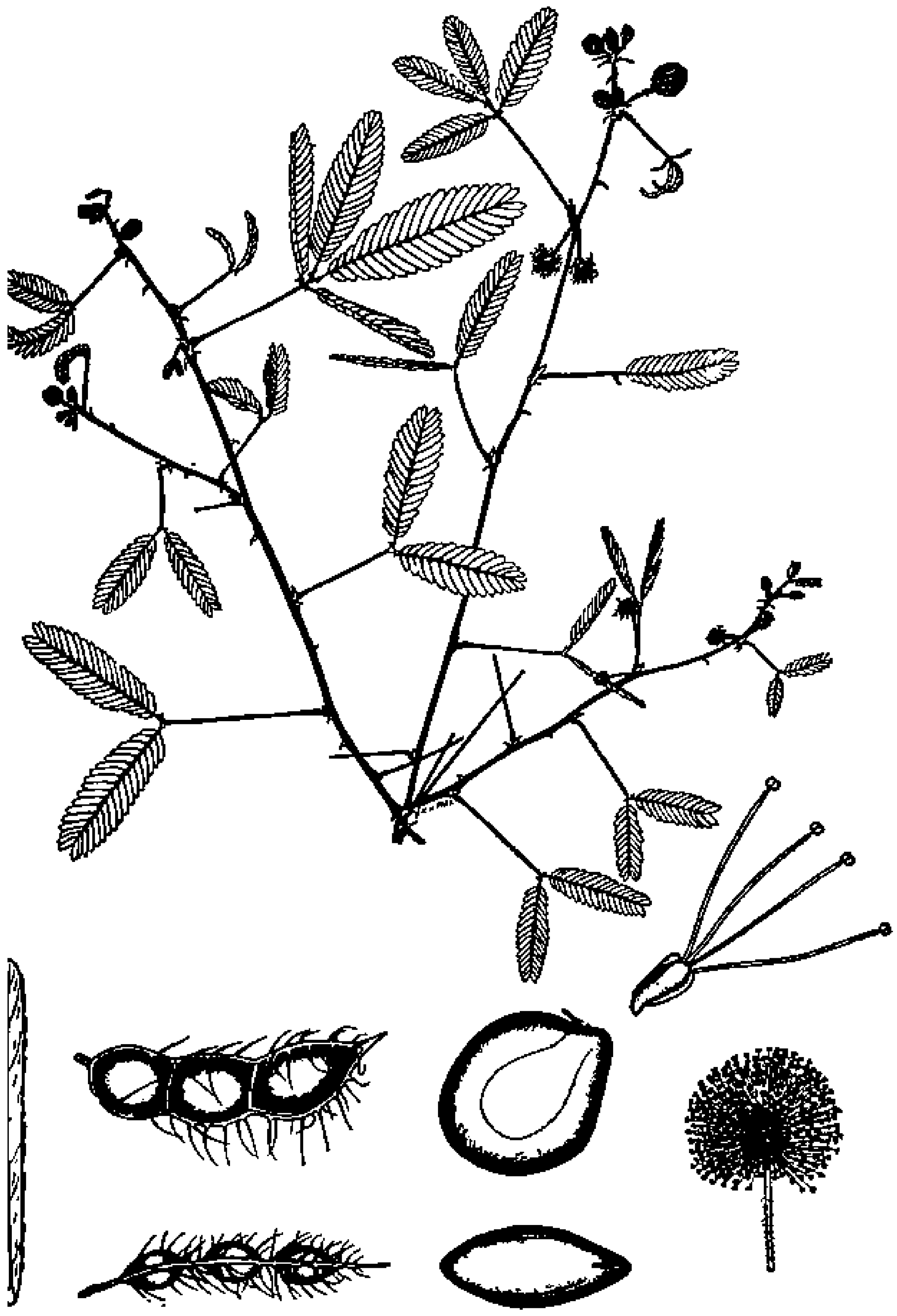
The lavender flowers are about a quarter of an inch wide, but, to make up for their smallness, are aggregated into large, loose clusters borne in the axils of the uppermost leaves. The flowers are fragrant, especially at night, evidently to cater to night-flying insects. The smooth, roundish fruits are about three-quarters of an inch across and dirty yellow in color.

In India, the juice gained from incisions in the trunk is made into a cooling drink. The bitter leaves are occasionally boiled with other vegetables and eaten, while the flowers are prized as offerings of thanks in the temples. The woody cores of the fruits are made into beads. The whole drupe, and to a lesser extent the bark and flowers, contains a little known poison of a narcotic nature. According to Dr. Harry Arnold, children, poultry, and pigs, after eating them, have suffered serious symptoms of paralysis, irregular respiration and suffocation. These fruits are best left alone.

SENSITIVE-PLANT

THE SENSITIVE-PLANT (*Mimosa pudica,* Pea family) is native to tropical America but is now widely naturalized in warm regions. Its individual flowers are tiny, consisting mainly of 4 pink corolla lobes, 4 thread-like purplish stamens with yellow anthers, and a single purplish pistil. But so many of them are clustered together that they form conspicuous fluffy pink heads about three-quarters of an inch in diameter.

The sensitive-plant is a perennial, forming low tangled masses in pastures and waste places, particularly in moderately rainy regions. It becomes woody with age and then, especially, its recurved prickles are a nuisance to barefoot boys and bathers. It was long considered a weed in pastures, as it tends to crowd out more desirable forage plants. More recent experiments show that if it is mowed low to cut away the woody twigs and thereafter always heavily grazed, the tender new shoots will continue to form valuable feed year after year. The jointed pods, or loments, are prickly along their rim, probably to help in their distribution by animals to whose fur they adhere. The seeds do not fall out of



these pods. Instead, one-seeded segments break from the rim on ripening.

Many members of the Pea family respond to a variety of external stimuli with "sleep movements." The sensitive-plant, because of the rapidity of its movements, is by far the best known and most spectacular. When the leaves are touched, suddenly the leaf-stalk falls and even the smallest leaflets fold together. This is accomplished by the quick escape of sap from the microscopic cells of a specialized joint, called a pulvinus, into neighboring air spaces. It is like a garden hose stiff with water suddenly collapsing on closing the spigot. Then as the cells of the pulvinus slowly regain their sap and stiffen, the leaf assumes its normal expanded position. This movement is so striking that the famous sensitive plant is grown in many schools and universities as an aid in teaching. Should the students disturb the plant often, however, it will no longer react efficiently but will show signs of fatigue. If irritated too often, it may languish and might finally die.

PARTRIDGE-PEA

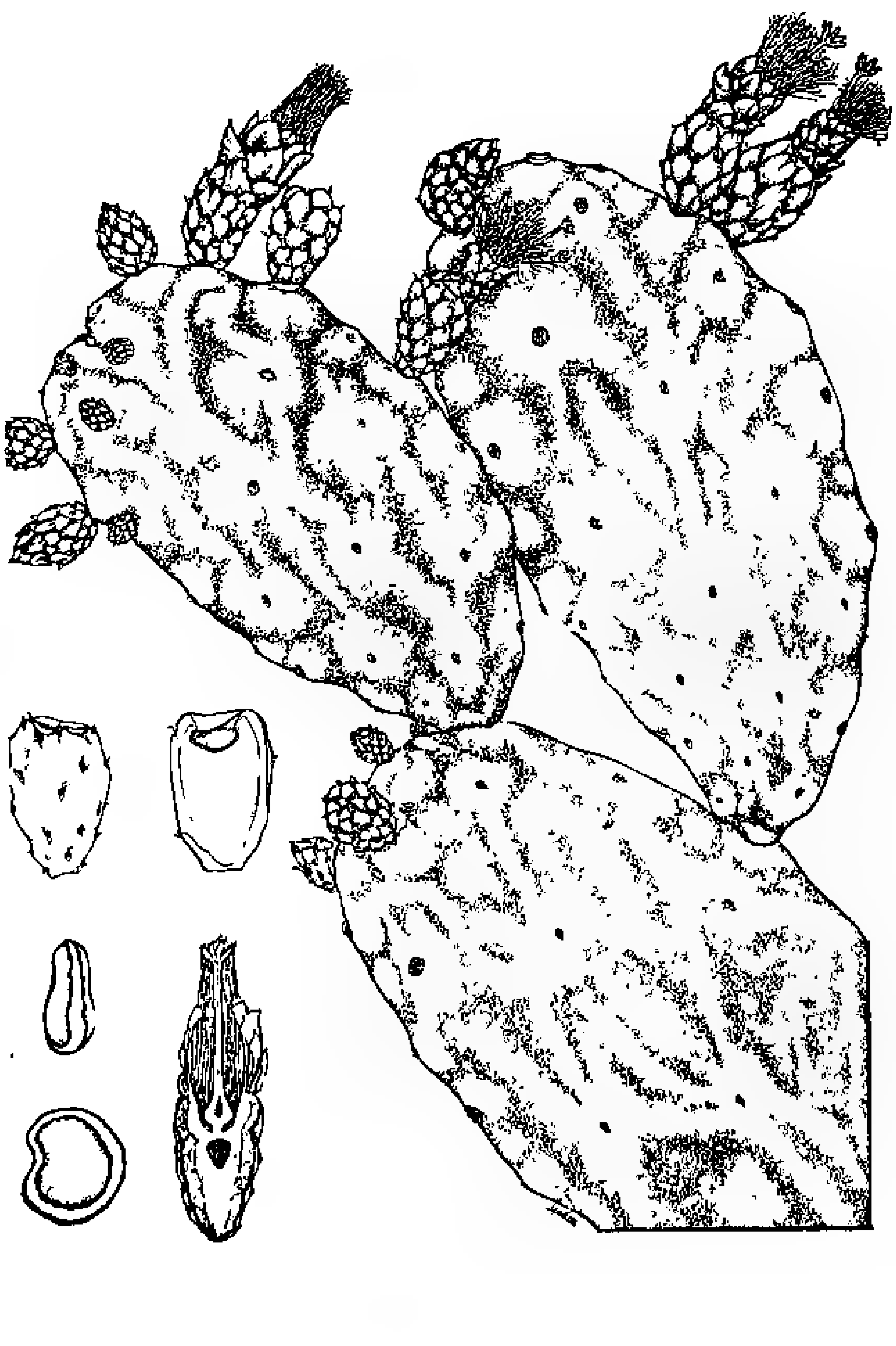
THIS PARTRIDGE-PEA (*Chamaecrista Leschenaultiana,* Pea family) grows in India, Ceylon, Java, Mauritius, Hawaii, and in many other regions. Other kinds, easily recognized as partridge-peas by their general appearance, are common in other tropical and temperate regions, where they grow in sunny pastures and waste places, often producing almost pure stands. They are erect, mostly quick-growing, rarely taller than three feet, and are more or less red where exposed to the hottest rays of the sun. Their yellow flowers, though slightly ir-

regular, are not the usual shape of pea flowers. The leaves superficially resemble the leaflets of the sensitive pea, and they fold together during hot, dry weather to reduce evaporation, and at night, in "sleep." The flattish pods on maturity and drying suddenly snap and twist apart, thereby tending to hurl their seeds to ground not occupied by the mother plant.

In Hawaii, the leaves and young stems of this partridge-pea are occasionally used by the Japanese for tea. Though the plant is at times eaten by livestock when found in weedy pastures, it is not generally favored by ranchers.

COCHINEAL CACTUS

THE COCHINEAL PLANT (*Nopalea cochenillifera,* Cactus family) is a spineless cactus about ten feet high. The flowers, on close inspection, are actually red, but they never spread open more than enough to allow their greenish style



and some 300 pink stamens to protrude into the open. The flowers are followed by purplish-red, juicy, edible fruit.

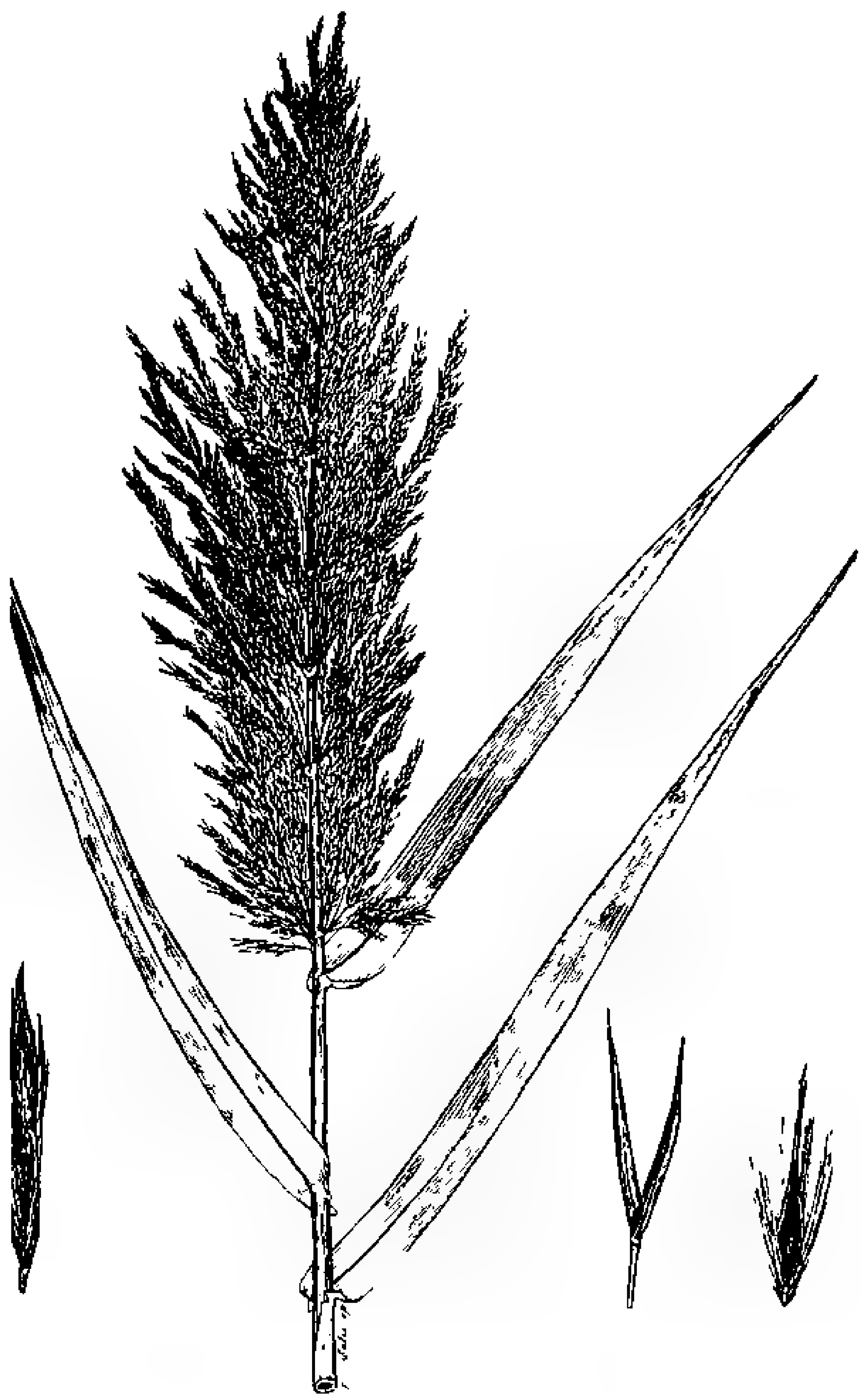
The original home of the cochineal plant is unknown. It has been cultivated since prehistoric times by the Indians in tropical America. Being spineless and therefore easily handled, provided one wears gloves to escape the tufts of tiny hooked hairs or glochidia, it was preferred for the production of cochineal, a scarlet dye that was popular up to a generation ago. When the Spaniards conquered Mexico in 1518, they found the cochineal industry well established among the natives. In 1523 Cortez was ordered to procure as much cochineal as possible to send to Spain, and during the colonial period this dye was one of the chief articles of tribute. The cochineal industry spread rapidly, plantations called nopalries arising in such diverse regions as Spain, India, Algeria, South Africa, Jamaica, and the Canary Islands. Some of these nopalries contained 50,000 plants set out in rows four feet apart. The records of the Canary Islands give an indication of the phenomenal growth of this industry. In 1831 this region exported only eight pounds of cochineal; whereas in 1869 more than six million pounds, valued at four million dollars, were produced.

Although the industry had been long and widely established, it was not until 1703, with the aid of a microscope, that the source of the dye obtained from this cactus was found to be a minute insect (*Coccus cacti*), now recognized as a scale insect remotely related to aphids and mealybugs. Previously the tiny red specks had been thought to be a seed of some kind.

In the nopalries, the insects, of which only the females are of economic importance, would be placed on the joints of the cactus and allowed to multiply. Then, every four to six months they would be collected by brushing them into a basket or bag. Enough escaped this process to produce the next harvest.

Cochineal insects also thrive on several other kinds of *Nopalea,* but as these are spiny they have never been used commercially. As in the case of indigo, the cochineal industry collapsed with the introduction of aniline dyes.

The bee and the cochineal insect are the only two insects, out of the myriads



that swarm over the earth, whose products have been consistently employed by man.

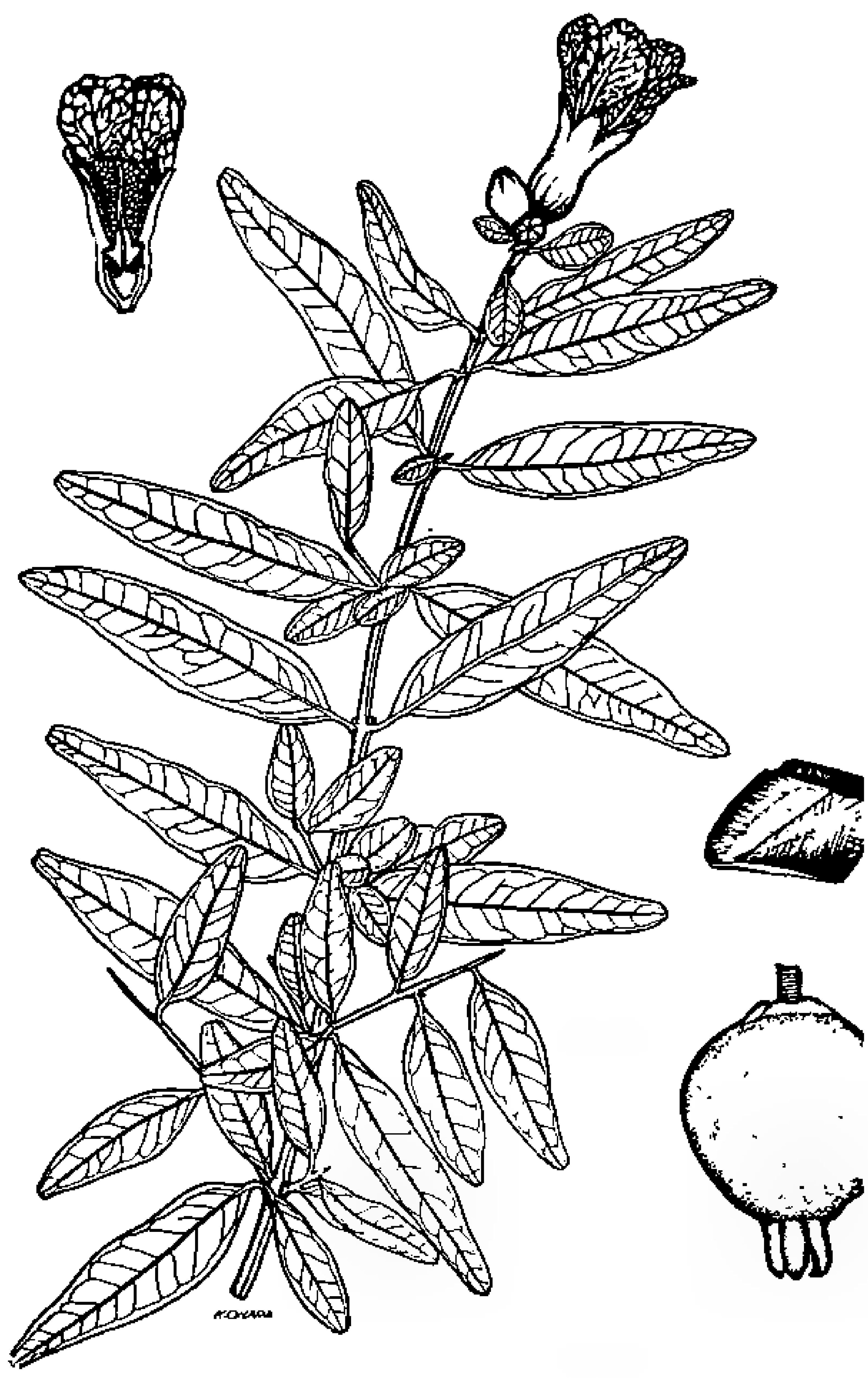
GIANT REED

THE GIANT REED (*Arundo donax*, Grass family) is a perennial grass, native to the Mediterranean region but escaped from cultivation in the many warm countries throughout the world where it has been planted since the earliest days. It cannot survive in colder climates.

Commonly growing about 8 feet high, this reed has sturdy culms, or stalks, one-half to one inch thick. It is highly ornamental with its striking plumes and coarse pale foliage. A variety with yellowish- to white-striped leaves is especially popular for growing as isolated clumps in gardens. This variegated kind produces its most contrasting markings when grown in exposed sandy situations. Besides being grown as an ornamental, the giant reed has commercial uses in many countries. The bamboo-like stems are used in the New World for lattices, mats, screens, and in the construction of adobe houses. In Europe, on the other hand, they are used mainly for the reeds of clarinets and organ pipes.

POMEGRANATE

IN PREHISTORIC TIMES the range of the pomegranate (*Punica granatum*, Pomegranate family) was extended, by cultivation, from its native home in



western Asia and northwestern India to all the Mediterranean countries. In modern days it has been carried to all the tropical regions of the world, where it not only is planted for its edible fruit and ornamental flowers, but where it has often become naturalized. The plant is so common and so prized in Spain that its flower is her national emblem, like the fleur-de-lis (or iris) is that of France.

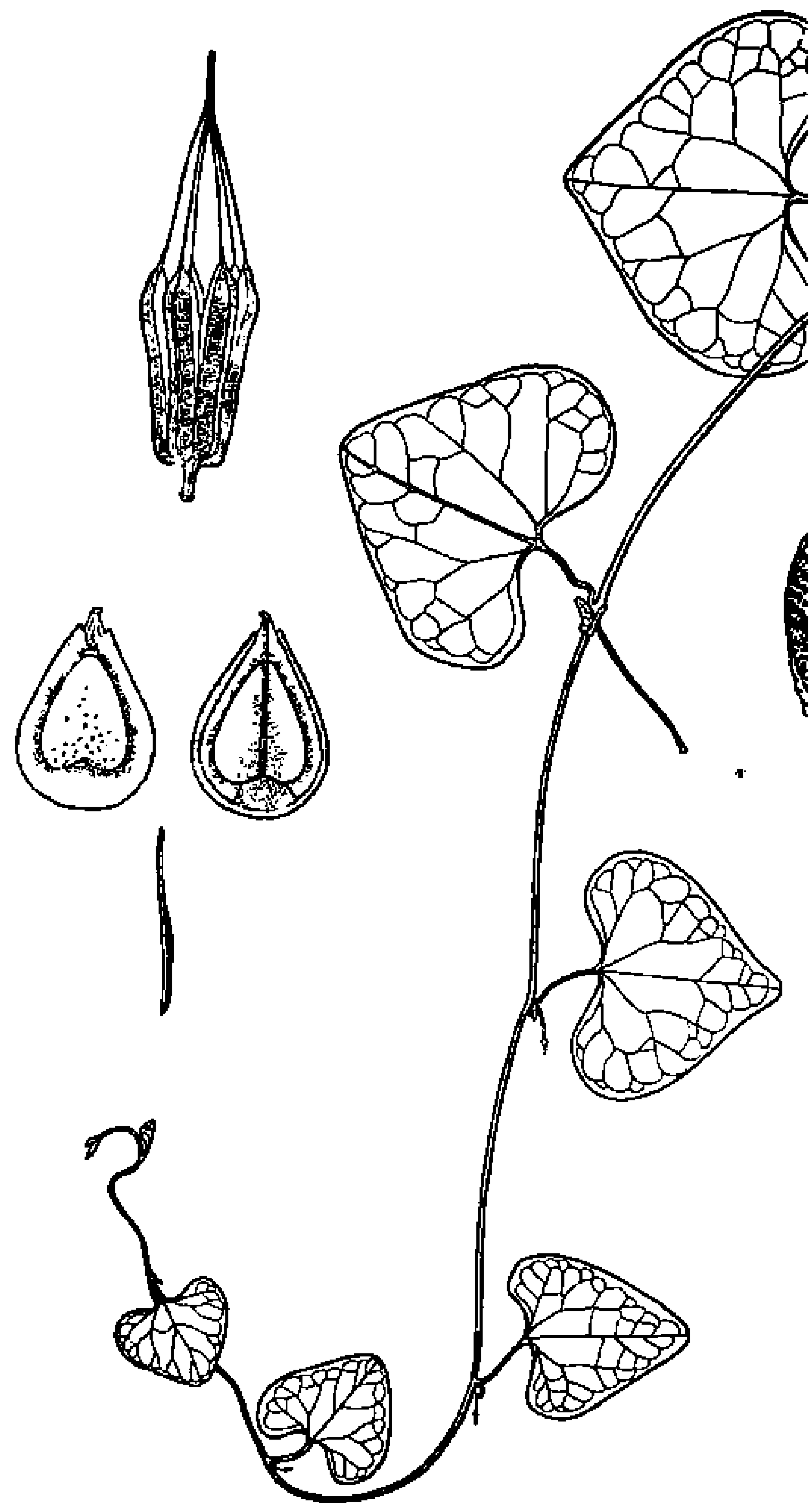
The Swedish botanist, Linnaeus, named the pomegranate *Punica* in 1753 because this was the classical name for Carthage, the city from which the ancient Romans first obtained the fruit. The English word "pomegranate" means "apple of many seeds."

The Carthaginians, according to Pliny, had already developed several distinct horticultural forms. Some dwarf forms have been developed with particularly beautiful flowers at the sacrifice, unfortunately, of palatable fruit.

The common pomegranate of arid roadsides and old, neglected gardens is a freely branching shrub or small tree, easy neither to crawl through nor to climb. Its twigs, particularly in dry regions, often harden and become spine-like at the tip, like those of some seedling apple growing in a neglected pasture. The few blossoms are either a beautiful scarlet or orange in color, and usually occur in modest clusters at the ends of long slender branches. As the flowers give place to the leathery-skinned fruits, the heavily weighted branches arch gracefully toward the ground. The stalks or peduncles thicken in order to bear the weight of the fruit, which may reach a diameter of 3 inches.

Both the flower and fruit of the plant exhibit certain features which have led many botanists to believe that the pomegranate and the cactus had a common ancestor long, long ago. They are, in fact, considered distant relatives today.

The edible portion of the pomegranate is the seed, the outer coat of which (the testa), instead of being hard, consists of a delicate tissue filled with sweet, fragrant, reddish juice. This juice is the base of the syrup grenadine. In the Orient, the root, rind, and seed, all rich in tannin and hence possessing astringent qualities, are used for medicinal purposes.



CALICO-FLOWER

THE CALICO-FLOWER (*Aristolochia elegans,* Birthwort family) is a quick growing twiner, sometimes, like its hardier relative, *A. durior,* known by the name of Dutchman's pipe. Like that familiar porch-climber too, its leaves are more or less broadly heart-shaped. The flowers are peculiar not only in shape but in structure. Instead of bearing petals, the pendent flower consists of a strangely tubular calyx abruptly curved upon itself. Then it suddenly flares out into a hollow dish-shaped expansion, termed a limb, almost 2 inches wide and 3 inches high. This is curiously marked with rich purplish-brown blotches, supposed by some persons to resemble decaying meat—a supposition that to me seems a bit far-fetched. Flies and other insects as a general rule are not as conscious of color as they are of odor. It is more likely that the disagreeable odor emanating from the flower attracts the scavengers and that the dark calyx expansion helps them to blunder buzzingly into the central yellow bull's-eye. Entering the floral grotto for light refreshments, the visitors may effect pollination and thus insure the formation of seed.

The fruit, emulating the flower in oddity, is in addition graceful. It is a mahogany-colored capsule, resembling in miniature an inverted parachute. Its six segments split apart only partially, thus exposing the flat, roundish-triangular seeds. These seldom spill out in good weather, when they would merely fall to the ground below and crowd the mother plant. Instead, most of them escape in boisterous weather when their hanging basket shakes to and fro, and the wind insures a greater opportunity for wide distribution over the countryside.

Although the calico-flower is a native of Brazil and neighboring countries, it is now planted in many warm and tropical regions for ornament and curiosity. It will rapidly cover a porch or arbor with leafy greenness.

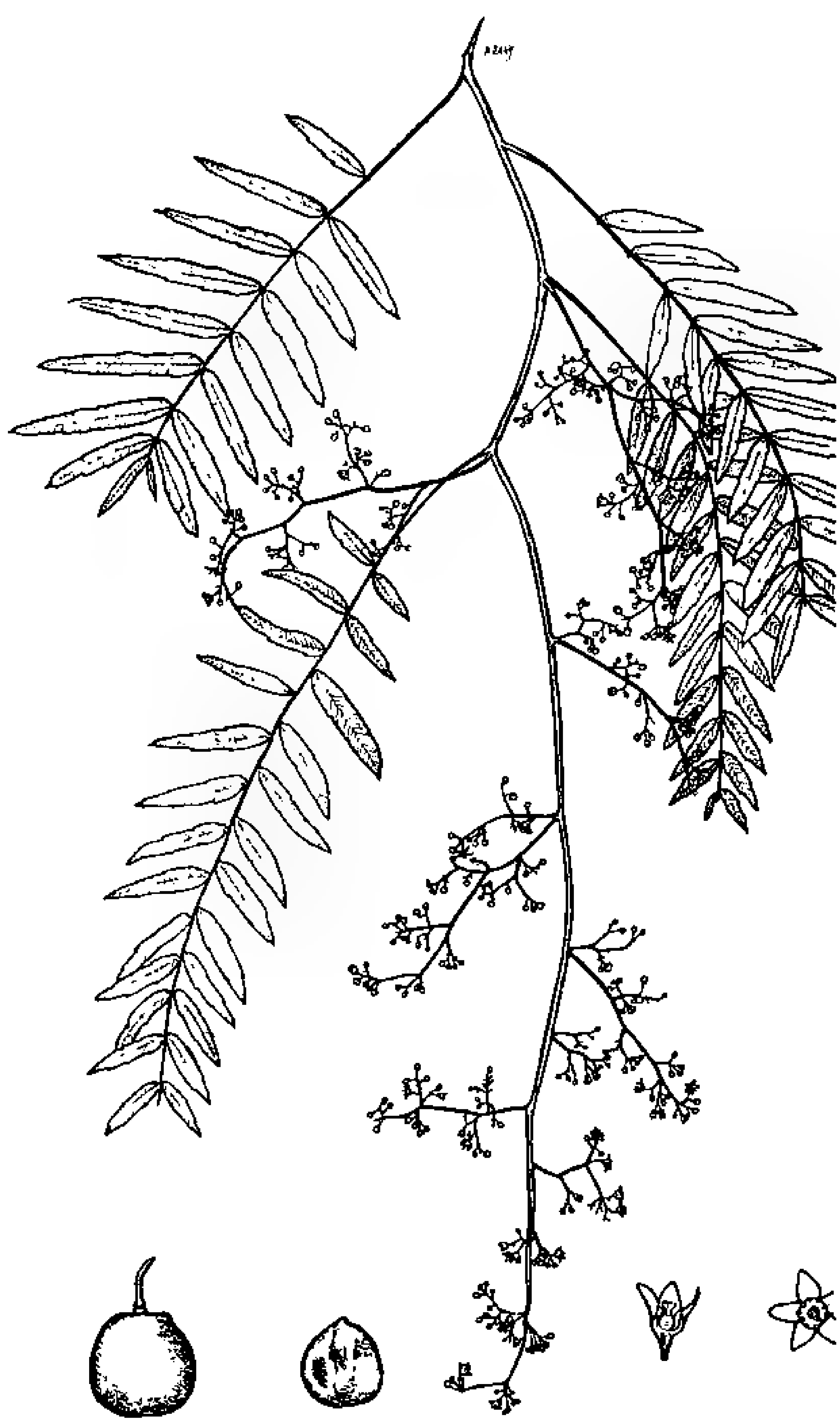
CALIFORNIA PEPPER-TREE

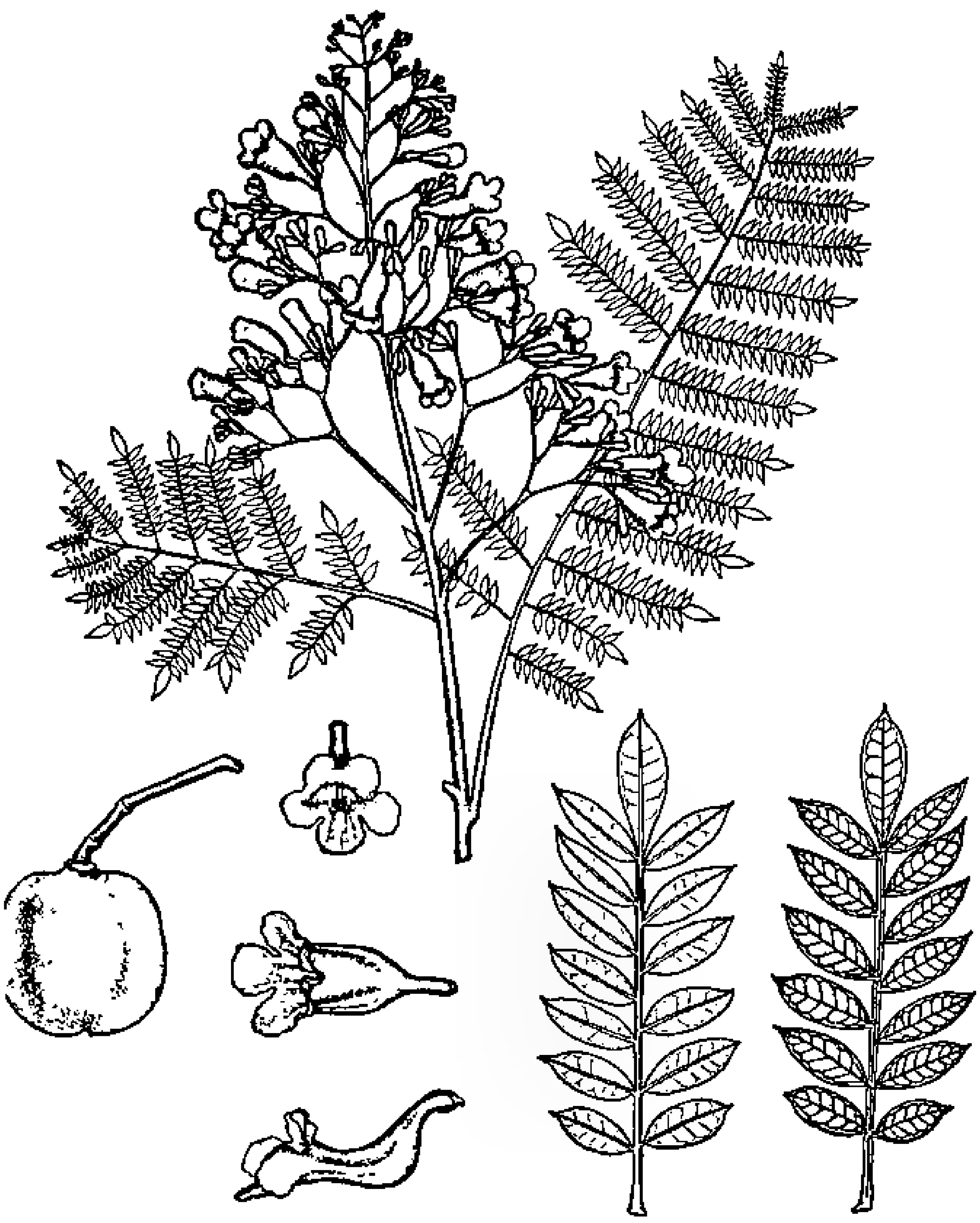
THE SO-CALLED California pepper-tree (*Schinus molle,* Cashew family) is not native to California at all but to South America. It has long been planted in sunny, dry California, however, as well as in other tropical or subtropical countries, especially in the drier districts.

Though the tree is small, in age it may develop quite a massive, gnarled trunk. Its numerous, flexuous branches are not unlike those of the weeping-willow, and are loosely hung with thickish gray leaves. Each resembles the frond of some delicate spleenwort or similar fern. About half of the plants raised deserve to be discarded, for they bear staminate or male, flowers that wither after shedding their pollen. The female, or pistillate, plants produce, on the other hand, an especially lovely sight when their insignificant flowers mature into spherical, pale red fruits. These are often seen among Christmas decorations.

A single leaflet of the California pepper-tree, when plucked and placed immediately in a basin of still water, will shoot about like a torpedo-boat, from the force of an oil that is expelled from the broken end.

Besides being planted for ornament along streets and in gardens, this pepper tree has a number of more practical uses. The resin is occasionally employed as a purgative, the leaves as a dye, and the berries for the making of a syrup, a vinegar, a beverage, and a pepper substitute.





JACARANDA

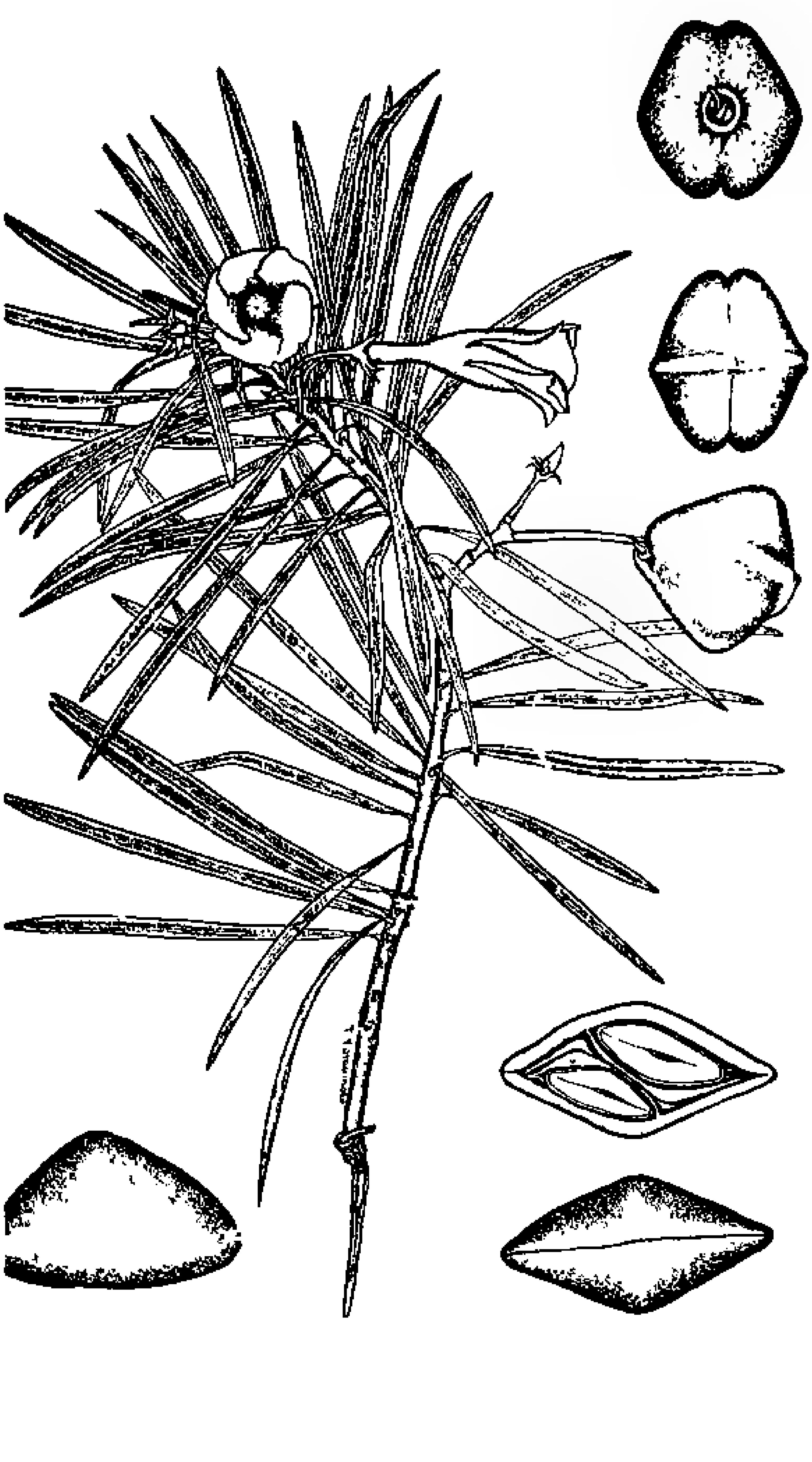
A NATIVE OF BRAZIL, the acute-leaved jacaranda (*Jacaranda acutifolia,* Bignonia family) has been introduced into many tropical and subtropical regions such as Florida, California, Hawaii, Malaya, India, and the West Indies, usually under the wrong scientific name. Even the common name jacaranda is seldom pronounced correctly. It comes from Brazil, where the literates speak largely Portuguese, and in that language the letter "j" is pronounced like the "z" in "azure," and in this word the last vowel is accented.

The acute-leaved jacaranda—there are many other kinds besides—is a handsome tree of medium size. Its large leaves are twice-pinnate with the ultimate segments only about one-third of an inch long. As a result, the foliage is gracefully fern-like, and even the seedling makes an attractive pot plant. At the ends of the branches, amid this greenery of leaves, appear large clusters of deep blue flowers, each about two inches long and somewhat bell-shaped. Even after they have fallen, these flowers long retain their color to carpet the lawn with their same azure beauty. In Hawaii the jacaranda flowers about April, the same time the pink-and-white shower (*Cassia javanica*) bursts into bloom. Thus these two plants make beautiful street and garden trees particularly when planted close to one another. Instead of bearing a long bean like the shower, the jacaranda matures a few flat capsules of rich brown coloring, circular in outline, for each flower cluster. These pods, at times gilded for costume jewelry, are about two inches in diameter and contain many seeds, each about half an inch long. These are very light and are furnished with a whitish membrane which retards the speed of their fall from the topmost branches. The slightest breeze will carry them a safe distance away from the parent tree and thus avoid overcrowding.

LUCKY-NUT

THE LUCKY-NUT (*Thevetia peruviana,* Dogbane family), so-called because its seeds are carried in the pocket as talismans, is a large shrub or small tree with waxy, yellow, bell-shaped flowers and many shiny narrow leaves resembling those of the oleander. For these two characteristics it is sometimes known as the "yellow oleander." The lucky-nut, however, is native to tropical America, far from the home of the true oleander, which is in the Mediterranean region. It is now grown extensively in warm and tropical countries for ornament, thriving especially under arid conditions. Of late years an orange-flowered form has been planted in Hawaii and elsewhere. The fruits are like small, irregularly-shaped, green apples, each containing a woody stone, or endocarp, containing two seeds.

The juice of this garden ornamental is watery-milky, a characteristic, it is well to remember, of many poisonous plants. Here this sign does not fail us as the lucky-nut has the unenviable reputation of being the most frequent cause of dangerous or even fatal poisoning of animal and man in Hawaii. All parts of the plant are dangerously poisonous, the active principle being a digitalis-like substance known as thevetin. This causes a slow and later an irregular pulse accompanied with vomiting and shock. Unlike the poisonous jatrophas which could well be eradicated because of their potential danger to inquisitive children, this plant might be grown with profit under limited plantation conditions for medicinal use. Today, hundreds of pounds of lucky-nut seeds, laboriously gathered from isolated plants growing in gardens and unkempt graveyards, are being shipped from Hawaii monthly to the continental United States. There they are used in the making of medicine valuable in certain heart conditions. In Yucatan cotton soaked in the juice is placed in the cavities of teeth to relieve toothache. It is also applied to chronic sores and ulcers. It is almost needless to say that to practice such folk medicine is dangerous and unwise. In the



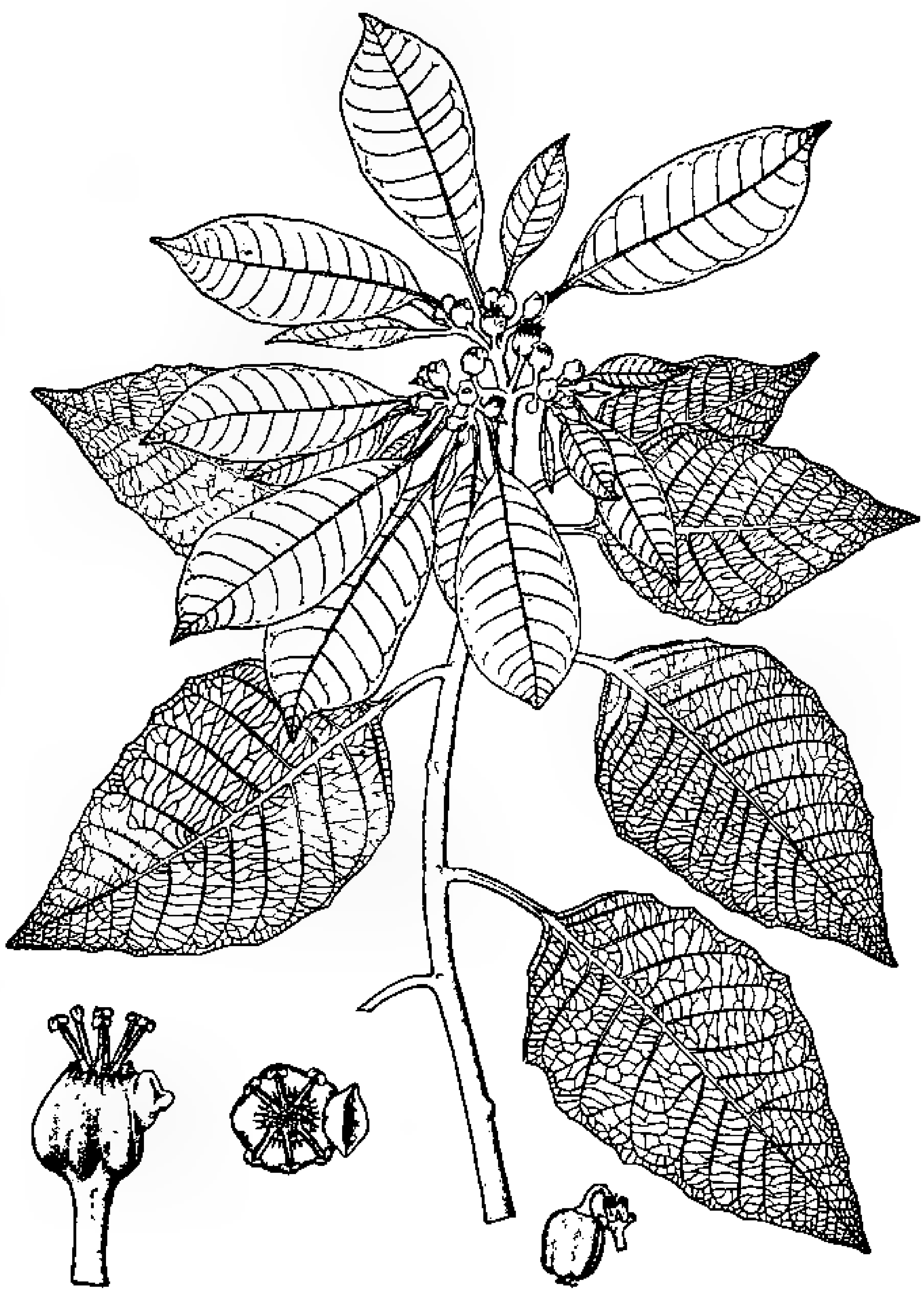
Bahamas, the fruits have been collected for years to make into pendants and charms.

POINSETTIA

THE FAMILIAR, handsome red poinsettia of Christmas-time (*Poinsettia pulcherrima,* Spurge family, called by many botanists *Euphorbia pulcherrima*) is a Mexican plant now found nearly everywhere in cultivation. In warm countries it makes coarse, spindly hedges that vindicate themselves by their riotous color in midwinter.

During the last few decades, horticulturists have concentrated on developing many variations of the scarlet poinsettia. As a result, we now have "filled" or double forms, and forms where the scarlet is replaced with pink, white, canary yellow or intermediate shades, as well as some with variegated leaves. In spite of such modifications, few will fail to recognize these plants as simply derivatives of the common poinsettia. A bit difficult to recognize, perhaps, are the dozen or so "poor relations," some very much poorer than others. All are American. Many, however, have been scattered fairly well throughout warm regions to become weeds of fields, roadsides, and waste places. The fiddle-leaved poinsettia (*P. cyathophora*) and the painted-leaved one (*P. heterophylla*), have their scarlet areas much reduced in size but are still pretty plants. Another poinsettia (*P. geniculata*) has lost all claims for beauty by replacing the scarlet with a faint greenish-yellow. Some others are nothing more than ugly green weeds.

The poinsettia commemorates the name of Ambassador Joel Roberts Poinsett of South Carolina, who brought the first plants north from Mexico in the middle 19th century. All of its relatives have the same peculiar structural plan, one of extreme degeneration of the individual flower. The colorful "petals" of the red poinsettia, for example, are simply leaves, or bracts, colored to attract insects. The bulky "flowers" with a lateral nectar gland are not flowers at all. They are complicated flower clusters. The single "stamens" eagerly projecting upward are staminate flowers degenerated to such an extent that nothing remains except a flower stalk and, joined to it by a conspicuous but minute node, a



single stamen. Similarly, the bulky 3-celled "pistil" is actually a separate pistillate flower in which almost all other floral structures have disappeared. Such an extremely modified flower cluster, called a cyathium, is characteristic of a vast host of Spurge family members.

Another characteristic common to the family is the milky juice, which is poisonous in varying degrees. Dr. Harry Arnold, from his experience in handling cases of plant poisoning during his long medical practice in Hawaii, has formulated two rules that everyone should remember:

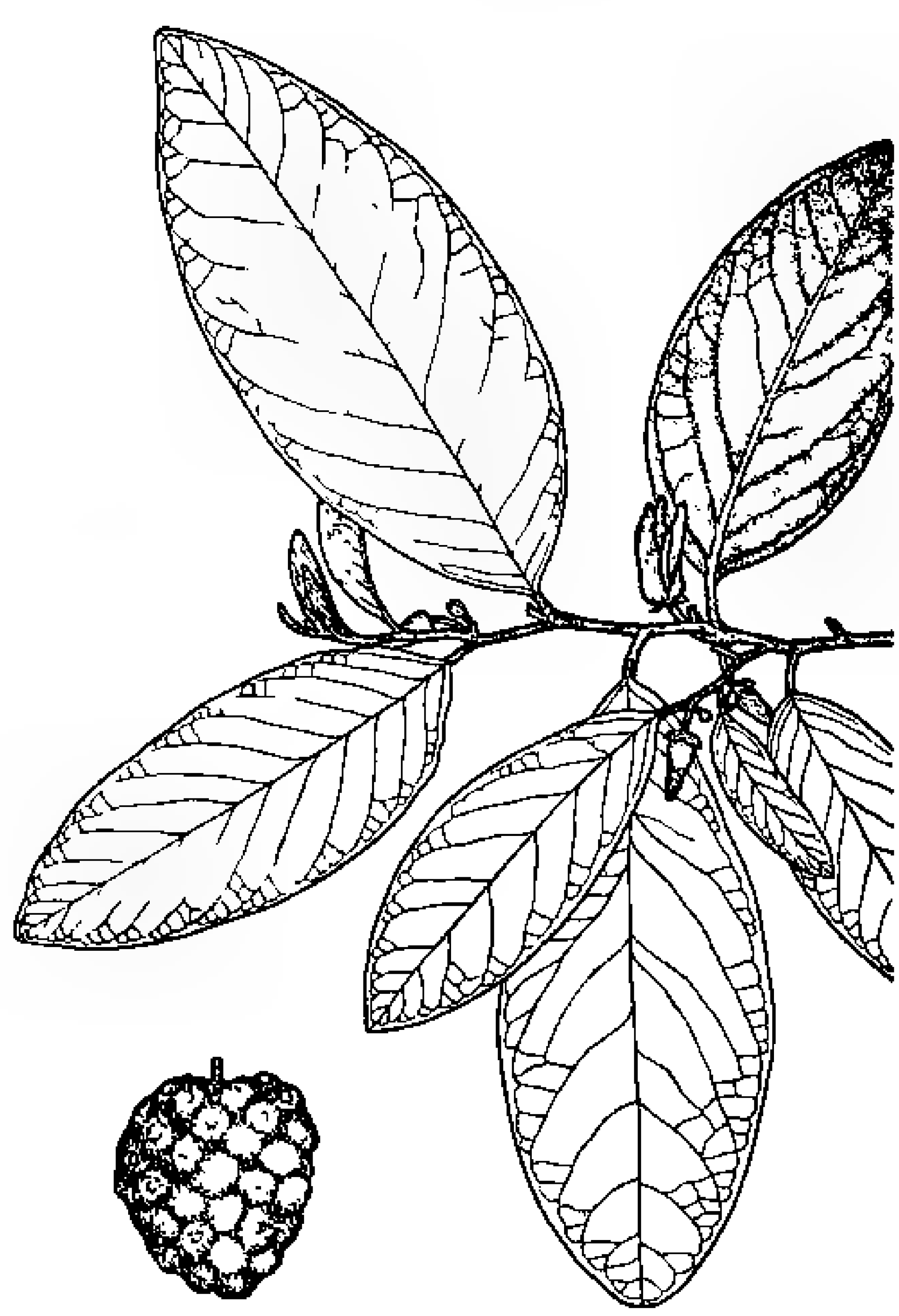
1. Never eat or taste any strange fruit, leaf, or root.

2. Usually, plants closely related botanically have similar properties.

The poinsettia can be deadly poisonous when eaten (though to touch it does no harm). In passing, therefore, it may not be amiss to warn against intimate contact with *any* member of the Spurge family. In general, *beware of plants with milky juice!* And this warning should include the Dogbane family too.

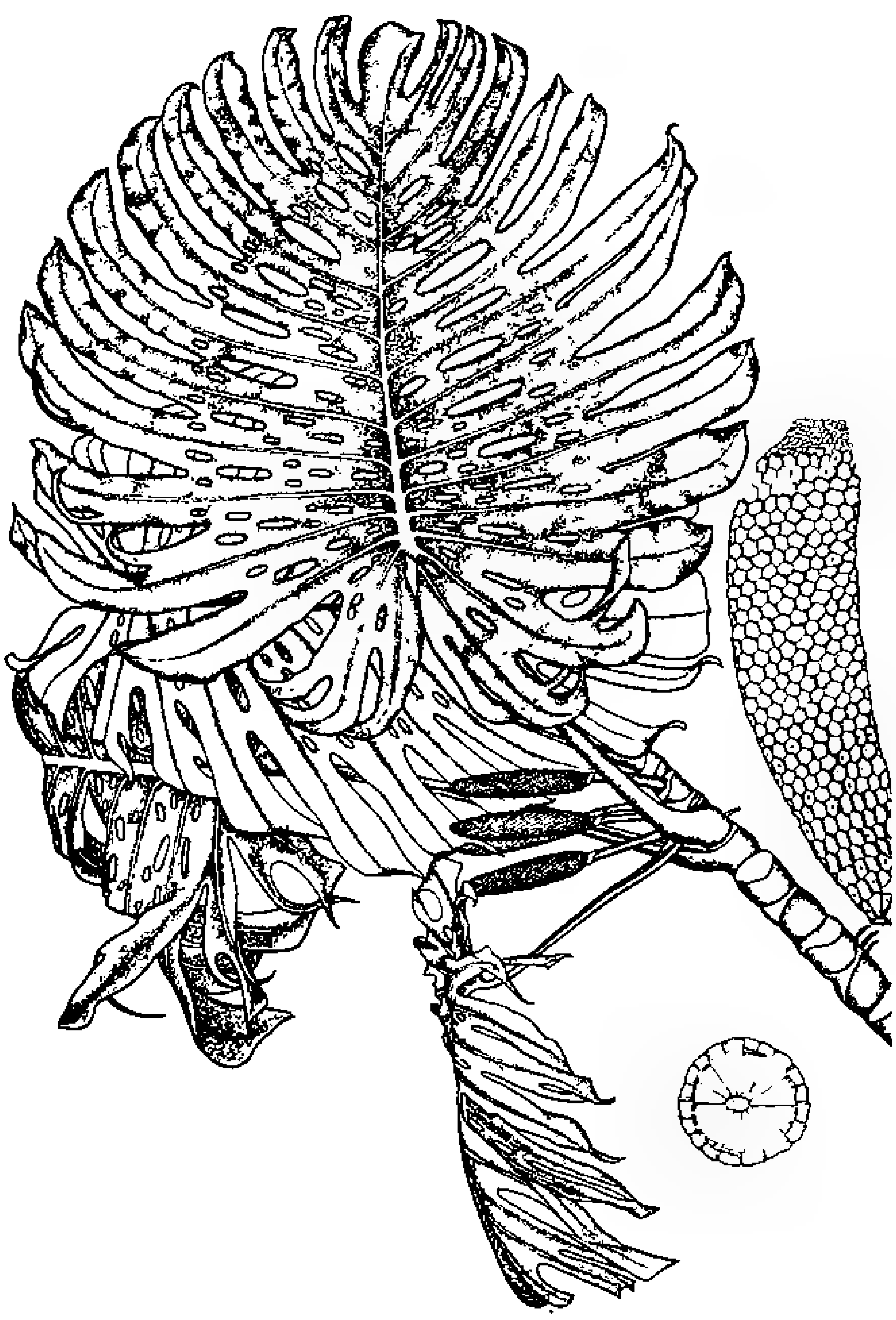
CHERIMOYA

THE CHERIMOYA (*Annona cherimola,* Custard-apple family) is a small erect or somewhat spreading tree with velvety twigs and leaves. The flower is fragrant but hardly a thing of beauty with its thick leathery petals. But, like many of its relatives, all rather primitive representatives of the plant kingdom, it contains a very indefinite number of carpels and as a result grows into a rather variable fruit. This may be all the way from round to cone- or heart-shaped or even irregular, and may weigh from a few ounces to about five pounds. Each carpel in the flower shows itself in the fruit as an indistinctly marked roundish or 5-angled area with a circular scar at the middle. The fruit, even when ripe, is covered with a delicate, light green skin.



The cherimoya is commonly eaten fresh as a dessert fruit for its white, moderately juicy pulp. This has been described as pleasingly flavored like a combination of pineapple and banana. The seeds are large, brown, shiny, and numerous except in the better, cultivated forms.

The word CHERIMOYA is merely a modification of CHIRIMUYA, the Peruvian name. This fact, as well as the frequent discovery in ancient Peruvian graves of terra cotta vases modeled in the form of cherimoya fruits is good evidence for the belief that the plant is native to the mountainous regions of Peru and probably Ecuador. It has been cultivated for centuries, and thrives particularly in subtropical regions and at higher elevations in the tropics almost everywhere.



CERIMAN

THE CERIMAN (*Monstera deliciosa,* Arum family) is a coarse, woody climber, or liane, inhabiting the steaming jungles of Mexico. It is now grown in many tropical gardens and under glass in temperate regions for its curious leaves and its edible fruits. The leaves, which are long-stalked, have blades that are roundish in outline but slashed at intervals half way toward the center, giving a somewhat star-shaped effect. The rest of the blade is characterized by large perforations, more or less regularly placed. Their function is uncertain.

The ceriman occasionally produces massive club-shaped collective fruits. These are built up of hundreds of small, roundish, single fruits pressed so firmly one against the other as to appear 5- or 6-sided. These collective fruits are, as the Hawaiians would say, "itchy" and inedible until dead ripe. Thereafter, they have a delicious fragrance and delectable flavor somewhat intermediate between that of a pineapple and a banana. Dobrizhoffer, who saw the ceriman growing in the jungle in 1784, described the fruit as "entirely covered with a soft, yellowish skin, marked with little knobs and a dark spot in the middle. Its liquid pulp has a very sweet taste but is full of tender thorns, perceivable by the palate only, not by the eye, on which account it must be slowly chewed but quickly swallowed. The stalk which occupies the middle, has something of wood in it and must be thrown away. This ponderous fruit grows on a flexible shrub resembling a rope, which entwines itself around high trees."

We know now that the ceriman, like its relative, the jack-in-the-pulpit and other members of the Arum family, is provided with needle-like crystals of calcium oxalate. These are responsible for the pain occasioned by eating the fruit when not dead ripe.

Red Cross Display Attracts 100,000 Visitors to Garden

BETWEEN the public opening of the New York Botanical Garden's Red Cross display at 4 o'clock the afternoon of Sunday, March 4, and the dismantling of the display less than a month after, more than 100,000 persons saw the floral red cross (illustrated on the Journal cover last month) and the Red Cross recreation center in its Philippine jungle setting. The display was presented at the instigation of the Bronx County Red Cross 1945 War Fund.

Only about half of the 18,000 persons who were waiting outside on the opening day were able to gain entrance. The hour was set late because of the formal program, attended by members of the Garden and of Red Cross committees, with which the display was unveiled.

Seated between colorful rows of spring flowering plants in House 5 (where the pelargoniums had been), the invited guests listened to talks

Looking into the jungle from inside the Red Cross hut in the conservatories, with four of the Red Cross workers who were in attendance during the show. From left to right they are Mrs. Walter Burkhardt, Mrs. Herbert Mould, Mrs. Lloyd E. Combes, and Mrs. Beatrice S. Rogalin.

Part of the Philippine jungle scene, with Red Cross recreation hut, grass-covered, in the background, shown during March in the Garden's conservatories in the interest of the Red Cross 1945 War Fund.

by Roderick Stephens, Honorary Chairman of the Bronx County Red Cross 1945 War Fund and a director of the New York Chapter of the American Red Cross; by Newbold Morris, President of the City Council; by Lieutenant-Colonel Benvenuto R. Diño of the Philippine Army; and by Mrs. Elizabeth Williams, Red Cross overseas recreation hospital worker, who had recently returned from two years in the South Pacific, including six months on Guadalcanal. Mrs. Williams also spoke on the Garden's radio program the following Friday. Lieutenant-Colonel Diño, speaking in impeccable English, though it is not his native language, gave an enthralling account of what the Red Cross has done in the Philippines since the beginning of the war. He is attached to the plastic surgery staff of the Columbia-Presbyterian Medical Center in New York City.

Joseph R. Swan, President of the Garden, presided, and during the program he called to the platform Lambertus C. Bobbink, for whom the red azalea in the exhibit had been named. The curtain which hid the Red Cross display from view was drawn aside by Vera Zorina, star of the current production of "The Tempest," who spoke briefly on what the Red Cross had meant to her in giving her the only contact she had

had for several years with her stranded family in Norway. Before she spoke she was presented with a bouquet of red carnations by Rebecca Divers, eight-year-old daughter of John Divers of the gardening staff, and younger sister of Margaret Divers, who performed the same service when Pearl Buck spoke at the rose program held in honor of Mr. Bobbink in 1939.

Two hundred potted specimens of the azalea "Lambertus C. Bobbink" went into the floral red cross, and another 200 of the hardy white azalea "Snow" were used in the background. All of these plants were provided for the display by the firm of Bobbink & Atkins. "Lambertus C. Bobbink" is a recently patented azalea of the indica type and is said to be the reddest variety yet developed.

The second feature of the Red Cross display was a jungle scene, presumably in the Philippines (and praised by Colonel Diño for its verisimilitude), with a Red Cross recreation center equipped with a phonograph, boxes for writing desks, benches covered with native mats, and other items likely to be found in such a jungle rest house by our fighting men today when they have a moment for relaxation. Except for the area occupied by the 12-foot red cross, all of House 4 was transformed into the setting for the recreation hut, with plants that are native to the islands of the Pacific and others that are known to have become naturalized there. The layout of the paths was altered so that visitors could feel that they were wandering at will among the tropical trees. Half hidden at one side was a smaller thatched hut bearing a sign to indicate that it was for medical service.

Photographs from several of the Pacific islands, lent by the Red Cross authorities, provided models both for the background and for the huts themselves.

SPEAKERS AT OPENING OF THE GARDEN'S RED CROSS DISPLAY

Upper left: Mrs. Elizabeth Williams, telling of a hospital experience while on duty in the Pacific. *Upper right*: Joseph R. Swan, presiding. *Center*: Newbold Morris, voicing a plea for the Red Cross. *Lower left*: Lieutenant-Colonel Benvenuto R. Diño, describing the work of the Red Cross in the Philippines. *Lower Right*: Margaret Divers presenting a bouquet to Vera Zorina just before she pulled the cord which revealed the Garden's floral red cross to the waiting spectators.

*How the Sacred Bo Tree Came to Ceylon**

By Mary F. Barrett

IN the year 288 B. C. a religious procession entered the city of Anuradhpura in Ceylon. With all the pomp of Oriental rites a sacred object in a golden vase was deposited near buildings prepared for those who were to care for it.

This religious relic was a cutting from the Indian fig tree under which Gautama was said to have been meditating when his incarnation as Buddha took place, as he received complete knowledge as to the meaning of existence. The tree thereafter was called Bo, the Sanskrit word for knowledge. In Pali, which probably was Gautama's language, the vernacular name was BODHI. BUDDHA comes from a related word.

Missionaries from India had introduced Buddhism into Ceylon, and their zealous converts had begged the reigning Indian monarch to send them a cutting of the original Bo tree. This request, though readily granted, involved a problem: how to obtain a piece without disobeying the rule that no part of the sacred tree was to be severed. A miracle seemed the only solution—and, fortunately, when a vermilion line was made around a twig of the proper size, the cutting in a miraculous manner dropped off.

The history of the tree which developed from this cutting is said to have been recorded for more than 2,000 years. It has been called a living antiquity, and the oldest historical tree. Linnaeus named the species *Ficus religiosa,* borrowing the second word of the binomial from a descriptive title by an earlier writer. But it was called also "devil's tree," probably by protesting Christians.

Ficus religiosa is unique because its leaf blades are shaped like those of a cottonwood poplar, but have a long lash-like tip. On their slender petioles these blades tremble like poplar leaves.

The species is so easily propagated that it now has a wide distribution. Originally growing wild in the sub-Himalayan forests and in adjacent sections of Bengal and Central India, it had not yet reached as far south as the island of Ceylon at the time of Buddha's incarnation, but it is now generally found there, both as a wild and a cultivated tree. The cutting from the original sacred tree was the first of the species to grow there.

In Florida the Bo has been used as a street tree along Bird Avenue and Biscayne Boulevard in Miami, and on the high school grounds at Fort Meyers there is a fine symmetrical specimen.

A young potted specimen can be seen in the conservatories at the New York Botanical Garden.

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* The historical part of this article is based on material by J. E. Tennent appearing in his two-volume book, "Ceylon," published in London in 1860.

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.)

Visionary and Practical Botanist

JOHN MERLE COULTER, Missionary in Science. Andrew Denny Rodgers III, 321 pages, illustrated, indexed. Princeton University Press, 1944. $3.75.

This is the biography of a pivotal figure in American botany for the half-century 1878-1928. To use the author's own words, "Coulter was able as an organizer and, having a great feeling for the application of science, was more the visionary, conceiving and interpreting large principles in botany." Rodgers' biography of Coulter is authoritative, carefully prepared and fully documented. The well assembled index, because of Coulter's world-wide associations, practically amounts to an international index of botanists!

Rodgers delineates well the birth of the books that have come to be known by, shall we say, "teaching tags"—Porter and Coulter; Coulter and Rose; Arthur, Barnes and Coulter; Coulter and Chamberlain; Coulter and Nelson; and perhaps the best known text in its field, Coulter, Barnes and Cowles. Coulter wrote on a botanical subject with equal effectiveness as a paragraph in a text, as a popular lecture, or for *Popular Science Monthly.* Quotable quotes from Coulter's addresses: "This is an age of theses, of germinating plantlets, not one in a thousand of which develop any further." Again, "Universities should be recognized as the greatest opportunity for research and high schools must be recognized as the greatest opportunity for teaching."

There are two groups of readers, both large, who will not want to miss this biography of Coulter: past or present students of the University of Chicago and professional botanists everywhere. For the general reader interested in botanical history, however, the book lacks sustained interest. The early chapters surely will hold everyone's attention for their tempo. But the long quotations from letters are wearisome, for their full significance cannot be apparent to many readers. Technical terms, allusions and inferences, references to the literature mentioned with telegraphic brevity—these characteristics render letters of scientists rather unintelligible to the lay reader.

The rare use of anecdotal materials that etch men's lives is a deficiency. We would enjoy more briefs like that of D. T. MacDougal: " . . . in northern Arizona where with Navajo blanket, tin cup, and beef extract jar, he spent the summer collecting." Or the occasion told of Bray, who, when he had finished his studies in Germany, cabled Coulter, "What?" Coulter cabled back, "Texas." Behind these occasions lie riches for the biographer, seldom to be found in the citation of graduate theses.

Rodgers has introduced an array of associates of Coulter; indeed, for pages at a time his name may not be mentioned, but this is scant relief from the recitation of Coulter's academic duties that fill the pages. Rosters of names make tedious reading at the best; when significant, such groups of men must be individually characterized, just as we identify a friend with some terse phrase upon making an introduction. Especially important is this identification of men in a biography, since the names may pass with the generation.

Perhaps a quotation from Professor Beal may be appropriate at this point: "No one can make a book which will in all respects suit another if that one has any originality."

There is one tendency in our literature that is misleading and untruthful; it is reference to the "compilation" of a flora. "Britton's immense *North American Flora* project was still in process of compilation and publication." Local flora lists may still be compiled but Britton's monumental work, Fernald's revision of Gray's *Manual,* St. John's *Flora of Southeastern Washington and adjacent Idaho,* Jepson's *Flora of California,* Abram's *Flora of the Pacific States*—these, to cite specific examples, and many others that might be mentioned, were not compiled! They represent a careful synthesis of materials, and were not simply brought together as discrete descriptions. Quite naturally there may be occasions when an author draws heavily upon a monograph, but these materials, when admitted to a manual, must be adapted to the needs of that work. To say that a flora is a compilation is both unfair and untrue.

But the book is almost wholly free of technical error, even in extensive references to botanists by name. "Herbert E. Copeland" should read E(dwin) B(ingham) Copeland (p. 32).

The stories behind the founding of the Desert Laboratory at Tucson, Arizona, and of the Boyce Thompson Institute at Yonkers, New York, are most interesting. Collateral readings which will add much to Rodgers' accounts of Coulter in Colorado and in Indiana are, respectively, William H. Jackson's *Time Exposure*—for it was Jackson who took the "magnificent photographs" on Mount of Holy Cross—and David Starr Jordan's vivacious *Days of a Man.*

JOSEPH EWAN,
*Foreign Economic Administration,
Bogota, Columbia.*

The Negro Scientist

I KNEW CARVER. G. Lake Imes. 24 pages. Good Will, Inc. 1940 Druid Hill Ave., Baltimore 17, Md., 1943. 25 cents.

A former associate of the great Negro scientist at Tuskegee Institute writes of him as intimately as a person can write of a man who remained aloof in his private life and who permitted practically no one in his laboratory. Dr. Imes' brief story is a straightforward account of the traits and accomplishments of an unusual man.

CAROL H. WOODWARD.

For Little Folk

OUTDOOR ADVENTURES: From Seed to Tree; Along the Creek; Little Creatures with Many Legs. Charles Gable and Ellen Schulz Quillin. 46 pages, illustrated. Albert Whitman & Co., Chicago. 1944. 50 cents

Three small books in a nature science series, in which the facts of plant, animal, and insect life are given in a narrative concerning four small boys and girls (among them a precocious one called Marylee) and their very wise Uncle Jack.

BROADCAST

By BERNICE S. BRONNER

EXCEPT *for woolens and allied materials made from animal hairs, many of our textiles—even the man-made ones such as rayon—are derived directly from plants. What they come from and how they are processed to meet the demands of clothing and household use was told on the Garden's radio program over station WNYC Dec. 1 by Bernice S. Bronner, textile expert, of the American Standards Association. The paragraphs below have been adapted from her talk.*

WE owe a great deal to plant growth for our clothes and household textiles—their use antedates recorded history. And today our war effort depends so heavily on the utilization of vegetable fibers that it is impossible to pay due tribute to plant life.

Among natural plant fibers, cotton, of course, is the most important; but others have their place to fill in the textile world. They fall into three classifications, according to the Textile Fiber Atlas. First come the seed hairs, which are fibers attached to the seeds of a plant, intended to help with dispersal of seeds by the wind. Cotton is the chief one. There are also milkweed and kapok, but they are too weak to spin into a yarn and instead are used for stuffing in life rafts and life jackets. Second are the fibers taken from the stems of plants—flax (linen fabrics are made from this), hemp and jute (used for twine and rope), and ramie (sometimes called grass cloth or China grass).

Third are the fibers taken from the leaves of plants—sisal and Manila hemp used for rope and twine; pissava palm fiber used for brooms; coconut fiber used for matting and doormats; raffia palm fiber, used for mats, baskets, hats, plaited textiles. But none of these are used for clothing—at least in the U. S. A.

Even some of the man-made fibers come from the plant world. For example, rayon is based on plants, either wood chips or cotton linters—that is, the very short fibers which will stick to the seed after the longer fibers have been removed by the cotton ginning machine. The cotton linters or the wood chips (usually spruce or pine) are treated with chemicals until they are changed to a liquid state. This liquid is forced through tiny holes grouped in a disc like the holes in the spout of a watering pot. The size of the hole decides the size of the tiny filament, for as soon as the liquid goes through, it is hardened (either by passing it into a chemical bath or into hot air). It can be immediately wound on spools, then twisted into yarn ready for weaving or knitting. These filaments are ordinarily endless—though when the rayon fibers are mixed with other short fibers to make a fabric less expensive, to lighten the weight of a cloth, to give a desirable color effect, or to lend a certain texture—they are cut into short lengths. If a manufacturer is mixing rayon with cotton, for example, he cuts the continuous filament of rayon to the same length as the cotton fiber he is using. This short length rayon is called "spun rayon."

Rayon, under the microscope, looks like a slender, smooth, glass rod, whereas cotton looks like a flat twisted ribbon, soft and dull.

How the minute fibers of cotton are worked into the beautiful fabrics we know is like a miracle even to those who work with them every day. The fiber length is from one-half to one and one-half inches, depending on where it is grown. When picked, it is a tangled mass in the burst-open seed pod. The seeds, leaves, and dirt, must be cleaned out. Then it is fed between long rolls of tiny wire points which gradually straighten out the fibers so they lie fairly parallel. The wide sheet of fibers is then little by little drawn out narrower to the size of the lead in a pencil. A twist is then put in, and it is ready to go to the weaver or knitter.

Many different names have been given to different types of cotton fabrics, and each has its distinguishing characteristics. For example:

Gingham is almost always woven in checks or plaids, in which the colored threads or yarns are dyed before weaving, so the cloth looks the same on both sides.

Chambray is distinctive in that its lengthwise yarns are always white or much lighter colored than the filling yarns which run crosswise. This gives a soft, monotone effect. The filling yarns are dyed before weaving.

Seersucker has a characteristic pucker that will not wash or wear out. This pucker is woven in. It used to be made with alternating stripes of linen and cotton, the cotton shrinking and leaving the linen to pucker. But now it is done by the weaver setting up the lengthwise yarns on the loom so that first a few are tight, then the next few loose, alternately the width of the loom. After the filling yarn has been put in by the shuttle, the loose lengthwise yarns are caught in a permanent pucker.

Plissé or *crinkle cloth* is often sold wrongly for seersucker. Its crinkle is caused by a chemical printed on it. Wherever the chemical touches, the cloth contracts. This contraction is not permanent—you can pull it out between the fingers, although it will spring back.

Piqué has cords running lengthwise—sometimes both ways, forming little squares; then it is called *waffle piqué*.

Corduroy has lengthwise ribs of fibers standing straight up, and forming an excellent cushion for wear.

Velveteen has this same vertical fiber arrangement, but no ribs—the surface is plain like velvet.

Terry cloth is woven with tiny loops on one or both sides. The purpose of these loops is to absorb moisture—hence the use of this cloth in towels, robes, bath mats, etc.

Percale has a close, plain weave, and is made in several weights. In the better grades it is crisp and smooth—as in fine percale sheets. As such it differs from sheeting *muslin* which is fuller to the touch and heavier.

Outing flannel is a lightweight plain weave cloth which has been "napped" on one or both sides. To raise this nap or fuzz, the fabric is run between fine wire brushes or teasel burrs, which drag some of the fibers up out of the weave. This fuzz will flatten down after washing, because cotton fibers have little natural resilience.

Notes, News, and Comment

Robert S. Williams. Thirteen years after being retired from active work on the scientific staff of the New York Botanical Garden, Robert S. Williams died in Minneapolis at the age of 86, March 13. An account of Mr. Williams' Botanical Garden career, which began in 1899, will be given in a later number of the Journal.

Traveler. T. H. Everett, accompanied by James G. Esson, Editor of the *Gardeners' Chronicle of America,* spent a week the latter part of March in visiting the Missouri Botanical Garden in St. Louis, the conservatories and plantings in Garfield Park, Chicago, and in Schenley Park, Pittsburgh, and other places.

Visitors. When Dr. E. Laurence Palmer, Professor of Rural Education at Cornell University, came to the New York Botanical Garden for the Garden's radio program on "Winter Nature Study in New York" Feb. 23, he brought with him two of his graduate students, David B. Turner and Gilbert V. Mouser, whose successful work in recruiting "students of natural wonders" from his high school classes in Greenville, Ill., is the subject of an article in *Nature Magazine* for January.

Dr. Shan-Ming Chen from Peiping, China, who has been working in plant pathology for several years with Dr. E. C. Stakman at the University of Minnesota, visited the Garden in late February while on his way to Chungking where he is to serve with the Bureau of Agricultural Research.

Dr. William J. Bonisteel spent a few hours at the Garden March 24, during a brief trip home from his work in drug production in Latin America.

Defense Work. Two employees of long standing in the horticultural department left the New York Botanical Garden last month to engage in defense work. One was Harold Wilson, son of the late Percy Wilson, who had worked at the Garden more than 15 years and for much of that time had been responsible for the labeling of the plants at the Garden. The other was Joseph W. Tansey, Greenhouse Foreman, who has been in charge of the growing of plants for indoor and outdoor display. A graduate of Cornell University and of the Garden's Science Course for Professional Gardeners, Mr. Tansey had been employed by the Garden since 1934, first as a student gardener. He was made Chief Foreman Gardener in 1943.

Lecture. Mrs. Annette Hervey, who has been working on antibiotics for several years in Dr. Robbins' laboratory, as a graduate student and volunteer, reported on her work March 1 to the Englewood Garden Club, which last summer provided a scholarship which made it possible for her project to be continued.

Certificate. The Civilian Defense Volunteer Office has presented the New York Botanical Garden with a certificate because it "has patriotically and generously contributed to the cause of Civilian Defense." The Garden did extensive work in presenting Victory Garden instruction in co-operation with the C.D.V.O. Elizabeth C. Hall accepted the certificate for the Garden.

Medal. Rutherford Platt, a member of the Corporation and a frequent lecturer at the Botanical Garden, was awarded the John Burroughs Medal for 1945 at the annual meeting of the John Burroughs Association at the American Museum of Natural History April 2. Dr. Clyde Fisher made the presentation.

New Position. Dr. Roberta Ma, who had worked as assistant to Dr. Robbins in his laboratory since October 1940, accepted a position March 16 with the Ferment Acid Corporation, to work on organic fermentations with micro-organisms. The research is being done at the Boyce Thompson Institute for Plant Research, Inc., at Yonkers, N. Y.

Conference. Dr. Frances E. Wynne spoke on "Bryophytes of the Blue Ridge, Virginia," where she went on a collecting trip last summer, at the conference of the scientific staff and registered students of the Garden March 16. Her talk was illustrated with her own kodachrome slides.

Resigned. Mrs. Gussie Miller, who had been secretary to Dr. F. J. Seaver since 1926 and who has served as curatorial assistant for the past ten years, resigned her position March 15 because of her forthcoming marriage. During the years that she had worked for the Garden, she had developed a wide acquaintance among the country's mycologists, through correspondence, through her extensive work on *Mycologia,* and through their visits here. She was responsible for the 24-year index to Mycologia that was published in 1934. In recent years she assisted both in the editorial work and the business management of this periodical.

Membership in

THE NEW YORK BOTANICAL GARDEN

and what it means

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

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

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

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

A subscription to the Journal and to Addisonia.

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

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

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

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

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

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

* * * *

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

* * * *

Classes of membership in the New York Botanical Garden are:

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

Contributions to the Garden may be deducted from taxable incomes.

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

A legally approved form of bequest is as follows:

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

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

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

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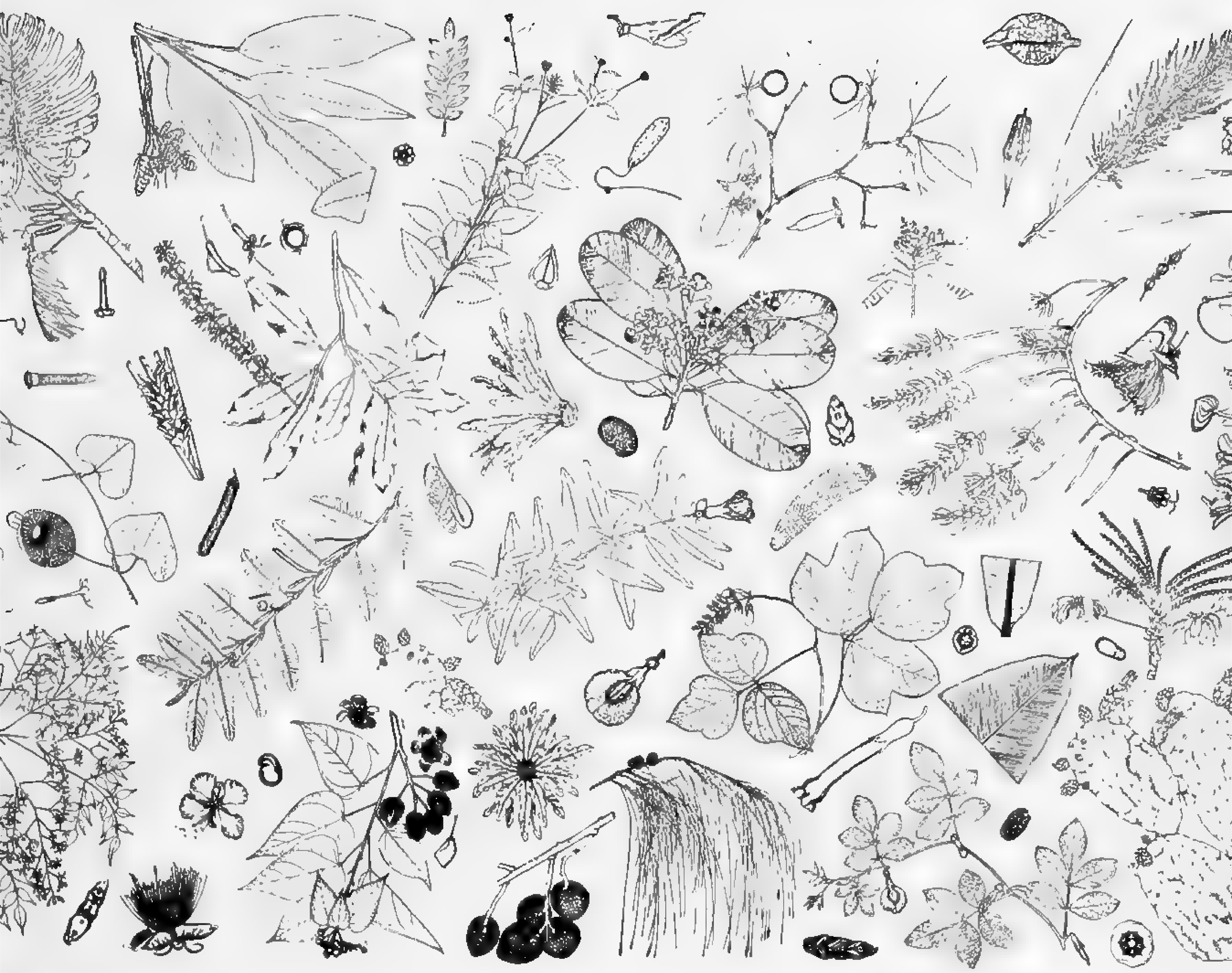

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IN TWO SECTIONS

SECTION ONE

PAGES 101-128

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

Carol H. Woodward, Editor

"TOWARD A BETTER, SANER LIFE"

The two paragraphs below comprise part of a message sent to the New York Botanical Garden in recognition of its fiftieth anniversary by Dr. David Fairchild, famous plant explorer who, through his connection with the United States Department of Agriculture for many years, has been responsible for bringing many plants of economic value into the United States. Since his retirement, Dr. Fairchild has been President Emeritus of the Fairchild Tropical Garden in Coconut Grove, Florida.

* * *

TO INSPIRE youth to live surrounded by plants instead of surrounded by brick and mortar walls, ceilings and pavements is a task than which there is none greater or more enduring in its benefits. Build high your living plant collections and your forces that will interest people in them, and you will perform for New York a service the importance of which it would be impossible to overestimate.

Man must not live in cities, imagining he is surrounded by the best environment possible. Like an oasis in a desert of handmade structures, the New York Botanical Garden can attract millions to its collections and convert them toward a better, saner life.

David Fairchild

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ROSE-GROWERS' DAY

June 13, 1945

THE third annual Rose-Growers' Day to be arranged by the New York Botanical Garden in co-operation with the American Rose Society, through the society's second district (New York State) will take place Wednesday, June 13, at the New York Botanical Garden. The occasion is being combined this year with Members' Day for June at the Garden. Though registration is free, all persons planning to attend are asked to send their names and addresses to the Garden in advance, as an aid in making seating arrangements.

Following is the program:

10 a.m.—Inspection of the Rose Garden, under the leadership of Mr. L. C. Bobbink and his associates.

MORNING SESSION

R. C. Allen, Secretary of the American Rose Society, Presiding

11 a.m.—"Soils and Fertilizers for Roses"
George A. Sweetser, Executive Secretary
New England Rose Society

11:30 a.m.—"A Botanist Looks at a Rose"
H. A. Gleason, Assistant Director and
Curator, New York Botanical Garden

12 noon—Question Period

12:30 p.m.—Picnic Lunch—each to bring his own.
(The Garden will serve a cold drink.)

AFTERNOON SESSION

Paul F. Frese, Chairman, Second District, American Rose Society, Presiding

2 p.m.—Round-Table Discussion for Rose-Growers
T. H. Everett, Horticulturist, New York
Botanical Garden, Moderator

In the event of rain, the program and lunch will take place in the Museum Building. Otherwise, it will be adjacent to the Rose Garden.

Growing the Trailing Arbutus

An Appeal for More General Culture of Epigaea repens

By F. L. Arland

THE trailing arbutus, *Epigaea repens,* known to New Englanders as the Mayflower, is to many the loveliest of our native wildflowers. Many things contribute to its fascination—its leathery evergreen foliage, the form and color of its often hidden flower clusters, the earliness of its blooming season, its shy habit of growth, often far from human habitation, its scarcity, and perhaps above all the exquisite fragrance of its flowers. To search under the leaves for these dainty flowers on a bright spring day (where the law does not prohibit) gives one a thrill which fortunately can come more than once in a lifetime.

Variations in Epigaea

Found growing in the wild from Newfoundland to Florida and as far west as Saskatchewan, the trailing arbutus shows many variations in habit of growth, form and color of foliage, conformation of flower clusters, and color of flowers, which ranges all the way from pure white to a solid deep pink. Most often growing in partial shade, it is frequently found in rather dense shade and occasionally in the open with no shade other than that provided by low-growing grasses and weeds. In dense shade the foliage grows well and is of good color, but few flowers are produced. In the open with little or no shade, the foliage is scant and of poor color, while many blossom clusters occur. With few exceptions, the plants are dioecious, bearing either pistillate or staminate flowers. Plants with perfect flowers are occasionally found. A double-flowered form with two and sometimes three rows of petals, found near Plymouth, N. H., more than fifty years ago, has apparently disappeared. A similar double form was found about twenty years ago in Massachusetts. A colony of arbutus with double flowers found some years ago at Guilford, Conn., is still in existence.

Pioneers in Arbutus Culture

Attempts to transplant arbutus from the wild and to grow it satisfactorily were made for many years, with little success. In 1906 Frederick V. Coville, of the United States Department of Agriculture, began a series of experiments to determine the possibilities for cultivation and improvement of the wild blueberry. In two years of experimental work he discovered that the blueberry, together with many other plants including the trailing arbutus, required an acid soil. He also made the important discovery that both the blueberry and the trailing arbutus are apparently dependent for healthy growth upon the presence in their roots of a beneficial fungus. Applying the knowledge gained from these experiments, Dr. Coville succeeded not only in growing and improving the blueberry but in being the first to report the successful growing of arbutus from seed. Although his method was published in 1911 and again with wider circulation in 1915, cultivation of arbutus is rare even among those who grow other wild flowers.

Nursery-grown plants have been offered for a number of years by nurserymen specializing in wildflowers. George D. Aiken, in his "Pioneering with Wildflowers," describes his method of growing the arbutus both from cuttings and seeds in his nursery at Putney, Vt. Robert S. Lemmon at New Canaan, Conn., has grown thousands of arbutus plants from seed and successfully transplanted many of them to natural locations in his woods. Florence L. Barrows at the Boyce Thompson Institute for Plant Research, Inc., at Yonkers, N. Y., began in 1933 a comprehensive study on propagation of the plant from cuttings and seeds, including an investigation of the beneficial root fungus. The results of her studies were published in 1936 and 1941 in *Contributions from Boyce Thompson Institute.* Reprints of both articles were subsequently issued by the Institute.

This pioneering work has made it possible for anyone who loves wild flowers and has even a small garden to grow arbutus successfully, provided only that he lives where climatic conditions do not prevent. The wide variations in the plant as found in different locations and the possibility of selecting plants with desirable characters for crossing make the growing of arbutus from seed a fascinating hobby. That improved forms of the plant can be developed by crossing and selection is, I believe, beyond question—improved not only in flowers and foliage but in adaptability to garden culture.

Soil, Moisture, Drainage, Shade

Requirements for satisfactory growth of the arbutus are not as exacting as is generally believed. Acid soil, constant moisture, good drainage and some shade are apparently required for optimum growth. Yet the plant is frequently found growing where one or more of these requirements is not met. Tests made on soil where arbutus was growing in the wild have in some cases shown the reaction to be neutral or even slightly on the alkaline side. As to moisture, the plant is frequently found on upland hummocks or banks where the supply of water must at times be low. And, as previously mentioned, it sometimes occurs where there is little, if any, shade. All of this indicates that we still have some things to learn about the growth requirements of this fascinating little plant, and makes it desirable that its more general cultivation be encouraged. By widespread cultivation under different conditions, we should fathom more of its secrets.

Problems in Acquiring Seed

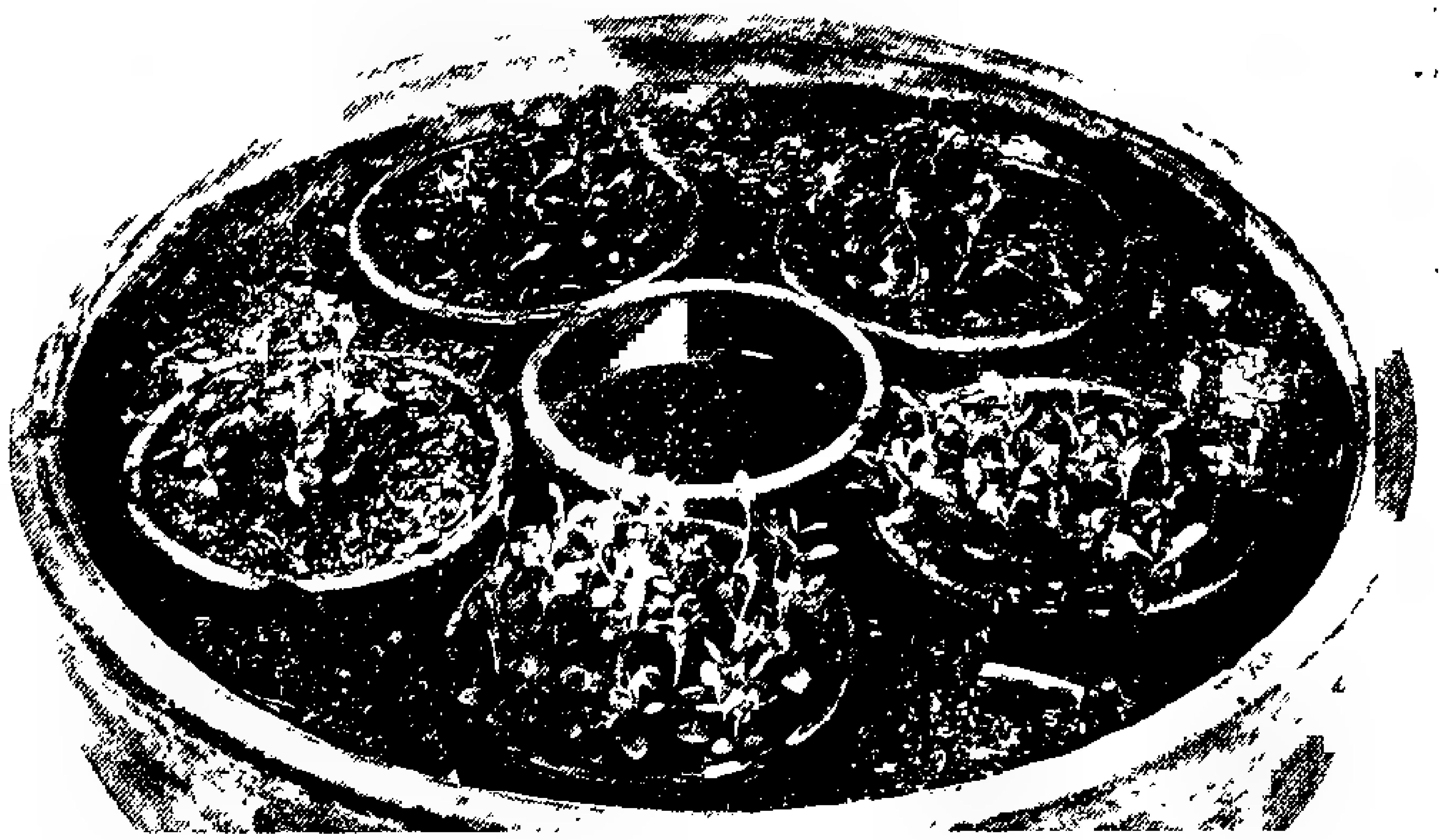
Arbutus seed is borne on the surface of a white berry-like fruit with a cover or capsule which splits into five segments when it is ripe. As many as 500 seeds are sometimes found in a single capsule. As plants with perfect flowers are unusual, cross-pollination is ordinarily necessary to get fruit. This, together with the fact that the flowers appear in the early spring when few flying insects are about, results in the rather infrequent appearance of seed capsules. Hand pollination is easily effected by transferring the pollen of a staminate flower to a pistillate flower by means of a small camel's-hair brush. One staminate flower will often furnish enough pollen for several pistillate flowers.

The period from pollination to maturity and opening of the capsule varies from 40 to 55 days, being most frequently between 44 and 50 days. To be sure of getting the seeds when they are ripe, one must watch carefully, beginning about five weeks after pollination, for signs of splitting of the capsule. Small black ants are very fond of the seeds or of the pulp on which they grow, and can completely remove all seeds and pulp from the capsule in a surprisingly short time. A capsule showing no sign of splitting in the morning will sometimes be found open and entirely empty before night. One should not wait for the capsule to be fully open but should pick it at the first appearance of a split.

The seed is easily separated from the pulp by rubbing between the fingers and may be planted at once, although this is not necessary. Seed three months old with no special treatment has shown average germination, while seed kept under refrigeration at 40° to 50° F. for six years has shown germination of sixty percent. Seed may readily be kept over from one year to the next by sealing in small vials and storing in a household refrigerator. Excessive drying of the seed should be avoided.

Growing Seedlings of Trailing Arbutus

A satisfactory soil mixture for starting seedlings consists of one part of peatmoss, two parts of well rotted oak leafmold, and one part of sand. The peatmoss and leafmold should be rubbed through a one-eighth-inch sieve. Flats or pots may be used, adequate drainage being provided in either case. It is essential that the seed be kept moist after planting. One way to assure this, used by the writer, is to plant the seed in 2- or 2½-inch pots, placing several of these in a large pot or bulb pan, surrounding each small pot with damp peatmoss. Another small pot with its drainage hole corked is placed in the center and kept filled with water. The whole is covered with a sheet of glass or an inverted glass bowl.



Young seedlings of trailing arbutus in two-inch pots, kept moist with a flower-pot plugged and filled with water in the center.

The small pots in which the seeds are to be planted should be about one-third filled with small pieces of broken pots or other drainage material before filling with the soil mixture. After the soil is leveled off and pressed down, it is covered with a thin layer of finely sifted sphagnum moss. After watering thoroughly, care being taken to avoid disturbing the sphagnum, the seeds are distributed evenly over the surface and not covered. The sphagnum may be omitted and the seeds sown directly on the soil mixture, if desired, but more uniform results have been had by the writer when the sphagnum was used. Forty to fifty seedlings can be grown in a 2-inch pot. Kept in light shade, the seed will germinate in five or six weeks. Ordinarily, no watering other than refilling of the center pot will be necessary.

When two to three months old, the seedlings can be transplanted to 2- or 2½-inch pots, using the same soil mixture, and kept growing through the winter in the house (or greenhouse if one is available). Nearly a year may be gained in this way, as some plants will blossom the second spring following sowing of the seed. If this is not done, three years are required to get a blossoming plant. Care must be taken to insure proper moisture conditions for the transplants, particularly if grown in the house where the air is ordinarily much too dry. This can be accomplished by sinking the pots in damp peatmoss in a deep flat or other container and covering with glass. The plants should be in shade for the greater part of each day. After their first winter, the plants must be left outside, where they will remain dormant during the cold weather.

Young Plants Taken Outdoors

When moved outside in the spring, the potted plants should be sunk in damp peatmoss in a coldframe, the glass sash being replaced by a lath frame giving half shade—that is, with the space between the laths the same as the lath width. Or the coldframe may be located near a tree or on the north side of a building where it will be in shade during the brighter part of the day. The plants should be watered once a week in the absence of adequate rainfall.

In the late summer, the one-year-old plants should be repotted in 3- or 4-inch pots, unless it is desired to transplant them at that time to a bed or other permanent location. Left in the coldframe in the 3- or 4-inch pots, they will grow to blosoming size, some of them blooming the following spring.

In the late fall after the trees have shed their leaves, the plants should be covered with three or four inches of oak leaves. The lath frame or some twigs should be used to hold the leaves in place during the winter. In the spring when frost is out of the ground and danger of hard freezing weather is over, the covering of leaves should be gradually removed.

Transplanted seedlings about one year old.

A flowering plant of Epigaea reopens twenty-one months from seed.

Reproducing Choice Plants from Cuttings

Trailing arbutus is readily grown from cuttings. If one wishes to propagate an especially good plant found in the wild, or a particularly good seedling, this method must be used. Cuttings may be taken at any time from spring until early fall, but preferably soon after the plants have blossomed, or in the early fall when stems and leaves ordinarily contain more moisture than in the dry weather of summer. They should be three to five inches in length and any dead blossoms should be removed.

A mixture of one part of clean, sharp sand and one part of granular peatmoss has been found satisfactory as a rooting medium. A large pot or a deep flat may be used, all of the cuttings except the top leaves being covered by the sand-peatmoss mixture. This should be pressed firmly around the cuttings and kept moist but not wet. Kept in a cold frame in shade, the cuttings should be well rooted in two or three months. If made in the spring, they may, if well rooted, be potted in 3- or 4-inch pots in the early fall, using the same soil mixture as for seedlings. Cuttings made in the summer or fall are best left in the rooting medium and protected over winter in the coldframe. These can be potted the following spring after growth has started. Plants from cuttings will generally blossom the second spring following the making of the cuttings.

An Arbutus Bed in Yard or Woodland

Pot-grown arbutus plants can be readily transplanted to and successfully grown in a properly located and prepared bed in one's yard. Or, if one has a bit of woodland, it is possible to establish plants in a natural setting. Lacking the patch of woods a bed may be established where it will be shaded for a part of the day by a tree or shrub or by a building. Where space is available on the north side of the house or garage, a bed can be easily prepared provided there is no danger of the space being reached by roots of adjacent shrubs or trees. The soil should be removed to a depth of 18 inches and the bottom of the hole covered with about 3 inches of small stones or coarse gravel. The hole should then be filled to within

A plant in full bloom three years from a cutting.

about 6 inches of the top with a mixture of equal parts of peatmoss and sand. The top layer of 6 inches then is filled with a mixture of two parts oak leafmold, one part peatmoss, and one part sand.

If the bed is located near trees or shrubs, trouble may be had from their roots entering the prepared soil and absorbing moisture, unless precautions are taken to prevent it. Where only a few roots are encountered, they may be cut off about a foot from the bed when the planting is established and be re-pruned yearly thereafter. If the roots are numerous or it is desired to avoid the annual root pruning, a sheet metal or concrete barrier may be interposed between the bed and the tree or shrub. This should go to a depth of 2½ feet and overlap the bed at both ends.

Two- or three-year-old plants are best for transplanting to beds, although well grown one-year-old plants may be transplanted successfully. Spring or early fall is the best time. The plants should be well watered when set out and frequently enough thereafter to prevent their drying out until well established. A covering of pine needles thick enough to almost hide the plants will aid in holding the moisture and will eventually work down and form a mulch between the plants. The bed should be covered for the winter with three or four inches of oak leaves applied soon after the leaves have fallen, and kept in place by twigs or evergreen branches. This covering should be removed gradually in the spring when danger of hard freezing has passed.

Avoiding Tree-root Invasions

While arbutus grows naturally in the woods, it is not easily established there. If planted in rich soil under forest trees, the tree roots soon grow into the better soil and rob the plants of the moisture required for their growth. One method of overcoming this difficulty which has been employed with some success is to use a very poor soil such as a half sand, half peatmoss mixture. A hole about a foot in diameter and a foot deep is made, all roots being removed. This is filled with the sand-peatmoss mixture in which the pot-grown plant is set. The plants are well watered and covered with a mulch of pine needles. This planting is best done in the early fall. The soil around the plants must be kept moist during the fall, and some watering may be required the following summer. Given a light mulch of pine needles and peatmoss each year, the plants grow very slowly but seem to be well established after three or four years. The locations selected should of course, have good drainage and be preferably on a northerly slope. If the natural soil around the plants is alkaline, it should be given a mulch of peatmoss and pine needles when the plants are set out, with small additions yearly thereafter.

RADIO PROGRAMS

Alternate Fridays, 3:30 p.m., WNYC (830 on the dial)

May 4 ***Prospectus for Garden Week***
Carol H. Woodward, Editor
Journal of the New York Botanical Garden

May 18 ***The Next Fifty Years***
Arthur Cronquist, Assistant Curator,
New York Botanical Garden

June 1 ***How to Grow Fine Roses***
P. J. McKenna, Garden Consultant

June 15 ***Vegetable Crops Through Summer and Fall***
Arthur King,
Superintendent, "Northview," Mt. Kisco

June 29 ***Nutrition from Home-Grown Vegetables***
Eloise Davidson,
Director, Herald-Tribune Home Institute

Tropical Plants the World Around

By Otto Degener

II

The second of Mr. Degener's articles representing material being prepared for his forthcoming book, "Plants of the Tropics, Illustrated," is presented here. Another will follow. As in the first, the majority of the drawings have been adapted from his "Flora Hawaiiensis" or "New Illustrated Flora of the Hawaiian Islands." Both are part of the series which began in the Journal for March with Rupert C. Barneby's article entitled "Notes on the Vegetation of the Mediterranean Littoral," all based on the series of free lectures given at the Garden during the winter on "Plants of the Regions Where Our Men and Women Are Serving." An article by Hugh M. Raup will conclude the series.

ANATTO-TREE

THE COLORING MATTER in much of the butter, cheese, margarine, and chocolate that is sold in the United States comes from the seeds of the anatto-tree (*Bixa Orellana*, Bixa family). A native of tropical America, the plant is widely grown elsewhere in warm climates.

The anatto-tree, or ACHIOTE, is a small tree, rarely reaching twenty feet in height. It has pale yellow, soft, light wood, and dark brown twigs bearing large, narrowly heart-shaped leaves.

The showy flowers, which usually have the pink of peach-blossoms with many stamens in the center, are followed by green capsules an inch or more long, covered with soft slender prickles. These capsules turn a brownish red and eventually split open, exposing the seeds, an eighth of an inch long, each covered with a pulpy red testa, or outer coat. It is from this seed-coat that the red, orange, or yellow dye is obtained. The coloring principle is known as bixin and has the chemical formula of $C_{21} H_{34} O_2$. The dye is obtained by stirring the seeds in water, either hot or cold, evaporating the mass, and forming it into cubes or rolls for commercial use. Besides certain foodstuffs, the dye is used for cosmetics, oils, and varnishes, and formerly for wool and silk.

The Indians of South America, who considered the anatto-tree sacred, cultivated it for untold centuries, as certain remains in ancient Peruvian graves attest. They were the first to use its seeds as a dye, smearing their entire bodies with it,* partly for ornament, both in

* See "Achiote, the Blood Tree" by V. W. von Hagen, in the Journal of the New York Botanical Garden for April 1940.

daily use and in special ceremonies, and partly as an insect-repellent. They also color and flavor their food with the seeds. In parts of South America, as well as in Asia where the tree has been introduced, the leaves and roots are used as a digestive tonic and the tough stringy bark is made into twine. In the Philippines the seeds are ground and used as a condiment.

The generic name of the anatto (*Bixa*) is derived from Bicha, a tribe of South American Indians. The specific name commemorates Francisco Orellana, discoverer of the Amazon.

AFRICAN TULIP-TREE

THE AFRICAN TULIP-TREE (*Spathodea campanulata*, Bignonia family) is a coarse, quick-growing, erect tree with soft, worthless wood, readily blowing over or losing branches during severe wind storms. Its large leaves are compound, bearing usually 11 to 13 leaflets. Though attaining a height of 75 feet under the most favorable conditions, this vigorous tree may flower when only 15 feet high.

The flowers appear in dense, erect clusters at the ends of erect branches. When young the longitudinally ridged, tawny-haired calyx protects the rest of the flower from the outside air and from marauding insects. In fact, the calyx encloses it in a watery juice that bathes every part. Urchins in Hawaii and elsewhere, knowing of this peculiarity, pluck the largest flower buds. Breaking off their tips, they squirt the contained liquid for quite a distance at one another. To them the plant is the "fountain tree."

The African tulip-tree is very showy when it bursts into flower, particularly in the rainy season. Its irregularly cup-shaped corolla is 3 to 4 inches long, and is of bright orange-red with fine golden-yellow margins on its five crisped lobes. In about two days it falls to the ground unwilted, covering the lawn with color like its relative, the jacaranda.

The fruit is a woody capsule about 5 inches long, boat-shaped and narrowed at both ends. It contains a broad septum or diaphragm to which about 500 seeds are attached. These are very flat and light with a membranous hyaline wing. As the capsules open, usually first along one side, these seeds fall slowly, like feathers, to the ground, often a considerable distance from the parent plant. Conditions in Honolulu are so favorable to this African tree that the countless seeds germinating in flower beds and hedges become a nuisance. The tree then becomes a veritable weed.

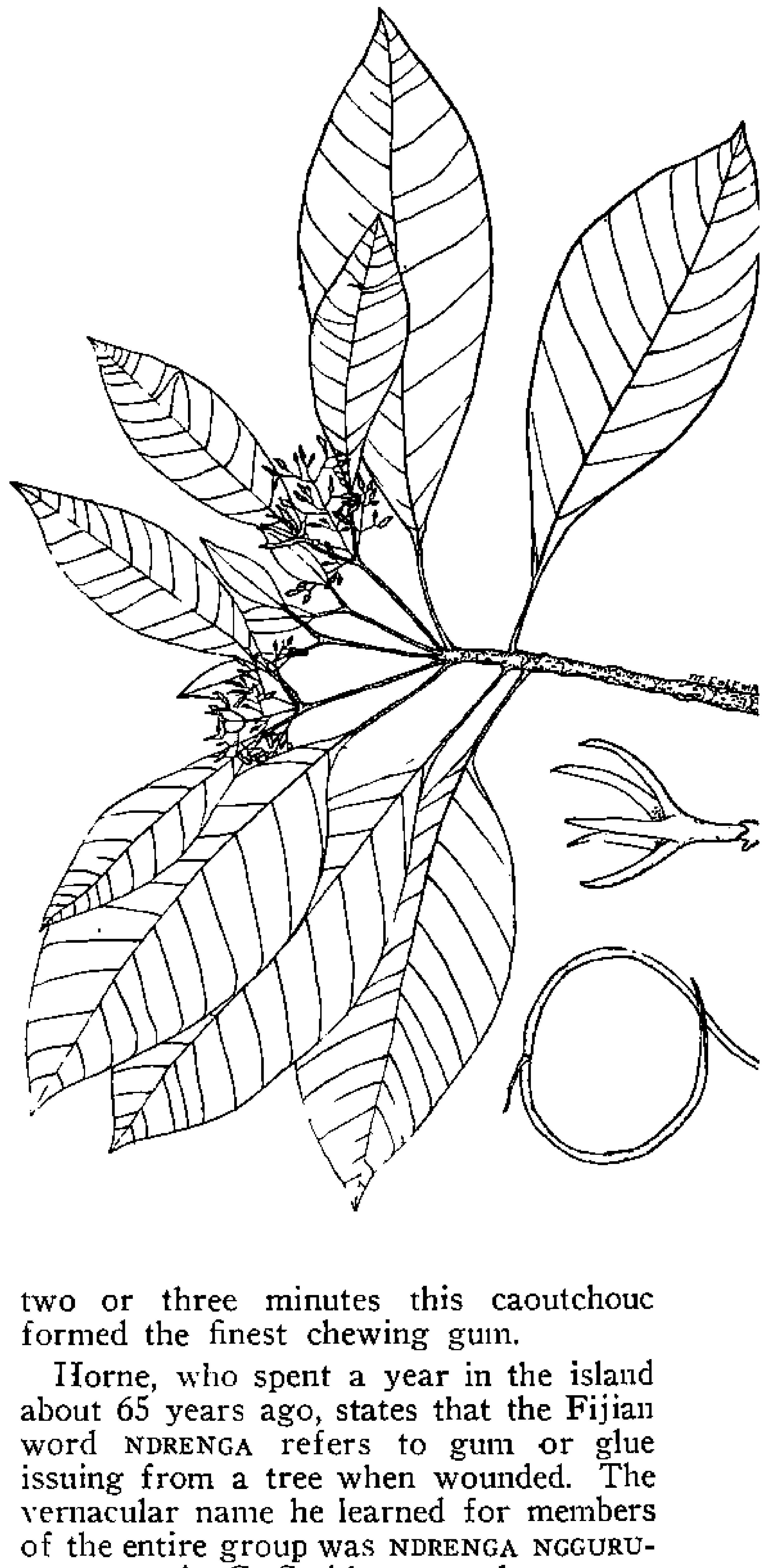
The common African tulip-tree is native to western tropical Africa, while another kind (*S. nilotica*) with hairy leaves and non-ridged calyx is native to eastern tropical Africa. Though the trees are usually ugly with broken limbs, they are planted in many warm countries because of their gaudy flowers, which in *S. nilotica* are even brighter orange-red than in *S. campanulata*. Both trees thrive even in fairly dry regions.

ALSTONIA

THERE ARE UPWARD of fifty kinds of alstonia (Dogbane family), native to tropical Asia, Australia, and the islands of the Pacific. Their generic name commemorates Dr. Charles Alston, Professor of Botany in the University of Edinburgh, in the middle 18th century. They are quick-growing shrubs or small trees exuding milky juice. The smooth leaves are either opposite or whorled. The small, clustered flowers are tubular, 5-lobed, and usually white to yellow. Each flower contains two well-developed carpels which mature into twin pods, often of surprising length. The seeds are light, and adapted for distribution by the wind.

The Indian alstonia (*Alstonia venenata*), which grows about 8 feet high, has beautifully veined leaves and delicate flowers. Readily propagated by cuttings, it is occasionally grown for curiosity and ornament. The handsome devil-tree, a giant among its relatives, attaining a height of 90 or more feet, is botanically called *Alstonia scholaris* because its wood was used several hundred years ago for making school-children's writing tablets, according to the report of an early explorer. This species grows in tropical Africa and Asia through Malaya to tropical Australia. It has bitter milky juice. The medicinal bark long has been used in Indian and Philippine folk medicine, while its relative, *A. constricta*, is used in Australia as a tonic and in the treatment of malaria. Though their active principles are alkaloidal, they cannot compare in effectiveness with cinchona bark.

At least half a dozen alstonias grow in Fiji, of which I found *A. costata*, *A. montana*, *A. plumosa*, *A. Reineckeana*, and *A. vitiensis*. From my native assistants, Timoce Bebe (translatable into Timothy Butterfly) and Aloisio (Aloysius) Tambualewa, both of whom learned to be expert collectors during my eight months in the islands, I learned how to gain chewing gum. They broke the twigs or leaves off the alstonia, permitting the latex to exude. Within a few seconds the droplet had become tacky and was removed with a stick. It was then touched to other droplets exuding from wounds they had made in the tree until a sufficient amount had been collected for a sizable mouthful. After congealing for



two or three minutes this caoutchouc formed the finest chewing gum.

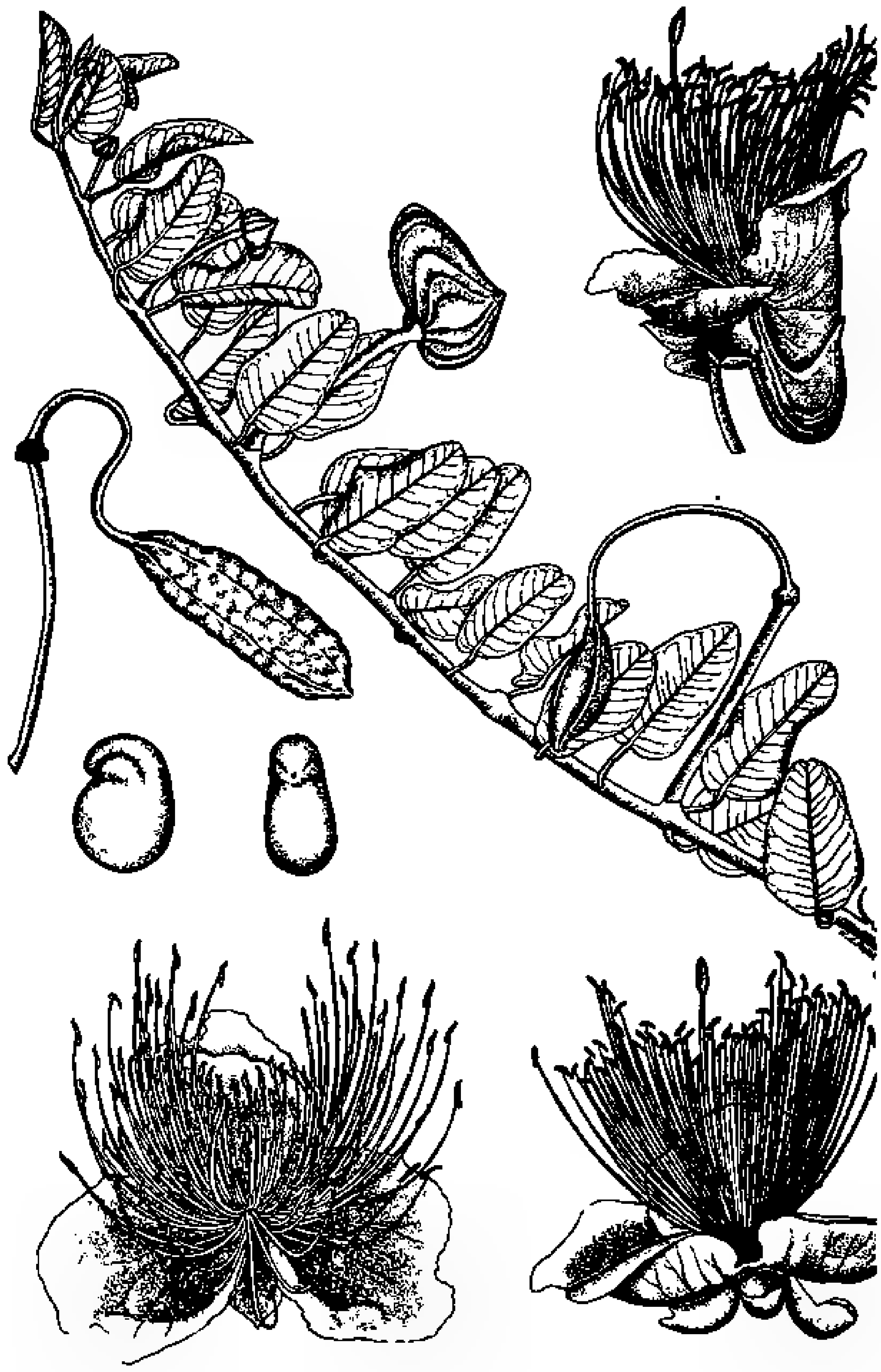
Horne, who spent a year in the island about 65 years ago, states that the Fijian word NDRENGA refers to gum or glue issuing from a tree when wounded. The vernacular name he learned for members of the entire group was NDRENGA NGGURU-NGGURU. A. C. Smith reported NDRANGA as the name on Vanua Levu for one species, while I found NDRENGA-NDRENGA, MBULEKI and MBULEI used as other names in other dialects.

Besides its value to the Fijians for chewing gum, some alstonias are used medicinally. A branch is put in the fire to wilt. Its bark is then scraped off and put into the cloth-like base of a coconut leaf stalk. This is then squeezed to express a non-milky juice into sore eyes to cure them.

Returning to the New York Botanical Garden with my dried Fijian specimens and my notes on native lore, I consulted the rare tomes in the library there, and then learned that Horne had discussed the alstonias as potential rubber producers. He stated that the trees abound in all parts of Fiji and that the natives "collect the juice in their mouths, which makes the caoutchouc as adhesive as glue, and of about the consistency and color of putty. To get the juice, the Fijians break off the leaves from the branches, and collect it as it flows from the petioles and the wounds on the branches caused by the breaking off of the leaves. The branches are next broken off the trees, and each branch is broken up into pieces from 6 inches to a foot long. As fast as the pieces are broken, first one end of them is placed in the mouth, then the other, till the mouth is full of crude caoutchouc. Several mouthfuls are collected together and squeezed into a round mass or ball. This method of collecting the juice, with the ruthless manner of breaking the trees, somewhat surprised me when I first saw it done. Since then repeated trials in all parts of Fiji have convinced me that the sap or juice does not flow freely by wounding the bark on the trunk of the tree in any way whatever. This is the reason for breaking the branches. The youngest branches of the tree contain most juice. When the old or firm wooded branches are broken very little sap flows from them. When the young branches are broken the sap flows rapidly for a few seconds. It soon coagulates when exposed to air, and the wound has to be freshened to cause the sap to flow anew. When the branches are broken into pieces of about a foot in length the juice flows from the ends and the pieces are drained almost entirely. A little more may be obtained by breaking the pieces in the middle but very little. The juice flows from between the bark and the wood and from the pith, or from between the pith and the wood. The coagulated juice would seem to have some attraction for the juice in semi-liquid condition. If a portion of the coagulated juice be applied to the semi-liquid juice adhering to the ends of a broken branch, the slightest touch makes them join firmly. The adhesion is so perfect, that the portions will not be separated, and a slight pull takes the semi-coagulated juice clean out of the many fissures or cracks in the ends of the broken branch. To obtain crude caoutchouc from this tree the juice has simply to be collected and worked with the fingers. It requires no other preparation. The juice congeals so rapidly that when collected in dry weather it requires little if any drying. The caoutchouc may be sent to market in balls, or it may be pressed in moulds into long thin pieces, 1 or 2 inches broad and an inch in thickness (more or less) as may be required. Samples of it have been sent to England, and the quality was highly valued: –some of the samples as high as 2s. 6d. per lb., a price equalling that of the best Para caoutchouc."

I am devoting so much space to the genus *Alstonia* because it deserves serious consideration by men in the Service, and by scientists and business men who are not entangled in colonial red tape or who can circumvent it. The alstonias are quick-growing, vigorous plants adapted for plantation culture. An Indian kind is readily propagated by cuttings, indicating perhaps that its relatives likewise can be propagated rapidly. By this asexual propagation, individual trees possessing superior qualities can be raised in great numbers. *A. scholaris* and Fijian kinds have been used in folk medicine for countless generations by many peoples, obviously because of certain valuable properties. Products gained from *A. scholaris* and *A. constricta* are used as a substitute for the antimalarial quinine. We do not know until proper tests have been made whether some other species may not be superior. Because alstonia latex was collected by mouth by the Fijians years ago does not mean it must be gathered that way today. Modern technique has devised grinding, dissolving, and other more practicable means of gaining latex from plant tissues. Investigators and producers in the fields of rubber, chewing gum, and medicine are waiting for the opportunity to obtain specimens of alstonia for testing.

Fiji's contribution to emergency war research in quinine, rubber, and chewing gum failed, alas, because of one picayune bottleneck. Tim and Aloysius were not granted permission by the Colonial Government to renew their purchases of the paltry amount of kerosene necessary to keep their Coleman lanterns burning. Without proper drying, the samples they collected for me molded while in transit and reached the Botanical Garden in New York a worthless rotten mass. Here we have the ridiculous paradox of emergency war research being postponed until the war is won, fuel restrictions are eased, and the emergency no longer exists. Instead of these native experts employing their talents in bringing to light plants that may aid the war effort, they are now employed at tasks that any white beachcomber, unacquainted with the Fijian plants about him, can perform. According to latest information, Tim is a woodchopper at a daily wage of about 45 cents per day in the Nandarivatu region; while Aloysius is a road laborer, at a similar wage, in the Serua district. Perhaps some one, during his travels, may have the opportunity to tarry in Fiji, resolve the bottleneck, hunt up disheartened Tim and Aloysius, and turn them back into the jungle they know so well in search of plants. These specimens, properly dried, should be mailed to the New York Botanical Garden for proper testing as to their possible war value. All kinds of alstonias, their seeds and cuttings, are particularly desired.



CAPER

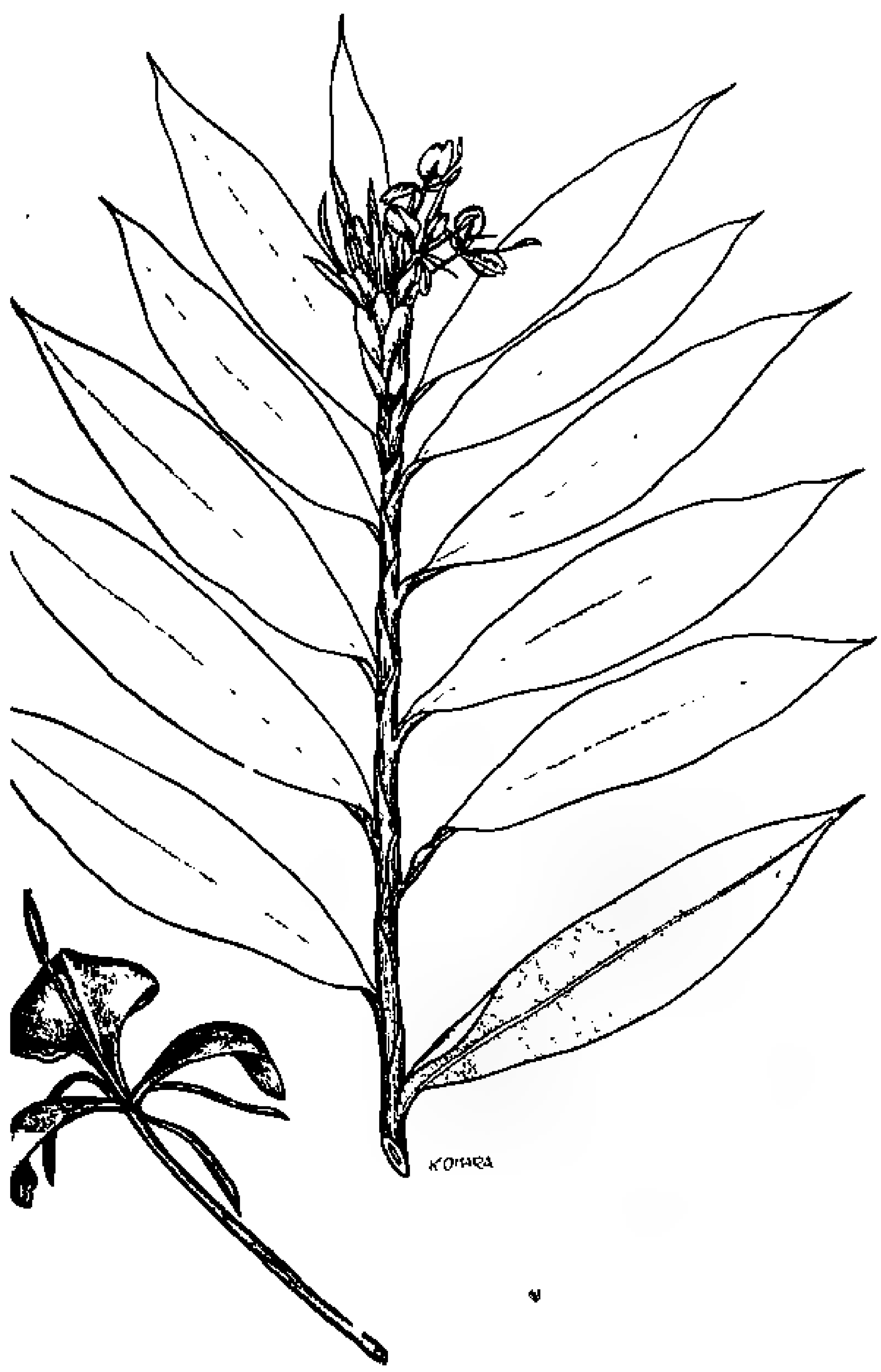
THE HAWAIIAN CAPER (*Capparis sandwichiana*) is a member of the small Caper family, a close relative of the Mustard family and possessing some of the same pungent qualities. It is a sprawling shrub always growing in arid regions, often on sun-scorched cliffs occasionally drenched with salt ocean spray. Its stems are brittle, and its oblong leaves are very pale green and dull. Instead of lying flat and fully exposed to the sun, these leaves are held almost vertically, perhaps to avoid their too great exposure to its drying rays. At the base of each leaf-stalk are two obscure hair-like appendages called stipules. On studying the large series of capers deposited in the herbarium of the New York Botanical Garden and coming from an area extending from the Pacific to the Mediterranean, we can observe a curious fact. The stipules, which are hardly visible in Hawaiian plants, become larger the farther west we go until in the Mediterranean these structures have become formidable spines. There the plant is fittingly called *Capparis spinosa.*

Few people see the caper in its true beauty because its large white flowers bloom only at night, fading pink and dying toward morning. They are about 3 inches across, and bear upward of 200 slender stamens. They resemble somewhat the flower of the night-blooming cereus in miniature. The yellow fruit of the caper is technically a many-seeded berry borne on a curiously long stalk.

The Hawaiian caper plant has not been used by man; but its European counterpart, known to the ancient Greeks, furnishes the caper of commerce. Though the industry is a relatively unimportant one, small caper plantations occur in southern Europe and in the southern United States to supply the gourmet with the chief ingredient for his characteristically pungent caper sauce. The *pièce de résistance* of this sauce is the unopened, immature flower bud of *Capparis spinosa,* gathered in the morning and pickled in salt and tarragon vinegar.

GINGER-LILIES

THE YELLOW GINGER-LILY (*Hedychium flavum,* Ginger family), here illustrated, is, according to Roxburgh, "A native of the vallies amongst the hills near Silhet, where it is called Kattia-rityam by the natives." This is in the Himalayas. The plant is a coarse perennial herb with pale, fragrant rootstocks. Unlike many members of the Ginger family, it possesses only one kind of stem. This is erect, about 5 feet high, and leafy along two sides. It finally produces at the end a series of loosely overlapping bracts which subtend very fragrant, rather delicate, yellow flowers.



A very closely related plant is the common white-flowered ginger-lily (*H. coronarium*), probably likewise native to the Himalayan region. The fruit of both is an oblong, one-inch capsule, which splits open by three valves to expose 20 to 40 bright red seeds. But fruit of these plants is seldom seen, at least in Hawaii, though flowers occur abundantly and often.

The ginger-lilies because of their beauty and great fragrance were probably introduced into the Hawaiian Islands by the Chinese. Other races admired them and planted them in their gardens, too, and soon these ornamentals escaped into the open forest and meadow, particularly in rainy regions. Both kinds are highly prized by the Hawaiians for the making of leis, or garlands. The common ginger-lily with its white flowers is more widely cultivated in warm countries than its yellow-flowered relative. The stems of these plants have been used in the making of paper.

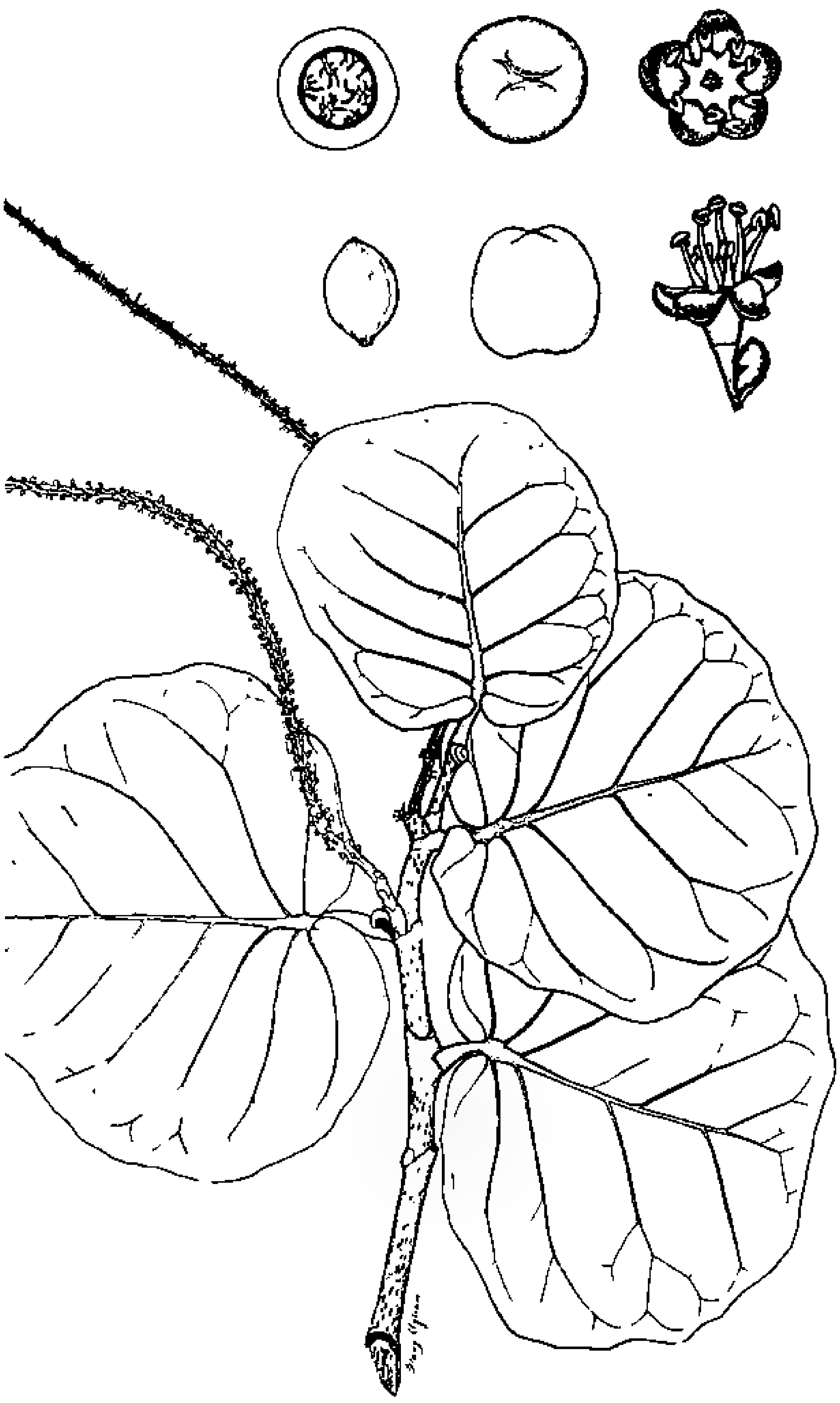
SEAGRAPE

MANY KINDS of coccolobis are native to the West Indies region, the kind coming into cultivation the most being the seagrape (*Coccolobis uvifera*). From its peculiar clasping stipules, called ocreae, the botanist can recognize the plant as a member of the Buckwheat family even without studying its flower.

The seagrape is a rounded shrub or tree usually about 15 feet high. Its spreading branches bear large, irregularly circular leaves which are shiny and more or less reddish when young. They soon turn pale green, except for their red midrib and nerves.

According to Gonzalo Fernandez de Ovieda (1478-1557), royal warden to the gold mines of Castilla de Oro (Panama), the Spaniards employed the leaves as a substitute for writing paper, scratching messages upon the smooth surface with a pin.

The numerous greenish yellow flowers appear on slender spikes. They are not showy. As they mature, the weight of



the densely clustered, grape-size fruit at length drags the spike down to a pendent position. When ripe, these fruits are greenish mauve with faint greenish dots. They contain a thin layer of sweet-acid pulp surrounding a woody stone and are edible raw, but rather troublesome to eat because of the scarcity of flesh. They can be made into a delicious jelly, and in the West Indies are also made into an alcoholic drink.

The wood of the seagrape is dark brown and heavy. When found of sufficient size it is used for furniture and cabinet work.

The seagrape forms coastal thickets from the West Indies and neighboring parts of continental tropical America north to southern Florida; also in Bermuda. It is becoming increasingly popular in tropical countries primarily as an ornamental and a windbreak near the sea. Like some casuarinas, it is tolerant of ocean spray and will grow in almost pure sand.

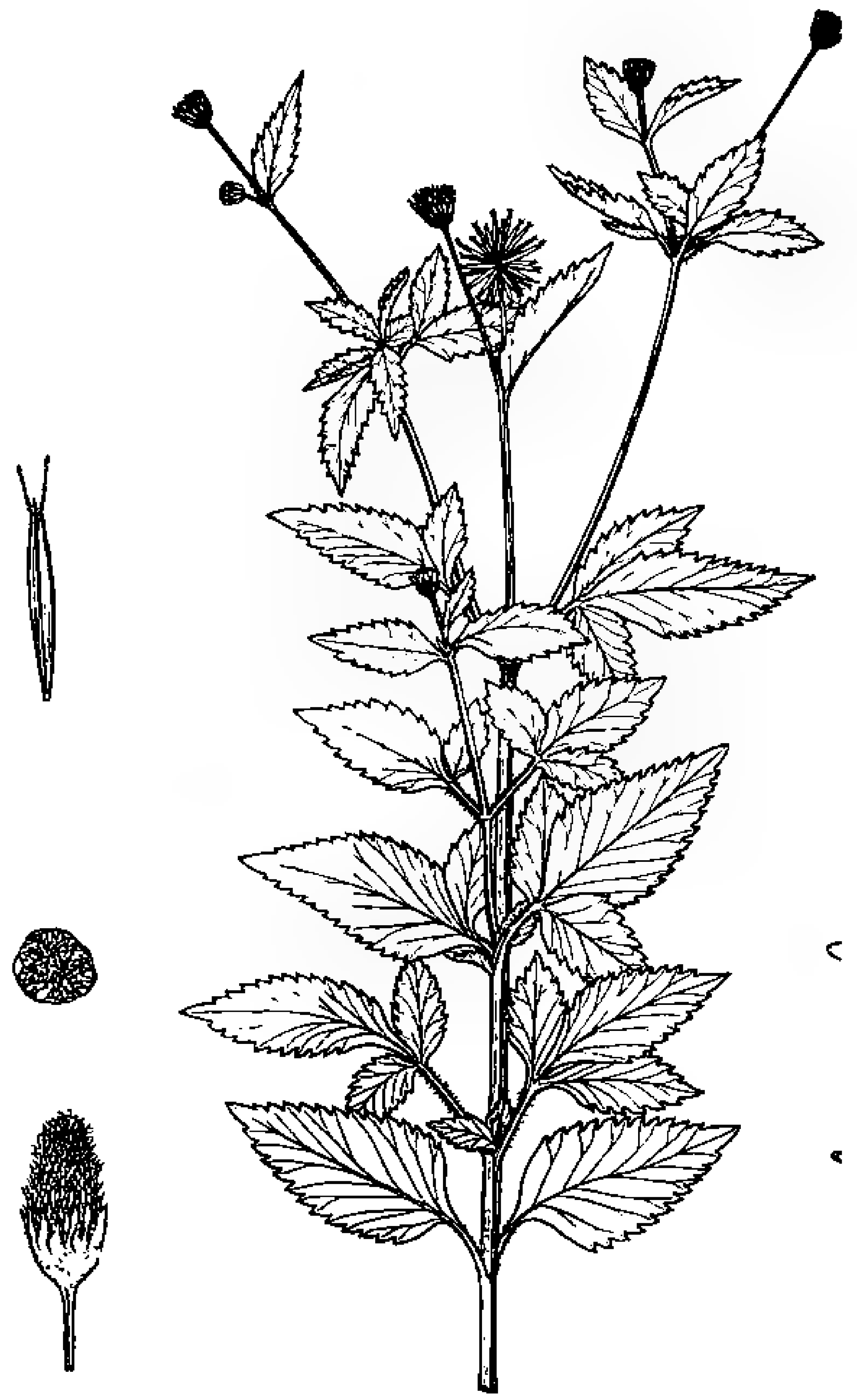
INDIAN MULBERRY

THE INDIAN MULBERRY (*Morinda citrifolia,* Madder family), a distant relative of the coffee, is a small tree with coarse, angular branches and large shiny leaves which occur in pairs except where a flower cluster is formed. The cluster consists of a short stalk supporting many closely packed flowers in various stages of development. While those near the top are yet green buds, older buds below them are unfolding as small white flowers. Below these, in turn, stand the remains of former flowers which now consist merely of enlarging, green ovaries. Even before the last flowers in the cluster have bloomed, the older ovaries ripen into small, pale yellow fruits, which press against each other with such force that their sides become flattened. As the entire cluster continues to grow and ripen, the single fruits unite into one large collective fruit like the breadfruit or pineapple, showing on its surface the faintly pentagonal or hexagonal outline of each individual ovary.

The Indian mulberry is found in Australia, southeastern Asia and throughout the South Seas. Because of the many uses of the tree, the natives may have carried it with them during their extensive wanderings from island to island. It probably also reached isolated islands on its own power, for each seed is provided with a bladder which gives it buoyancy for distribution by ocean currents.

The earlier Hawaiians, who knew the plant as NONI, and many other Pacific peoples, ate the foetid fruit in times of famine, preferably cooking it to make the taste less disagreeable. The juice of the fresh fruit, acting as an insecticide, was also used in cleansing the hair. When overripe, the fruit could be used as a poultice. The Hawaiians also pounded the leaves and the bark of the stem, cooked the mass, strained it, and drank the resultant liquid as a tonic. Probably the greatest use of the NONI was for dye-ing bark cloth. A red dye was made from the bark of the root after boiling with lime derived from coral, while a yellow dye was made from the trunk. Many of these uses, with some modifications, were practiced by other islanders. For instance, the Filipinos placed ripe NONI fruit in a box with sugar and, after a few days' treatment, relished the jam-like mixture. So far as known, the seeds have no use. During times of scarcity the young leaves were eaten raw or cooked as a potherb.

A few years ago, I discovered an Indian mulberry plant in Fiji with beautifully variegated leaves. It came true from the seeds I gathered, and is now being planted in Hawaii for ornament.



SPANISH NEEDLE

THE SPANISH NEEDLE (*Bidens pilosa*, Composite family), is a highly variable weed, native to tropical America but now found naturalized and usually common throughout the tropics. It is partial to waste places, cultivated fields, and pastures.

Depending on the richness of the soil and especially the rainfall, the Spanish needle varies in height from one to three or four feet. It is almost entirely herbaceous. While its lowermost and uppermost leaves are simple, the others, far the most numerous, are compound, bearing three or five or occasionally seven leaflets. All the leaves are thin and are sharply toothed. The flower-like head, characteristic of this family, consists of scores of minute flowers or florets, each bearing five petals. Those at the periphery are at times greatly modified, two or three of the petals having united and become greatly enlarged to simulate a true single petal. The seeds, technically achenes, are black, long, and 2- or 3-pronged at the end. These prongs are so efficiently retrorsely barbed that no person or animal can touch a mature plant without carrying away numerous needle-like stickers.

Within a few days after the Japanese hordes bombed Pearl Harbor, I wrote articles for the Honolulu newspaper on plants that might be eaten during times of scarcity, a possibility staring us islanders in the face. Among these dishes, I recommended the tender shoots and leaves of the ubiquitous Spanish needle cooked as a potherb. I, myself, found this vegetable quite palatable when boiled in a few changes of water, drained and seasoned. Numbers of families tried this new and unusual food, long known to the Javanese, during those first anxious weeks in Hawaii.

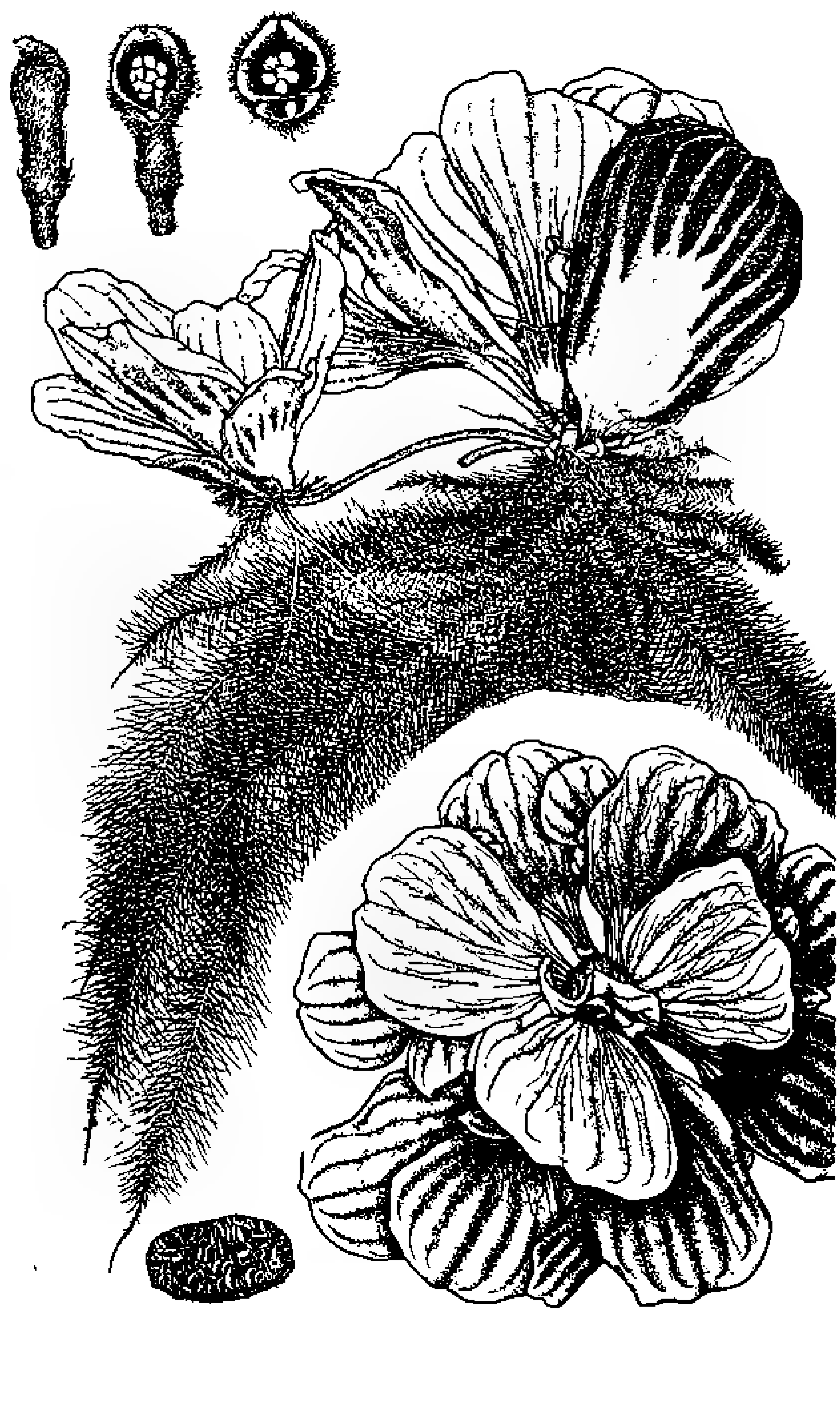
Nevertheless, the Spanish needle is primarily a troublesome annual weed. Not even cattle care to eat it.

WATER-LETTUCE

MOST MEMBERS of the Arum family are either marsh dwellers or plants growing in regions of excessive rainfall. The water-lettuce (*Pistia stratiotes*) has forsaken its ancestral marsh home to launch itself upon the water. It may be found in various forms in ponds and sluggish streams throughout most of subtropical and tropical America, Asia and Africa. It is familiar to people of colder climates as an interesting aquarium plant.

The water-lettuce consists chiefly of a huge mass of feathery roots connected by a short stem to a loose spiral rosette of broad leaves. These are light green, more or less velvety-scurfy on both sides to shed water, and spongy-inflated for their lower two-thirds. These leaves keep the plant floating so blithely.

As the water-lettuce increases in size, it produces new plantlets at the ends of brittle runners, or stolons. With the wind rippling the water or blowing patches of the plant here and there across the surface, these stolons are apt to break off and isolate the young plants from their parent. This is the way the water-lettuce increases in numbers asexually, often so rapidly as to cover relatively large bodies of water in a very short time. Sexual reproduction does not differ materially from that of most members of the Arum family. Careful search among mature plants should disclose a spathe and its spadix, in this case very small and degenerated in comparison to the large, gaudy structures of the calla-lily. Instead of being free, the short spadix is attached within the small, hairy, yellowish spathe on one side. It bears a few whorled, staminate flowers above the single pistillate one. This, upon pollination, develops into a tiny green irregularly ellipsoid fruit, slimy within, and containing many roundish oblong seeds.

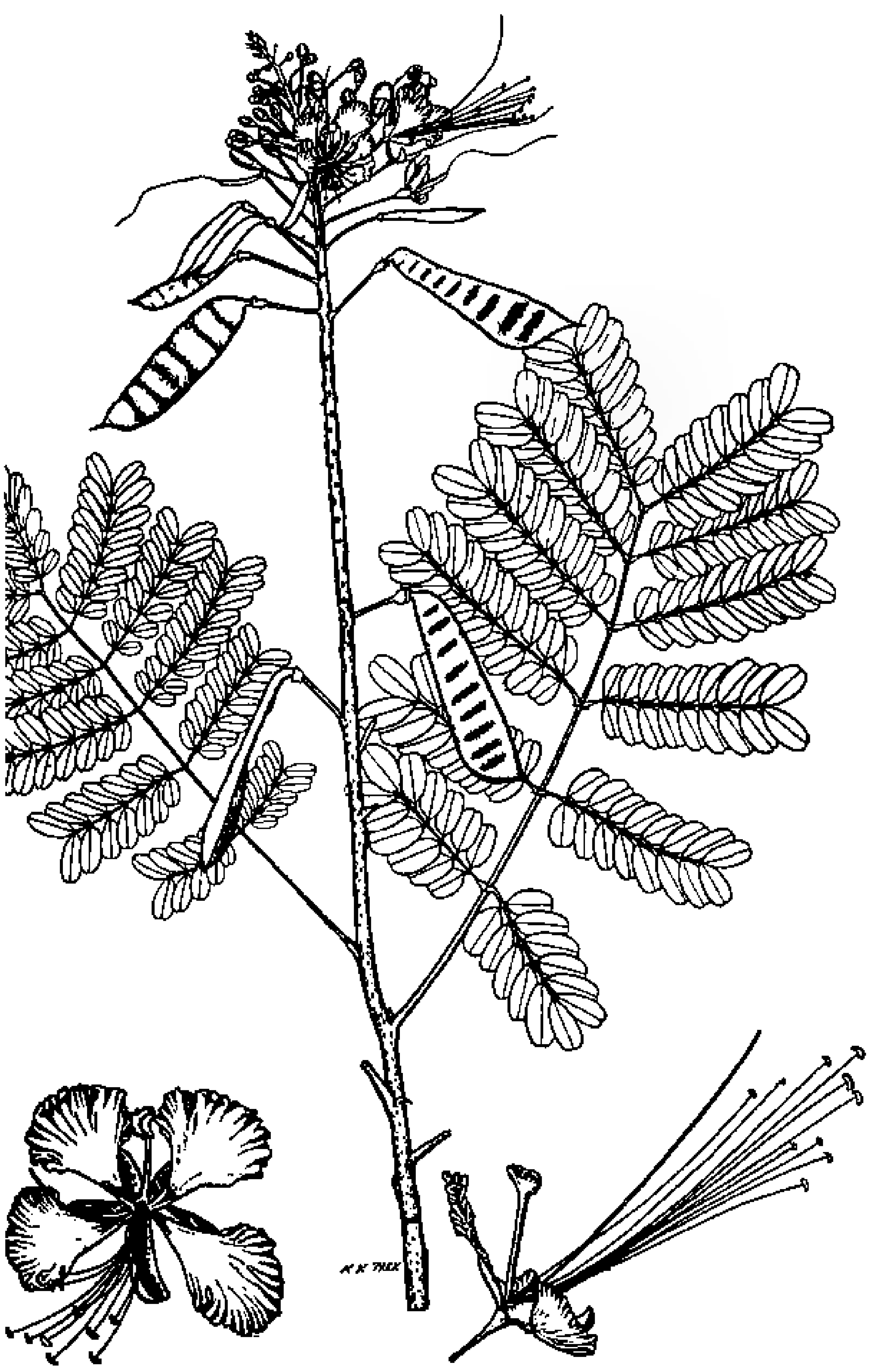


The water-lettuce, like the water-hyacinth, is essentially a weed, fouling water-courses and competing with such cultivated crops as taro and rice. Both weeds, during floods, are apt to be swept out into the ocean where the salt water quickly wilts and kills them.

FLOWER-FENCE

BOTANICALLY, the flower-fence is a true *Poinciana,* while the royally magnificent street tree commonly associated with that name, surprisingly, belongs to another group called *Delonix*.

The flower-fence is a leguminous shrub or small tree rarely over 15 feet high. Its branches are often armed with prickles and an old plant can produce an impenetrable tangle. The large leaves are beautifully fern-like with their numerous small oblong leaflets. The twigs end strictly upright in graceful clusters of red flowers tufted with long spreading stamens surrounding a single red pistil.



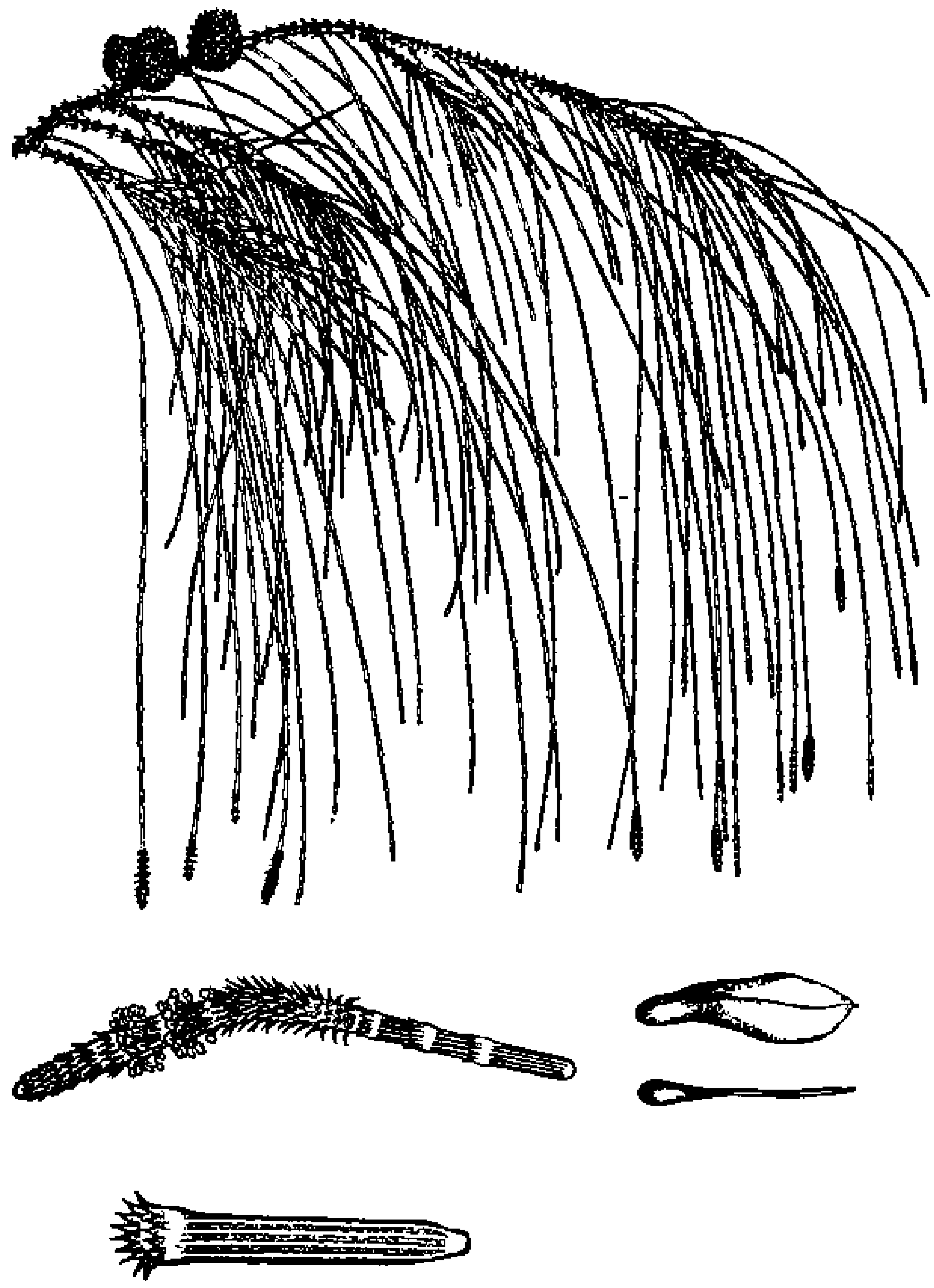
In the typical flower-fence (*Poinciana pulcherrima,* Pea family) the almost regular petals are at first red shading to yellow toward the crisped margin. After some time these same petals deepen to dark red shading marginally to a lighter red. The filaments are bright red, tipped with purplish anthers. There is little wonder that Linnaeus, who first named this plant scientifically, called it in Latin "the most beautiful poinciana." He described it as native to India, but most botanists believe he erred. There is some evidence to suspect its home to be somewhere in the West Indies. A yellow-flowered form (forma *flava*) also occurs in cultivation. The fruits of both kinds are flat and nondescript bean-like pods.

The flower-fence is grown in many tropical regions for ornament, thriving in sunny, moderately dry situations.

CASUARINA

ALL THIRTY or so members of the Casuarina family are so characteristically similar that familiarity with one is sufficient to be able to recognize all. They are peculiar to Australia, forming "shadeless forests" where the ostrich-like casuary bird roams, and they also grow on some of the smaller Pacific islands. Most kinds are tall, quick-growing trees, often of considerable size.

From a distance most casuarinas appear like tall pines bearing long, drooping needles and small cones. Upon closer inspection, however, one will observe that these plants have little in common with pines. The structures that seem to be needles, or true leaves, are actually long green jointed branches that hang and wave in the breeze. At each joint, or node, are five to fifteen minute teeth, the number varying according to the particular kind of casuarina. These teeth are the actual leaves of the tree, degenerated almost to invisibility. They are homologous to the needles of the pine, not analogous to them.



Some of the slender green branches end in catkins. These consist of several whorls of minute leaves bearing pale staminate, or male, flowers that are greatly reduced in size and structure. The pistillate, or female, flowers, on the other hand, are borne clustered on shorter branches. The female flowers are also greatly simplified, each consisting of a single pistil with its scarlet end receptive to pollen. After the pollen grains have reached the pistils and the ovules within have begun to develop into seeds, the entire catkin increases in size to become a cone-shaped structure, at first green, but finally brown. This eventually sheds the ripened, brown, winged seeds. The "cone" is not like the true cone of the pine tree, but is totally different in development and structure.

The wood of the casuarina likewise differs from that of the pine. It is ordinarily dark red, as the name "beefwood" implies, whereas that of the pine is light yellow; it is extremely hard, as its name "false ironwood" suggests, whereas that of pine is soft. Study of the two woods under the microscope will show still greater differences, that of the casuarina being more like oak, as its name "she-oak" indicates.

Obviously the common casuarina is highly specialized for existence in dry regions. Its leaves have degenerated to such an extent that they are almost nonfunctional, the green stems serving in their stead. By dispensing with leaves, the plant has enormously reduced the surface that it would otherwise expose to the drying rays of the sun. Furthermore, to conserve the moisture that would ordinarily escape from the inner tissues of the plant, the microscopic air-pores, or stomata, necessary for respiration have sunk into sheltered grooves in the slender green stems. Thus the casuarina can flourish in regions of little rainfall where most plants with ordinary leaves would perish from drought.

The casuarina most frequently planted throughout tropical and subtropical regions is *C. equisetifolia*. Like most of its relatives, it is strikingly graceful, and is a favorite street and garden tree. It grows rapidly in hot, coastal dunes and acts as a valuable sandbinder and windbreak at the ocean where few other trees will live. This species and most other kinds will also grow in the drier uplands, thus being of value in reforestation. They can become an intolerable nuisance, however, when inconsiderate neighbors plant them too close to the property line. The tree's aggressive rooting system steals the food and moisture from garden and crop plants in the vicinity, while the continuous rain of needle-like branches poisons the ground and will actually kill a lawn already well established.

The wood of *C. equisetifolia* and most of its relatives is so dense and hard that all but the stoutest nails will bend under the hammer blows before penetrating it. The wood is so heavy that it will sink in water. It is strong, elastic, and durable, and suitable for beams and posts so long as these remain dry; but not for construction work in or near the ground where exposed to dampness. There it rots rapidly. It is worthless for boards because of its tendency to warp, especially when exposed to strong sunshine. It should not be cut up until thoroughly seasoned. The tree is ready to be cut for firewood when about ten years old, making excellent fuel even when green and when wet with rain. In Fiji it was used for war clubs and for the three- or four-pronged forks used only at cannibal feasts. The bark is astringent and occasionally used for tanning, and the cone-like fruits are often gilded or silvered to be worn as costume jewelry.

QUEENSLAND NUT

THE MACADAMIA, or Queensland nut (*Macadamia ternifolia,* Protea family), was named in honor of Dr. John Macadam, Secretary of the Philosophical Institute, Victoria, Australia. It is a native of northeastern Australia.

The tree becomes 50 to 60 feet high. The leaves, which are either opposite or whorled, are painfully prickly along their margins, somewhat like those of the holly. The type varies almost imperceptibly into a shorter tree with wavy rather than spiny leaf margins, which has been described as the variety *integrifolia.*

The flowers of the macadamia are whitish and small, and are borne in moderately showy pendent clusters. They mature into 2-valved brownish fruits which split open chiefly on one side to expose their single, shiny, light brown seed. This seed, perhaps because of its large size and extremely hard seed coat, is incorrectly known as the macadamia "nut."

Since the early 1930's macadamias have been coming into the mainland market of the United States, from groves planted on the drier forehills of the Hawaiian Islands. There the tree grows well from sea level to an elevation of 2,500 feet, thriving with an annual rainfall of 35 to 100 inches. It may begin to bear when only three years old, though the common age is seven. It matures nuts occasionally twice a year, one crop appearing in April and May and the other in October and November. A mature tree may average 300 pounds of nuts annually. The kernels contain about 75% oil and are of good quality, comparing favorably either raw or roasted with other edible nuts.

The main drawback in macadamia culture is the great hardness of the shell. This disadvantage is now being overcome

by breeding thin-shelled strains. Nowadays commercial growers first cut through the tremendously hard seed coat with a circular saw to shell the "nut." The owner of a single tree or two, however, probably follows my method. I place a nut in a slight depression in a stone doorstep. Then shielding my eyes, I strike the marble-shaped seed hard and sharply with a hammer. Three or four times it may fly off across the garden uninjured. The next time, the hard seed coat may break to free the tasty meat within.

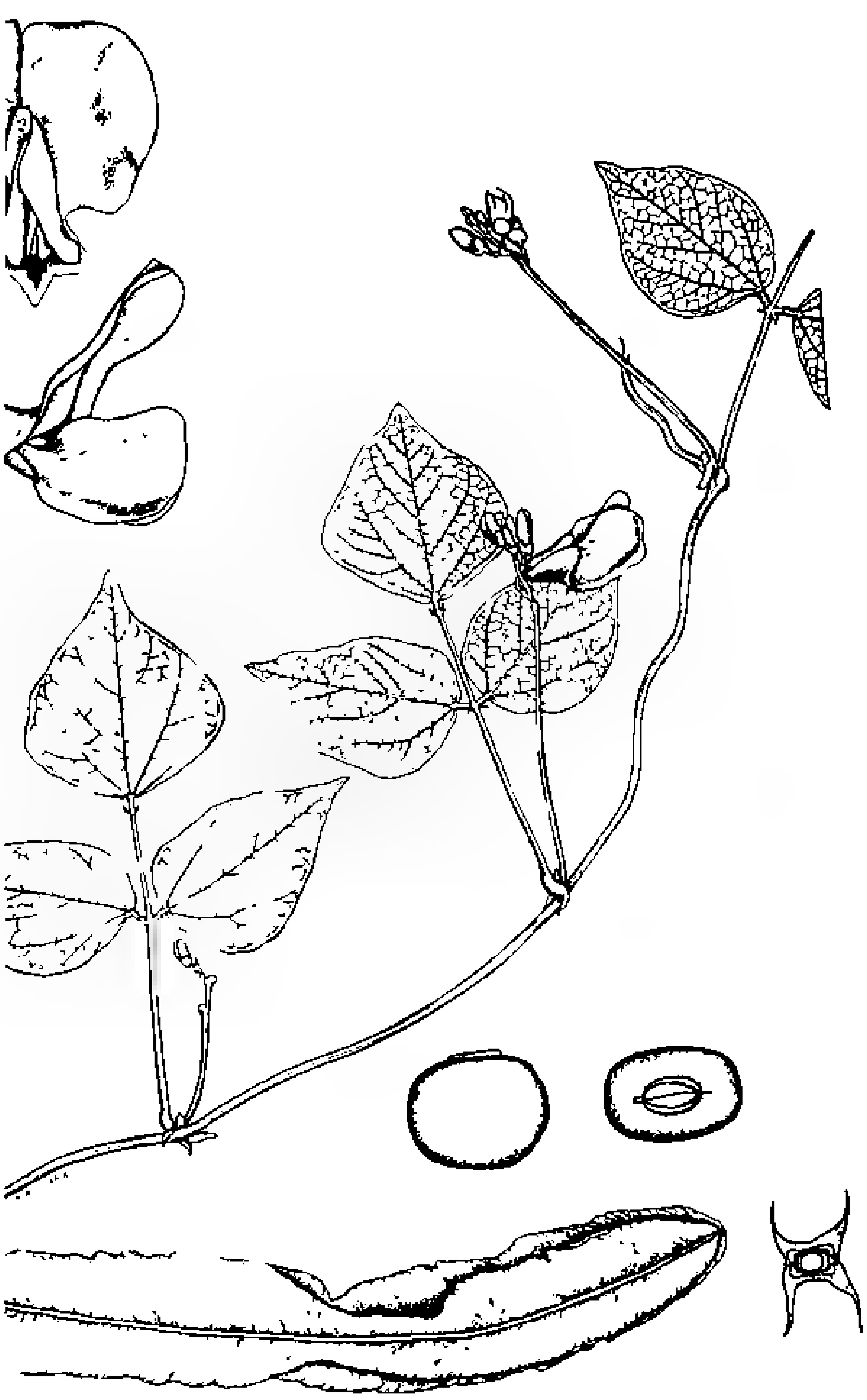
The wood of the macadamia is valuable for cabinet work, while the tree with holly-like leaves is particularly recommended for planting for ornament and shade. The macadamia deserves greater popularity in warm regions. In 1941, I sent superior Hawaiian strains to Vanua Levu, Fiji, in an attempt to start a new industry among the nearly bankrupt copra growers of that island.

GOA BEAN

THE NATIVE HOME of the goa bean (*Psophocarpus tetragonolobus*, Pea family), is not known, but it is thought to be India or perhaps Mauritius. The plant is prized as a vegetable in the Orient and planted there and occasionally elsewhere.

The goa bean is a perennial, dying down to a large taproot during unfavorable seasons. It is not an unusual looking plant when in flower, seemingly being just one more of the myriads of twining beans found in warm countries. Its pale violet-blue flowers hardly deserve a second glance, but they develop into unforgettably queer pods. These are not stringbean-shaped at all but are provided with four longitudinal papery wings with irregular margins. These pods are first entirely green or tinged with dark red. In many leguminous plants the pods, under stress of drying in the sun, violently split open, or dehisce, to hurl and scatter their seeds. The pods of the goa bean, on the contrary, mature into brown papery wind-catchers which may not open to liberate their dozen or so white to brown or black seeds until blown across the parched countryside.

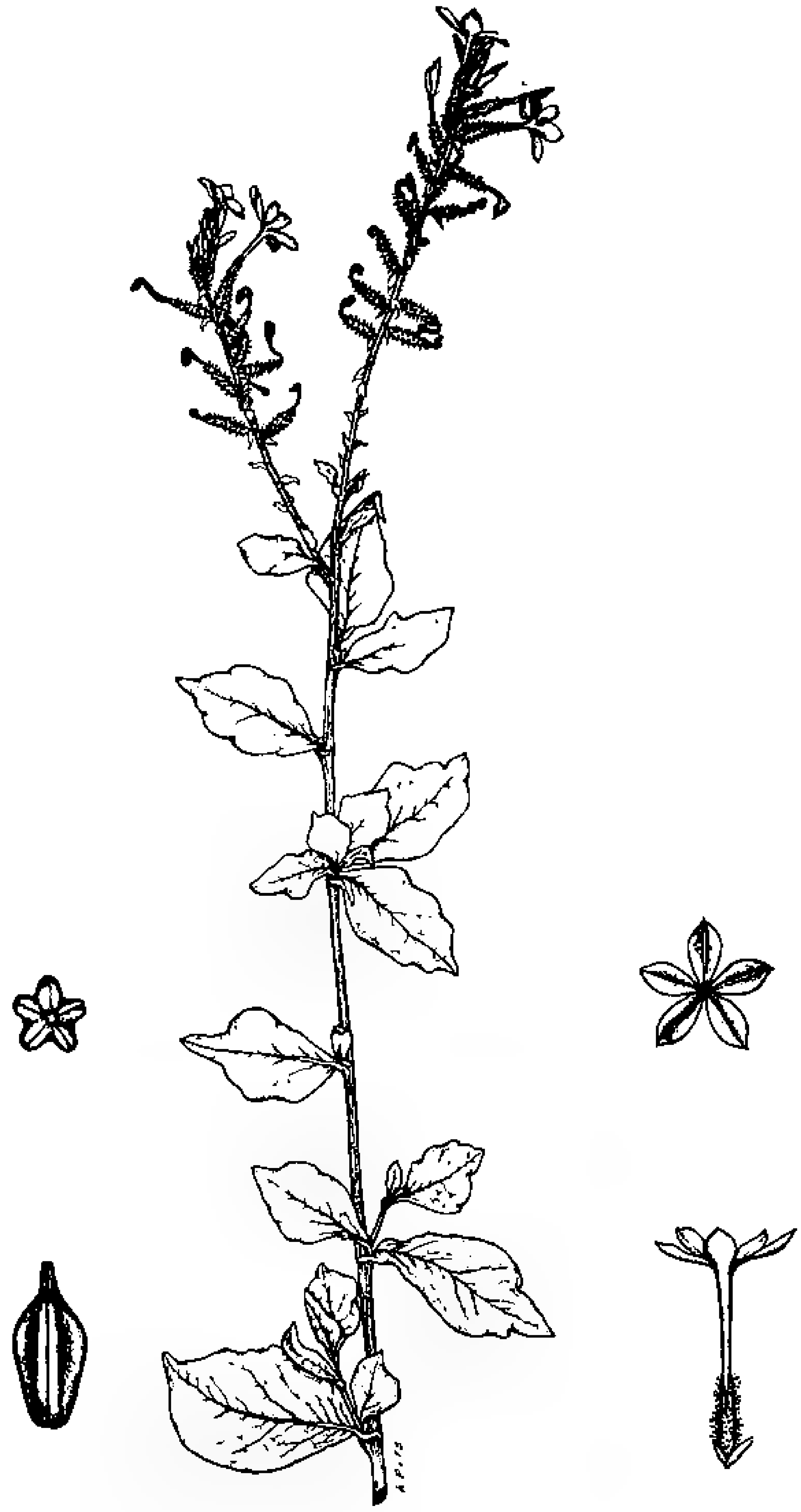
When young and tender, the pods are sliced, cooked, and eaten like stringbeans. In Burma the fleshy roots are also eaten, an acre planted to goa yielding one to two tons. Almost all parts of the plant are eaten in Java. There the young leaves, shoots, and crisp young pods are eaten steamed or even raw. The ripe seeds are considered a delicacy when roasted. The flowers are eaten or added to various dishes to color them blue. Not only that. . . . When the plant is parasitized by the fungus *Woroninella psophocarpi*, the young parts of the goa bean swell and become turgid, and are highly prized as a delicacy when steamed.



WILD PLUMBAGO

THE WILD PLUMBAGO (*Plumbago zeylanica*, Plumbago family) is native to many tropical regions, preferring hot dry rocky localities exposed to salt sea breezes. It is found even in the most isolated of Pacific islands. This is probably due to its fruit being surrounded by the dried calyx, which is beset with sticky gland-tipped hairs and thus admirably adapted for transportation by migratory birds over extensive stretches of ocean.

The plumbago is a straggling shrub with numerous, very slender, brittle branches arising from a common rootstock. The leaves are oblong to rounded and beneath are white-granular. The white flowers arise in sparsely branched clusters at the ends of the twigs. They are narrowly tubular for almost an inch and then expand abruptly into five spread-



ing lobes. The calyx is sticky even before the seeds have formed. A cursory inspection usually discloses numerous ants and other crawling insects entrapped, as with fly-paper, in the viscous mat of hair. These unwanted guests are thus prevented from raiding the flower's supply of nectar, reserved for flying insects, which can efficiently carry pollen from the flower of one plumbago plant to that of another without danger of losing it in a miniature jungle of undergrowth. This is one of the many novel ways by which cross-pollination is effected in flowering plants. The resulting seeds usually grow into more vigorous plants.

TREE TOBACCO

THE TREE TOBACCO (*Nicotiana glauca,* Nightshade family) is native to drier regions of South America. Though called a tree, it rarely becomes taller than 15 feet. With its peculiarly pale glaucous-blue to rarely purple tinted leaves and its clusters of tubular, dull yellow flowers, it can be easily recognized from afar.

The tree tobacco is occasionally planted for ornament. It usually soon escapes from cultivation to become a nuisance on dry cattle ranges, in waste places, and on land but recently reclaimed by dredging from the sea, where it will endure better than most other plants the salts that have not yet been leached out.

POTATO-VINES

TWO ORNAMENTAL potato-vines are commonly trained over walls, trellises, porches, and out-houses in tropical and warm countries. Both are very coarse, soft-wooded lianes producing flowers so resembling glorified flowers of the "Irish" potato that even a novice will recognize their bearers as members of the Nightshade family. The plants have been cultivated from cuttings for such a long time that they are rare seeders, seldom producing their small tomato-like berries.

Wendland's potato - vine (*Solanum Wendlandi*), here shown, has somewhat prickly stems and leaf-stalks, large oblong leaves often more or less lobed or cleft, and 2½ inch bluish-purple flowers. It is a native of Costa Rica.

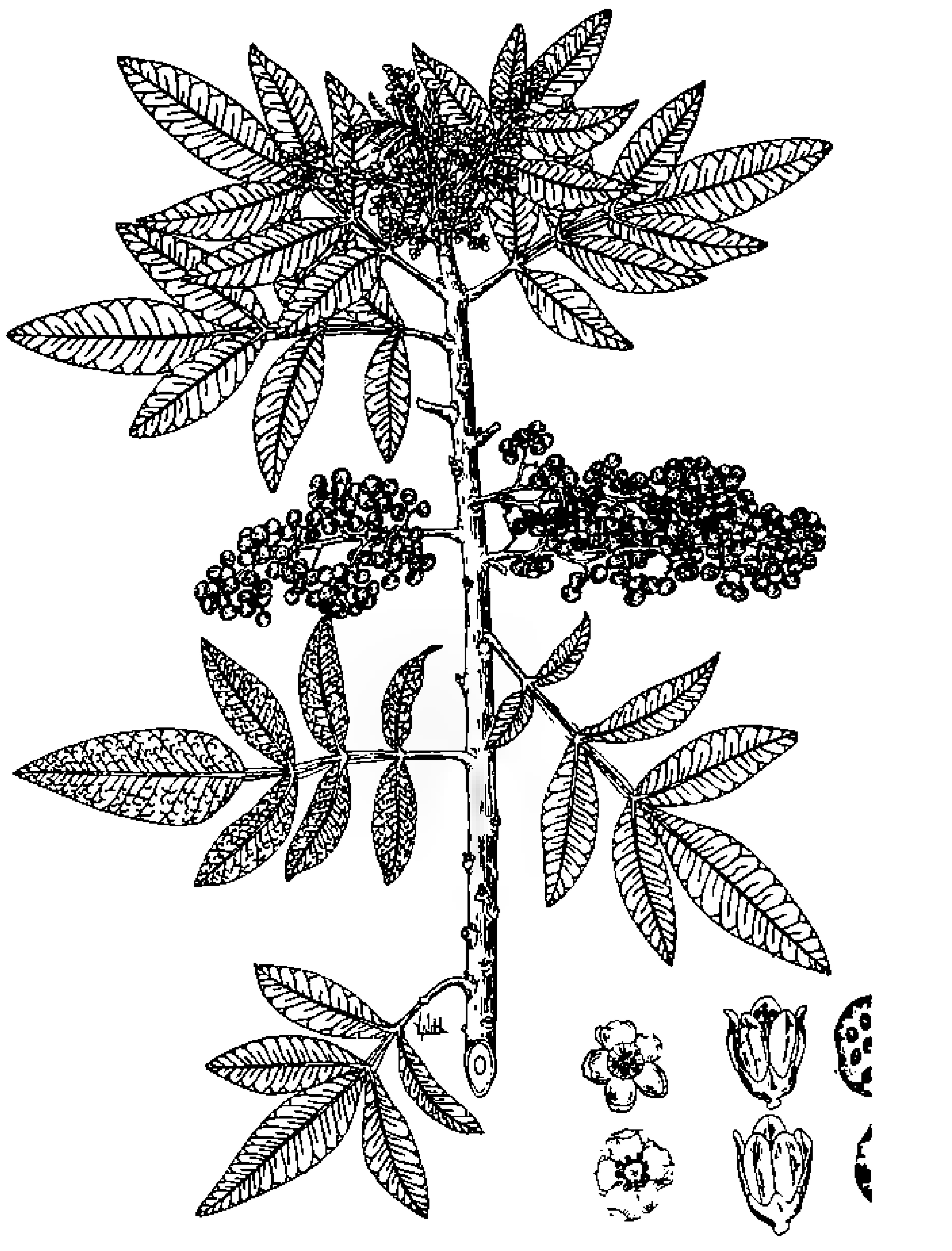
Seaforth's potato-vine (*Solanum Seaforthianum*) differs from its close relative mainly in being less coarse, in being devoid of prickles, possessing smaller leaves, and bearing one-inch purplish-blue flowers. It is Brazilian. Both plants may be seen in cultivation in the greenhouse of the New York Botanical Garden.

DAY-CESTRUM

THE DAY - CESTRUM (*Cestrum diurnum*. Nightshade family) is an American plant now grown in most tropical countries. It is a shrub or small tree with many slender grayish branches. The leaves are broadly elliptic, shiny above but dull and unusually pale green beneath. The flowers are borne abundantly in short clusters in the axils of the leaves. The tubular white corolla is provided with five lobes which finally become com-

pletely recurved to expose five dark anthers and the single dark green stigma.

Like so many members of the Nightshade family, this cestrum produces roundish berries. These change from greenish white through bright purplish blue when unripe to almost black when ripe. Not quite half an inch long, they are fleshy with purplish juice and, though considered inedible by man, are greedily eaten by birds. The day-cestrum owes its popularity as a garden plant not so much to its small whitish flowers and colorful fruit as to the delicate fragrance with which its flowers permeate the air during the day.



BRAZIL PEPPER-TREE

THE BRAZIL PEPPER TREE (*Schinus terebinthifolius,* Cashew family), like its relative, the California pepper-tree, is native to South America. It is a small, spreading tree with coarse, more or less horizontal branches, which bear many compound leaves consisting of 5 to 9 leaflets on a slightly winged rachis, or stalk.

Like its congener, our plant is dioecious, with male and female flowers arising on different individuals. This fact is very disconcerting, as I myself have experienced. I planted a seedling, hoping it would mature in a few years time and add color to my garden with its bright red berries. It matured after two or three years as expected but, instead of its inconspicuous flowers developing into brilliant red clusters of berries, they dropped off. I had carefully nurtured a male tree! The only practicable procedure was to chop it down and to begin afresh. By planting a number of seedlings, I increased my chances of having a pistillate tree among them. When the seedlings began to flower, I destroyed all but a single, healthy pistillate tree with the result that my garden was dressed up with very colorful and appropriate clusters of holly-like berries at Christmas time. Pollen had evidently come from a staminate tree in the neighborhood.

Though the fruit is sometimes used medicinally in South America, the Brazil pepper-tree is grown for ornament throughout warm and tropical regions. It is too small for a street tree, but is very suitable in the garden. It thrives in spite of drought, abuse and neglect, and is even hardy as far north as San Francisco.

Current Literature At a Glance*

Mycophagy. Edible fungi are the subject of an article by Dr. F. J. Seaver, simply entitled "Mycophagy," in the May issue of *Gourmet* magazine. An elaborate cover design, showing in color eight of species mentioned, was made by a staff artist of the magazine working partly under Dr. Seaver's supervision.

Greens from the Field. Wild plants that are useful as greens and pot-herbs are nicely illustrated and described in a leaflet issued this spring by the New York State Department of Health at Albany, New York, which is distributing the information free.

Living Memorials. To further the idea of "living monuments" as war memorials, the Conservation Committee of the Garden Club of America has sent a questionnaire to members asking for information about native groves or individual trees or stands of native plants which are worthy of preservation, and particularly asking whether any of these could be considered as suitable war memorials.

A booklet entitled "Living Memorials" offers suggestions for kinds of memorials (such as a rose garden, roadside planting, sanctuary, or forest) and presents a plan of organization for carrying through such a project and assuring its permanence. Copies may be obtained from "Living Memorials," 636 Southern Building, Washington 5, D. C.

Fruit-Tree Spraying. Practical advice on spraying for the home grower of fruits is given in the February *Arborist's News*, published by the National Shade Tree Conference at Wooster, Ohio.

Windbreaks. In regions where winds sweep over wide areas and often damage farm crops, a windbreak, or shelterbelt, of trees can serve a multiple purpose. U.S.D.A. Farmers' Bulletin No. 1405, "The Windbreak as a Farm Asset," tells which trees are best for shelter planting in different areas and explains how they not only protect crops, but also prevent soil from blowing, control snow drifting, reduce evaporation, and provide a modest amount of wood for cutting. (Five cents from the Superintendent of Documents, Washington 25, D. C.)

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

Santa Barbara. An illustrated guide to the Santa Barbara Botanic Garden, which is devoted to native California plants, has recently been issued. It contains a list of the principal plants found in the Garden, keyed to a map, and illustrations of outstanding scenes and specimens.

Middle American Crops. Fibers, oils, timber, bamboo, insecticides, are among the products which Middle America can furnish a world that has been cut off from many needed supplies. How these crops are being developed in Mexico, Central America, and parts of the West Indies is the subject of an article in *The Atlantic Monthly* for January under the title of "New Crops for the New World."

Ocean Plants. From Lt. E. Yale Dawson, author of "Botanizing in an Open Boat," which appeared in this Journal in June 1944, comes "An Annotated List of Marine Algae and Marine Grasses of San Diego County, California," published as No. 7 of Occasional Papers of the San Diego Society of Natural History.

Mexican Botany. The second bulletin of the Sociedad Botánica de México, of which Prof. Maximino Martínez is president, and Dr. H. W. Rickett is an honorary member, contains an article on plants of Baja California with a list of common and botanical names, and notes on some orchids, on the botanical names of plants of Tepoztlan, and on *Tricholaena rosea.*

Erosion. A scene in the ancient ruined Roman city of Timgad in North Africa is shown in the March issue of the Canadian magazine, *Forest and Outdoors*, with an article by Dr. Walter C. Lowdermilk on erosion as the blight of all "Promised Lands."

Window Boxes. Useful instructions on window-box gardening by Henry Teuscher are issued as one of a series of leaflets from the Montreal Botanical Garden. Ornamental perennials are treated in three other articles in the leaflets recently issued.

Notes, News, and Comment

Board Member. Mrs. Albert D. Lasker of New York City was elected to the Board of Managers of the New York Botanical Garden at the meeting held April 19.

Visitors. Drs. F. R. Fosberg, Walter Hodge, and William Drew, all recently returned from two to three years of cinchona work, chiefly in Colombia and Ecuador, were recent visitors at the Garden. Dr. Fosberg has returned to his post with the Bureau of Plant Industry and Dr. Drew to the University of Missouri, while Dr. Hodge has had his leave of absence from Massachusetts State College extended to enable him to direct the botany department at Medellin University in Colombia for the coming year.

Among other visitors of the past month were Manfred Wahl of Philadelphia, recently elected member of the Garden's Corporation; Dr. Geneva Sayre of Russell Sage College, making some studies of mosses; Dr. Margaret Fulford, University of Cincinnati; Dr. A. E. Parr, Director of the American Museum of Natural History; Mrs. Hildegard Schneider of The Cloisters, doing research on *Acanthus;* Dr. A. J. Grout, Honorary Curator of Mosses; Dr. Walker Arde, Jr., of Philadelphia; Dr. Donald P. Limber, U. S. Bureau of Entomology and Plant Quarantine; Dr. Edgar P. Wherry, University of Pennsylvania; Major Frederick Ruff of McDill Field, Florida, formerly of the U. S. Forestry Service; Sgt. Edwin F. Steffek, formerly Associate Editor of *Horticulture*; James G. Esson, Editor of the *Gardeners' Chronicle of America*; Fannie A. Root, Executive Secretary of the Pennsylvania Horticultural Society; Marcel LePiniec, Bergenfield, N. J.; Dr. John Shuman, former graduate student at the Garden; Mrs. Robert Cushman Murphy, recently returned from Venezuela; Dr. Elizabeth Hazen, New York State Department of Health; and artists Helene Carter and Edith Farrington Johnston, both of whom have obtained material for many book illustrations dealing with plant life from the New York Botanical Garden.

Motion Picture. The Garden's full-length motion picture in color has been shown in recent weeks by Elizabeth C. Hall at the Parish House of the Collegiate Church of St. Nicholas; by G. L. Wittrock at the Hollis Colony Club and the Concourse Plaza Hotel; by Carol H. Woodward and E. E. Naylor at the Art Center of Washington Heights; and by Mrs. Robert H. Fife before the Garden's Advisory Council.

Lectures. Dr. A. B. Stout spoke on "Lilies for Gardens" before the Working Gardeners of Bronxville, an Affiliate of the Botanical Garden, March 27. Otto Degener was the speaker for the Torrey Botanical Club meeting at the Garden April 18, on "Plant Life and Customs of the Hawaiian Islands." He also addressed the Staten Island Institute of Arts and Sciences March 18 on the same subject. Elizabeth C. Hall addressed the City Gardens Club May 3 on "Turns with a Garden Bookworm." Prof. Edmund W. Sinnott of Yale University, a member of the Corporation of the Botanical Garden and, until his departure from New York, a member of the Board of Managers, spoke before the Barnard Botanical Club April 20 on "The Problem of Size Determination in Plants."

Radio. Arthur King, Superintendent of "Northview," the estate of Mrs. Jesse Isidor Straus at Mt. Kisco, represented the New York Botanical Garden on a radio program given by the American Women's Voluntary Services over WWRL of Queens April 18. Mr. King, who is an instructor in practical gardening for the Botanical Garden, spoke on "Succession Planting." Carol H. Woodward spoke on "Spring at the New York Botanical Garden" on Lilian Okun's program, "This Is Our Town," over WMCA March 31.

Conference. George T. Hastings, who, before his retirement from the biology department of Theodore Roosevelt High School in the Bronx, was active in nature study guidance for school groups at the Botanical Garden, was the Garden's guest speaker at the monthly conference April 12. Under the title of "The Flora and Scenery of California," he showed many kodachromes, some of which have been used to illustrate a book he has just completed on "Trees of Santa Monica."

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 1944. This is an illustrated booklet of 40 pages, containing the record of the year's activities, financial report for the fiscal year, publications of staff members, and a list of members of the Garden. Copies will be mailed without additional cost to Journal subscribers upon request.

Recent Deaths Among American Botanists

L. R. Jones. One of the outstanding plant pathologists in the United States, Lewis R. Jones, Professor Emeritus at the University of Wisconsin, died in Orlando, Florida, March 31 at the age of 81. Many of the best known plant pathologists of today received their training under Dr. Jones in the department which he developed at Wisconsin and in which he pioneered as a teacher in his field. He was one of the earliest members of the National Research Council.

C. C. Curtis. A member of the Botany Department of Columbia University for 35 years, until his retirement in 1934, Dr. Carlton C. Curtis died at the age of 80, April 10. He was living at Tryon, N. C. He had joined the faculty at Columbia as a tutor two years after Dr. N. L. Britton left his active work there to become the first Director of the New York Botanical Garden. Dr. Curtis, who was made Associate Professor in 1908, was the author of several textbooks of botany—among them "Nature and Development of Plants," which has been called the first modern textbook of botany in the United States. During the early years he frequently lectured at the New York Botanical Garden.

Samuel J. Record. The Dean of the Yale School of Forestry, Prof. Samuel J. Record, died of a heart ailment after a week's illness Feb. 3, at the age of 63. During his 35 years at Yale, he had built up the School of Forestry's collection of woods to a total of 36,000 specimens, representing 11,100 species of trees, believed to be the world's most comprehensive collection of its kind.

He was founder, editor, and manager of the quarterly magazine *Tropical Woods*, and for 12 years was editor of the Yale School of Forestry periodical. He was the author of numerous books, chiefly on the timbers of the New World, which became the title of his latest work, done in collaboration with Robert W. Hess and published in 1943.

Message from Mexico

THE first four months in southern Mexico, on the Garden's expedition in which E. J. Alexander and Thomas MacDougall are taking part, have resulted in more than a thousand numbers being collected, with an extensive area yet to be covered before the return trip begins. Besides the botanical specimens for scientific study, seeds of promising ornamentals are also being gathered. In a letter mailed from Ixtepec, Oaxaca, early in April, Mr. Alexander describes some of his materials as follows:

"Collecting has been pretty good, considering the dry season, and especially good for seeds. I now have 1,018 numbers of which about 300 are seeds, and some of them are good. A fine lobelia 10 to 12 feet tall with big, bright red flowers 3 inches long; the tree *Mentzelia Conzattii* with deep golden flowers 3 inches across; a 20-feet tree-dahlia with neat rose-purple flowers; a fine shrubby salvia with deep blue flowers; two good tree senecios; a gaultheria with rose-pink flowers; a neat little heath-like stevia; several fine morning-glories—buff-yellow, royal purple, and intense lilac; a fine orange-yellow quamoclit; three thevetias, none of which is in cultivation, and one of which has delicious-flavored fruit. Also, a nice glossy-leaved passiflora with small lavender flowers and plentifully borne crimson fruits; the intense orange marigold relative, *Clomenocoma aurantia;* a showy *Cestrum* with fragrant yellow flowers and white berries; the tree-daisy *Podachaenium eminens;* a deep blue lupine; a fine *Heliconia* with drooping orange inflorescence, two nice purple eranthemums; several fragrant white eupatoriums; the beautiful *Astianthus viminalis* with long willow-like leaves and golden flowers—a tree 50 feet tall and free-flowering; several new things among cacti and succulents; many others also, this is just some of the cream. There are also fine things of which I have specimens but whose fruit has not ripened yet—I may not get seeds of them. I am particularly proud of some fine tillandsias and an orchid with pink flowers—*Odontoglossum Cervantesii;* and I haven't been in Chiapas yet!"

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.

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

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

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

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

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

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

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

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

Periodicals

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

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1 a year; single copies 15 cents. Free to members of the Garden. Now in its 46th volume.

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

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

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 100 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

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1945

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

A Message From

Columbia University

in the City of New York

PRESIDENT'S ROOM

Read at the Rededication Ceremony at the New York Botanical Garden May 13, 1945.

WE AT Columbia University take great pleasure and pride in joining the New York Botanical Garden in its rededication to public service. The relationship of the two institutions has been long and close.

The University's interest in Botany is deep-rooted. It goes back to the appointment of Dr. Samuel Latham Mitchell as Professor of Botany in old Columbia College in 1792. The rolls of the University contain among others such names as Torrey, Hosack, Britton, Underwood, Rusby, and Harper, many of them identified also with the Garden. That the University had some part in the founding of the Garden and that close co-operation between us has continued for the public good is a profound satisfaction to us all.

The University's efforts in that direction will not lessen. May the Garden ever increase its service to science and to the entertainment, the recreation, and the instruction of the people.

NICHOLAS MURRAY BUTLER.

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June 1945

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

JOURNAL

of

THE NEW YORK BOTANICAL GARDEN

VOL. 46 JUNE 1945 No. 546

Garden's Post-War Plans Are Announced For Changes in Physical Equipment And For Enlargement of Staff

Greatest Campaign in Institution's History Will Aim at Raising $4,900,000 For Expansion and Improvement

PLANS for extensive improvements and additions to the buildings, grounds, and equipment of the New York Botanical Garden and for expansion of the scientific staff to meet the growing needs for botanical research in ever widening scientific and industrial fields were announced jointly at the conclusion of Garden Week by Joseph R. Swan, President, and Mrs. Harold I. Pratt, a member of the Board of Managers, as co-chairmen of the Garden's new Committee on Plans and Development.

With this announcement came news of the greatest financial campaign in the Garden's history, with the Honorable John W. Davis as national chairman.

The new plans for expansion and improvement will involve a capital expenditure of $2,305,000, besides an additional sum of $4,275,000 to increase the Garden's endowment. The post-war budget of the City of New York will provide for $1,680,000 of the capital expenditure, leaving a balance of $4,900,000 to be raised by private subscription.

Details of the announcement and of the plans involved will be published in the ***Garden Week Report*** (announced on page 131) to be issued during the summer and distributed to all Journal subscribers and members of the Garden.

Discovery of Six New Antibiotics Announced by Dr. Robbins

FROM the physiology laboratory in the basement of the Museum Building, where Dr. William J. Robbins has been working with a small group of assistants for the past two years or more on substances similar to penicillin, have come six new antibiotics which inhibit the growth of other micro-organisms.

Announcement of the discovery was made by Dr. Robbins during the ceremony at which the honorary degree of Doctor of Science was conferred upon him by Fordham University.

"In association with my immediate colleagues and assistants, Dr. Frederick Kavanagh and Mrs. Annette Hervey, I am pleased to announce the discovery in our laboratories of six new antibiotic substances," Dr. Robbins said. "These have been named PLEUROTIN, GRISIC ACID, PLEURIN, IRPEXIN, OBTUSIN, and CORTICIN.

"These six substances resemble penicillin in the fact that they inhibit the growth of other micro-organisms. They are, however, different from penicillin as judged by their solubilities, bacterial spectra, and other characteristics and are distinct from one another. They are formed in culture by species of a group of fungi known as the Basidiomycetes, a group from which antibiotic substances have not hitherto been described.

"Our experiments have been limited to tests *in vitro*, though we are making arrangements for animal tests, and we are not prepared to predict that any one of these new antibiotic substances will be found to have therapeutic value. However, the discovery that representatives of the Basidiomycetes are active in producing antibiotic substances is of considerable theoretical interest.

"We have investigated up to the present some 400 species only of the 25,000 or 30,000 in this group. Even if none of the six substances I have mentioned prove to be of practical importance in medicine, no one can foretell what might be discovered, if the means and men were available to examine the 25,000 or more species of Basidiomycetes still uninvestigated. The pursuit of science is a long road and life is short."

Director Given Honorary Degree By Fordham University

THE honorary degree of Doctor of Science was conferred upon Dr. William J. Robbins by Fordham University at a special ceremony in Keating Hall at Fordham the evening of May 24.

In the address on "The Function of a Botanical Garden," with which he followed his acceptance of the honor, Dr. Robbins made the first announcement of the discovery in his laboratory of six new antibiotic substances.

After the address of greeting to the audience, in which the Reverend Robert I. Gannon, S.J., President of Fordham University, paid high tribute to the New York Botanical Garden and to the Director and the staff, other addresses were given by Henry de Forest Baldwin, oldest member of the Garden's Board of Managers, on "Fifty Years of Service to the Public" and by Joseph R. Swan, the Garden's President, on "The Next Fifty Years." Both of these addresses, also a translation of the Latin speech with which the degree was conferred, will be published in the special Garden Week booklet to be issued during the summer and distributed with the Journal.

Rockefeller Center Receives English Holly Trees From N. Y. Botanical Garden

TWO English holly trees (*Ilex Aquifolium*), representing one of several species of *Ilex* known to have been grown on the same site 140 years ago were presented to Rockefeller Center by the New York Botanical Garden in a ceremony May 10, as a prelude to the Garden's fiftieth anniversary celebration, which began a few days later.

GARDEN WEEK REPORT

CELEBRATION of the New York Botanical Garden's fiftieth anniversary brought 137,000 visitors to the grounds in the eight-day period which stretched from Sunday, May 13, when the Garden was rededicated by Mayor F. H. La Guardia to another fifty years of useful service, through Sunday, May 20, when another outdoor program brought the week's events to a close.

Several direct descendants of the Garden's founders and one wife of a founder—Mrs. Andrew Carnegie—were the guests of honor for the day and at tea on Founders' and Members' Day, May 14. Children's Day, Army and Navy Day, International Day were among the other special events during the week, in addition to the guided tours of the Main Conservatories and of the Museum Building twice each day, the motion picture "Plants and the Life of Man" and the informal talk by a staff member every day in the lecture hall, and the most popular feature of all the three World's Fair trains (generously lent by the New York Zoological Society) which carried visitors all day long on trips around the grounds.

A complete report of Garden Week, as the golden anniversary observance was designated, will appear in a special booklet to be issued during the summer and distributed with the Journal to all members and subscribers.

In making the presentation, the Garden acknowledged the Elgin Botanic Garden, founded by Dr. David Hosack in 1801 and in 1811 given to Columbia University, as its direct ancestor.* This first botanical garden in New York City occupied the 20-acre area lying roughly between what is now Fifth and Sixth Avenues and 47th and 50th Streets, where Rockefeller Center stands today.

The presentation of the holly trees was made by Joseph R. Swan, President of the Botanical Garden, to Barton P. Turnbull, President of Rockefeller Center. The two specimens were placed on the ninth floor terrace of the United States Rubber Company's building. After the ceremony, members of the Garden's Board of Managers were guests of the Rockefeller Center management at lunch.

* An account of the Elgin Botanic Garden and of other predecessors of the New York Botanical Garden is given in the Journal for August 1942.

Tropical Plants the World Around

By Otto Degener

III

The third in Mr. Degener's series of articles, based on his lectures at the New York Botanical Garden last winter, on the general topic of "Plants of the Regions Where Our Men and Women are Serving," is presented here. The majority of the drawings have been adapted from the originals made for his "Flora Hawaiiensis" or "New Illustrated Flora of the Hawaiian Islands," while some are from his "Plants of Hawaii National Park."

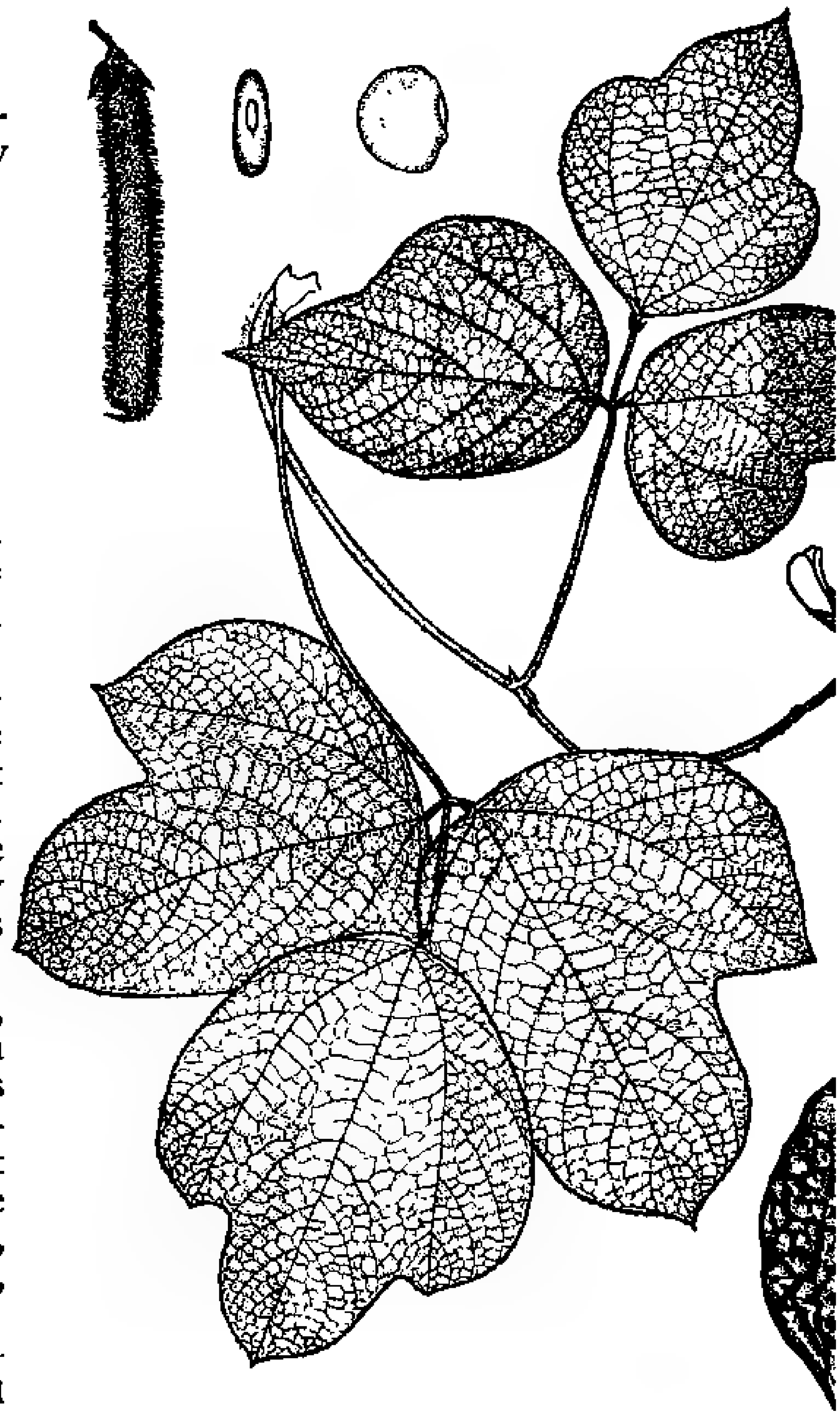
KUDZU

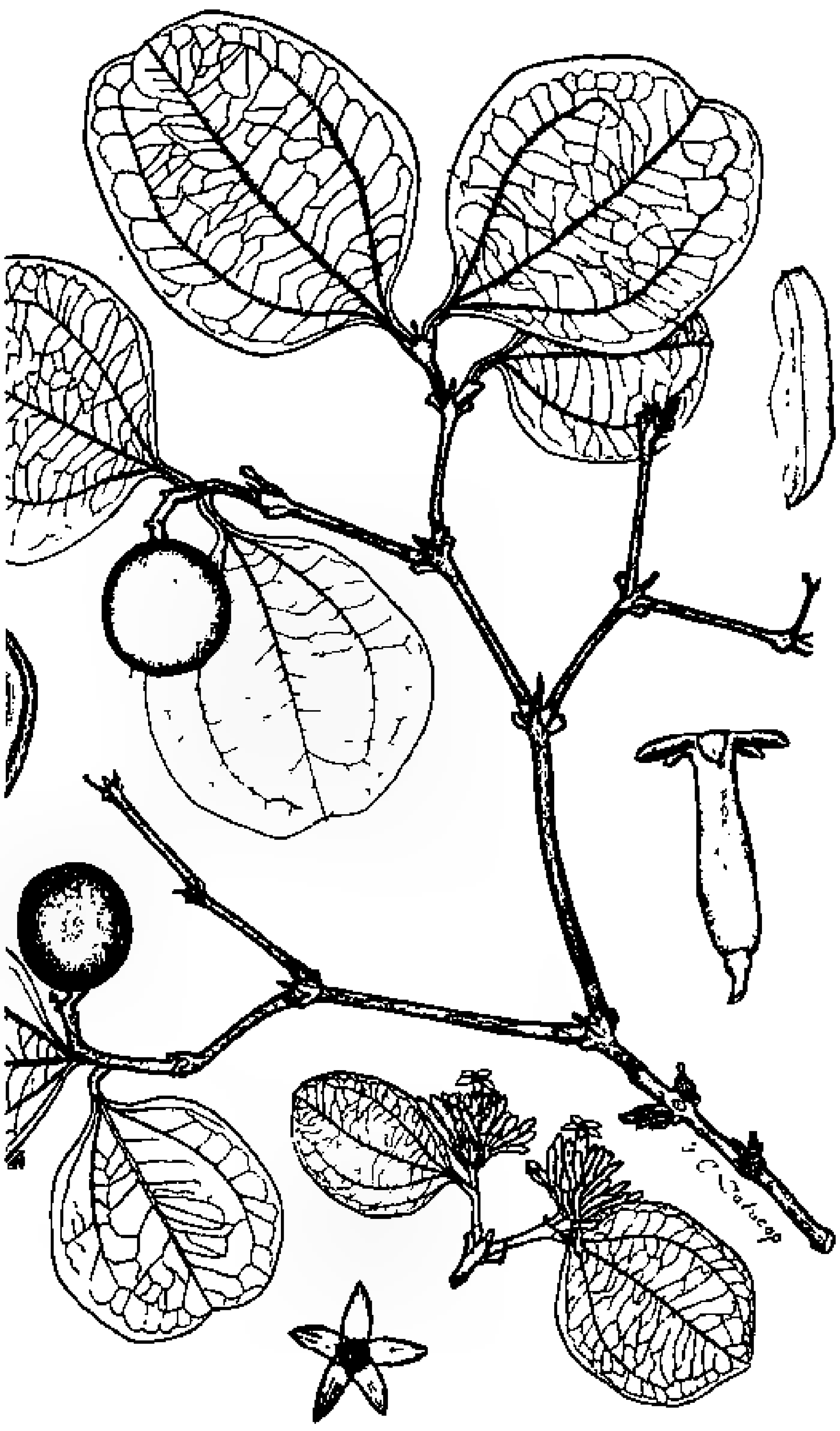
THE KUDZU-BEAN (*Pueraria Thunbergiana,* Pea family) is a hairy perennial vine, native to warm and temperate regions of Asia. It often reaches a length of 60 feet, and when growing on the ground, the long streamers tend to root and establish new colonies.

A little digging will unearth the edible tubers that are produced by this creeper. These tubers commonly grow six to ten inches long and almost as wide. The Chinese prepare a starch from them.* The bark of the younger shoots furnishes ko-pu fiber, which is made into rope, nets, and, if of good quality, into "grass-cloth." This cloth makes comfortable summer undergarments, for it does not cling to the skin. The plant has been grown commercially in southern France for its fiber, and in the ,Orient not only for its roots and fibers, but also for its edible leaves and young shoots.

In Europe and America the kudzu-bean, which bears reddish purple flowers with a large yellow spot near the center, is grown primarily as a fast-growing ornamental vine for arbors and trellises. It has recently been encouraged in the South as a cattle feed and soil binder, where it is especially useful on poor, eroded lands.

* See the Journal of the New York Botanical Garden for September 1938, p. 203.





STRYCHNINE

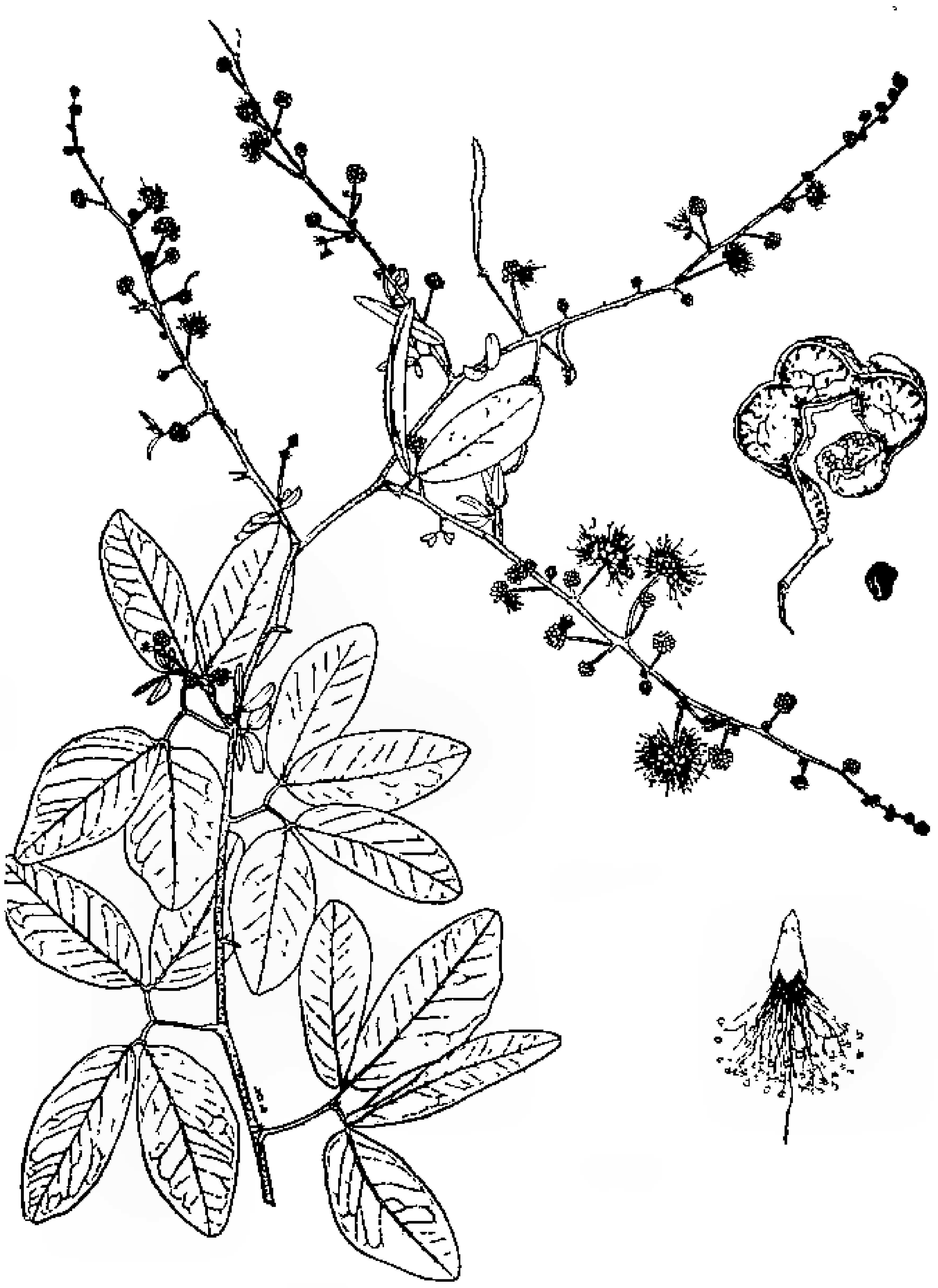
A STRYCHNINE TREE (*Strychnos nux-vomica,* Logania family) is a dangerous tree to use as an ornamental, for, as the scientific name indicates, the stomach is turned if its "nut" or seed is eaten.

Growing generally in the drier forests of Ceylon, India, and Burma, the nux vomica is a twiggy tree of ample size. Its leaves are roundish and shiny, its clustered flowers tubular and small. The fruit, about the shape and color of a mandarin orange, ripens from August to November in India, but in the few introduced trees studied in Hawaii it generally matures in March. It is very attractive, and contains an abundance of juicy, slightly bitter flesh which is eaten by monkeys and birds. Dr. Harry Arnold, who made a study of the trees in Hawaii from a pharmaceutical standpoint, taking a cue from the monkey, ate some fruit without harmful after-effects. He warns others, however, from repeating the experiment. The beautiful gray velvety seeds are about an inch in diameter but thin, thus resembling ornamental buttons. These seeds contain large quantities of the violently poisonous alkaloids brucine and strychnine, the latter a world-famous tonic for various heart diseases. Because of the danger of having inquisitive children sample the attractive fruit and seed from the trees that have been planted in Hawaii, employees gather fruits as soon as they fall. Arnold records the odd fact that during the flowering season in Hawaii, toads die of convulsions after having carelessly snapped up a fallen flower or two with their sticky tongue while eating their regular crawly insect fare. These toads (*Bufo marinus*), by the way, are so robust that they will swallow red-hot centipedes, scorpions, and hornets with only a blink or two, and will hop away unharmed after an auto has run over them on a lawn. To succumb to a flower of the strychnine tree is eloquent of the plant's potency. All parts of the tree harbor the poison but the seed contains much the greatest concentration, and is, therefore, the commercial source of the drug. In case of accidental poisoning, the stomach of the victim must be immediately emptied with some emetic, and a physician called.

QUAMACHIL

THE QUAMACHIL (*Pithecellobium dulce,* Pea family) is often called Madras thorn, under the erroneous assumption that this tree is native to India. Roxburgh corrected this error in 1795 when he stated that this plant "is not a native of the Coast of Coromandel, probably not of India; it has been introduced from the Philippine Islands, for the sake of the pulp which fills the legumes." Bentham, about fifty years later, corrected the implication that the quamachil is a native of the Philippines. He explained that it originated "in the hot regions of Mexico, and introduced from thence to the Philippine Islands, and from those islands into East India." Now the plant is of wide distribution in the tropics, particularly in the drier regions.

The thready, whitish flower clusters are not particularly ornamental; the spirally twisting greenish to red pods



are a nuisance in littering sidewalks and gardens; and the hardening stipular thorns falling with the twigs during windstorms are a bane to barefoot boys, and, in some countries, their barefoot elders. Nevertheless, I have always admired the tree for its light gray bark and slender, often drooping branches, clothed with numerous leaflets arranged in a way to suggest a giant maidenhair fern.

The tree is quick growing and precocious in its ability to seed when only a half dozen or so years old, and yet it will attain a height of 40 to 50 feet in favorable localities.

The curious pods, which are soft and leathery, help to attract birds. While still dangling from the tree, they burst open with the ripening of the small, black, and shiny seeds. From near the attachment of the seeds to the pod arises a huge, irregular, spongy, sweetish, white tissue called an aril, actually a part of the seed itself. This spongy pulp is sold for food and is also said to be made into a drink similar to lemonade. The seed-filled beans are used regularly in Mexico as cattle fodder. The bark contains about 25% tannin and is of considerable economic importance in Mexico.

In Hawaii I have seen young trees clipped into attractive hedges. There the seeds, deprived of their aril, are boiled to soften them, and then strung into garlands or fashioned into other curios.

GIANT GRANADILLA

STRANGEST of the passion-flowers, because of its fruit, is the giant granadilla (*Passiflora quadrangularis*, Passion-flower family), a variable vine native of tropical America. The fragrant flower is about 5 inches across and bears pinkish, slightly fleshy sepals and petals; but the crowning glory of this passion-flower is the corona of more than 100 purplish-blue threads transversely striped and marked with white.

The vine grows quickly from a more or less fleshy swollen root, which, after baking like a sweet potato, is edible. The young stems are quadrangular or 4-winged, but become roundish and woody with age. The leaf blades, which may be either smooth or wrinkled, are up to 6 inches long and roundish except for the pointed tip. The leaf stalks, or petioles, are each provided on the upper surface with three pairs of "extra-floral nectaries," glands with a function not definitely understood. At the base of each petiole are two prominently leafy stipules which were evidently useful in protecting the leaf bud, of which they were actually a precociously developed part, and the stem bud slowly developing in the leaf axil.

The fruit of the giant granadilla is the largest known in the family, becoming 8 to 10 inches long. To obtain it in abundance, artificial pollination often is necessary. After harvesting the fruit, it is best to prune the vine back to its main branches.

Botanists maintain that the Passion-flower family is closely related to the Papaya family. A comparison of the fruit of the giant granadilla with that of the papaya should convince anyone of

ORANGE-JASMINE

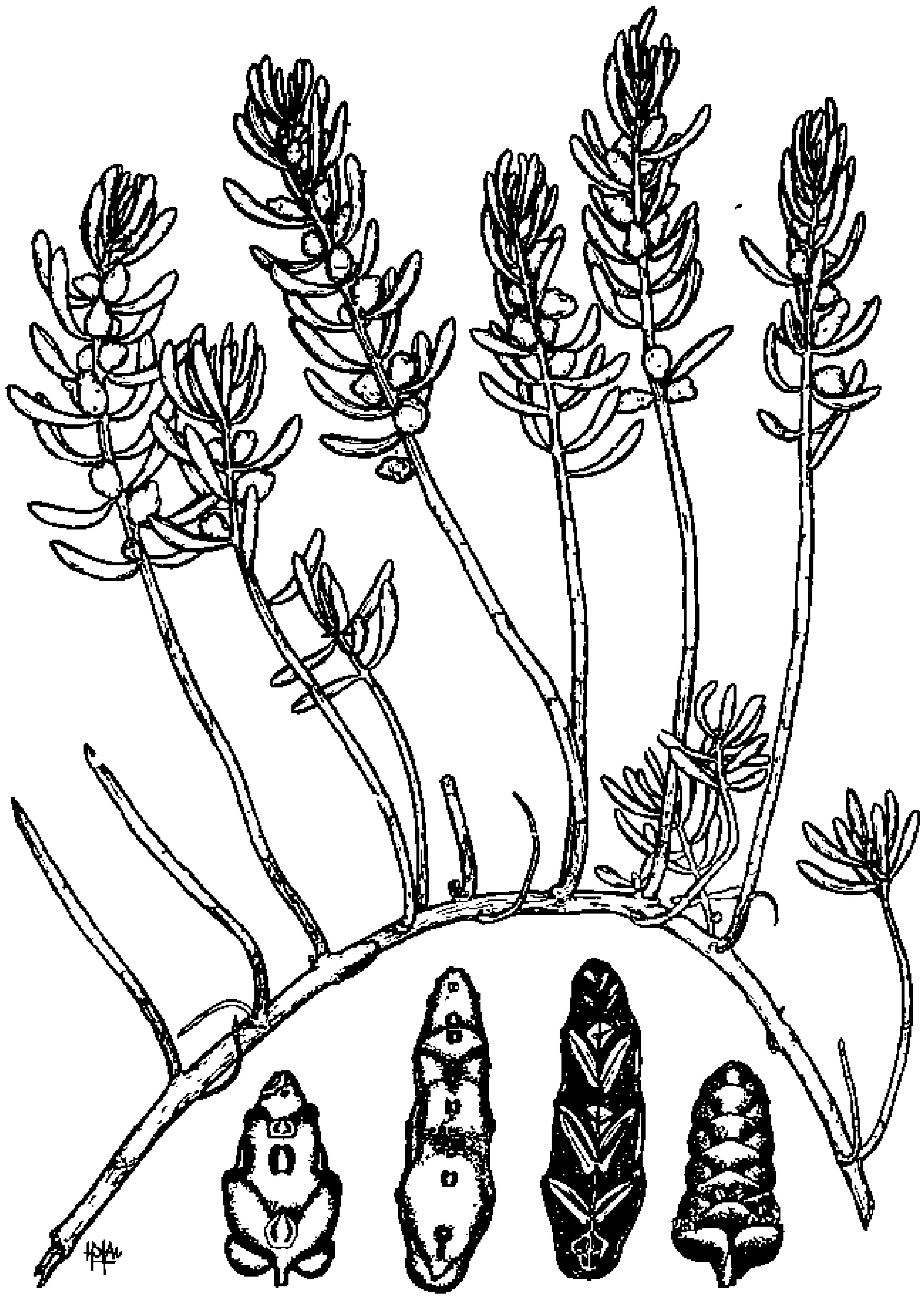
THE ORANGE-JASMINE (*Murraea paniculata* or variety, Rue family), by many incorrectly called "mock-orange," is a shrub or small tree with numerous slender, mostly erect, leafy branches. The leaves are alternate, and consist of 3 to 9 shiny, dark green leaflets with undulate margins. The clustered white flowers, which are about three-fourths of an inch wide, scent the air with a sweet, far-reaching fragrance. The fruit, containing two seeds, is a roundish red berry about half an inch long, covered with oil glands like the rind of its relative, the orange.

The orange-jasmine, with several confusing varieties and forms, is native from India to Malaya. It is planted throughout warm and tropical regions for ornament, for fragrance, and for training into dark green hedges. The wood resembles boxwood and is similarly employed.

this fact. It not only resembles a greenish yellow papaya on the outside so closely as to be confusing; it likewise has a rind up to 1½ inches thick. The seeds also are similar in structure to those of the papaya, but instead of being surrounded by an almost tasteless, inedible pulp, they are embedded in a delicious, sweet-acid, purplish pulp which is eaten raw or made into a sherbet. While the fruit is unripe, the rind may be eaten boiled like squash or unripe papaya.

Besides being planted throughout the tropics for its fruit, the giant granadilla is also grown on trellises for ornament and curiosity, a kind with blotched leaves (var. *variegata*) being particularly odd-looking.

The name "granadilla" is the diminutive of the Spanish word GRANADA, meaning "pomegranate."



SALTWORT

THE SALTWORT (*Batis maritima*) is so very different from all other plants that it constitutes a family all its own—the Saltwort family. It is a sprawling shrub less than one and a half feet high. Its older branches are grayish yellow and brittle; the younger, light green and fleshy. The shiny, crisp-watery leaves are curved upward and are shaped like miniature frankfurter sausages. The plants are of two distinct sexes. The staminate flowers are greatly reduced in structure, and are borne in compact, shingled clusters. The pistillate ones are less degenerated, yet likewise occur in ugly clusters which at length mature into almost shapeless, potato-like, aggregate fruits.

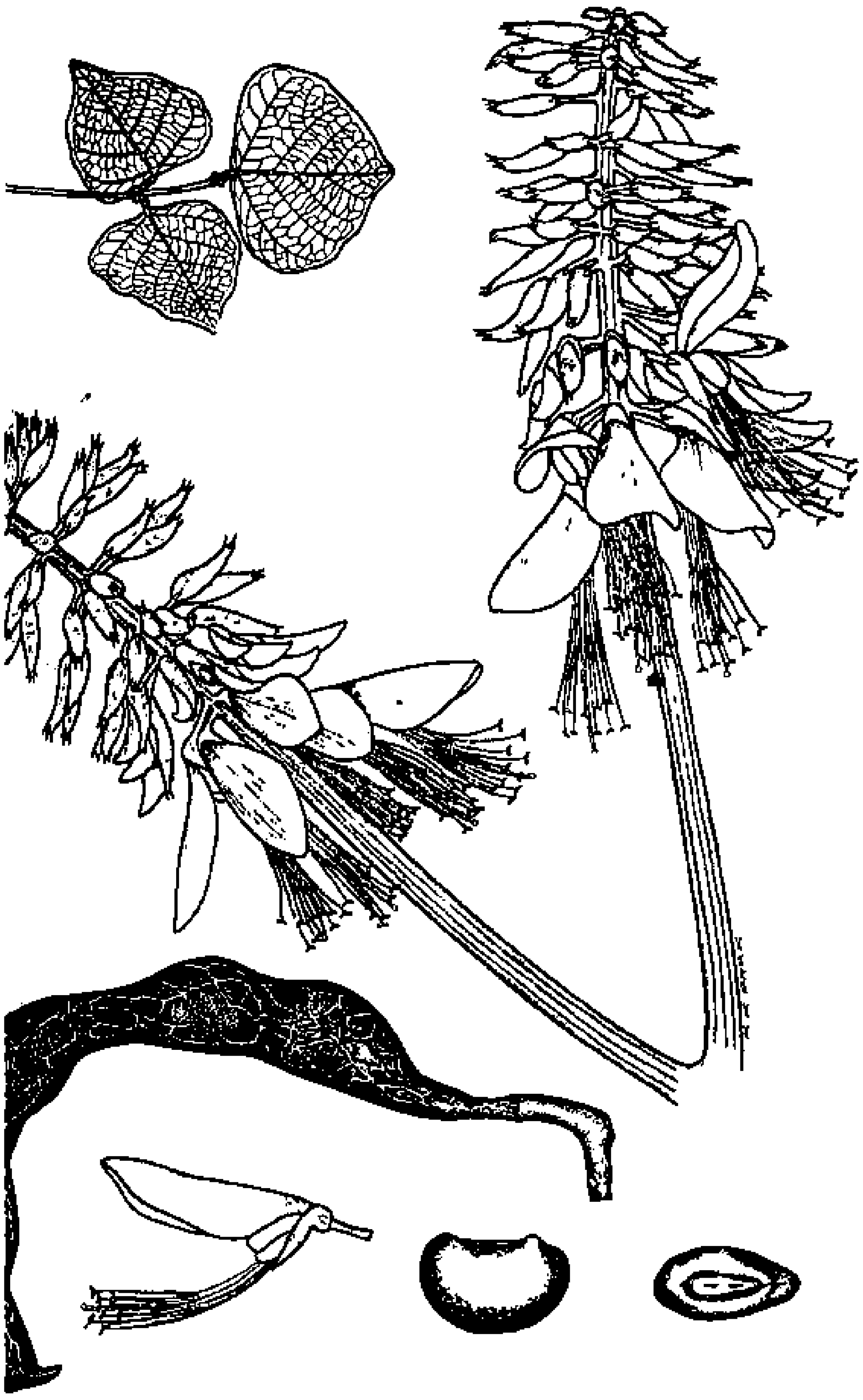
Though the saltwort is an unattractive plant as a whole, its choice of habitat gives it considerable value, for it helps to reclaim land from the ocean. It is typical of coastal mudflats which during storms and high tides are inundated with salt water and during good weather are left mercilessly exposed to the intense heat of the broiling sun. It grows gregariously along the coast from North Carolina and California to northern South America; also in the West Indies. It has been known naturalized in the Hawaiian Islands since 1859, gradually spreading throughout the archipelago. After land was reclaimed from the ocean about Pearl Harbor, huge clouds of coral dust made life almost unbearable for the neighboring housewife on windy days. The Federal Government effectively stopped this nuisance about 1930 by planting the saltwort as a ground cover on these coral plains.

The common name for the plant in Hawaii is "pickle-weed." Moreover, in Jamaica it is said to be used as a pickle.

CORAL-TREE

IN COLD and temperate climes the Pea family is represented mostly by herbs and vines. In warm regions, however, the family runs largely to woody plants, many becoming sizable trees. One of these is the variegated coral-tree (*Erythrina variegata*), which attains a height of 65 feet. It has green leaves marked with pale yellow especially about the midrib. It is undoubtedly a mutant, or sport, arising in India or Malaya and maintained in cultivation by those Oriental lovers of beauty before the coming of the practical white trader. It evidently originated from the common coral-tree (*E. variegata* var. *orientalis*) which differs from it in having its leaves entirely dark green. This wild plant, here figured, is widely distributed from India far into the Pacific. It is not native to Hawaii, its place there being taken by the endemic WILIWILI (*E. sandwicensis*) of arid forehills.

The fruits of the coral-tree are readily disseminated by ocean currents. In Fiji, for instance, the tree grows along the shore with its roots often actually laid bare by the waves, and its spreading



branches dropping their foot-long pods into the water. These pods perchance drift to some distant shore, tardily opening there to liberate their dark carmine, bean-shaped seeds.

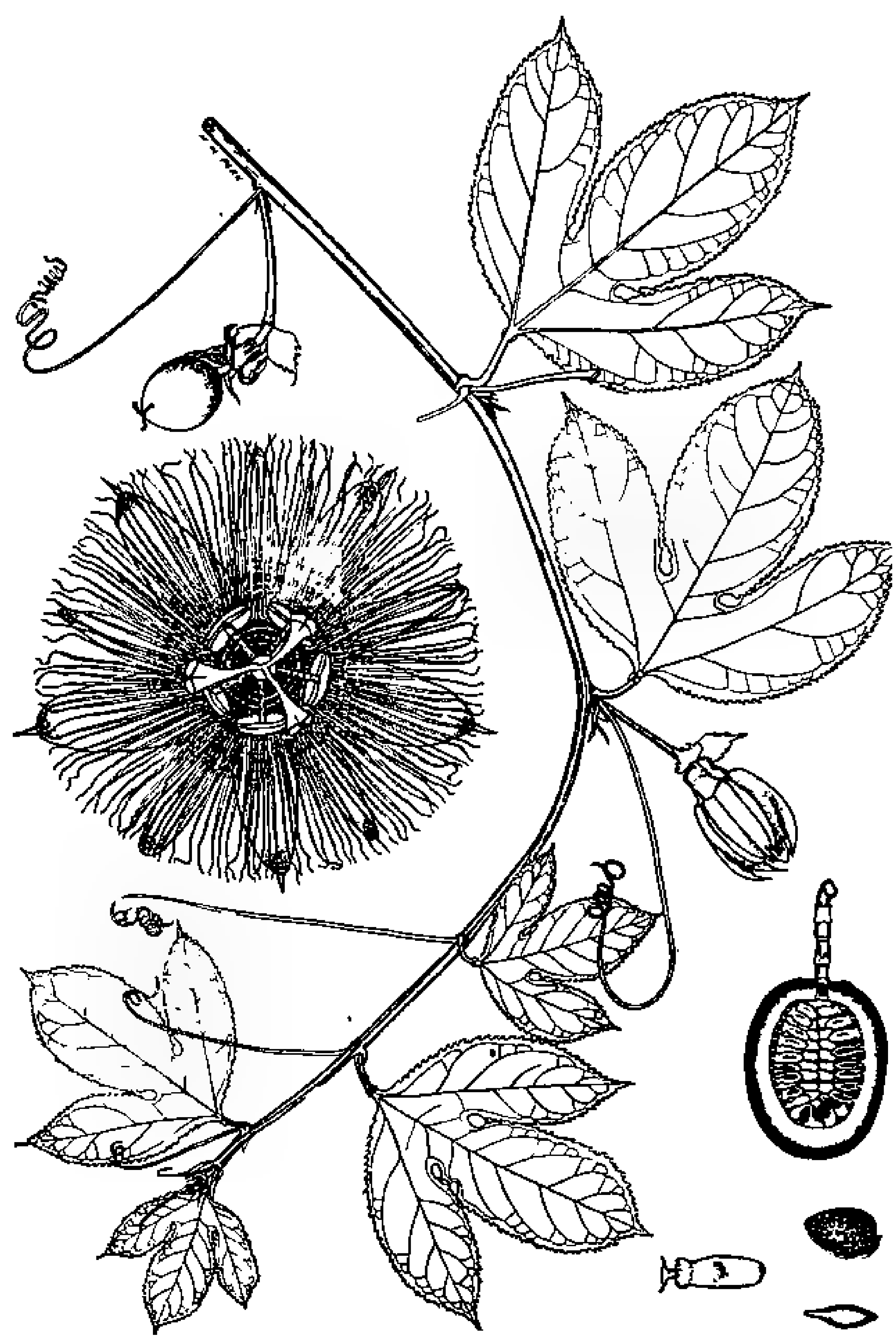
The leaves of the coral-tree with their three leaflets resemble closely those of the common garden bean. They are deciduous, and after they have fallen and the tree has passed through a period of rest, the brilliant red flowers appear in spreading terminal clusters. When in bud each one fancifully resembles the blood-covered claw of a tiger. This accounts for one name of the tree being "tiger's claw." Upon blooming the claw expands into the greatly enlarged upper petal, or standard.

The leaves and tender shoots of the coral-tree can be cooked and eaten as a potherb.

PURPLE GRANADILLA

NOW CULTIVATED in many tropical and warm regions, even where subject to a few degrees of frost, the purple granadilla (*Passiflora edulis*, Passion-flower family) came originally from Brazil. In countries where it has been introduced, as in Hawaii, it often escapes into sunny forests.

The purple granadilla is a coarse woody climber with deeply 3-lobed leaves and with axillary flowers about 2½ inches across. The white petals furnish a background for the two series of spreading, pale purple threads that constitute the corona. Though the flower is attractive, it does not compare in beauty with many other kinds of passion-flower. The fruit is roughly the shape and size of a hen's egg, and has a thick hard rind



which becomes dull brownish purple when ripe, finally wrinkling. It is filled with about 200 seeds, each surrounded with an edible, sweet-acid, yellowish, slimy pulp. After one becomes accustomed to the raw-egg-like, slippery texture, the pulp is delicious eaten out of hand, particularly from dead ripe, wrinkled fruit. It has a claret flavor. Usually it is made into a beverage by beating it up in a glass of water with sugar and a pinch of bicarbonate of soda. It is also canned commercially, usually blended with other fruit juices.

Several forms of this plant occur, some with white flowers, some with yellow fruit. This last is grown extensively in Australia.

JAK-FRUIT

PROBABLY NATIVE to tropical Asia, the jak-fruit (*Artocarpus heterophylla*, formerly called *A. integra*, Mulberry family) now is cultivated in many tropical countries. It is a tree becoming 50 or more feet high, and produces abundant sticky milky sap on wounding. Its large leaves are stiff and more or less oblong. Ordinarily they have smooth margins, but when growing from water sprouts and seedlings, they may be 3-lobed. This ability of the plant to produce two shapes of leaves accounts for its receiving the scientific name *heterophylla*.

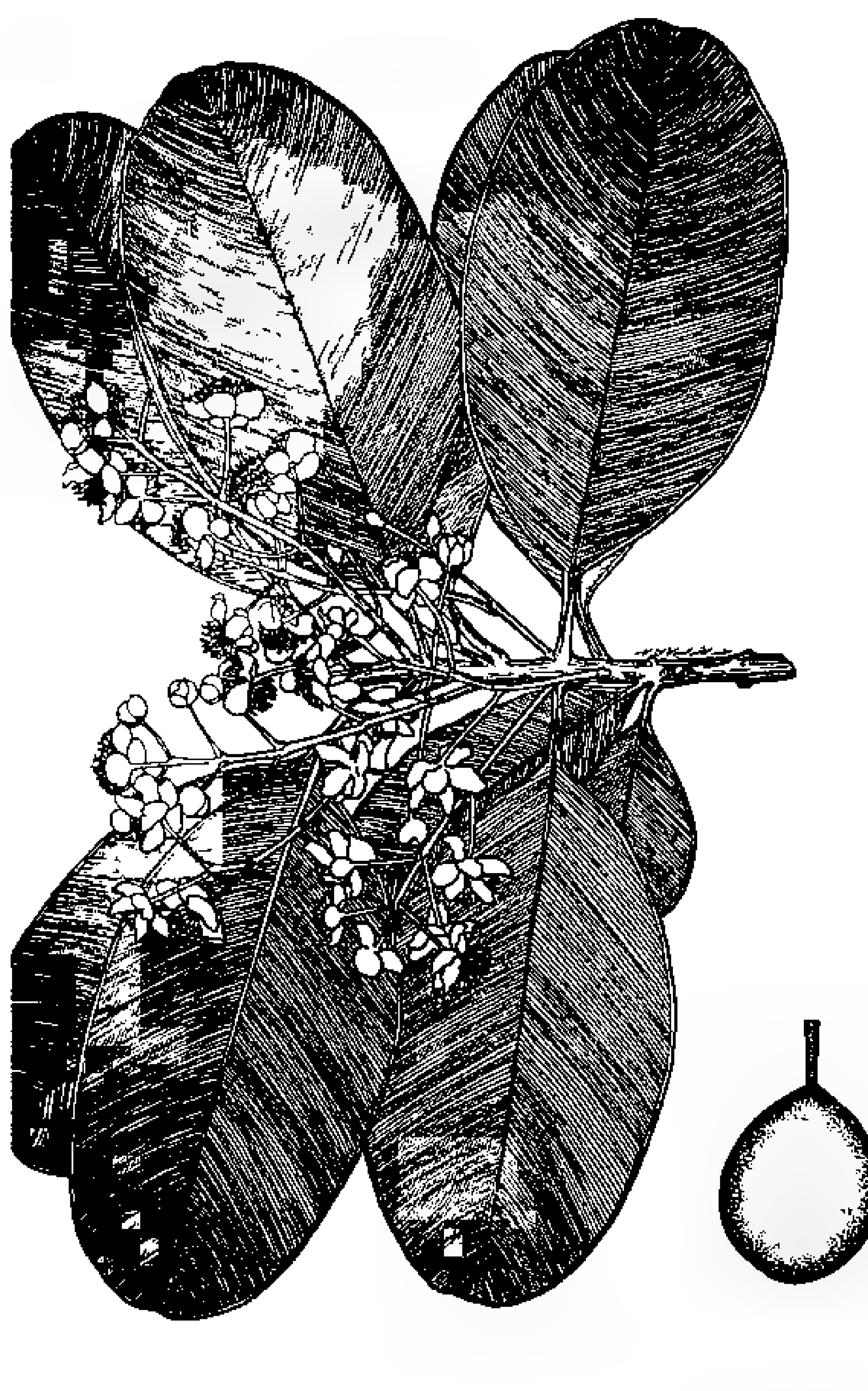
Like its relative, the breadfruit, the jak-fruit has two distinct kinds of flowers: "male" or staminate, and "female" or pistillate. They are tiny but, being grouped by the thousands, build up large, dense clusters. The male clusters appear near the ends of the branches. They are stoutly club-shaped, 2 to 4 inches long, yellowish green, and pleasingly fragrant like a ripe muskmelon. The female clusters are larger than the staminate ones and develop in a curious fashion on short thick branches directly on the main trunk, or occasionally on the main branches. Since the collective fruit is up to 2½ feet long and 1 foot thick and finally weighs from 20 to even more than 70 pounds, it would break down anything less than a stout branch! It is oval to more or less globose, with a rind consisting of sharp, hardened, floral parts. Even at a great distance, it is evil-smelling. Nevertheless, it contains areas of cream-colored, soft, and flaky pulp which is edible either raw or cooked. According to one traveler, "It is considered delicious by those who manage to eat it, but it possesses the rich, spicy scent and flavor of the melon to such a powerful degree as to be quite unbearable to persons of a weak stomach." Cattle also are fond of it. The large brown seeds, after roasting, resemble chestnuts in flavor and lack the almost overpowering odor of the pulp.

The wood makes excellent timber and is also valued for cabinet work. When freshly cut it is yellowish but with age becomes dark red like mahogany and is little inferior to it. In India the heartwood is used for a yellow dye for mats and cloth.

KAMANI

THE TRUE KAMANI of the Hawaiians (*Calophyllum inophyllum,* Mangosteen family) has a number of relatives in tropical Asia and America. All are trees with clustered white flowers, stone-fruits, and opposite leaves that have parallel cross-veins so unusually numerous that a fragment of a leaf is all that is needed to identify the plant.

The kamani grows near the ocean from tropical East Africa and India through Malaya into the South Seas. It is resistant to destruction by ocean spray and is therefore gaining favor as an ornamental and a street tree along the coast where most other plants would die. It grows to a height of 60 feet or more, and produces wood that is excellent for building and for cabinet work. The yellow juice exuding from its trunk is one of the sources of the medicinal tacamahaca resin of commerce, an ingredient of certain plasters and ointments. The fruit, it is said, is eaten by East Indians; while the edible seed within it furnishes the green medicinal poonay oil which the Ceylonese use as a remedy for ulcers and for hoof disease of cattle.



The Hawaiians used the wood for bowls and for parts of their outrigger canoes. The Fijians, besides using the wood for canoes, squashed the leaves in water and used the liquid as an eye medicine. From the fruit they extracted the kernel, pounded it, placed it in a bowl in the sun, and used the liberated oil to rub themselves with in preparation for athletic contests. Wherever the tree grows, it has manifold uses. A similar tree with many uses is the MARIA (*C. antillanum,* formerly called *C. Calaba*), native to the West Indies.

INDIGO

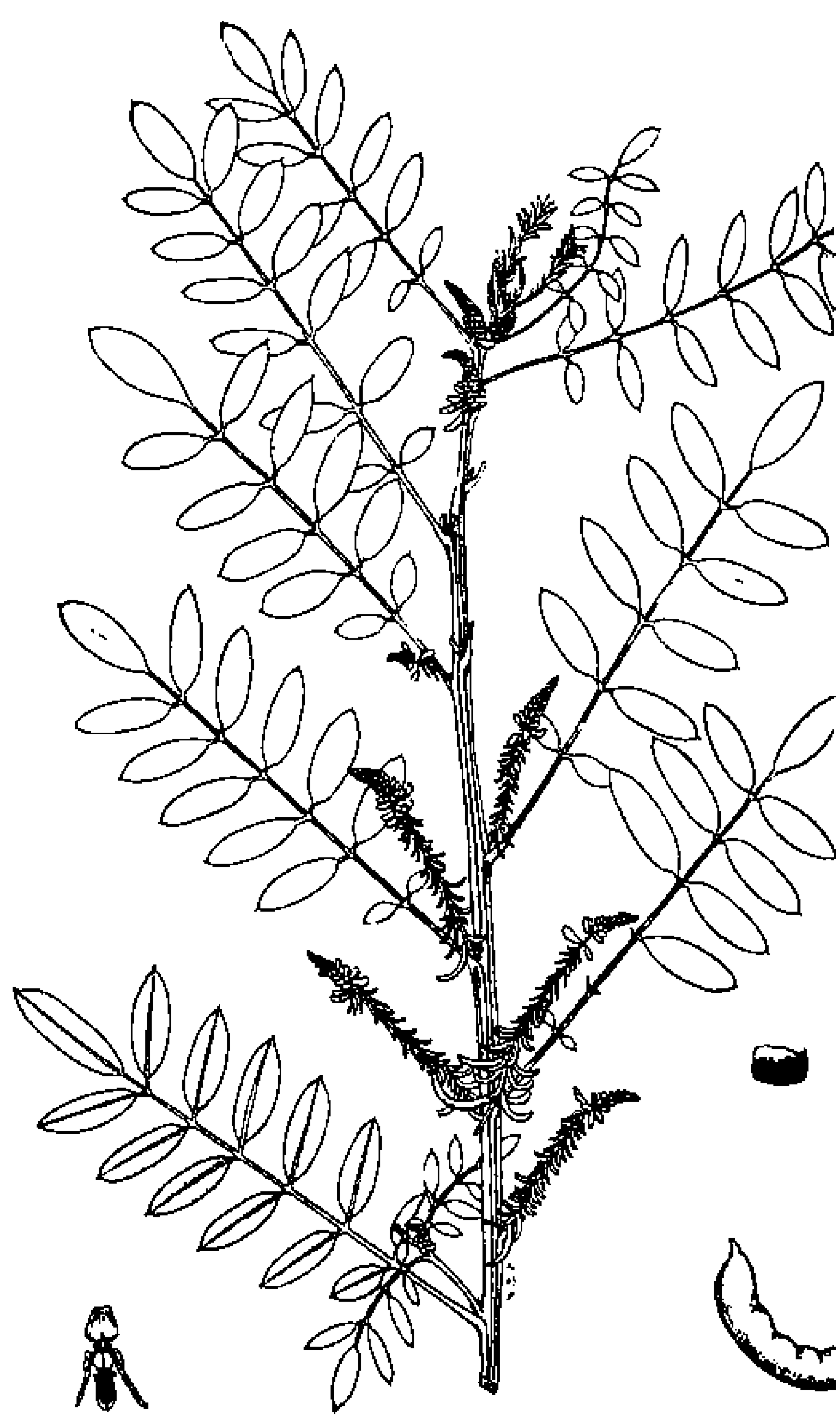
OF THE SEVERAL kinds of indigo found growing naturalized in tropical or warm regions, the so-called wild indigo (*Indigofera suffruticosa,* Pea family), here figured, is the commonest. It is native to the West Indies, but may be found as an almost pantropic invader in pastures, waste places and open woods. It is an erect, much branched shrub 4 to 5 feet high. The leaves bear 7 to 15 leaflets and are finely hairy. The small pea-like flowers are a dirty orange in color. They are borne in clusters usually shorter than the leaves. The pods are strongly curved upward, and less than 1 inch long. Knowing this plant, one can readily recognize many of its relatives. For example, the true indigo (*I. tinctoria*), a native of Asia, looks very much the same. Its flower clusters are likewise shorter than the leaves, but the plant as a whole is only about half as high. The pods are straight and over 1 inch long. The creeping indigo (*I. endecaphylla*), as its name indicates, is a low plant. Its pink to scarlet flowers occur in clusters mostly longer than the leaves. Its pods are only about as long as those of the wild indigo. These and several other kinds of indigo owe their distribution in regions really foreign to them mainly to the days when the indigo dye industry still flourished, and the plants were cultivated in plantations. The intensely blue substance indigo ($C_{16}H_{10}N_2O_2$) derived from them is never found in the plant as such. It is obtained from a glucoside, called indican ($C_{14}H_{17}NO_6\ 3H_2O$), especially abundant in the leaves, by decomposition with an enzyme accompanied by atmospheric oxidation.

The word indigo, states William F. Leggett,* "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 work AL-NIL, which not only stood for 'blue' but also became the ancestor of the modern dye-word ANILINE."

In the natural process of making the dye commercially, indigo seeds are sown in rows. In about three months the plants begin to flower and at that time are cut in the morning a few inches above ground. The crowns sprout again and thus two or even as many as four successive crops may be harvested per year. The freshly cut plants are placed in tanks, weighted with planks or bamboo, and covered with water to which lime has been added. Here they remain for six to fifteen hours, by which time the leaves have turned pale and the water has become greenish. This liquid is led into a second tank, where it is kept in constant agitation for one to three hours either by mechanical means or by wading coolies who beat it with bamboo paddles. During this process the dye settles as a bluish paste or mud. This is cooked after draining off the water, then pressed, dried, and made ready for refining into the finished blue dye. By this method one acre planted to indigo will produce about 500 pounds of paste.

Indigo was exported from India into southern Europe as early as the time of Alexander the Great. Then around the sixteenth century it gradually came into use in central Europe. Here it competed with the dye woad, of identical composition to indigo but derived from a Eurasian plant (*Isatis tinctoria*, Mustard family). Woad growers in England, Germany and France therefore discouraged the use of this cheaper and actually superior Asiatic product, calling it devil's dye and devil's food. During the seventeenth century they induced their governments to legislate against it; Henry IV of France even punished indigo importers and users with death. In 1737, however, the last restrictions against the use of indigo were repealed, and indigo finally displaced woad entirely. Indigo plantations sprang up throughout the tropics, and flourished. The end of this indigo-growing industry was heralded by Baeyer who discovered in 1882 how to make the identical dye synthetically from toluene. His method was not commercially practicable and hence did not harm the growers. But it stimulated further chemical research. Then in 1891 Heumann discovered a cheaper method of making indigo synthetically. His process was so inexpensive and the dye so pure that the demand for the natural product quickly waned. As a result, the indigo plantations failed in most countries and today survive practically only in India and Java where sordid labor conditions prevail. There, now, better kinds are chiefly used (*I. arrecta* and *I. sumatrana*).

Wild indigo is generally avoided as food by stock; creeping indigo is actually toxic to rabbits. A little indigo scattered in a pasture, according to E. Y. Hosaka, stimulates the growth of associated grasses. This may be due to the former's ability to fix atmospheric nitrogen with the aid of bacteria and thus enrich the soil.



* Leggett, W. F., Indigo—The Medieval "Devil's Dye," in Journal N. Y. Botanical Garden **44**: 233-238, 1943.

HYACINTH-BEAN

THE HYACINTH-BEAN (*Dolichos lablab*) is probably native to Africa, but has been cultivated throughout the tropics for food and ornament for a very long time. It often escapes from cultivation, becoming naturalized in waste places and roadsides. Ordinarily a climber or trailer, it is quite variable, and some dwarf shrubby forms occur. The flowers vary from white through pink to purple. The broad, warty-margined pods developing from white flowers usually contain yellowish seeds; those from purple flowers, usually black seeds.

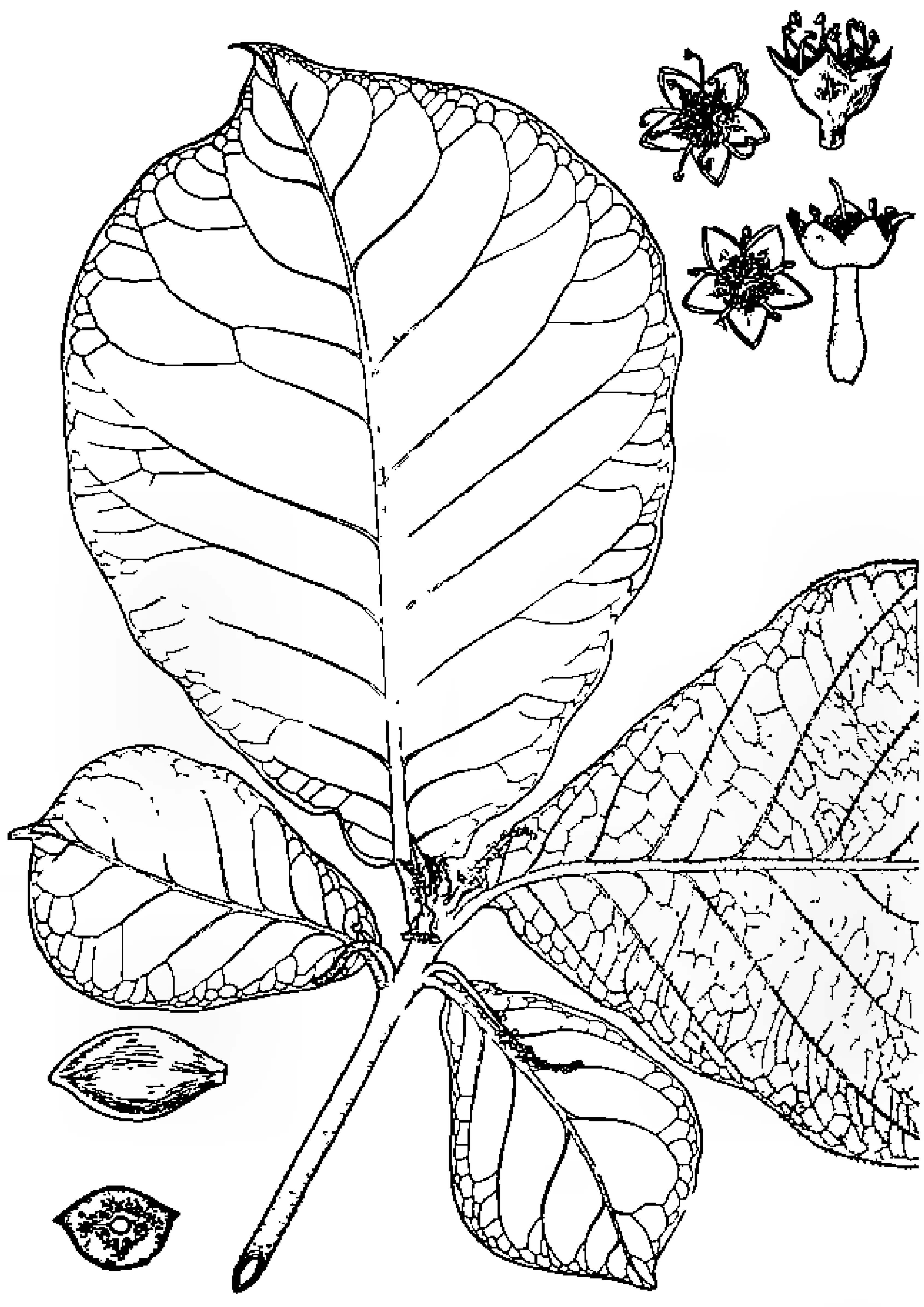
The young leaves and flowers of the hyacinth-bean are edible cooked as a pot-herb. The young pods may be cooked and eaten like string beans. The part most commonly used as food, however, is the large yellowish seeds which closely resemble thick lima beans in shape and are similarly prepared.

Not all forms of the hyacinth-bean are wholesome. Black or dark seeds and wild forms may contain prussic acid, a dangerous poison.

INDIAN ALMOND

THE INDIAN ALMOND, or false kamani of the Hawaiians (*Terminalia catappa,* Terminalia family), is almost the only tree that shows true autumn coloration in the tropics. The leaves turn a brilliant red before they fall, thus compensating for branches periodically bare. This festive "autumn" coloration frequently occurs twice a year!

The false kamani is a typical littoral, hardwood tree becoming 40 to 75 feet high. It has stout, horizontal branches bearing its wide, foot-long leaves clus-

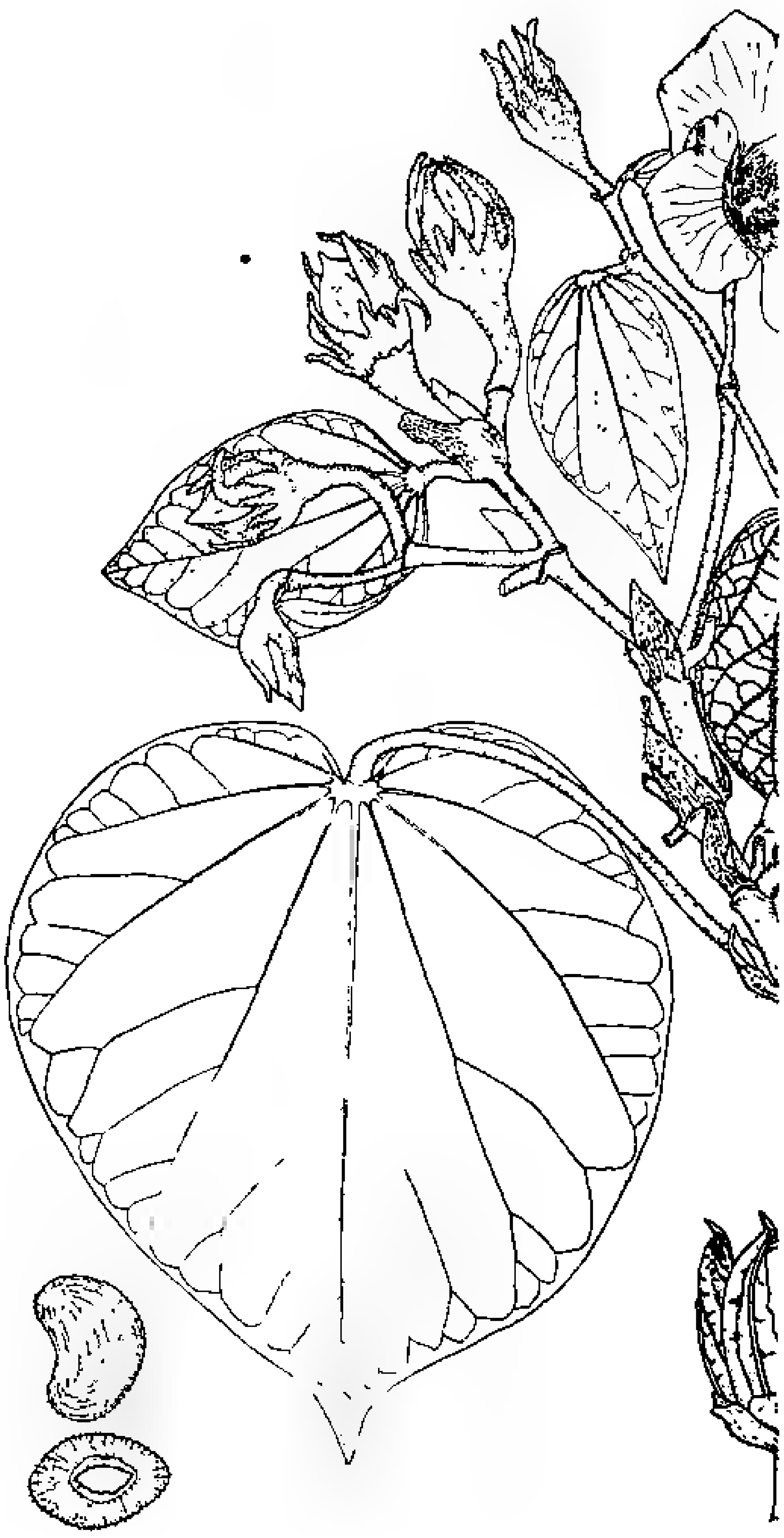


tered at the ends. Its small greenish flowers smell foetid. They are of two sexes and are borne on rat-tailed stalks arising from the axils of the leaves. Some of the flowers toward the base of the stalk gradually mature into compressed-oblong greenish to reddish fruits almost two inches long. They are richly supplied toward the outside with corky tissue which no doubt accounts for the tree being scattered by ocean currents throughout the East Indies, its native home.

Even though the Indian almond is deciduous and litters the ground with its large leaves, in many warm countries it is planted along streets and in gardens for beauty and shade. It will grow not only near the sea but also far inland.

The single kernel, only 1 to 1½ inches long and less than ¼ inch thick, is difficult to extract from the surrounding hard and corky tissue, but to do so is worth the effort, for it is an edible morsel deliciously flavored of almond.

It is curious that some of the older Hawaiians believed it bad luck to have the false kamani growing near their front door.



HAU

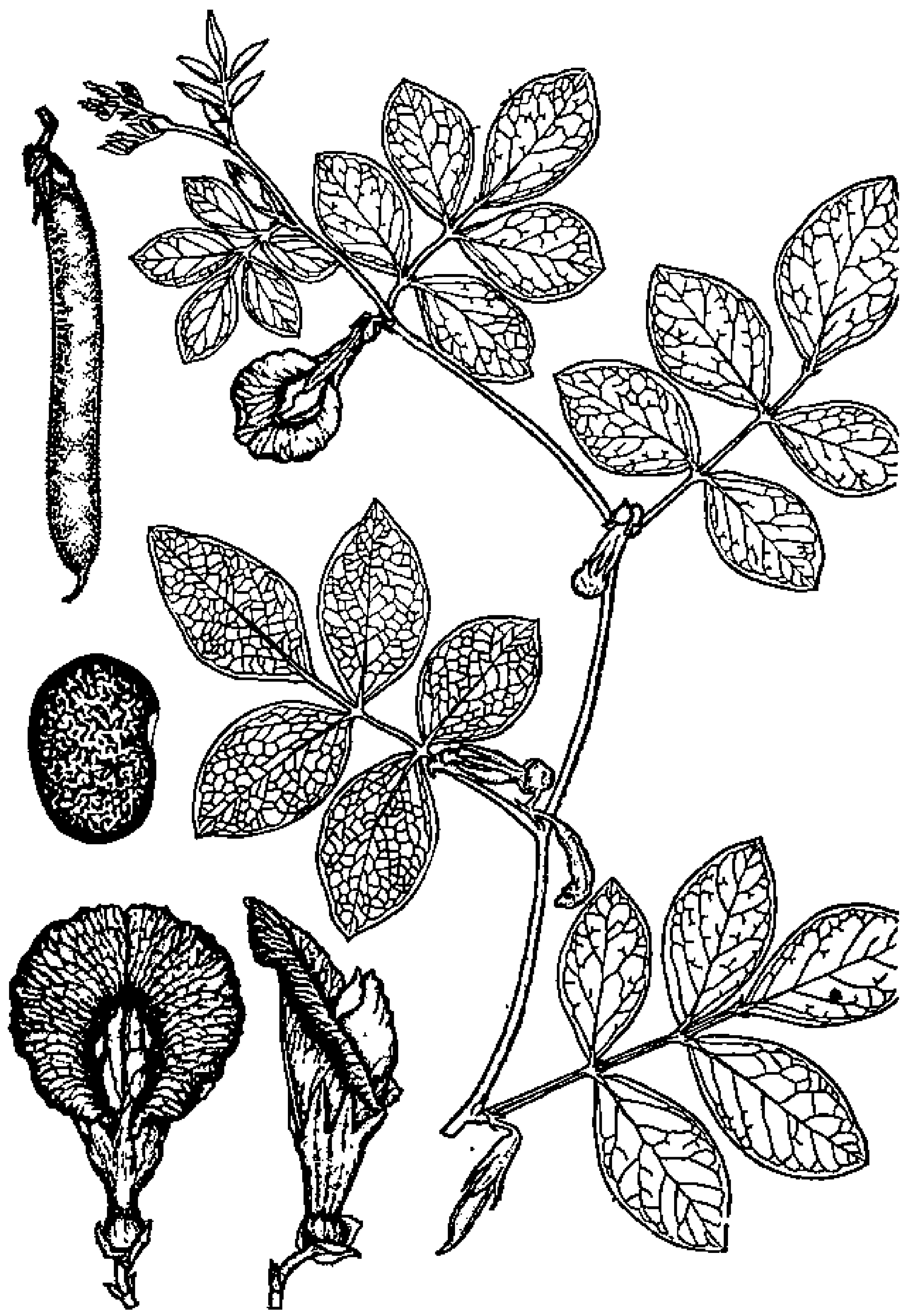
THE SMALL TREE called by the Hawaiians, HAU (*Pariti tiliaceum*, Mallow family), or a variation of this word by most other South Sea islanders, grows in most tropical countries, thriving near the ocean where the salt spray of severe storms may perhaps burn its heart-shaped leaves a little, but will never kill the plant outright. The hau is, in fact, so difficult to kill that hau fence posts, for example, will usually strike root and grow into healthy trees.

The hau usually has a gnarled trunk and curving branches which strike root upon touching the ground. These, with maturing seedlings, form extensive tangles of almost impenetrable thickets.

The large flowers are borne singly or a few together in the axils of the upper leaves and at the ends of the branches. They closely resemble the hibiscus flower in shape, and like the flowers of cotton, which is a relative of both these plants, they are changeable in color. When the petals unfold in the morning they are sulphur-yellow, with or without a brownish center. With the advance of day, they gradually assume a reddish tinge, and the following day they drop to the ground a rich brown. After several months the parts of the flower that remain on the branch have formed into a capsule which splits open to shed the roundish seeds.

Though the hau is inedible, it has manifold uses. It was held in such high regard by the Hawaiians that it was a grave offense for a commoner to cut any of its branches without special permission. The extremely tough, pliable bark was stripped from the trees for use as rope, several such strands plaited together forming a hawser strong enough to haul huge logs to the shore for fashioning into canoes. The bark was also made into a good quality native cloth. The wood, being very soft, light, and tough, was made into fish-net floats. Moreover, because of the conveniently curved branches, it was especially useful for adz handles, also for outriggers and the struts attaching them to canoes. Hau branches placed along the shore signified that fishing there was "kapu," or, as the early missionaries incorrectly spelled it, "taboo." For making fire, a pointed stick of hard wood was rapidly rubbed back and forth in a block of dry hau wood. As it dug a deeper and deeper groove, the accumulating hau dust would start smoldering and finally ignite. This spark was then placed in tinder and carefully blown or waved back and forth in the breeze to a flame.

The Fijians, who live about as far south of the equator as the Hawaiians do north of it, knew the plant as VAU and used it in many ways like the Hawiians. In addition, they plaited beautiful mats from its bark, fashioned it into turtle nets, and shredded it to form the LIKU, an abbreviated woman's skirt three to four inches long. The LIKU of the common women consisted of one row of fibers, all the same color. Those of the ladies, however, were often composed of two or three rows, each dyed a different color.



BUTTERFLY-PEA

THE BUTTERFLY-PEA (*Clitoria ternatea*, Pea family), a slender perennial vine, was named scientifically for Ternate, an island in the Moluccas. Whether this plant is really native to Ternate, however, we do not know. It is evidently of Asiatic origin, and now is cultivated throughout the tropics mostly for its beautifully blue flowers. These are almost 2 inches long, and instead of growing like other papilionaceous, or pea-like, flowers, they are held horizontally and upside down. Thus, the specialized flattened petal, called the standard, acts as a convenient "landing field" for flying insects.

When a plant has been long in cultivation, its chance variations are often carefully propagated by man and thus guarded against dying out. The butterfly-pea is no exception. Double-flowered blue, single- and double-flowered white, single lavender, and single speckled-flowered strains have been recorded as grown in gardens. Such strains differ not only in color and shape of flower, but also in color and shape of both pod and seed.

In the Philippines, the pods of this plant are eaten like string beans, while in Amboina the flowers are boiled with rice to tinge it blue.

A River Is Named

By W. H. Camp
Cuenca, Ecuador

" . . . AND, in addition, a map—accurate as possible—is to be prepared of the region traversed, this to be appended to the report."

Thus did the official directive end. And that is why on an evening approaching a recent Christmastide I sat in front of the palm-thatched house of a Jivaro Indian head-hunter on the edge of the Cordillera Cutucú —the last of the Andean ranges on the Ecuadorean margin of the vast Amazonian plain—with my accumulated notes of compass and altimeter readings, putting lines and marks on what, before, had been a blank space on the map.

"This river," I said to Patéhi, pointing to the boiling, treacherous stream below us, "is the Chiviaza."

"It is called that by the old men," he replied.

Then pointing to the east, to the ruggedly sculptured region and the master stream-valley which drained it and where, for nearly the last month I had been working, I asked: "And by what name is that river called?"

Patéhi paused in his work, laid aside the small jar of poison with which he had been tipping the darts for his blow-gun, and thoughtfully scratched under the long coil of his hair. Then calling one of his wives—a beautiful girl taken from the Gualaquiza tribe, and obviously quite happy in Patéhi's household—he told her to fetch something from inside the house. It was the ceremonial girdle she had worn the previous night while dancing for me to the half-muted throbbing of Patéhi's pagan drum. She handed me the musically tinkling girdle and Patéhi pointed out some brilliantly colored beads which adorned it, beads made from the seed of a vine I had seen growing abundantly along the river's bank, far up the valley.

"The beads," said Patéhi, "are called ETZA, and they grow along that river. The river has no name. We only say that we are going to 'the place where the beads grow.' That is enough."

Knowing a little of their basic language and something of the way the Jivaros compound their words, I took the name of the bead and also the

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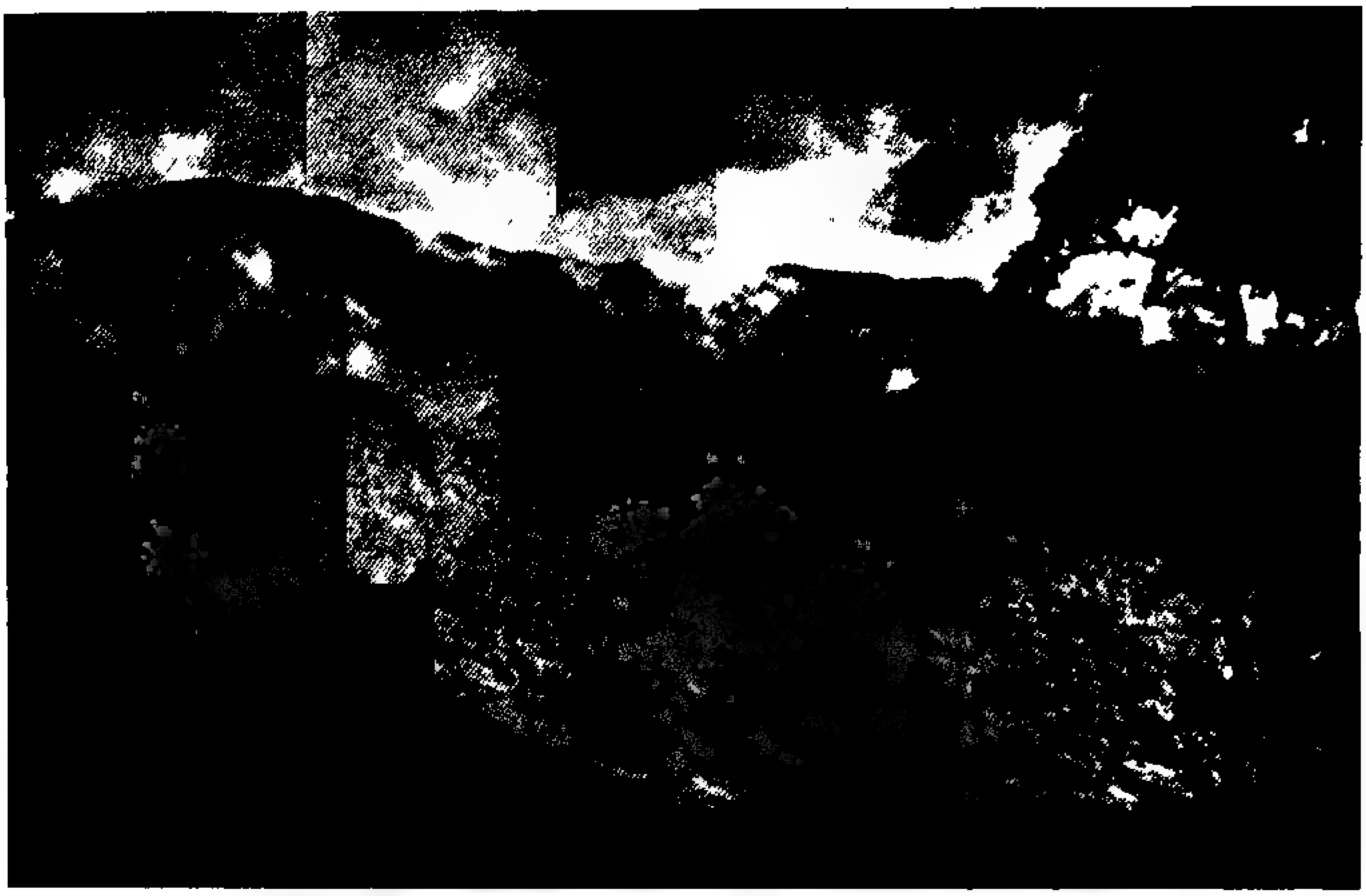
ON THE COVER

The western rim of the Cordillera Cutucú, in the Oriente of Ecuador. View looking southeastward across the valley of the Río Upano. The palms in the foreground are the spiny-trunked Chonta, the fruit of which is a much sought food in season, and whose hard wood furnishes material for the blow-guns and throwing spears used by the head-hunting Jivaro Indians who inhabit the region.



The central range of the Cordillera Cutucú and the headwaters of the Etzéntza; a rare view because of the nearly continuous clouds which blanket the inner and higher peaks.

word for river, ÉNTZA, and joined them into a single name. Then, beside one of the new lines running its tortuous course across that once blank space on the map, I placed the word ETZÉNTZA.

To others who, someday, may chance across that word on a map, it will be the name of another of the rivers fumbling its way westward out of the tangled wildernesses of the Cordillera Cutucú . . . and nothing more. But to me it always will be "The River Where The Scarlet Beads Grow"—a river along whose precipitous, rain-soaked banks and jungle-clotted upper regions I once hunted drug-plants for a war thousands of miles away, while my friend Patéhi, with his blow-gun and its deadly, poisoned darts, hunted monkeys for their meat.

Collecting in Ecuador

WITH the Government's quinine project in South America having been brought to a close within the past few months, Dr. W. H. Camp, who had been searching for *Cinchona* trees in Ecuador for more than a year, is now remaining in that country for another six months, approximately, to carry on general botanical exploration for the Garden. The paragraphs below comprise part of his report for April, his first month on the new project.

"Ten packages and boxes of equipment, food and residual specimens were moved from Quito to Cuenca, and one box from Quito to Huigra (a base for proposed future work during the next several weeks). The services of Sr. Giler in handling the packing of these boxes, the coaxing, cajoling and threatening of freight agents at the various points of change deserve praise.

"Still recovering from a serious illness which extended over several months, another assistant, Sr. Francisco Prieto, was under strict orders not to over-exert himself as yet. However, he made several trips into the southeastern part of the province of Cañar, the eastern part of the province of Azuay, and the central part of the same province in the vicinity of Cuenca. While these collections probably contain little which is really startling, they are of considerable interest for he was in rather constant contact with local Indian "doctors" (MEDICOS DEL CAMPO) who gave him information on the medical and other uses of the majority of these plants, as used by the local Indian population."

Dr. Camp's work will take him next onto the western slopes of the Cordillera

Western Trip

CONTINUING the co-operative agreement between Utah State College and the New York Botanical Garden for the exploration of the Intermountain Region and eventual publication of the flora, Dr. Bassett Maguire is spending the summer in the West. Leaving New York the first week in May, he picked up Prof. Arthur H. Holmgren of Utah State College at Logan, and they began the summer's field work together in southwestern Nevada, where they have set up the southern limit of the area to be worked. Two more seasons of field work are planned before the exploration of area will be completed.

Robert S. Williams

By John Hendley Barnhart

WORD has reached New York of the death in Minneapolis, March 13, of Robert S. Williams, the oldest member, both in years of life and years of service, of the scientific staff of the New York Botanical Garden.

Robert Statham Williams was born May 6, 1859, at Minneapolis, Minnesota. Even in his youth he was an enthusiastic student of nature, but his early interest was in birds rather than plants, and his first published papers were chiefly ornithological. At twenty he went to Montana, where he lived for nineteen years, the first nine years as a miner, but collecting plants throughout this period. He built the first cabin in what is now Great Falls, where he lived from 1888 until 1892.

In 1898 and 1899 he visited Yukon Territory, and brought back the first collection of plants made in the Klondike. Even before this he had begun to specialize in the study of mosses, and to this group of plants he devoted the remainder of his life, but he continued to make occasional observations on birds.

In December, 1899, he was appointed Museum Aid at the New York Botanical Garden, and he remained in the employment of the Garden continuously until his death more than forty-five years later.

During his first ten years at this institution, he was sent on several extended collecting trips. The first was to Bolivia, in 1901-1903; the second to the Philippines (Luzon and Mindanao, up to 8,000 feet), in 1903-1905; the third to Panama, in 1908. Each of these, like his earlier Alaskan trip, formed the basis of papers published in this Journal and in the Bulletin of the New York Botanical Garden.

After his return from the Panama trip he spent all of his time at the Garden where he was Assistant Curator from January 1906 to June 1910, Administrative Assistant from July 1910 to 1932 and thereafter Research Associate in Bryology. He was never formally retired, but owing to advancing age and increasingly poor health he was given the title "Research Associate in Bryology" and granted a permanent leave of absence.

He was an honorary life member of the Torrey Botanical Club, and a number of his papers appeared in its Bulletin. He was keenly interested, of course, in the work of the Sullivant Moss Society, and served as its president from 1924 to 1930; he was a frequent contributor to the pages of its journal, *The Bryologist*. His contributions to moss literature were too numerous to be listed here.

Robert Williams was studious, quiet, retiring, almost reticent, and had few intimates. He was highly regarded by his associates, and esteemed by all who knew him. He was largely self-educated, but made up to a remarkable degree for his lack of early advantages, and his painstaking work in the field of bryology is of permanent value. He never married, and spent his last years with a sister in his native city.

Notes, News, and Comment

Examiners. On May 21, Dr. B. O. Dodge served as a member of the examining committee for the Faculty of Pure Science at Columbia University, when Harriet Taylor was the candidate for the degree of Doctor of Philosophy. Her dissertation was "A Study of the Lag Phase in the Growth of Yeast Cultures." On May 25, he again served as a committee member, examining candidate John Leutritz, Jr., whose dissertation was "A Wood Soil Culture Technique for Laboratory Study of Wood-Destroying Fungi, Wood Decay, and Wood Preservation."

On May 23, Drs. F. J. Seaver and B. O. Dodge were both appointed members of the examining committee for candidate Anne M. Hanson, whose dissertation was "A Morphological, Developmental, and Cytological Study of Four Saprophytic Chytrids." Dr. Dodge, however, did not attend because of a scheduled lecture in the Garden's Nature Study course on "Diseases and Pests of House Plants, Home Gardens, and School-room Plants."

Groups. Members of Wellesley-in-Westchester held their annual meeting May 9 in the Members' Room. After lunch they were conducted through the Rock Garden, returning to the Members' Room at 2:15 to hear a talk by T. H. Everett.

Pupils from the 8th grade of Good Counsel School, White Plains, visited Range I on May 11.

Lectures. Otto Degener, Collaborator in Hawaiian Botany, gave a lecture on Hawaii at Washington Junior High School, Mt. Vernon, May 18. The drawing of *Alstonia* which appeared with Mr. Degener's article in the May Journal was made by Milton Coleman, a student at this school.

"Types of Intra-Specific Incompatibilities" was the subject of a lecture given by Dr. A. B. Stout for the Torrey Botanical Club on May 16, at the New York Botanical Garden.

The Garden Club of Montclair, N. J., an Affiliate of the New York Botanical Garden, invited Dr. E. E. Naylor to give a lecture to their group on May 21. His subject was "Vegetative Propagation."

G. L. Wittrock gave a lecture May 21 at the Lutheran Church, Valhalla, N. Y., on, "Indian Food Plants."

Visitors. In addition to those who came especially for Garden Week, visitors to the Garden during May included T. A. Russell of the Department of Agriculture in Bermuda, May 8, and Dr. Frank D. Kern of Pennsylvania State College, May 15.

Spraying Job. To help in preventing the spread of the fall canker-worm, or inch-worm, of which there have been increasingly bad infestations in New York and nearby states in recent years, the Conservation Commission of New York State last April lent the Garden a powerful spray machine with operator and supervisor from Albany, and devoted three full days to spraying the Garden's trees. Elms, maples, and some of the oaks, the first to come into leaf, were already being attacked by the inch-worms. The service was being provided through the courtesy of Perry B. Duryea, Conservation Commissioner and W. M. Foss, Superintendent of Forest Pest Control.

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.)

A Chronicle in American Biology

THE WOODS HOLE MARINE BIOLOGICAL LABORATORY. Frank R. Lillie. 284 pages, illustrated, indexed. University of Chicago Press, Chicago, 1944. $4.

The Marine Biological Laboratory at Woods Hole, Mass., has played a unique role in the history of American biology and in the lives of many biologists. Founded in 1888, it has grown from small beginnings, and after many precarious years, has reached a firm basis as the outstanding marine laboratory of the world. It has attracted students and investigators from virtually all the universities and colleges of America and from many European ones. The story of the founding of the laboratory, its trials, growth, and eventual success is told ably by Professor Lillie, who for so many years served as its director. Professor Lillie has been assisted in the writing by Professor E. G. Conklin, who has contributed a chapter on the geography and early history of Woods Hole and has collaborated with Professor Lillie in two other chapters.

Professor Lillie has been associated with the laboratory since its early years, and he knew intimately the founder, Professor C. O. Whitman. Early chapters recount the founding by Louis Agassiz of the Anderson School of Natural History on Penikese Island in 1873, a school which lasted for but two seasons, and of the immediate predecessor of the Woods Hole Laboratory, the Annisquam Laboratory operated by Professor Alpheus Hyatt from 1881 to 1886.

Professor Lillie's book will always stand as an excellent historical treatment, though the reviewer feels he somehow fails to get across the spirit of the Laboratory and the role which it has played in bringing youthful students and investigators in touch with the leaders of many fields of research. More than any other institution, this Laboratory has served to break down barriers in American biology—barriers of specialization, of age, of professorial dignity, of geographic isolation.

Unfortunately, botanical courses and investigation have been but a relatively minor adjunct at Woods Hole, in spite of the outstanding investigators who have spent some seasons there. This reviewer believes the fundamental mistake has been to focus attention primarily on problems of alga morphology and taxonomy and to omit consideration of planktonic organisms; marine ecology, and particularly plant physiology. Even general physiology at Woods Hole has been considered as zoological physiology. Perhaps Professor Lillie's book may stimulate students of botany and botanical investigators to recognize the opportunities at Woods Hole.

DAVID R. GODDARD,
University of Rochester.

Plants From English Countryside and Garden

FLOWERS IN BRITAIN. L. J. F. Brimble, 393 pages, illustrated with photographs, drawings, and colored plates. Macmillan Co., London and New York, 1944. $4.50.

In "Flowers in Britain" Mr. Brimble presents a popular introduction to the classification and relationships of the flowering plants native or cultivated in Great Britain. In the opening chapters (Part I) the structure of a representative dicotyledon is discussed in simple terms. Parts II and III, which make up the bulk of the book, are devoted to an annotated catalogue of the families, taken up in the order (slightly modified) of Hutchinson's "Families of Flowering Plants." Each family is subdivided into native, ornamental and economic plants, a not entirely satisfactory arrangement owing to the fact that the genera, and not infrequently the species, fall into more than one of these categories and are then discussed twice.

The indigenous flora of Britain is quite fully dealt with, most of the commoner or spectacular species being described in a few lines, and a large number of these illustrated in the seventeen attractive and accurate colored plates. To the details of appearance and habitat is added a quantity of information concerning their medicinal properties, both real and supposed, and of the folklore which has grown up around them. A similar plan is followed covering the exotics, these being illustrated by photographic reproductions, while about thirty line-drawings, in the main of excellent quality, serve to clarify points of floral structure and anatomy.

Those parts of the book which emphasize the relationships existing between native and cultivated plants, and their alignment together in a logical system of classification based on an evolutionary sequence leading from the simple to the more complex, are without doubt the most valuable. There are all too many flower-lovers (to whom the volume is evidently addressed) who have never appreciated the affinity between a cigarette, a tomato, and the scream of an uprooted mandrake, and to this class of readers "Flowers in Britain" can be recommended without reservation. When the author goes further afield, into families little known in Britain, the matter becomes diffuse or superficial. We are told, for example, that *Distylium racemosum* "is a Japanese evergreen shrub with graceful glossy leaves." No more. The sentence might as well have been omitted.

A conspicuous feature of "Flowers in Britain" is the inclusion of quotations, largely verse, from a wide selection of ancient and modern writers. Many sources are drawn upon, poet and poetaster alike, from Homer to Shelley and one Sarah Roberts Boyle, and a few of the selections are to the point. For the most part, however, they are purely statements of emotion. They serve rather to underline the fatal ease with which a poet of real stature, when brought face to face with a flower, can fall into coy and mawkish sentimentality. More Pliny and Dioscorides, and less Wordsworth, would have effected a vast improvement.

"Flowers in Britain" is printed in clear type on paper of good quality and is almost free from typographical errors—a remarkable wartime achievement. The few misrepresentations of fact are relatively unimportant, and do not seriously detract from the value of the book as a whole. The statement that the Venus's flytrap (*Dionaea muscipula*) is native to "North and South California" might perhaps have been avoided by more careful proof-reading, but it is difficult to explain how the Levantine *Astragalus gummifer*, the ancient source of gum tragacanth, comes to be labeled "Australian."

RUPERT C. BARNEBY.

Three Dozen Lithographs Of Fruits for Birds

A BOOK OF WAYSIDE FRUITS. Margaret McKenny. 78 pages, illustrated by Edith F. Johnston. Macmillan, New York, 1945. $2.50.

Again Margaret McKenny and Edith F. Johnston have combined their talents, and this time have produced "A Book of Wayside Fruits." The purpose of this book is to acquaint the public with fruit-bearing plants and shrubs which provide food for hungry birds throughout the seasons. The thirty-six plants are arranged according to their maturity. Each is described in a page of text and is illustrated by a full-page plate in color. Margaret McKenny's text is interesting and easily read, depicting the importance of the plants to our bird population. Edith Johnston shows herself a master of form and color. It is good to find an artist who sacrifices none of the true characteristics of the plant for artistic effect. These pictures are exact reproductions of the flowers, foliage, and fruits. It is unfortunate that wartime restrictions made it necessary to print these beautiful pictures on such inferior paper. The colors are impaired by the grayness of the paper and do not have the lustre and life of the originals. The lithography and colors are so carefully executed that inferior paper has not spoiled them, and certainly many people will want to add this to their collection of garden books.

THEA M. GLEASON.

A Guide to the Gardener's Promised Land

ANNUAL FLOWERS FROM SEED PACKET TO BOUQUET. Dorothy H. Jenkins. 223 pages, illustrated with photographs and drawings, indexed. Barrows, New York, 1945. $2.75.

Though at times she stands on the Mount of Vision and sees the Promised Land ablaze with annuals of many kinds, it is gratifying, in this book by Miss Jenkins, to find that she is also entirely aware of the valley below and the thorny paths through the wilderness. She tells of the joy of planting flats indoors in late winter or early spring but she knows, too, that after filling every available container and every sunny window with seeds of miraculous flowers to adorn that Promised Land, the new gardener often awakes to the fact that the seedlings must be transplanted at least once, and there is not another flat or another bit of sunlight to be found anywhere. "A half dozen pans of seed," Miss Jenkins says, "have a distressing way of turning into three dozen flats two weeks after the seeds have been planted." Let the green ambitious gardener take notice.

Partly because of such facts but also because of house conditions, this reviewer does not recommend the very early start suggested in this book. Though with perfection indoors, seeds planted in late January or early February may hold out in good shape till outdoor planting time, it is pretty hard with only window—not greenhouse—conditions, to keep them from getting long, lanky and spindly as they reach for the sunlight. Perhaps a sunroom may accomplish all that is asked for, but it is a gamble for many amateurs. March planting or even early April would seem best for most gardeners, even if the plants bloom a little later. It won't be so much later, at that.

The book is good and useful with its cultural directions, its suggestions of flowers for different conditions, its excellent lists of flowers for cutting, vines for sun or shade, flowers according to color, and many possible combinations. It is simple and practical.

One does not agree with everything, of course. *Cynoglossum*, the Chinese forget-me-not, is a lovely flower of exquisite color, but unless one sits up nights cutting off dead blossoms, horrid little "beggar ticks" of seeds are produced to stick to one's best stockings. If this reviewer could have only one petunia, it would be Flaming Velvet with its rich glowing crimson trumpet, and Miss Jenkins does not mention it. Blue flowers are no good in a dim chancel of a church. They melt into the background. Stocks don't want to bloom early because they would rather be biennials. Why, when telling of ways to get rid of cutworms, does such a good gardener as Miss Jenkins not mention going out at night with a light (a flashlight in non-war times) and picking them off the ground or using the infallible collars, especially since nice stiff ones may now be bought in 10-cent packages?

These are minor matters and do not change the fact that this is a good useful book, especially valuable to the beginning gardener.

SARAH V. COOMBS.

Technical Guide to Wax Production

COMMERCIAL WAXES, NATURAL AND SYNTHETIC. A symposium and compilation edited by H. Bennett. 583 pages, tables, glossary, appendix, index. Chemical Publishing Co., Brooklyn, 1944. $11.

This high-priced volume of ordinary-book size, containing much technical information and many pages devoted to a wax formulary for industrial use, obviously is intended for sale to the trade dealing in waxes, rather than to students or the public in general. In addition to manufactured and synthetic waxes, the volume deals also with natural waxes obtained from animal, mineral and plant sources, and the botanically interested reader is attracted at least by the list of about 30 waxes obtained from as many kinds of plants.* These waxes are removed from the surfaces of leaves, fruits and other parts of the plants by melting in boiling water and skimming operations, and are used in the manufacture of a great variety of products, including shoe, furniture and auto polishes; lacquers and varnishes; phonograph records, carbon paper and electrical insulating compositions, to mention only some of them.

E. H. FULLING.

* An article describing a wax of commercial possibilities from a new plant source in tropical America will appear in an early number of the Journal.—C.H.W.

BROADCAST

By Edward Jerome Dies

"STREAMLINING the Age-Old Soybean" was the title of the radio address given for the New York Botanical Garden by Edward Jerome Dies over WNYC Jan. 12. Mr. Dies is President of the National Soybean Processors' Association and is the author of "Soybeans: Gold from the Soil," which was reviewed in this Journal in May 1943. Portions of his talk are given here.

STORY book tales may be found in the history of the soybean.

Earliest writings on the subject go back to the time of the pyramids. Even before they were built, and twelve centuries before Solomon fashioned his temple, the soybean was hoary with age.

An Oriental legend tells of the first human use of the soybean by a beleaguered caravan in China, but for the first written record of the soybean we must turn to the Materia Medica set down by Emperor Shen-Nung in 2838 B. C.

In 1712 A.D. a German botanist, out of Japan, introduced the soybean to Europe, but the curio caused little more than a tolerant yawn. By the turn of the nineteenth century plant scientists in most countries were familiar with the legume, but they did not yet embrace it for domestic purposes.

Then in 1804 a Yankee clipper ship in full sail slid down the coast of China searching the ports for a return cargo. Uncertain as to the length of the homeward journey, the captain ordered several bags of soybeans tossed into the hold as a reserve food supply. It was thus that the first soys entered America.

Desultory efforts were made to whip up popular interest during the next century. It remained for the late Dr. C. V. Piper of the Bureau of Plant Industry in Washington to carry the torch for the soybean. In 1907 he sent a brilliant young assistant, Dr. William J. Morse, to the Orient to study the soybean and to bring back many types and varieties. Dr. Piper, who had likened soybeans to gold from the soil, did not live to see the immense development in this country. But Dr. Morse, still in government service, has been carrying on the work for 37 years.

Today in this country the miracle bean is big business—a 500 million dollar a year business. The vast soy garden sprawls across the rich lands of the Midwest . . dips into Dixie . . . patterns a bit of the East and Southeast, and is creeping slowly northward.

From this garden the miracle bean moves to the marts of trade in wagons, trucks, trains and steamboats. It passes through the great processing plants that convert it for the most part into livestock and poultry feed and products for the dinner table. It also goes into a long list of lesser uses.

In 1934 this country grew 23 million bushels of soybeans. Now we grow nearly 200 million bushels annually, a crop that has increased nearly ten fold in ten years. In the stream of agricultural history there are few events more striking than this dizzy rise of the soybean.

* * *

American genius has been streamlining the ancient soy. Alert agronomists, top-flight chemists, nutritionists, and home economists across the land have worked feverishly to bring about the latest developments.

Despite the many present uses, by far the two principal products still are soybean oil meal for feeding livestock and poultry, and soybean oil for numerous edible products.

A river of soybean oil has flowed into such consumer goods as shortening, salad dressings, and a long list of other products, including margarine, which is growing in popularity because of improved taste and added vitamins and other factors that make it a nutritious and agreeable spread.

Sensational newcomers in the food field have been soy flour, soy grits and flakes. These products now are being consumed regularly in popular pancake and muffin mixes, in marcaroni and spaghetti, in ice cream and bakery goods. Soy flour has been used for some years in sausage, meat loaves and other products. It is an excellent binder and adds protein value. The baking industry constantly has increased its use of soy to intensify the nutty flavor of products and to maintain moisture longer, thus deferring staleness. The incomplete proteins of wheat bread, when supplemented by a percentage of soy flour, have not only the protein of the soy added but all the wheat protein mobilized as well, as has been strikingly demonstrated in experiments by Dr. D. Breese Jones, United States Department of Agriculture, and other leading authorities.

Far-reaching research work is being carried on at universities and government and private laboratories. In the future children no longer need eat candy free of protein, because many types will contain a distinct protein nutritional value hitherto absent.

Foreign governments have been purchasing soy flour and other soy proteins in large quantities to fortify bread and other products.

Even in peace times millions of Americans, particularly in the South, have had a diet short of protein. This new low-cost protein, soy flour, may solve the problem. It is already deeply rooted in the American diet, touching the lives of most of the nation's 138 million persons, including those in the armed forces.

* * *

Use of soy protein for industrial purposes likewise holds bright promise. Two general types now are available. One is the mechanically prepared protein compound, manufactured today in commercial quantities. It is used principally in the field of adhesives for plywood and various coatings that require an adhesive binder. A hundred million square feet per month of water-resistant three-ply plywood are currently being manufactured with soybean glue.

The other general type is the pure protein prepared by chemical methods. Known as alpha protein, this item has increased substantially since the war began. But except for military uses, it still is available only in experimental quantities. Principal use for the isolated protein is in the field of foam solutions, for fire fighting equipment, paper co: ings, paper sizing and paints. Mc progress is being made here with the industrial soy proteins than elsewhe in the world, and this progress ste wholly from research.

A synthetic soy wool, soft and flee as lamb's wool, has been developed. Co mercial usage is yet to come.

Typical results of research at the go ernment's great Northern Regional R search Laboratory are Norepol, a ru ber substitute, and Norelac, a new res of remarkable properties. Incidentall the world rubber market has shudder at the thought that America is capab of producing synthetic rubber to the e tent of 80 percent of the world suppl Soy could be a contributing factor.

In expansion of industrial usage soy proteins and soy oils the horiz seems limitless.

* * *

As indicated, the soybean has had colorful history. It has stirred up bloo clashes in the Orient. Some claim th Japan's initial attack on China was i spired in a measure by the lush pri of China's immense soy crop.

Hitler's blitzkriegs were aided by t soys which he has stored for years again possible shortage and to fortify ratio as field kitchens rolled into battle area It is even declared that the terms of t shaky Hitler-Stalin pact had provide for a steady flow of soybeans to l siphoned from the Orient to German over the single-track railroad spannin the broad stretches of Siberia. Hitl waited impatiently for the soys. Shippin dates were violated one after anothe The promised flow became a mere trickl Hitler's food minister sounded an alarn Finally the hysterical Fuehrer storme at the Russian ambassador, who alwa found new excuses. A light dawned o Hitler when other promised articl failed to appear. Then came his lon delayed blow at Russia, which sounde Hitler's doom. He realized Russia ha out-smarted him on every count, inclu ing delivery of the coveted soys.

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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CAROL H. WOODWARD, Editor

WHAT IS A HERBARIUM, AND WHY?

From the address of Dr. F. J. Seaver on "A Collection of Plants and How it is Used" given at the Garden May 15 as part of the Program for Garden Week.

A HERBARIUM is a collection of dried plants usually pressed, classified, and so arranged that they constitute a huge filing system, any part of which is easily available at any time for scientific study and comparison. Such a collection is just as essential to the student of taxonomic botany as is a library itself, in fact the one is used to supplement the other. For when a so-called new species is described and the description published it is based on some particular specimen of plant material. This is known as the *type specimen.* Such specimens are exceedingly valuable for however carefully a description and illustration may be drawn, not all characters can be mentioned, and in case of a question it is quite necessary to have access to the type or original material on which the species was founded. The type is the last "court of appeal" in deciding the identity of a plant.

So important are the type specimens that they are often drawn out of the regular collection and kept by themselves in order that they may not suffer damage from repeated handling. Having preserved the type specimen of a species, it is then necessary to have other specimens of the same species from as many different localities as possible in order that we may determine the range of the distribution of a given species. This necessitates a tremendous collection for reference.

Such collections are used as bases for the publication of our various floras, among them Britton & Brown's "Illustrated Flora of the Northeastern United States and Canada," a work which is probably used in every college and university in this section of the world, and briefly known just as "Britton & Brown"; also Small's "Flora of the Southeastern States" which is the plant bible for that part of North America; and Rydberg's two Floras of the Rocky Mountain Region and of the Prairie States, equally important in those sections. The authors of all these books, our former colleagues, are dead and gone, but their works live on. And the collections on which these works were based are carefully preserved in our herbarium for future reference. These collections, together with something like 30,000 specimens which are added each year, will be used as the bases of other floras, some of which are now in course of preparation, looking toward a still better knowledge of the plants of North America.

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Gentian Walk in a Canadian Garden

How Gentiana Macaulayi, variety Wellsii, is Cultivated at Estevan Lodge, Grand Metis, Quebec

By Mrs. R. Wilson Reford

IT is a half revealed truth that gardeners, for the most part, differ from many of their fellow men in that when success has at length crowned their efforts, whatever may have gone before, toil, trial and error, disappointment after disappointment, failures, all are swept completely from memory—obliterated in the ecstasy of pure joy at the sight of the plants yielding up their loveliest rewards. For this reason, unless the amateur gardener is unusually persevering in keeping accurate records, he or she has little to offer by way of assistance to others when it comes to passing on more or less scientific information regarding the elements and conditions which have contributed to their particular achievements.

The present writer is no exception to this regrettable generality. However, as the cultivation of *Gentiana Macaulayi,* variety *Wellsii,* in the garden at Estevan has been comparatively simple it is possible that what there is to tell may be sufficient for some small degree of helpfulness to members of the companionage of gardening, who may wish to experiment in growing this matchless gem among alpine hybrids.

When the hybrid *Gentiana* x *Macaulayi* sprang from a Scottish garden into the orbit of the horticultural world it created a sensation and excitement such as only growers and hybridizers of flowers can comprehend. It was followed almost immediately by the further hybrid, x *Macaulayi* variety *Wellsii,* and both plants received an Award of Merit in London in September 1931. The difference between the two is very slight; *Wellsii* is generally considered to be even a better plant than the type.

So far as I have been able to ascertain, it has not been widely grown in the United States; therefore, before entering upon its story at Estevan, it might be well to mention some of its characteristics. It stems from far China, whose flora has so enormously enriched the gardens of today, for its parents are *Gentiana sino-ornata,* discovered by Forrest in Northwest Yunnan in 1904, and *Gentiana Farreri,* found by Reginald Farrer in 1914 in the alpine sward of northern Kansu-Tibet. *G. sino-ornata* is too well known to require anything being said about it here, but *G. Farreri* being much more rarely seen and bearing, as it does, so close a resemblance to the subject of this article, I cannot do better than quote indirectly from Farrer's own account of it:

> The superb *G. Farreri* sends out many flopping slender shoots from the stock, clad in very narrow foliage, and ending each in a single huge upturned trumpet, wide-mouthed, and of an indescribably fierce luminous Cambridge blue within (with a clear white throat) while, without, long vandykes of periwinkle purple alternate with swelling panels of nankeen, outlined in violet, and with a violet median line. As you see *G. Farreri* coming into bloom in mid-September in all the high alpine sward of the Da-Tung chain (Northern Kansu-Tibet) it is by far the most astoundingly beautiful of its race, reducing *G. verna* and *G. Gentianella* to the dimmest acolytes.

I share to the full Farrer's enthusiasm for the plant but take exception to his description of the colour as "a fierce luminous Cambridge blue," for it is something far lovelier than that; it is a turquoise blue at its very finest and it is the crossing of this shade with the intensely rich royal blue of *G. sino-ornata* that has given us the incomparably glorious flower of the *Wellsii* hybrid in its utmost brilliancy of blue—a colour that can sometimes be seen in a deep cloudless sky on October days in a northern climate.

Both plants, *G. Farreri* and the hybrid *Wellsii,* form the same kind of rosette from which, in early spring, spread branching shoots, but in the hybrid they are slightly larger in all their parts. Of the two, *Wellsii* has the stronger constitution. The difference in the formation of the blooms lies in *Wellsii* having more spreading corolla-lobes, thus giving the trumpets a wider appearance and making the whole flower rather larger than the *Farreri* parent.

As atmospheric moisture is the prime necessity for all gentians, at least as far as they are known to me, I ought at once to acknowledge that one of the major factors contributing to the successful growing of them at Estevan is that the place is situated on the banks of the Lower St. Lawrence river where the width of its salt waters approximates forty miles. Given such a position, with this large body of salt water flowing literally at the foot of the garden, it can readily be understood that there is an abundant supply of moisture constantly being given off; and, indeed, there is never a time when the plants which crave this life-giving element suffer from lack of it.

The growing of *Wellsii* began at Estevan in 1935 when some two dozen plants were purchased in England and the following year another fifty were imported. Prior to that, other species of gentians had been grown with sufficiently encouraging results to stimulate a deeper interest in the whole family. Gentian lore was sought out wherever it could be found and carefully perused; the Bulletins of the Alpine Garden Society of

The gentian walk at Estevan Lodge, Grand Metis, Quebec

England and the Journals of the Royal Horticultural Society proved veritable gold mines in which to quarry for the desired information. For five years *Gentiana Wellsii* was planted in various parts of the garden; the plants were even grown in the scree, where indeed they did extremely well. Nowhere did they fail to thrive, but in positions most favourable to them the increase was phenomenal; so much so that by 1940 the problem of providing them with greatly extended space had to be given consideration, if their cultivation was to be continued. By that time, through the experience gained in having grown the gentians under varying conditions and in association with various flowers, it had become clear that to obtain the full effect of their exquisite beauty, *G. Wellsii* should not be grown together with any other plant, and not even in too close proximity with others of the same race. There is a certain quality about these entrancing flowers, something that is perhaps best described as an aloofness in character, which renders their combination with other plants not only difficult but apt to produce an effect as of a sin committed against horticultural good taste.

To abandon growing *G. Wellsii* could not be contemplated. The alternative was to break new ground, and this was done. The ground prepared has since been named the "Gentian Walk" and is in the form of a curving path of 140 feet in length running between two borders of 4 to 4½ feet in width, a section of which is shown in the illustration on page 155. During the latter part of August, through September and well into October, there is to be seen, along that path, a miracle of beauty, for there, stretching out in long sweeps, are tens of thousands upon tens of thousands of the glorious blue trumpets of *G. Wellsii* at the height of its flowering. Truly a breath-taking spectacle.

It may be asked, how comes it that these plants of Asiatic parentage have adapted themselves so unreservedly to our Canadian climate and to a locality where winter temperatures frequently range down well below zero, while in summer the thermometer rises to over eighty degrees? The first answer to the question is, as already indicated, to be found in the ever present atmospheric moisture and the purity of the air, without which no gentian will flower, however well it may grow. The second is that their requirements have been met in regard to soil and their dislikes have been respected. Opinions differ as to their tolerance of lime but my own experience is that they most certainly do not require it for there is not the slightest trace of it in the soil where they are grown at Estevan. All are agreed that *G. Wellsii* will not endure a sticky or clogging sort of ground, that the plants must be given impeccable drainage, that the soil for them must be rich in humus and porous in texture. To accomplish this for the Gentian Walk at Estevan, the natural soil, which is chiefly of a forbidding sort of clay, was excavated to a depth of two feet and the first four inches filled in with beach stones about the size of an egg; after that six inches of gravelly grit and the remaining 14 inches given a mixture of two parts finely cut leaves, one part of peat and one of a gritty sand. Into this the gentians were planted and the whole strewn over with fine gravel. This gravel is, of course, not seen except in the spring when the plants are still in the rosette stage for the long shoots very quickly cover the ground completely. The borders are made with a very slight slope and this, together with the ample amount of grit incorporated into the soil, makes for the indispensable perfection of drainage.

The measure of care which *G. Wellsii* demands is more or less determined by the rainfall during the summer months, for the plants must never be allowed to become dry at the roots. If hot dry spells occur during mid-summer the gentians at Estevan are thoroughly drenched every second day with a sprinkler playing over them for hours, as even the atmospheric moisture is not sufficient to keep them in good health without water to the roots. In a cool climate, such as we have on the Lower St. Lawrence, gentians do best in full sun.

Given its dearest desires of moisture and soil ingredients, *G. Wellsii* will respond with such richness of increase that it may even become an embarrassment, for when that transpires, lifting and division become imperative. The prescribed time for this to be done is every three years, and if neglected the penalty is paid in general deterioration of the plants. In 1944 the time had come at Estevan for the *Wellsii* gentians to be divided and, though one absolutely quailed before the prospect of the labour it would entail, it was undertaken immediately after flowering in October.

Here perhaps there ought to be given a word of caution. All authorities on gentian growing, without exception, stoutly maintain that these, and other autumn flowering Gentians, should only be divided in early spring when they begin to show above the ground, but as circumstances make it impossible for it to be done at that season at Estevan, greatly daring, division has always been made in the autumn, and in no instance have the plants suffered any harm. When they were lifted last autumn they were so full with splendidly healthy strong roots that, with a view to their future well-being, each plant had to be divided into four as an absolute minimum for replanting, while into eight or ten would have been better—but where was the prepared ground for them!

Many of these gentians had produced from 150 to 200 blooms per plant, and naturally this wealth of flowering had exhausted much of the original nourishment put into the soil, so it was thoroughly reworked and finely cut leaves and peat were added in a two to one proportion. Directly after the snow will have melted in the spring and the ground is clear, the gentians are given a top dressing of leaves finely powdered in a grist mill. Into the borders of the Gentian Walk there were replanted in October 3,354 plants of *G. Wellsii,* many were sent to other gardens, while more than 2,000 were put into reserve to await the day when more time and labour will become available for the pursuit of the ancient craft of gardening—when the heavy war clouds will cease to cast their long, dark shadows of sorrow, and peace will return to men's lives over the face of the earth.

Tropical Plants the World Around

By Otto Degener

IV

Fourth in the series of articles based on the talks that were given by Otto Degener in the Botanical Garden's winter lectures, this is the next to the last in the series on "Plants of the Regions Where our Men and Women Are Serving." Illustrations used with Mr. Degener's articles are taken from his "Flora Hawaiiensis" or "New Illustrated Flora of the Hawaiian Islands" and "Plants of Hawaii National Park."

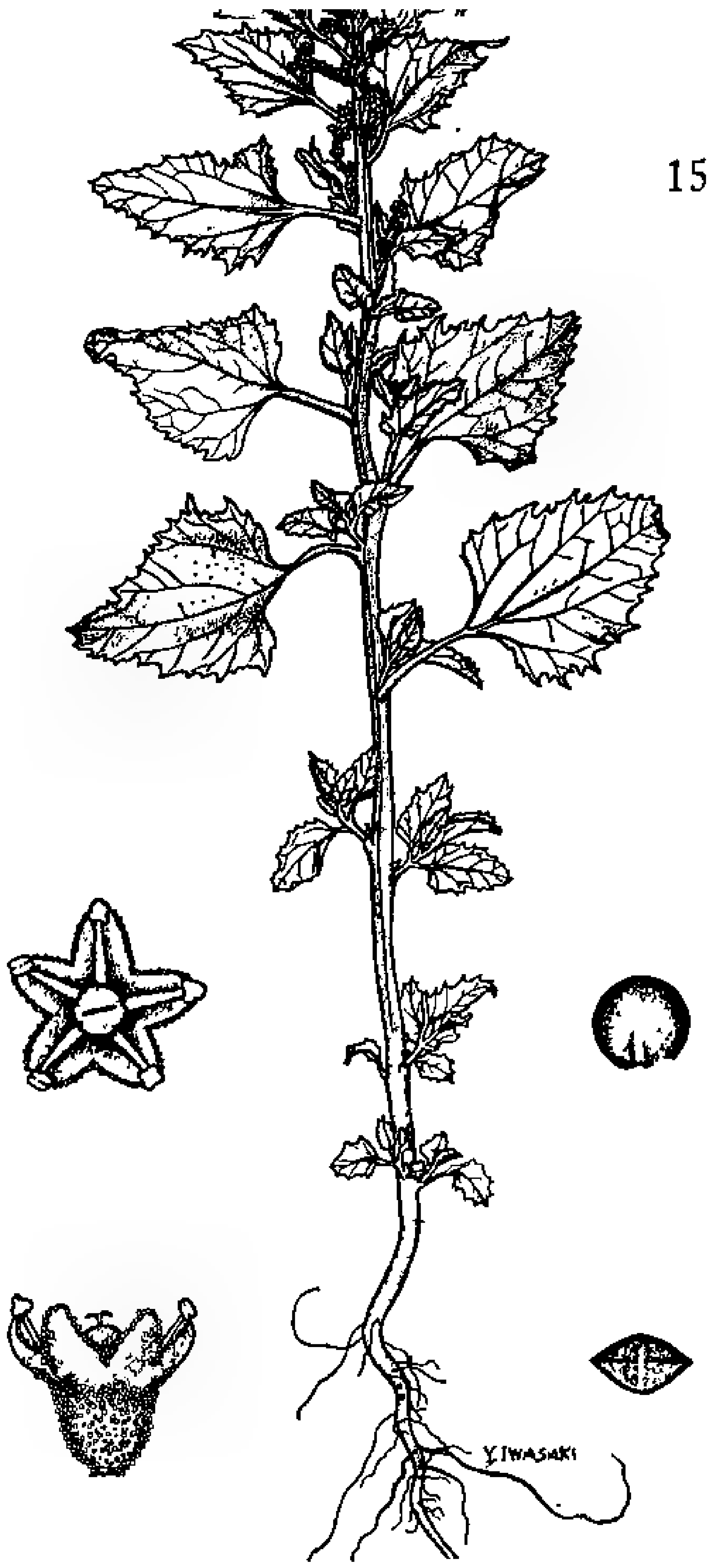
Next month's Journal will contain an illustrated article by Dr. Hugh M. Raup of the Arnold Arboretum on the flora of Alaska, from the Aleutians down the Alaska Highway, which he has explored.

PANAMA BERRY

THE PANAMA BERRY (*Muntingia calabura,* Linden family) is native from Mexico to the Amazon region. Though it deserves a place in every garden in the tropics, it has been introduced as yet into few regions besides Hawaii, Java, Siam, and the Philippines. The genus, of which it is the sole member, was named after Prof. Abraham Munting (1626-1683) of Groningen. An aberrant species, it shows so many characteristics typical of the Elaeocarpus family that some authorities place it there instead of in the Linden family.

A spreading, quick-growing tree becoming 45 feet high, the Panama berry has slender branches that are hairy and slightly clammy. These in turn bear leaf blades that are hairy on both sides and obliquely attached to their short stalks. The flowers, which arise in clusters in the axils of the leaves, are about an inch across, and have crisped petals of white or occasionally pink.

Though the tree is ornamental and unusual in appearance, its main delight, especially to children, is the roundish red berries which mature abundantly throughout most of the year. They are well over half an inch wide and are filled with a seedy but edible, juicy, sweet pulp. Those who eat the jam-like berries at afternoon tea can likewise regale themselves with a tea-like infusion of the leaves. Thus this tree when planted in the garden can give grateful shade, beauty, food, and drink, all at the same time.

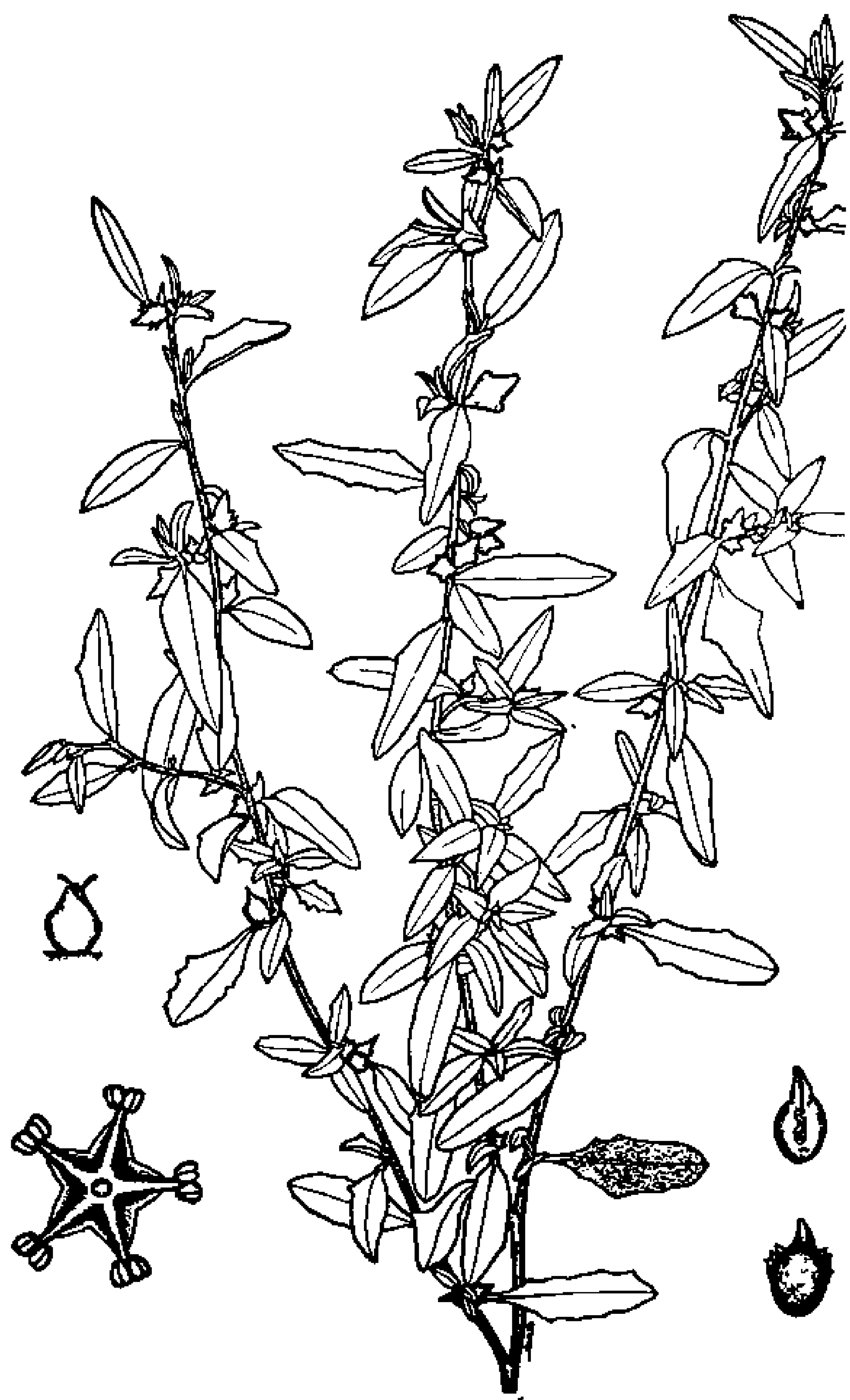


SEMI-BACCATE SALTBUSH

THE SEMI-BACCATE SALTBUSH (*Atriplex semibaccata,* Goosefoot family) has a long taproot, slender 1- to 3-foot branches that spread over the ground in all directions, minute male and minute female flowers, and many narrow 10-inch leaves often irregularly and obscurely toothed. These leaves are thick, gray, salty and, especially beneath, scurfy. The characters of the plant earmark it a xerophyte, or plant adapted for living in deserts—or at least in very dry situations. This is true. It is native to hot, dry regions of Australia. Besides being a xerophyte, this saltbush is likewise a halophyte, namely a plant which loves salt or at least tolerates a high percentage of salt or alkali in the soil. These qualities and its palatability to livestock have induced ranchers in many arid regions to plant it. The shrub has often found conditions so favorable in its new ranch homes that it has escaped and become naturalized, for instance, in Hawaii,

NETTLE-LEAVED GOOSEFOOT

THE NETTLE-LEAVED goosefoot, shown above, (*Chenopodium murale,* Goosefoot family) is an erect, evil-smelling, quick-growing annual, becoming 8 to 16 inches high, the larger plants frequently branching near the base. The leaves are thick, pale green on both sides, irregularly toothed and often mealy. The flowers are very small, green, and borne in clusters in the axils of the upper leaves. The mealiness of the plant, especially noticeable in the flowers, is due to minute hairs, which at the tip are enormously swollen with sap to form an easily loosened ball. The seed is black, shiny, very small, and produced in great abundance. Though this goosefoot is a native European weed, it has become naturalized in the New World as far north as Canada, and has gained a foothold in many warm and tropical regions also. It thrives in pastures, cultivated fields and even in salty, dry, beach sand close to the ocean waves.



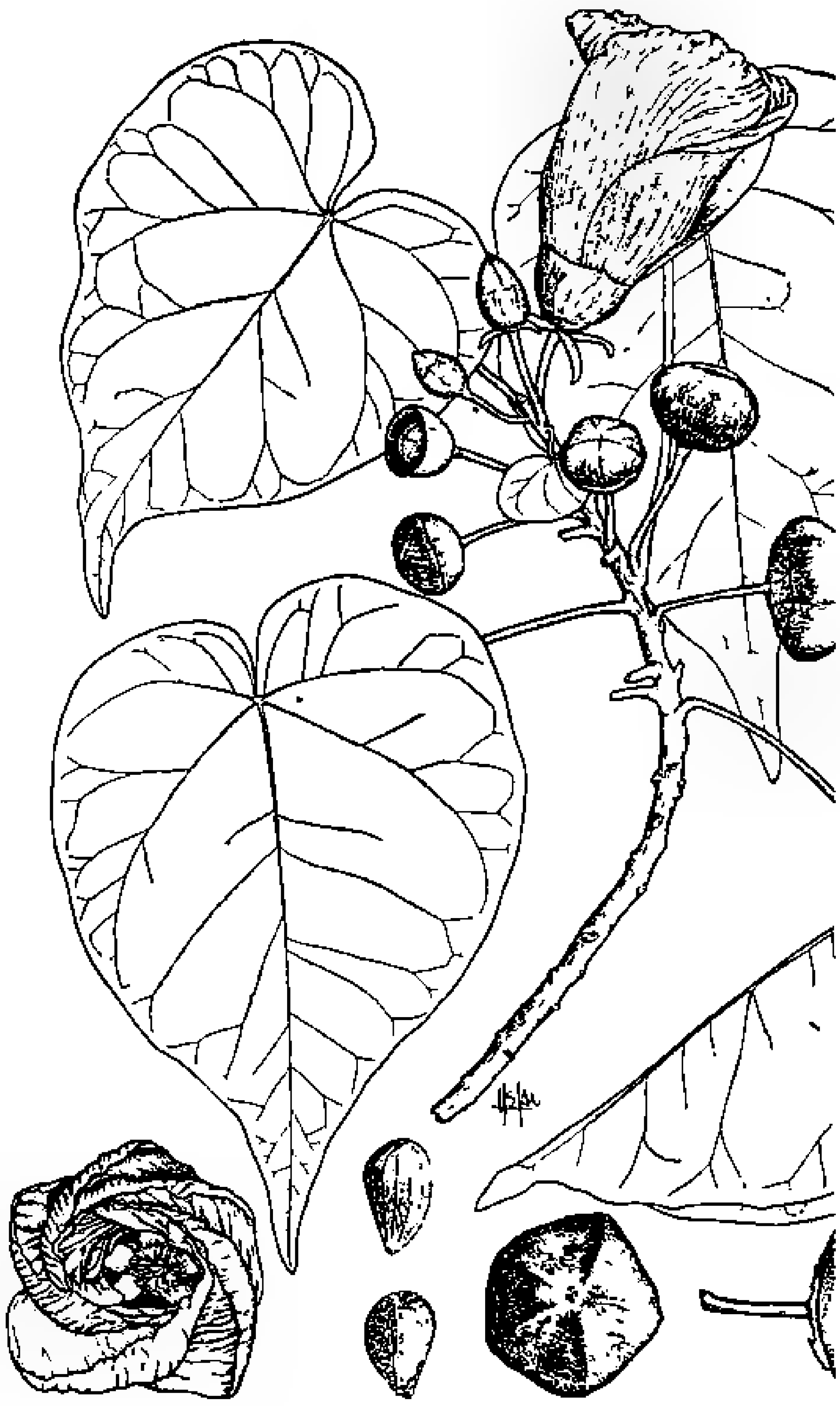
California, Arizona, and southern New Mexico.

The saltbush does not have particular value as forage for cattle and sheep where the more common range plants grow, but rather, it is important in furnishing stock with a nourishing, juicy feed to tide it over periods of drought when other plants have disappeared. It also enables stock to be pastured on ground too strongly impregnated with salt or alkali for the better feed plants to grow.

The quarter-inch-long fruit of this saltbush bears two modified leaves, or bracts, each finally becoming crisp, red, and watery-fleshy with a peculiarly sweetish salty juice.

PORTIA-TREE

THE PORTIA-TREE, or MILO of the Hawaiians (*Thespesia populnea,* Mallow family), has a predilection for growing near the ocean, where it makes an erect tree usually 15 to 30 feet high. It probably originated in the Old World but has been distributed during prehistoric times in the islands of the Pacific, in north Australia, in Indo-Malaya, along both coasts of Africa, and in the West Indies, probably reaching the latter region in the form of seed carried from west Africa by the main equatorial current. Such migration is possible as the seed, even after floating a year in sea water, can germinate and develop into a new plant.



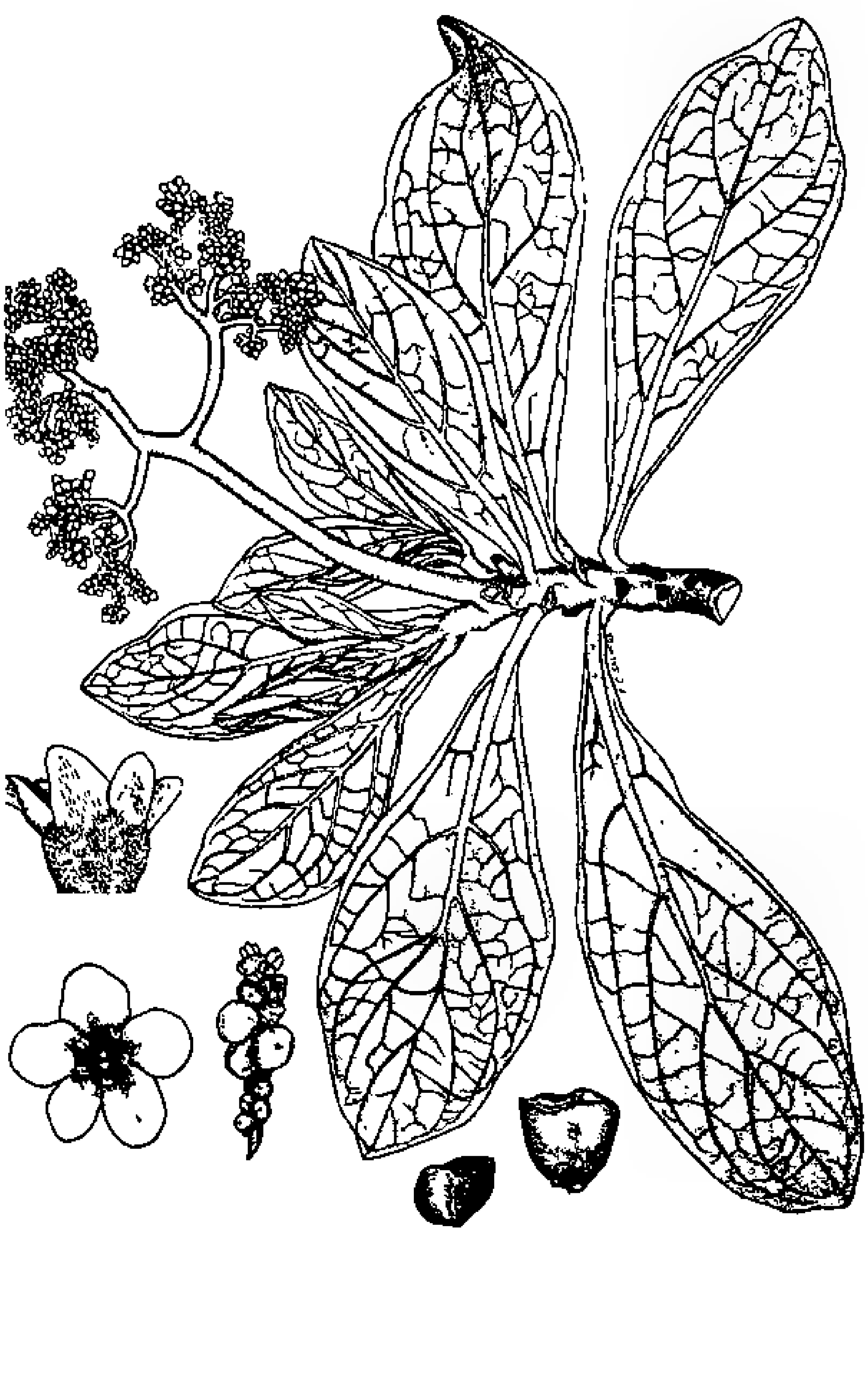
The leaves of the MILO are more or less heart-shaped, firm in texture and somewhat fleshy. In their axils appear the large, pale yellow, rather wrinkled flowers, which, like those of the related HAU, deepen toward evening to orange before eventually falling. The fruit is a brown, roundish, obscurely 5-angled capsule almost 2 inches across. It is leathery-corky and scarcely if ever breaks open except by decay. Like the seed, it is admirably adapted for distribution by the ocean.

The milo is not an attractive tree, but it thrives and produces dense shade in the drier coastal regions where most other plants would die; therefore, it has become increasingly popular for planting about beach homes. It is easily propagated, a limb stuck in the ground soon striking root and becoming established.

The peoples of Asia held the milo in such high esteem that Linnaeus named it *Thespesia,* a derivative of the Greek word for "divine." Its heartwood is highly prized, for it is heavy, hard, brown, curly-grained, and takes on a beautiful polish. Though not easily worked, it makes good timber for boat building, being nearly indestructible in water and almost immune to the ravages of termites. It is also valued for cart wheels and furniture. The Hawaiians and other islanders fashioned calabashes from it. They also used the seeds of the milo as a cathartic, and its inner bark for rope and twine. In times of famine its leaves, flower buds and flowers were eaten raw or cooked. Portia-nut oil, a thick, deep red substance, is gained from its seed.

VELVET-LEAF

THE VELVET LEAF (*Messerschmidia argentea,* Borage family) is a shrub or small tree often found along the sea coast in the South Seas. At the ends of its branches it bears tufts of thick, fleshy, brittle, more or less oblong leaves which are conspicuously covered with silvery hair, accounting for the plant's common name. The small flowers are white and numerous, borne in long-stalked terminal clusters which droop with age. The roundish, fleshy fruits, which are green even when ripe, are barely a quarter of an inch wide. They are furnished with corky tissue, which gives the plant an efficient means of dissemination by ocean currents. As a result, the velvet-leaf may be found growing wild throughout coastal regions from tropical Asia to Mauritius, Malaya, tropical Australia and most warm islands of the Pacific except Hawaii. The plant is, however, grown for ornament in Hawaii and in many other regions where it did not grow naturally, or wild, before. On many sandy South Sea islands the velvet-leaf is the tallest plant, affording prized nesting sites for sea birds. On many others it shows itself to be more adapted to strand life than even the coconut, forming a fringe seaward of this palm and actually touching the water at high tide with its branches.



Besides its value in enhancing the beauty of coastal gardens, the velvet-leaf has little importance. Its wood is worthless except for kindling. The leaves are sometimes eaten raw in times of scarcity, and in the Seychelles are dried and then smoked as a substitute for tobacco. In Samoa the plant is used in making a hair tonic.

DATURA

MULTIPLE FLORAL PARTS, as in the flower shown here, are typical in one form of the Hindu datura (*Datura metel,* Nightshade family). Native to the East Indies, the species now may be found in several varieties and forms which are grown for ornament or curiosity. Occasionally they become naturalized in fields and waste places in warm regions. This datura is a coarse perennial herb or shrub commonly 2 to 3 feet high, with ovate leaves and very fragrant, pale yellow, erect flowers about 6 inches long. The fruit is an erect yellowish capsule covered with blunt spines and opening somewhat irregularly to liberate many flattened yellowish seeds.

There are a dozen or more kinds of datura, all built on the general plan of the Hindu sort, and easily recognized as being related to it. The most common kind is the Jimson-weed, or Jamestown-weed, of tropical and temperate regions. The flowers of this are white to violet, the leaves somewhat lobed, and the capsules very prickly.

All portions of the plant are dangerously poisonous when eaten, the seeds most of all and the roots the least. Even honey made from the nectar may be dangerously poisonous. In fact, all daturas are poisonous, many of them deadly so. The poisonous principle is daturine, a mixture of atropine and hyoscine or hyoscyamine, the proportions varying according to the particular kind of datura. In case of poisoning, the patient should be induced to vomit; then, under a doctor's direction, be treated with morphine,

physostigmine, or caffeine. The drug is sometimes useful in relieving spasmodic asthma. The narcotic and intoxicating qualities of daturas have been known from time immemorial, and have been used in folk medicine and in religious rites by various peoples in both the Old and the New Worlds.

BRUGUIERA

ONE OF THE ELEMENTS of the mangrove swamp is the bruguiera (*Bruguiera sexangula*, Mangrove family), here pictured. The tree becomes 50 to 75 feet high but begins to flower when only 15 feet high. The leaves and branches closely resemble those of the common mangrove but the flowers are radically different. They are single in the axils of the upper leaves, waxy, nodding, longitudinally ridged, and about 1½ inches long. The calyx bears 9 to 11 narrow orange-red lobes. The 9 to 11 petals are orange-yellow and curiously split, and their outer borders are fringed with hair. The fruit consists of the persistent calyx lobes surrounding the enlarging root of the developing seedling, but this root never lengthens to the remarkable extent of that of the true mangrove seedling.

The bruguiera is native from India to southern China and Malaya, growing in salt marshes and estuaries. It is naturalized in Hawaii, where it had been introduced in 1922 to aid in reclaiming mud flats from the ocean and to help turn them into dry land. Another bruguiera (*B. gymnorrhiza*) grows in India, Malaya and Samoa. The Malayans eat its bark, leaves and fruit.

COCONUT

NIU or a variant of that word is the name by which the coconut palm (*Cocos nucifera,* Palm family) is known to the South Sea islanders and most peoples of the Orient. The tree is native to tropical Asia or thereabout. Its extensive distribution in maritime regions of the Old World since time immemorial is probably due as much to the fibrous husk that can float the nut for months in the ocean as to prehistoric man who carried the nut as food and drink on his long canoe voyages throughout the Pacific. Only years after the discovery of America by Columbus was the coconut introduced into the New World tropics, and now it flourishes there as though it were native. That early traveler, Marco Polo, definitely referred to "Indian nuts" growing in northern Sumatra, in the Nicobar Islands, and along both coasts of southern India. He described them as "of the size of a man's head, containing an edible substance that is sweet and pleasant to the taste, and white as milk. The cavity of this pulp is filled with a liquor clear as water, cool, and better flavored and more delicate than wine or any other kind of drink whatever." The word copra, the name of the dried meat of the coconut, is derived from the Sanskrit KHORPARA given to the same substance. This shows that the coconut must have been known in India from very early times.

The coconut tree never stands stately and stiffly erect like the royal palm—it curves upward from a slightly reclining and swollen base. The slender trunk, elastic enough to sway without snapping in all but the severest storms, may rise as much as a hundred feet into the air. It is topped with a massive crown of leaves, each 10 to 20 feet long and having about 100 leaflets on each side. Such a tree may be 60 to 70 years old, though individual trees may live 100 years or longer.

According to one observant writer: "From the time the tree is about ten years old it produces clusters of flowers one after another in continuous succession until its death. These are axillary and dependent for most of their nourishment on the leaf immediately below them. If this leaf be cut away, the flower cluster dies. To protect the flowers from injury during their development, the entire cluster is enclosed by a massive green structure termed the spathe. This finally bursts apart due to the pressure exerted by the enlarging flowers, and liberates them. The entire cluster consists of about thirty-five spreading branches, each thickly beset with several hundred closely pressed staminate, or 'male,' flowers. Toward the base of the lower branches, only a few pistillate, or 'female,' flowers develop.

"Each 'male' flower blooms but a single day, those toward the top of the cluster opening first. As thousands of these flowers are found in a single cluster, it takes almost a month until all have opened to expose their pollen. Some of this is undoubtedly carried away by insects which have been attracted to the flowers by nectar that exudes from three centrally located glands. Usually several days after all the pollen-bearing flowers of a cluster have bloomed and fallen, the large, globular pistillate, or 'female,' flowers bloom. This process is obscure, consisting mainly in the secretion of nectar toward their apex and the exposure of tissues receptive to pollen which the wind or some insect may perchance carry to it. Only then can the flower develop into a fruit. Since 'female' flowers bloom only after the 'males' have decayed, it is utterly impossible for the former to become pollinated with pollen borne in the same cluster."

This authority did not know that in Fiji and in many other South Pacific regions, parrots and flying foxes, or fruit-eating bats, with a wing-spread of almost a yard, likewise aid in cross-pollination of the coconut.

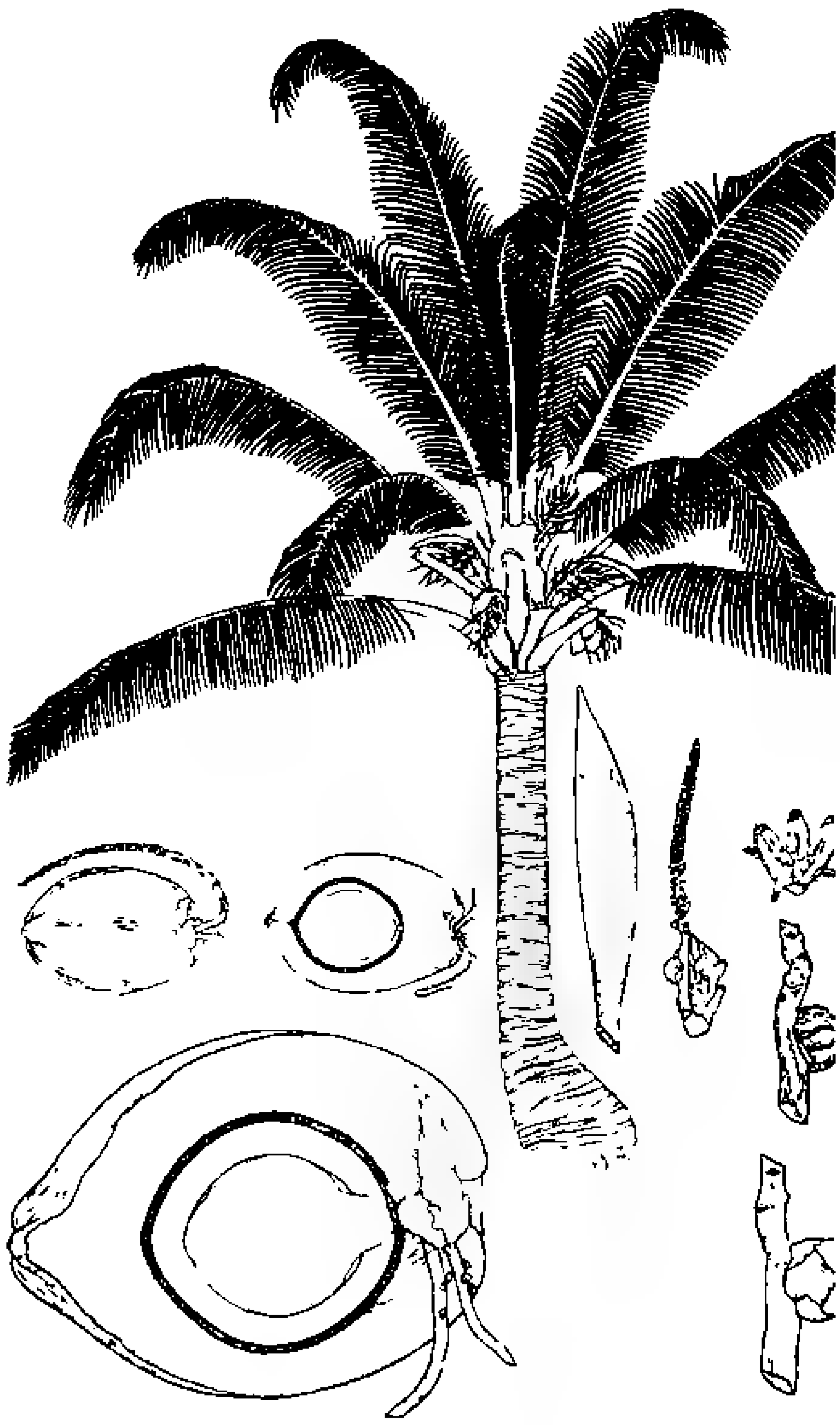
"About ten months after the bursting of the spathe," he continues, "the pistillate flowers have developed into fully grown fruits known as coconuts, which are completely ripe about five months later. Technically, these are not nuts at all but rather drupes, being characterized by an outer fibrous layer, or 'husk,' that surrounds an inner stony layer, or 'shell.' In the Malayan NAWASI variety, curiously enough, this husk is actually edible.

"The shell of all coconuts is marked with three 'eyes' near the stem end. These are germinal pores of softer tissue. Through one, which has a plug that lifts out with comparatively little pressure from within, the single seedling forces its way to freedom. The two remaining pores are useless to the plant. They are vestigial structures suggesting that the ancestral coconut palm bore fruit containing three seeds instead of just one.

"Within the shell of the coconut lies the white 'meat' or solid endosperm which is not part of the embryonic plant, but merely food stored up for its development by the parent. The embryo itself is a minute structure imbedded in the endosperm near the 'eye.' The liquid, commonly termed 'milk,' which fills the cavity of the young coconut, is likewise food for the embryo. It is the liquid endosperm.

"In falling from the tree, the ponderous seed is well protected by the thick husk from cracking. If it falls in a not too unfavorable locality, germination begins with the enlargement of the embryo and the growth of its first leaf or cotyledon into the cavity surrounded by the solid endosperm. Instead of being a foliar structure, this cotyledon is a white, spongy sphere, termed the haustorium. As this enlarges and presses against the endosperm, the latter disappears. This is because the haustorium first secretes a chemical substance, or enzyme, which dissolves the solid endosperm, whereupon it is readily absorbed and used for food. While this is going on, the stem of the seedling grows out through the 'eye' by pushing aside the plug. It then proceeds to bore through the husk to freedom. Meanwhile, roots have grown from the stem, just beyond the 'eye,' which ramify throughout the husk for nourishment and moisture. Finally the haustorium decays as the parental nourishment is exhausted, the roots penetrate the soil for mineral salts, and the stem unfolds its leaves in the sunshine, where they can synthesize food to maintain life. Thus about ten months after the fruit began to germinate, the young coconut has become established in the soil."

The coconut palm is the most valuable plant of the South Sea islanders. The long trunk was hollowed out and made into a canoe or, cut into segments, was fashioned into shark-skin drums. The leaflets, stiffer than the leaves of the screwpine, were ideal for plaiting into fans but, for that reason, made only mediocre mats. The slender midribs of the leaflets, tied together near the base, furnished the islanders with a useful broom. Singly, the midrib served to spit



the kernels of dried candlenuts to form the torch used to illuminate the interior of their houses at night. The massive midrib of the leaf itself was made into a musical instrument which resembled a jew's-harp, one end being placed between the teeth of the player. The rich brown, fibrous sheath at the base of each leaf served as a sieve. The stiff old flower cluster was used as a garden rake. Coir, the fiber derived after retting the husk, was occasionally used as a sieve. Its chief use, however, was in forming braided or twisted cord and rope of great strength. Coir is an important article of commerce today, being used also for brushes. It lies in the form of a mat before many a house door in Europe and America.

When Europeans, hatted and bonneted, drifted into the South Seas, some of the natives, trying to ape the immigrants, fashioned head-gear. They slit coconut leaflets in half lengthwise. This exposed the thread-like veins on each side. These were removed, cleaned and woven with such skill that the hats made from them were impervious to water. Nowadays urchins in Hawaii take a single unfolded, delicate, still yellow leaf from the crown of the palm and plait it into broad-brimmed hats to sell for a pittance to tourists who fail to realize that each hat they thoughtlessly buy probably spells the doom of an entire tree. Palms having no side branches die when their single delicate terminal bud is injured. This bud, termed the "cabbage," is edible either raw or cooked—but again, the use of it ends the life of the tree.

The coconut itself is of immense value to Pacific islanders. In fact, on many atolls where the infrequent rains are quickly absorbed by the parched coral sand and where wells supply only brackish water, the clear liquid endosperm, or "water," of the coconut is practically the only drink available for the thirsty natives. It is at its best when the coconut has reached full size yet is still unripe. At that stage the solid endosperm, or "meat," is soft and toward the cavity of the nut is transparent and jelly-like. This meat, edible at all stages, finally assumes the hard white condition known to all of us as the copra of commerce. The islanders scarify or grate the fresh meat and then express from it a milky liquid termed by them the "milk," the name applied to the watery endosperm by most Occidentals. They also gain from it an edible oil. To this they may add leaves or flowers of fragrant plants before using it as a lotion to annoint their hair and body. The haustorium of the seedling furnishes them with a light crisp fragrant food suggestive of a delicate cup cake. The shell can be beautifully polished and made into dishes and utensils. Because of its great value, there is little wonder that many island people venerate the coconut.

Commercial copra growers add to their revenue by pasturing stock among the older palms, training pepper plants to creep up the palm trunks, or planting their palms in alternate rows with rubber trees. The copra industry is an enormous one. Besides the use of shredded coconut for cakes and candies, copra is the source of oil for cooking, for the manufacture of many palm and vegetable oils, and for countless other industrial uses.

GOLDEN-SHOWER

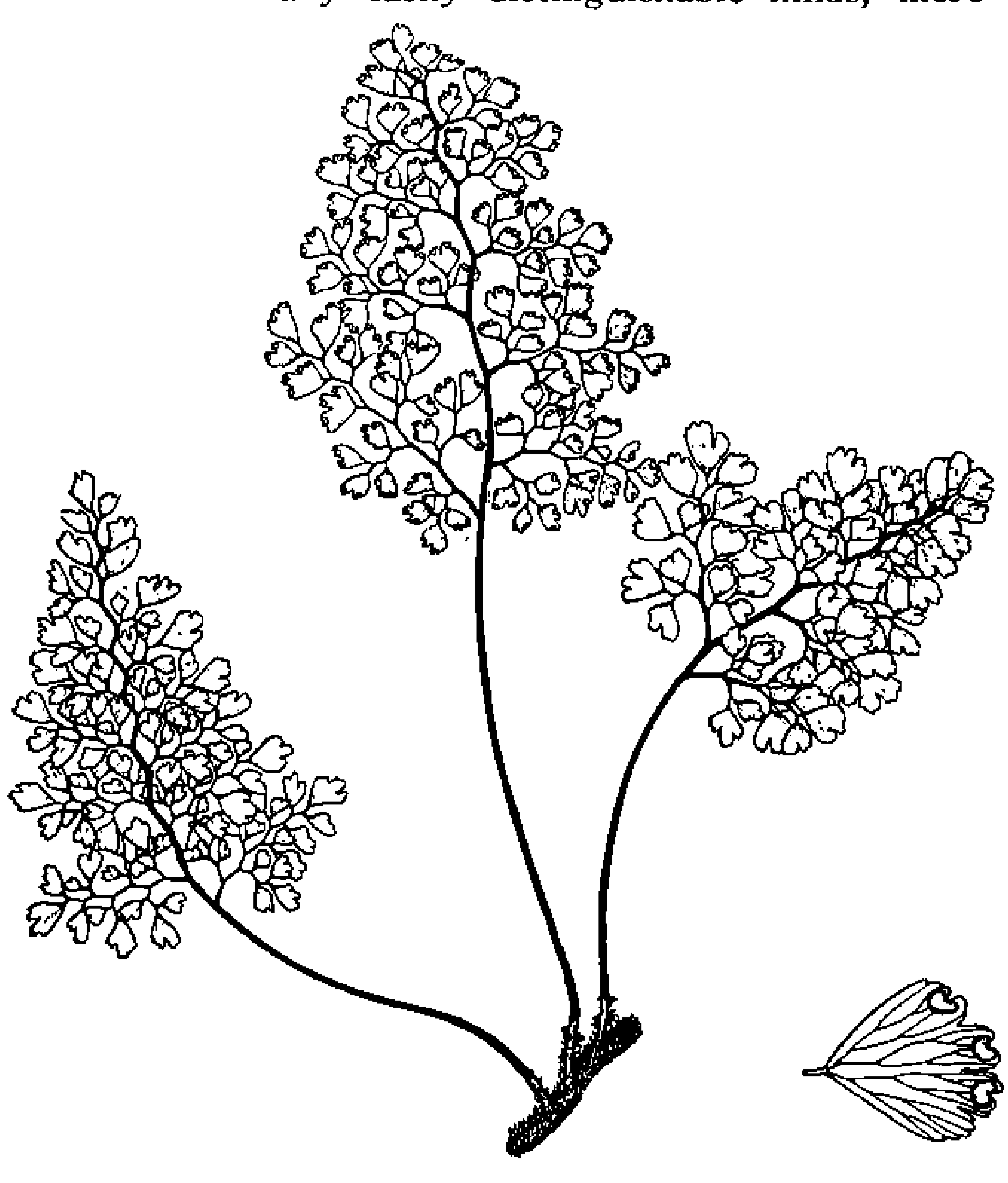
ONE OF THE MOST BEAUTIFUL trees planted in gardens and along streets in warm and tropical regions is the golden-shower (*Cassia fistula*, Pea family), a native of Asia. It thrives in moderately dry situations, and almost equally well in wet ones. It becomes 30 feet high, and bears large pale leaves, each with 8 to 16 roundish leaflets. The bright canary-yellow flowers are almost 2 inches across, and hang in abundant and magnificent clusters from the branches before the appearance of the leaves. The pendent pods are dark brown, 2 feet and more long, and contain hundreds of thin cross-partitions enclosing a blackish pulp and pale brown seeds. The pods look like so many pieces of old, slightly bent pipe hanging from the tree

and therefore the plant is known in some countries as the "pudding-pipe tree." These pods are the cassia pods of commerce. Their pulp is medicinal; it is edible and purgative. The bark is used for tanning. In Mysore the branches are put in the ground and worshipped, while the flowers are used as temple offerings.

MAIDENHAIR FERNS

MAIDENHAIR FERNS (species of *Adiantum,* Fern family) are numerous in the tropics, particularly in the New World. They are delicate, shade-inhabiting plants with wire-like leaf stalks of polished dark purple or black and fragile-looking fronds composed of wedge-shaped segments that are usually water-repellent. These segments appear to flap over at their ends and in such protected pockets are produced the spores, or reproductive bodies.

When plants have an extensive distribution, inhabiting isolated islands, for example, they are apt to develop localized or insular peculiarities. The maidenhair fern is no exception. While there are many easily distinguishable kinds, there



are many more varieties and forms abo the precise identification of which ev the fern experts disagree. There a however, three main kinds which t wanderer is apt to see in the open warm and tropical countries or in t greenhouse in temperate and cold on These are: (1) The southern maidenh or, as the scientific name would have the "Venus-hair" (*A. Capillus-Veneris* of temperate and tropical regions of t New World and of warmer regions of t Old. It is very variable and many autho ities consider the Hawaiian plant, he figured, one form of this species, while few do not. (2) The delta maidenha (*A. cuneatum*) of Brazil, cultivated l horticulturists throughout the world at least 15 recognizable varieties a forms. (3) The brittle maidenha (*A. tenerum*), native of tropical Americ

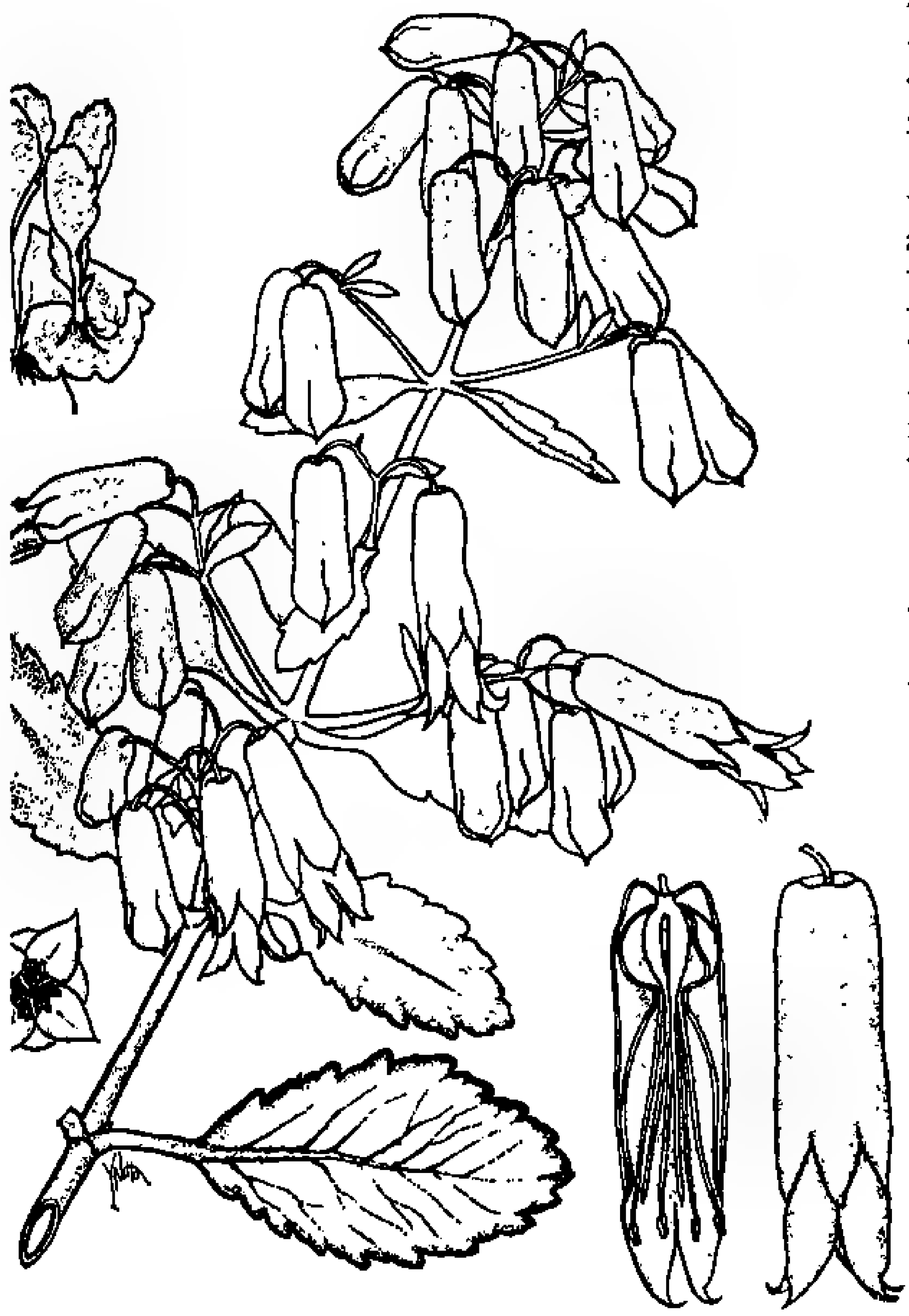
Besides providing horticultural subjec of great beauty, these ferns are of litt use to man. In former times a few ha been used in the preparation of a syr known as "capillaire."

AIR-PLANT

EVEN BEFORE a mature leaf of . air-plant (*Bryophyllum pinnatu,* Orpine family) has fallen to the groun a young plantlet may develop from ea notch around the edge, complete wi roots, stem and leaves. This precocio ability of reproducing asexually, whi has led to the vernacular name of "ai plant," is so sure, and the plant is resistant to ill usage, that it is found most botanical laboratories as an aid teaching. Even a detached leaf pinn to a window curtain will give rise young plantlets while thus suspended the air.

First scientifically described fro specimens found in Mauritius, the a plant is widely naturalized in the tropi It prefers dry, rocky, extremely sha waste places though it will also grow the sun. It is a smooth, very fleshy he somewhat woody at the base. Its leav are thick, brittle, 3 to 8 inches long, a strongly notched. To the taste, they a slightly sour.

Though the air-plant in the vegetati state is only half a foot or so high, flowering it shoots up an erect stem abo 3 feet high, which bears spreadi branches at the ends of which hang flo ers resembling miniature Chinese la



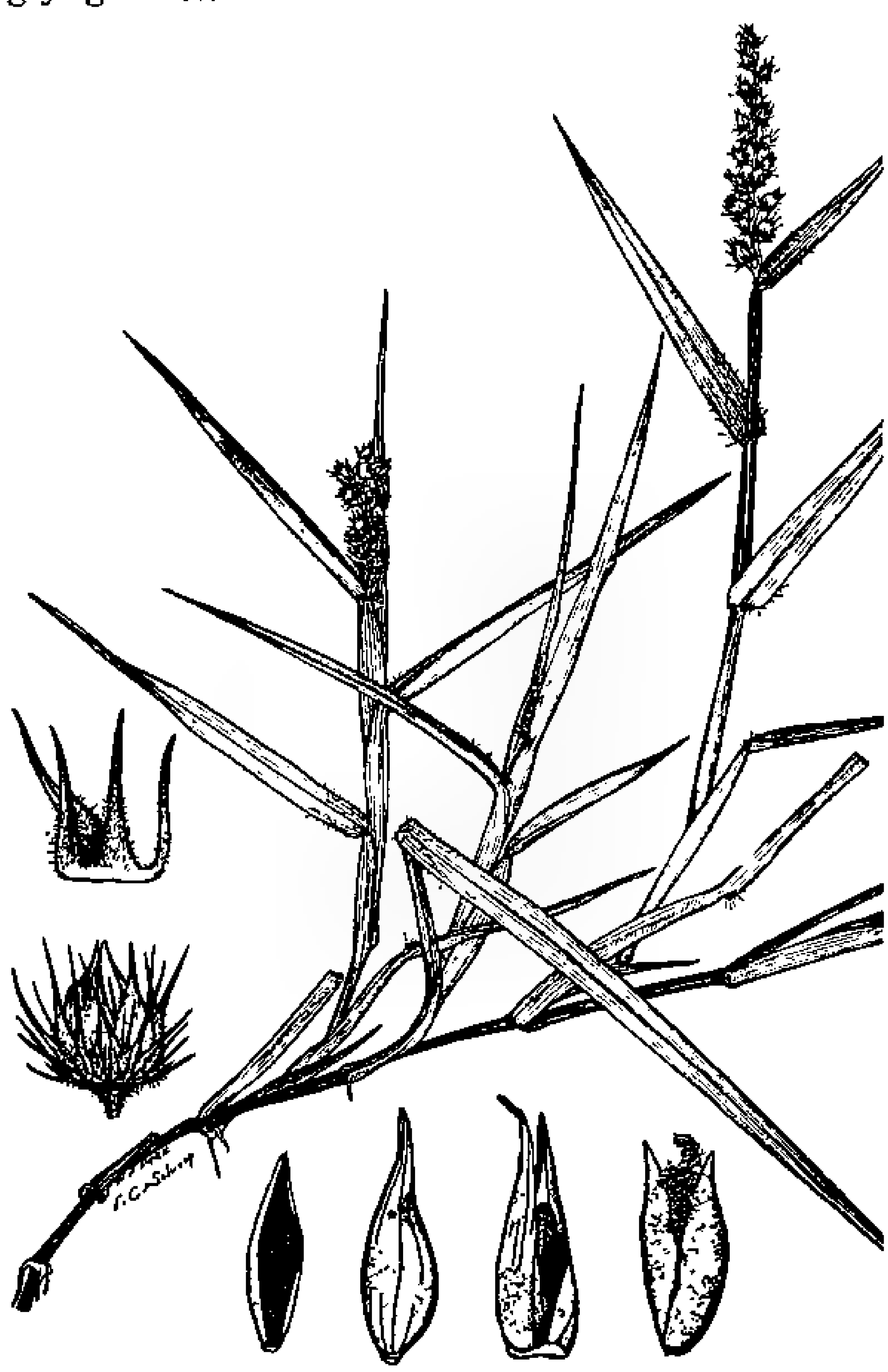
terns. These are about 2 inches long, green at the base, and toward the tips the four narrow petals are progressively flesh-colored. Children grasp the calyx at the open end and "plop" it like an inflated paper bag. They likewise rub the leaves to loosen their epidermis and then blow these skins up into little bags for bursting.

The flower is pollinated chiefly by sphinx moths, at least in Hawaii, and develops into a many-seeded capsule-like fruit. The air-plant probably owes its abundance not so much to its seeds as to its efficient means of reproducing plantlets adventitiously.

SANDBUR

THE COMMON SANDBUR (*Cenchrus echinatus,* Grass family) has about two dozen relatives scattered throughout temperate and mainly tropical regions. The one here figured is native to the southeastern United States and tropical America, and is naturalized in the West Indies, many of the South Sea islands, and Malaysia.

The sandburs prefer dry fields and waste places, especially in the lowlands and along the coast. They have a slight value as forage for cattle by growing where better pasture plants are rare. They are, however, primarily weeds—often painful ones. Instead of tasselling into many graceful clusters of spikelets, these structures become enclosed by retrorsely barbed bristles to form burs that break loose at the slightest touch. The bather walking through the dunes will not do so carelessly where these grasses are found. The properly shod walker will find the burs tearing his stockings and pricking the skin. In removing them from his clothes, the spines often prick, and because of their retrorsely barbed hairs, adhere to the fingers and draw blood. All in all, the sandburs are ugly grasses.



L. C. Bobbink Honored With Medal At Rose-Growers' Program

FOR "outstanding achievements and service to the rose," Lambertus C. Bobbink, dean of America's rose growers, was presented the Gold Honor Medal of the American Rose Society during the program at the third annual Rose-Growers' Day at the New York Botanical Garden, June 13. In making the presentation, Harry L. Erdman of Hershey, Pa., President of the Society, said in part:

"The American Rose Society thus brings recognition to the man who more than any other is believed responsible for the widespread use and successful culture of roses in America today."

After briefly reviewing Mr. Bobbink's life, which began in Holland nearly 80 years ago, Mr. Erdman recalled Mr. Bobbink's innovation in an understock for roses to be grown in America, in using a form of *Rosa multiflora,* instead of the formerly accepted Manetti and canina understocks, which had never been successful here. "In addition," he said, "Mr. Bobbink's introduction of many new hybrid tea varieties did more than anything else to increase the use of garden roses in America. To him great credit is also due for conserving and reintroducing the charming old-fashioned roses to the gardens of today.

"It is appropriate," he concluded, "that the medal should be presented in the garden which holds greatest interest for him. His uncanny instinct for what is best in plants has brought great horticultural riches to America, and his popularization of the rose has had far-reaching effects. All rose enthusiasts honor him as a great rosarian."

Rose-Growers' Day, which was arranged again in co-operation with the Second District of the American Rose Society, of which Paul F. Frese, Editor of the *Flower Grower,* is Chairman, served to bring together more than 200 rose enthusiasts from the eastern states. Most of them came

ON THE OPPOSITE PAGE

Rosarians, both amateur and professional, gathered at the New York Botanical Garden June 13 for the annual Rose-Growers' Day. Some who were seen on the platform and in the rose garden are shown on the opposite page. 1. L. C. Bobbink receives an award of honor from the American Rose Society through Harry L. Erdman, President. 2. Mr. Bobbink and Robert Pyle discuss the new yellow rose called "Peace." 3. George A. Sweetser gives sound advice on soils and fertilizers for roses. 4. Dr. William J. Robbins (right) talks with Philip Cox, Jr., Robert W. Eisenbrown, and Ludwig Menne (left to right).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early to view the garden of nearly 8,000 roses in company with Mr. Bobbink and his associates in the firm of Bobbink & Atkins.

The formal program began at 11 o'clock with Mr. George A. Sweetser of Wellesley Hills, Mass., Executive Secretary of the New England Rose Society, speaking on "Soils and Fertilizers for Roses." He was followed by Dr. H. A. Gleason, Assistant Director and Curator at the Botanical Garden, on the topic "A Botanist Looks at a Rose." Dr. R. C. Allen of Harrisburg, Pa., Secretary of the American Rose Society, presided during the morning session and Mr. Frese in the afternoon, which was taken up with a round-table discussion for rose growers. At noontime picnic lunches were eaten under the trees in the vicinity of the rose garden.

The complete addresses given by Mr. Sweetser and Dr. Gleason will be published in later numbers of this Journal.

T. H. Everett, the Garden's Horticulturist, was moderator for the afternoon's round-table discussion on the culture of roses. Among those who took part in the answering of questions, besides Mr. Bobbink, Dr. Allen, Mr. Frese, and Mr. Erdman, were Dr. L. M. Massey of Cornell University, R. W. Eisenbrown, secretary of Bobbink & Atkins, Robert Pyle of Conard-Pyle Company, J. H. Beale of the Boyce Thompson Institute, and Mrs. Charles Doscher, amateur rose grower, who is a member both of the New York Botanical Garden and the American Rose Society.

Plants and Their Significance In the Life of Man

By William J. Robbins

Presented May 14 as the first of five informal talks given by staff members during Garden Week at the New York Botanical Garden.

PLANTS are the basis upon which all other life depends. In the last analysis they supply us with all the food we eat, they maintain the oxygen content of the air and they are the primary source of those important accessory foods, the vitamins. Without plants we would starve to death, die of suffocation and expire from a combination of deficiency diseases.

The essential relation of plants to the food we eat, the air we breathe and the energy we dissipate with such reckless abandon is based on two of their characteristics. These are their ability to store the energy of the sun's rays in sugar, starch, cellulose, oils, fats and other constituents of the plant body, and their ability to construct from simple and elementary substances types of chemical compounds necessary for the existence of animals, including ourselves.

The first of these powers, limited from a practical standpoint to plants which possess the green pigment chlorophyll, is the familiar process of PHOTOSYNTHESIS in which the plant transforms water obtained from the soil and gaseous carbon dioxide from the air into sugar and oxygen.

The details of how chlorophyll works are, however, still unknown, and the basic and essential character of the process is not yet a part of our national thinking. If it were, the small group of men who are attempting to discover how photosynthesis occurs—that is, how plants store the sun's rays—would receive more encouragement and assistance than they do, and in the discussions of the future of synthetic rubber made from petroleum we would see some consideration given to the wisdom, from the long view, of using petroleum in quantity to make something which can be produced from the air and water by the activity of plants.

We can say that the coal and petroleum burned annually represents a net loss of potential energy, and *we can also say that in time, though not in what time, we will have to depend upon the energy fixed annually by plants unless some other source at present not at our command, for example, atomic energy, is discovered and methods for its utilization are devised.*

We may be justified in assuming that the annual energy fixation of plants approximates the equivalent, in tons of coal, of 3×10^{11}.

This astronomical figure is at first sight quite comforting, particularly when we learn that in energy value it is over 200 times the coal and oil burned in 1938. The difficulty is that most of this annual income is not used.

I shall not linger long on the second characteristic of plants so necessary for the existence of other life on this planet; that is, their ability to construct from simple and elementary substances types of chemical compounds essential for animals. Their capacity for making sugar from carbon dioxide and water, constructing amino acids from inorganic nitrogen and organic-carbon compounds, and for synthesizing vitamins enables us to live. Plants are able chemists and there is no substitute for them.

However, plants do more than fill our stomachs, warm our bodies and help us to go quickly from here to there. For example, plants are useful for the investigation of problems in science. For this purpose they have certain advantages. They can be grown in large numbers, and we have no compunction in destroying them in quantity if it is desirable for the purposes of the research. Their firm, well-delineated cell walls, general structure and methods of reproduction make them well adapted to the investigation of certain kinds of problems, and their infinite variety in morphology and physiology offers opportunity to select an organism best fitted to serve as experimental material for attack on a particular question.

In many other directions we find that research with plants has led to fundamental discoveries. The discovery of the nature of virus diseases to which belong the agents responsible for smallpox, yellow fever, influenza, poliomyelitis, virus pneumonia, foot and mouth disease, hog cholera, rabies, and many other afflictions of man, animals, and plants began with experiments by Iwanowski in 1892 on the mosaic disease of tobacco and was completed by Stanley in 1935 by the isolation from tobacco afflicted with mosaic of the active agent as a nucleo-protein of high molecular weight. The influence of day-length on reproduction was demonstrated for plants by Garner and Allard some years before the correlation of reproductive activity in animals and day-length was investigated.

Perhaps nowhere is the importance of work with plants for scientific objectives of general application demonstrated better than that which has been carried on with yeast. Pasteur's investigations on fermentation contributed in a major way to the germ theory of disease and to his later discoveries in the field of medicine. Investigations on the chemical changes induced in carbohydrates by yeast have had an immense influence on our knowledge of respiration and the intermediary metabolism of carbohydrates in animals, including man. At least two vitamins, pantothenic acid and biotin, were discovered from a study of yeast.

I scarcely need call your attention to the recreational value of plants. The opportunity to enjoy flowers, shrubs and trees acts as an antidote for the artificiality and tension of city life, relieves the drabness and monotony so frequently associated with existence in a small town or in the country, and satisfies a deep-seated desire in all of us.

Some one has said that gardening and a love of gardens are essential components of a full, sane and rounded life, and traffic with the soil and the green things that grow from it is one of the noblest and most healthful associations man may adopt. To own a bit of ground, dig it with a spade, plant seeds and watch them grow is a most satisfying thing, and fondness for such activity often comes back to a man after he runs the round of pleasure and business.

A garden gives the possessor fruit, vegetables and flowers; it also teaches patience and philosophy, pacifies and heals the body and the mind. This is recognized in the employment of gardening in occupational therapy by hospitals and prisons, a practice which has been used successfully and is increasing.

At the New York Botanical Garden some years ago we received an anonymous gift of money from an individual who stated that it was sent because the opportunity of enjoying the plantings in the Garden had prevented self-destruction. If one person was impelled to express his appreciation in this fashion there must have been many others less articulate or with smaller need who have felt the influence of plants in times of stress. *I believe that in the brave post-war world many are now planning, gardening will be recognized and given an important place because of its occupational and spiritual values.*

Everyone recognizes the economic importance of the common field crops—wheat, oats and corn; of the vegetables and fruits, and of lumber. These are items in our everyday living. Not every one realizes, however, how many other products are obtained from plants. The plant extractives industry alone, including drugs and flavorings, probably amounts in the United States to between 100 and 160 million dollars annually. It took a war, a war which cut us off from normal supplies, to make us appreciate how much our economy and our comfort and convenience depend upon many of these plant products from distant places. Rubber and quinine are two of the most generally known, but there are many others, for example, the sponge of the luffa gourd, the insecticide pyrethrum, chicle for chewing gum, the drug ergot, agar-agar, and cork. And yet in spite of the varied materials we now obtain from plants the potentialities of the plant world are but partially explored. The opportunity exists because not only are familiar plants incompletely investigated, but there are considerable areas of the earth botanically unexplored and thousands of species of plants still unknown to science. Any one of them might become as important to us as *Penicillium notatum,* the source of penicillin.

Another way in which plants contribute to our economic system is through the association of micro-organisms in the formation of various products—for example: cheese which depends upon the activity of the lactic acid and other bacteria and various molds; beer, wine and other fermented liquids produced by yeast; sauerkraut, vinegar, soy sauce and many others less well known or desirable. Bacteria, yeasts, and molds, as we learn to know them better, are increasingly used for producing specific chemical compounds which are beyond the skill of the laboratory worker or which can be made more cheaply by the micro-organism. Alcohol, acetic acid, acetone, glycerine, citric acid, gluconic acid, and riboflavin are some of these compounds. The most recent and illustrious addition to this list is of course penicillin. For a number of important, even essential, products, plants are the master manufacturers.

Industrial Memberships Created at Garden

A NEW category of membership has been established at the New York Botanical Garden, known as Industrial Membership. The resolution sanctioning it was passed at the meeting of the Board of Managers, May 31. Four classes are included in this new type of membership as follows:

Industrial Contributing Member
An annual contribution of $1,000 or a single contribution of $2,500 covering 3 years.

Industrial Sustaining Member
An annual contribution of $2,500 or a single contribution of $6,250 covering 3 years.

Industrial Patron
A single contribution of $25,000.

Industrial Benefactor
A single contribution of $50,000 or more.

A company qualifying in any one of the above categories shall be entitled to receive ten subscriptions to the monthly Journal of the New York Botanical Garden and one copy of all other publications as they appear, to the privilege of consultation with staff members of the Garden on subjects or questions of interest to the company concerned and to such other privileges as may from time to time be determined on recommendation of the Director with approval by the Board of Managers of the New York Botanical Garden. A suitably inscribed and engraved certificate will be given to each Industrial Member.

Contributions received from Industrial Memberships are to be segregated as a restricted fund to be appropriated at the discretion of the Board of Managers.

Notices and Reviews of Recent Books

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

Descriptive Key for Illinois

FLORA OF ILLINOIS. George Neville Jones. 317 pages. The University Press, Notre Dame, Indiana, 1945. $4.

The "Flora of Illinois" is an attractively printed book treating 2,124 species known or expected by the author to occur in Illinois. It is essentially a descriptive key, incorporating brief notes on distribution and habitat. Intraspecific units are in general not recognized, but the "strong varieties" of some other taxonomists are frequently raised to specific status. As has been pointed out at some length by a more eminent reviewer, the key to the families is imperfect, and a number of native species are omitted, but these defects are perhaps not so serious as has been made out. Those who may have been expecting a companion to Deam's "Flora of Indiana" will be disappointed, but the book should none-the-less prove useful to both the informed amateur and the professional botanist.

ARTHUR CRONQUIST.

Home Dyer's Handbook

VEGETABLE DYES FROM NORTH AMERICAN PLANTS. Douglas Leechman. 54 pages, indexed. Webb Publishing Co, St. Paul, 1945. $1.25.

This modest book is a unique contribution to the bibliography of vegetable dyes, as it is restricted to native plants. It will be of value to both professional and amateur dye mixers because it contains detailed instructions about making and using various natural dyes to produce desired colors. It includes a list of colors that can be obtained from various native materials, and also an alphabetical list of the usable plants. Much study has been devoted to the compilation of this book and its completeness makes it worthy of a place in every technical library.

W. F. LEGGETT.

From A to Z on Floriculture

COMMERCIAL FLOWER FORCING. Alex Laurie & D. C. Kiplinger. 598 pages, illustrated, indexed. The Blakiston Co., Philadelphia. Fourth edition, 1944. $4.50.

"Commercial Flower Forcing" by Laurie & Kiplinger is the only book in this country which covers commercial floriculture in a scientific and practical manner.

Originally published in 1935, the book is now in its fourth edition, which speaks well for its popularity. The new edition covers completely the latest developments in this field. The chapter on Hydroponics, commonly called Gravel Culture, which is slowly evolving into a commercial practice, has been brought up to date. Any grower with a basic knowledge of the functions of plants may undertake this form of culture on a small scale with almost certain results. It should be borne in mind, however, that these recommendations are based on work done in the Middle West and that because of different climatic conditions certain adjustments in the solution may be advisable for other parts of the country. The latest research in soil sterilization, the simplification of the use of growth-promoting substances, the importance of humidity, of temperature control, the newest pest-control measures and many other additions have been incorporated.

The old methods of years gone by have been analyzed and the best have been retained in this book.

This volume, with its 600 pages, is well illustrated and the authors are to be congratulated on the great and successful effort they have made in consulting with many leaders in this field, who have contributed their share of knowledge in making this book what it is.

Every wide-awake grower and student of floriculture should possess it, as it covers the field from A to Z in a most thorough manner.

HENRY M. BIEKART,
Agricultural Experiment Station,
New Brunswick, N. J.

Concerning the Culture Of Food Plants

VEGETABLE PRODUCTION AND MARKETING. Paul Work. 559 pages, illustrated, indexed. John Wiley & Sons, Inc., New York, 1945. $2.75.

"Vegetable Production and Marketing" is a well illustrated book full of nothing but essential information of value to home gardener, commercial farmer, teacher, and student. The sections on varieties, plant growing, harvesting, and marketing are particularly well done. Sections on disease and insect control are short and give few details. All phases of vegetable production from planning to harvest and storage are covered, with emphasis on factors that are not regional. The general organization, numerous clear illustrations, valuable lists of modern references at the end of each chapter, excellent index, and the listing of page, chapter number, and chapter heading or sub-heading on each page makes the book a very usable one.

E. MILTON ANDERSEN,
Rhode Island State College,
Kingston, R. I.

Florida Notebook

MY GARDEN IN FLORIDA. Henry Nehrling. Manuscripts compiled and edited by A. H. Andrews. 422 pages. Distributed by The American Eagle, Estero, Florida, 1945. $3.75.

Dr. Henry Nehrling, former Custodian of the Public Museum in Milwaukee, became interested in tropical and subtropical plants and bought some land at Gotha, Florida, in 1886, where he developed a garden. Later, he moved his chosen plants to Naples, on the lower West Coast. He died in 1929. Little, if anything, remains of his gardens, but fortunately, he kept voluminous notes, and these notes are edited from time to time and published, making a valuable contribution to the scant literature on the flora of Florida. The book is composed of articles written for *The Eagle* from 1922 to 1929. It is as informal as a horticultural diary, but well indexed. There is a preface by Dr. David Fairchild.

EVA NOBLE,
Jacksonville, Florida.

Notes, News, and Comment

Advisory Council. Mrs. Charles Doscher of New York City and Huntington, Long Island, and Mrs. Hugh Peters of Englewood, N. J., were elected to the Advisory Council at the meeting of the Garden's Board of Managers May 31.

Honorary. Mrs. Inez Haring of Poughkeepsie, N. Y., has been appointed Assistant Honorary Curator of Mosses, "in recognition of the fine services that she has rendered and is still rendering in the Elizabeth Gertrude Britton Moss Herbarium at the Garden."

Visitors. From June 19 until approximately July 19, Dr. Donald Rogers will be working daily at the Garden gathering information on the taxonomy of the fungus genus *Thelephoracea.* After the completion of this work, Dr. Rogers is leaving for Honolulu, where he will be located in the Department of Botany of the University of Hawaii.

For ten days from June 5 to June 15, Howard Scott Gentry of the University of Michigan visited the Garden, identifying his Mexican collections.

Dr. Harold Raistrick of the University of London visited the Garden on June 7 to discuss antibiotics with Dr. Robbins. Two other laboratory visitors were Dr. H. T. Herrick, Director of the Northern Regional Research Laboratories, Peoria, Ill., and Dr. Ralph Bennett of Commercial Solvents, Terre Haute, Ind. Other visitors to the Garden during the month included Dr. M. A. Chrysler of Rutgers University; Mr. and Mrs. John A. Blaser of Tallavast, Fla.; Dr. Arthur J. Eames of Cornell University, and A. Cook, a landscape architect from Miami, Fla.

Motion Picture. The Garden's full-length motion picture in color was shown at the Langhorne Community House, Langhorne, Pa., by Elizabeth Hall, June 6. The occasion marked the regular quarterly meeting of the Lower Bucks County Pomona Range.

Laboratory. Mary Stebbins, who received her M.A. degree from Smith College this year, is now employed in Dr. Robbins' laboratory. Paulette Brown, a student at Barnard College, is working in the laboratory for the summer. Dr. Mary Bartley Schmitt, who has been assisting Dr. Robbins in his research for several years, left in June upon the return of her husband, Major Chris B. Schmitt, from three years of service in the Pacific.

Lieutenant. Earle Dugan, who left the services of the Garden February 22, 1943, for the Army, has just been promoted to 2nd Lieutenant. He was wounded in action in Europe during the year and is now stationed at Gotha, near Leipzig.

Corporation. At the last annual meeting of the Corporation of the New York Botanical Garden, the name of Mrs. Lee Krauss of Wynnewood, Pa., was proposed and accepted for membership in that body.

Men's Garden Club. Dr. Stout's hybrids of *Hemerocallis* were made the object of a special visit to the Garden by the Men's Garden Club of New York July 2. Dr. Stout addressed the group, explaining some of his work with these day-lilies.

Tree Breeding. Dr. A. B. Stout spent several days during June at Philadelphia, Pa., in consultation with Dr. E. J. Schriener and other members of the Northeastern Forest Experiment Station in special considerations of the work of forest tree breeding in which he is collaborating. He inspected the plantings of selections of poplar hybrids and of seedlings of these hybrids now being grown at the Morris Arboretum. He also spent a forenoon at the Hemlock Arboretum developed by Charles F. Jenkins at "Far Country," near Philadelphia.

Torrey Vasculum. Among the historical objects displayed in the Museum Building during Garden Week was a small metal vasculum in which John Torrey collected plants. Measuring approximately 8 inches in height and 5¼ inches at its greatest width, the container is painted black and bears John Torrey's name. It was recently deposited at the New York Botanical Garden by Princeton University, with the herbarium also brought to the Garden.

Research Committee. Dr. William J. Robbins has been elected a member of the Committee on Research of the American Philosophical Society for 1945-1946.

Flower Guides. Three vest-pocket booklets on flowers have been written by T. H. Everett and recently issued by the Whitman Publishing Company. Two of them deal with native flowers—one with woodland dwellers, the other with those that grow mainly in fields—and the third with garden flowers. Each species is illustrated. The three booklets will be reviewed in a later number of this Journal.

Tropical Plants. If paper can be made available, the New York Botanical Garden plans to publish at the earliest possible date a booklet containing the four articles on "Tropical Plants the World Around" written by Otto Degener and published in this Journal in April, May, June, and July of this year. The principal object will be to provide our men who are serving in tropical countries with a convenient guide to the plants—ornamental, curious, edible, and poisonous—which they are most likely to find on foreign shores in the tropics.

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

Membership in
THE NEW YORK BOTANICAL GARDEN
and what it means

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

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

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

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

A subscription to the Journal and to Addisonia.

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

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

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

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

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

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

* * * *

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

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

* * * *

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

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

Contributions to the Garden may be deducted from taxable incomes.

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

A legally approved form of bequest is as follows:

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

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

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

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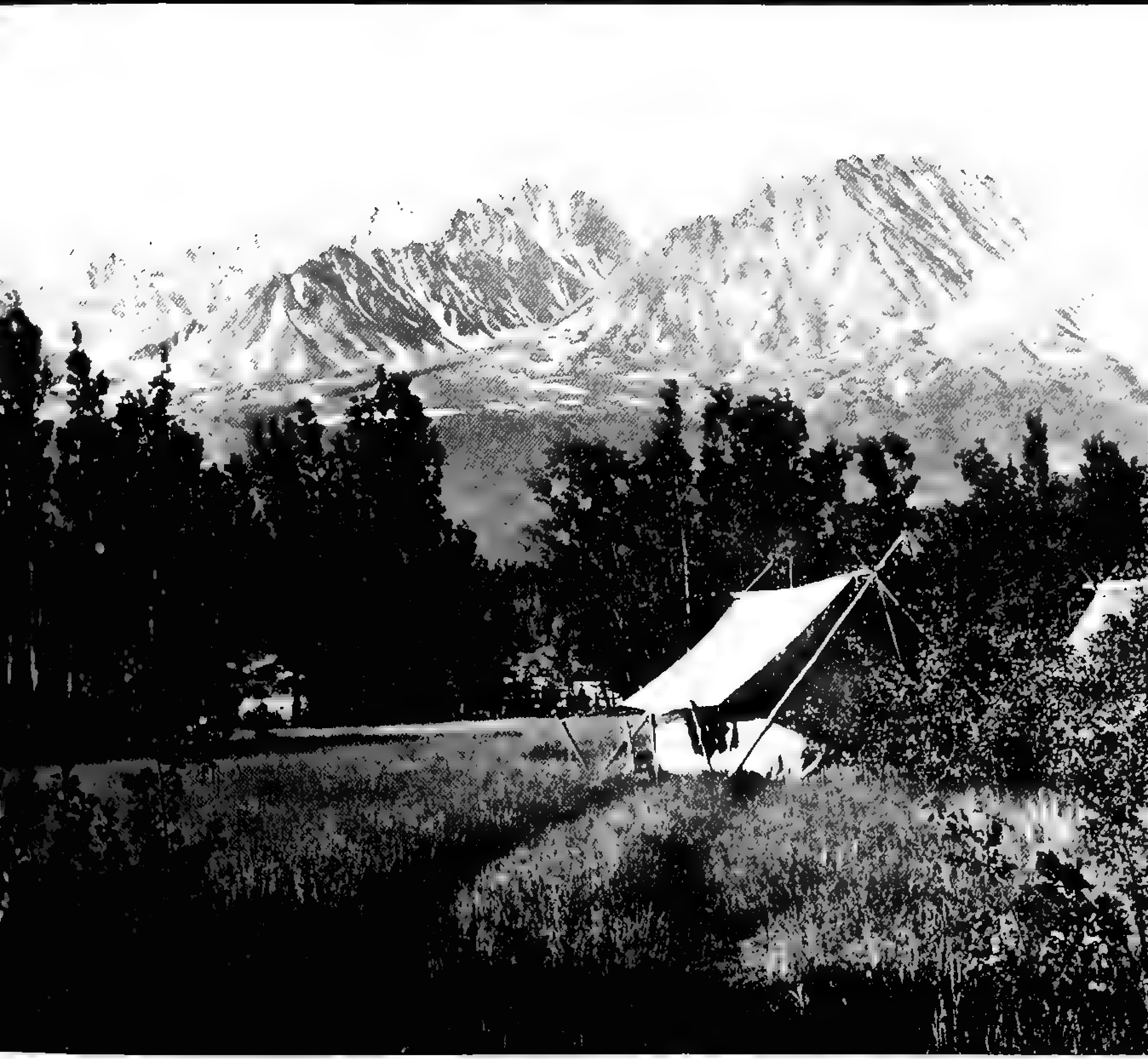
THE NEW YORK BOTANICAL GARDEN



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AUGUST
1945

IN TWO SECTIONS
SECTION ONE
PAGES 177–204

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

BETTER PLANTS FOR HUMAN NEEDS

From the address of Dr. A. B. Stout given at the Garden May 17 as part of the program for Garden Week.

MAN obtains better plants for his needs by a combination of several methods: —

1. He finds plants growing wild or in cultivation in other lands. This is plant exploration.

2. He obtains cultivated plants from other countries and tests them for value and adaptability. This is plant introduction. This has become an important feature of the functions of experiment stations, government plant introduction stations and botanical gardens.

3. One of man's first basic discoveries was how to use seeds for a succession of a crop year after year, especially of annuals. Also man learned to conserve and multiply individual plants of merit by vegetative propagation, a method especially applicable in perennials.

4. Man continually learns better methods in the care of plants which effect increased yield and better products. This is advance in the practice of agriculture and horticulture.

5. Man learns and practices both the art and the science of breeding plants for improvement. In this he learns to direct and to control the processes of reproduction and heredity.

6. But best of all, man gives the choice plants which he develops together with his methods of practice and his scientific knowledge as a heritage to all men of all races; and each generation in turn adds its contributions.

For centuries in his relations with plants man was chiefly concerned with obtaining plants from the wild and with learning the practical methods

(Continued inside back cover)

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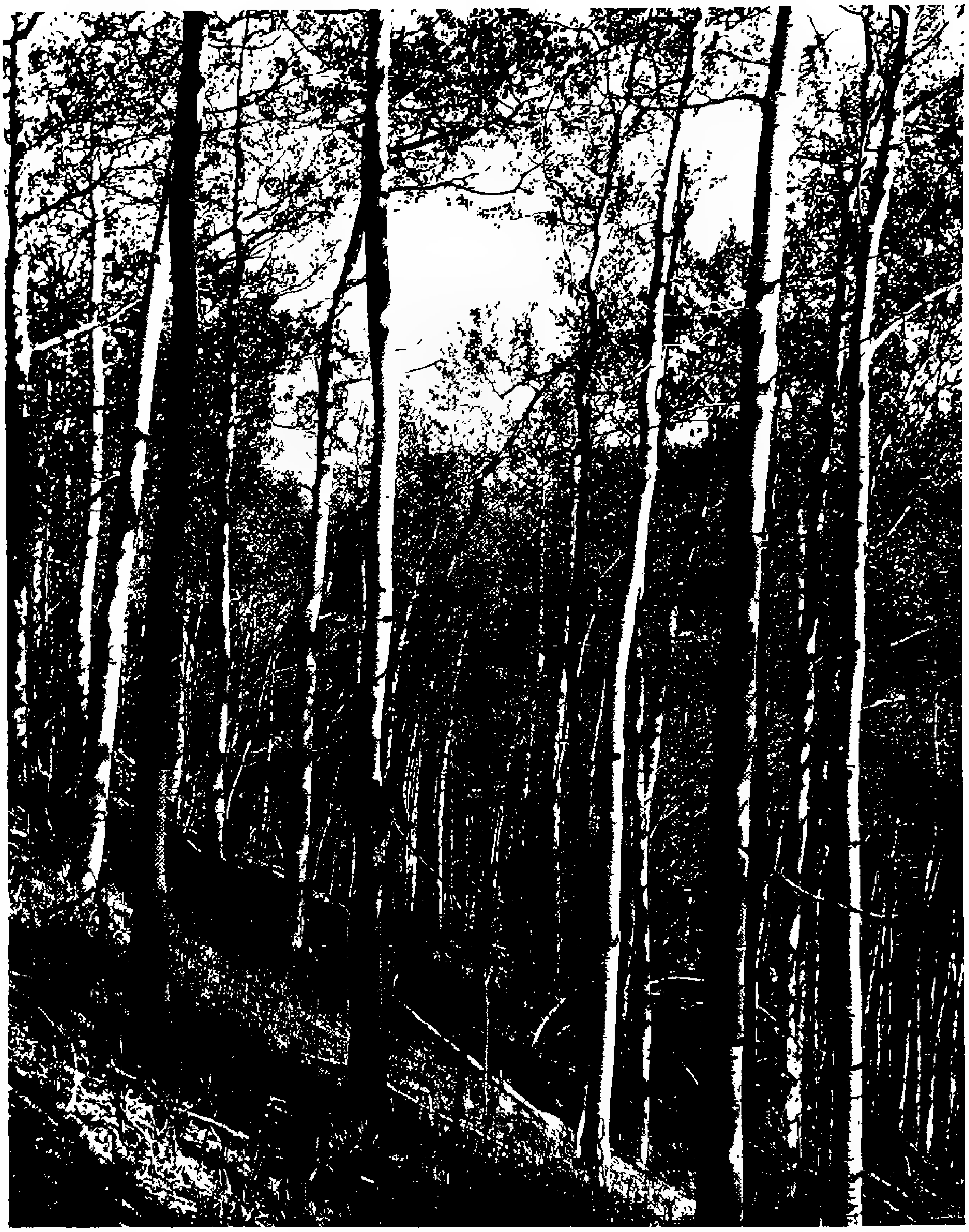
Vegetation Along the Alaska Highway And the North Pacific Coast

By Hugh M. Raup
Arnold Arboretum

RECENT EXPLOITS of the Army and Navy in the Pacific Northwest have focused the attention of millions of Americans upon those remote regions. For most people the Aleutian Islands, Alaska, or Yukon have been only so many items in geography books but now these same people may have sons or brothers or friends there. It becomes of great personal interest to know what kind of country the men are seeing and experiencing—whether it is all harsh and forbidding, or whether it has elements of attractiveness, beauty, and usefulness.

A glance at any good relief map will show that northwest America is ribbed by two great mountain systems. One is the northwestern extension of the Rockies. It reaches through central Yukon and then westward through northern Alaska. The other is a continuation of the Coast Range of California and Washington, extending, close to the Pacific, through northwestern British Columbia, adjacent Alaska, and southwestern Yukon. In southern Alaska it widens to form the Alaska Range, then narrows again into the Alaska peninsula and finally into the Aleutian chain. At the south these coastal mountains rise abruptly from sea level, but northward in the interior they rise above a broad plateau of moderate elevation, which

This is the concluding article in the series presented in this Journal on the subject of the Saturday lectures at the Garden last winter on "Plants of the Regions Where Our Men and Women are Serving." Dr. Raup talked on the vegetation of the region from the Alaska Highway to the Aleutians on February 10. Rupert C. Barneby's article in March on the vegetation of the Mediterranean Littoral was followed during the next four months by descriptions and illustrations of tropical plants the world around by Otto Degener.



Aspen forest on a south-facing terrace slope in the Beatton River valley, north of Fort St. John.

separates them from the other ranges, especially in Alaska. Northward and eastward the land slopes off rather gradually to the Arctic coasts and the interior plains of the continent. The nature and position of these great mountain masses have set the pattern for the life of the region. The climate, the plant and animal life, and finally the efforts of man to use the country have all been governed by them. The Pacific slopes have a comparatively mild oceanic climate, without great extremes of temperature and with heavy precipitation. The interior plateaus are by contrast cold in winter and warm in summer, with very low rainfall in summer and only moderate snowfall in winter. The northern mountains have very little timber on them and lie almost entirely under an arctic climate and vegetation.

There is not space enough in these brief notes to do more than describe some of the landscapes seen by our men. Most striking, perhaps, are those of the north Pacific coasts of Alaska, those among the Aleutian Islands, and finally those along the Alaska Highway.

THE ALEUTIANS

WE ARE INDEBTED to Dr. Eric Hultén, the Swedish botanist, for a recent and excellent description of the vegetation and flora of the Aleutian Islands. The islands are treeless except for some plantations of spruce on Unalaska, near the eastern end of the chain. Their principal vegetation is of meadows of one sort or another, and heath shrub communities. The chief variations from these types are on the ocean shores and in lakes and ponds. One type of meadow, called by Hultén the subalpine type, is composed of a thick growth of herbaceous plants among which a grass (*Calamagrostis Langsdorffii*), a sage (*Artemisia unalaschcensis*), a geranium (*G. erianthum*), aconite (*Aconitum kamtschaticum*), the common fireweed of the north (*Epilobium angustifolium*), and a few other species are especially abundant. With them are species of *Bromus, Polygonum, Castilleja, Trientalis, Aster, Arnica, Sanguisorba, Veratrum, Aruncus, Senecio,* and others. The soils of these meadows are rich and damp, and they lie at moderate elevations or on broad valley bottoms.

In some places, especially in the eastern islands, thickets of willow (*Salix Barclayi*) are interspersed with the subalpine meadows; but higher on the slopes both willows and meadows give way to a mixture of heath shrub and alpine meadow communities. The upper limit of the subalpine meadows and willow thickets is variable, but Hultén puts it at between 300 and 400 feet above sea level in some places. He states that the heaths and alpine meadows form a sort of mosaic, with the heaths on the more exposed, windswept surfaces and the meadows on slightly more protected surfaces.

The alpine meadows are mostly of smaller herbaceous plants, with such low or trailing shrubs as *Salix crassijulis* and *Rhododendron kamtschaticum*. There are, of course, all sorts of transitions between these and the subalpine meadows on one hand and the heath communities on the other. The principal heath types are apparently made up of the crowberry (*Empetrum nigrum*), blueberry (*Vaccinium uliginosum*), mountain cranberry (*Vaccinium Vitis-Idaea*), and mats of lichens and mosses. A variety of

Looking southward from an altitude of about 5,000 feet at Summit Pass, where the Alaska Highway crosses into the valley of MacDonald Creek and the Racing River. This section of the highway, about 100 miles west of Fort Nelson, is a scenic wonderland.

alpine grasses, sedges, other herbs and small shrubs are found among the heaths. In particularly exposed places there are spaces of barren soil. Much of the soil under the alpine heaths and meadows is subject to the peculiar effects of frost, resulting in the formation of soil polygons, turf-banked terraces and various forms of soil creep.

Alternate freezing and thawing of the soil, particularly in spring, results in the sorting of its surface materials; and on slopes there is a slow movement of soils downward. The sorting and downward creep, partially checked by vegetation, give a festooned appearance to the surfaces of hillsides. The plant communities on such sites are apt to be unstable and variable from place to place.

The climate of the Aleutians is notable for an abundance of moisture (the average annual precipitation ranges from 20 to over 100 inches), moderate temperatures with a small seasonal range, and an unusually large proportion of cloudy and rainy days. In general the weather is warmer and wetter in the eastern part of the chain than in the western part.

SOUTHERN ALASKA

THE SOUTHERN and southeastern coasts of Alaska have a still more moderate climate, with even heavier precipitation (over 160 inches a year in places). The vegetation of these regions is remarkable chiefly for its great coniferous forests. These forests are composed of Sitka spruce (*Picea sitchensis*), western white cedar (*Chamaecyparis nootkatensis*), the western hemlocks (*Tsuga heterophylla* and *T. Mertensiana*); and farther south the lodgepole pine (*Pinus contorta*), fir (*Abies amabilis*) and the western arborvitae (*Thuja plicata*). The trees are in dense stands in valleys and on mountain slopes, and grow to huge size. The ground cover is a heavy mat of mosses, and there is commonly a thick undergrowth of the spiny devil's club (*Oplopanax horridum*), with species of *Vaccinium*, *Rubus*, and *Menziesia*.

The contrast between this rich coastal forest and that in the interior

A flood-plain forest of white spruce and balsam poplar near the Liard River.

Barrow
Coppermine
Aklavik
Fort Good Hope
Great Bear Lake
Mackenzie River
Fort Norman
Great Slave Lake
Anadyr
Anadyr Gulf
Bering strait
Nome
Yukon River
Circle
Yukon R.
Fairbanks
Big Delta
Dawson
Tanana Crossing
Fort Simpson
Liard River
Northway
Gulcana
Anchorage
Valdez
Burwash
Kluane Lake
Whitehorse
Watson
Lower Post
Teslin L.
Fort Nelson
Summit Pass
Peace River
Seward
Skagway
Juneau
Fort St John
Dawson Cr.
BERING SEA
Bristol Bay
Kodiak Island
Gulf of Alaska
Prince Rupert
Fraser River
Aleutian Islands
Dutch Harbor
Attu
Aleutian Islands
Kiska
PACIFIC OCEAN
65°
60°
55°
50°
52°
175°
170°
165°
185°
180°
160°
155°
150°
145°
140°
135°
130°
125°

behind the coast ranges is sharp and striking. Nearly all of the trees and shrubs mentioned above disappear completely, giving way to simple, rather open forests of white spruce (*Picea glauca*), birch (*Betula papyrifera* vars.), aspen (*Populus tremuloides*), lodgepole pine, and a few other species. In places the forest is reduced to white spruce alone, sometimes interspersed with grassy prairies. The annual precipitation drops to less than 10 inches for much of the region, and there are long periods of clear weather. This is the region that has been traversed by the Alaska Highway, and will be best described from the standpoint of one traveling over that extraordinary road.

THE ALASKA HIGHWAY

THE HIGHWAY ITSELF is remarkably good, particularly in view of the rapidity and difficulties of its construction. It will stand as one of the major engineering achievements of our time. It was begun in March, 1942, as a military project to supply war materials to the north-Pacific area in case the Japanese should successfully harass our shipping in northern coastal waters. The initial track was located and built by the Corps of Engineers of the United States Army. It was done under a simple and effective agreement between Canada and the United States. The United States was to build the road, using both Canadian and American resources in men and materials, and was to maintain it until six months after the end of the war unless Canada should desire a return of the Canadian portion of the road before that time. Canada was to waive import duties, tolls, and other charges for traffic moving between the United States and Alaska. Once the initial track was laid down by the Army Engineers, the Public Roads Administration, under the Corps of Engineers, immediately began the work of improving grades, straightening the course, and putting in permanent bridges. The entire road has been surfaced with either gravel or crushed stone.

The present military function of the road seems to be the servicing of the airports that have been established at intervals along it between Dawson Creek and Fairbanks. Its maintenance and use in peace, however, present problems difficult to foresee and state.

The construction of an interior highway connecting the principal transportation systems of the continent with the Pacific ports of Alaska required the mastery of only one major mountain barrier. This can be seen at once from a glance at the map. Of the two great mountain systems of the northwest previously mentioned, the Coast and Alaska Ranges had already been crossed: by the White Pass and Yukon Railway between Skagway and Whitehorse, by the Alaska Railway from Seward to Fairbanks, and by a motor road from Valdez to Fairbanks. Since the southern terminus of the new highway was placed at Dawson Creek, in the agri-

Looking northwest across the Beatton River valley, about 100 miles north of the southern terminus of the highway.

cultural country of the upper Peace River well to the eastward of the Rocky Mountains, it was necessary to cross the latter to the valleys and plateaus of the intermontane region, which could then be followed to Whitehorse and Fairbanks. A lesser range in the intermontane country, an extension of the Cassiar Mountains of northern British Columbia, caused but minor difficulties.

These, then, are the topographic features that determine the nature of the landscapes seen along the Alaska Highway. First are the plateaus and foothills east of the Rockies, then the rugged masses of the Rockies themselves. The intermontane country is entered at the lower crossing of the Liard River, about 520 miles from Dawson Creek. The road then takes a westerly direction up the Liard valley to Watson Lake, and across the Cassiar Mountains to the lake country of the upper Yukon. In doing so it crosses the intermontane belt, and west of Whitehorse it comes up to the northern base of the Coast Ranges. These it follows closely for many miles, through the Alsek River and Kluane Lake regions to the upper Tanana valley of Alaska. The Tanana valley carries it out again into the central plateau region of Alaska and so to Fairbanks.

The Forests

Throughout nearly all of its 1,600 miles the highway passes through forested country. The only exceptions are at the southern end where there are agricultural prairie openings, and in a district some fifty miles long in the valleys of the Dezadeash and Alsek Rivers west of Whitehorse where some natural parkland occurs. Between Dawson Creek and Whitehorse the commonest forest type is composed of white spruce (*Picea glauca* vars.), lodgepole pine (*Pinus contorta* var. *latifolia*) and trembling aspen (*Populus tremuloides*). It occupies the better-drained soils up to altitudes of about 2,800 feet in the country east of the Rockies, and is the principal forest of the upper Liard region and the long slopes on both sides of the Cassiar Mountains. Its three principal trees, sometimes mixed with white birch (*Betula papyrifera* vars.), occur in a great variety of combinations depending in part upon minor variations in soil and exposure, but mainly upon the effects of fire. Fires have been of widespread occurrence in both the distant and recent past—so widespread, in fact, that it is nearly impossible to find a piece of woods that has not been burned at some time or other. In general, the pine and aspen are "fire trees," and do not repro-

The broad valley of the Tanana River with the Alaska Range at the left.

duce themselves after a single generation following fire. Their abundance and size in relation to the spruce in any given stand, therefore, are a rough guide to recent fire history of the stand.

There are several notable variations from this common type. The higher parts of recently-formed river flood plains have a rather dense timber of white spruce and balsam poplar (*Populus tacamahacca*). It closely follows the stream valleys, and nowhere has a wide lateral extent. Very dry soils on the uplands, such as sand and gravel outwash plains, have a much larger percentage of lodgepole pine than moderately drained soils. In some places, like the sand and gravel plains around Watson Lake in the upper Liard region, or the lake country southeast of Whitehorse, the pines predominate and in places may form a permanent type. Poorly drained soils made of heavy clay usually have a mixture of black spruce (*Picea mariana*), with white spruce, lodgepole pine and aspen. Such soils are common on the high plateaus between Fort St. John and Nelson, and between Nelson and Summit Pass. In these regions they are mostly at altitudes of 2,500 to 4,000 feet. Muskegs, or bogs, are of course common throughout wherever undrained depressions occur. Their principal forest cover is of black spruce, sometimes with larch (*Larix laricina*). On the foothill slopes of the Rockies and Cassiars is still another forest variant that should be mentioned, though it has only a small extent along the highway. It is composed of alpine fir (*Abies lasiocarpa*) in various mixtures with white and black spruce, lodgepole pine, and birch.

Beyond Whitehorse some notable changes appear in the forests, caused by the elimination of some species and the reduced abundance of others. A suggestion of the change is seen in the Cassiar Mountains west of the upper Liard, where the larch disappears from the muskegs. The simplification of the timber is greatest in the Alsek River valley and around Kluane Lake, where the forest is reduced to almost pure stands of white spruce which here occupies every kind of woodland habitat, from muskegs to mountain slopes. Between the White River and the upper Tanana the black spruce again becomes abundant, and in the Tanana valley itself the forest looks much like that along the Liard. Larch returns to the muskegs near Big Delta, about 100 miles east of Fairbanks.

ON THE OPPOSITE PAGE

Those who travel the Alaska Highway will be rewarded with these lake and mountain views. 1. Muncho Lake in the Rockies in the upper valley of the Trout River, with the road following its eastern shore. 2. The north, or big arm of Kluane Lake, narrow and fjord-like, with steep mountain slopes abruptly rising from the water's edge. 3. The southeastern end of Kluane Lake, looking toward the mouth of Slim's River. 4. Forests of white spruce cover the base of the mountains which tower above the southern shore of Kluane. 5. Elsewhere on the south shore of Kluane Lake the highway follows a tortuous course near the water's edge for many miles.

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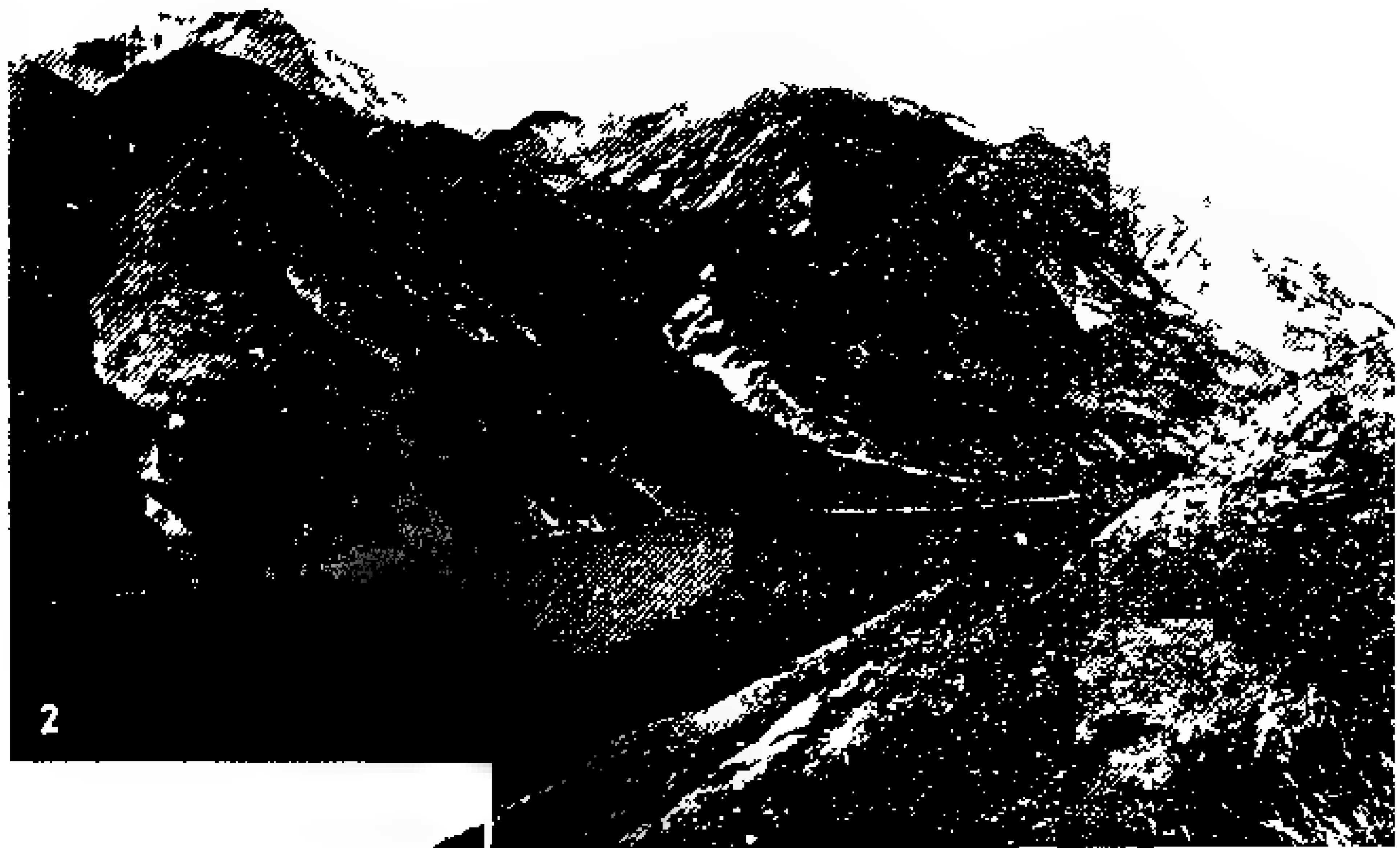

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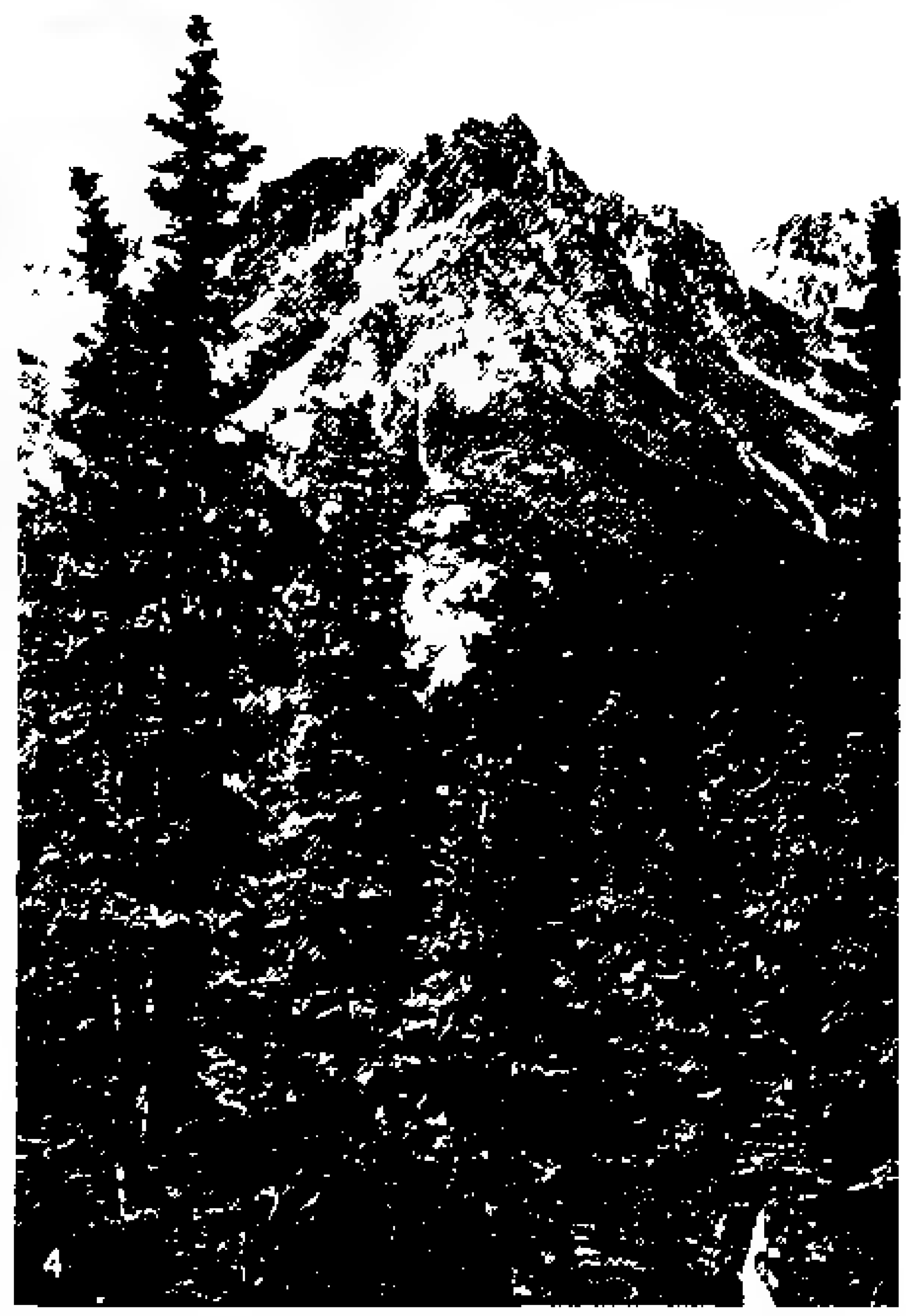

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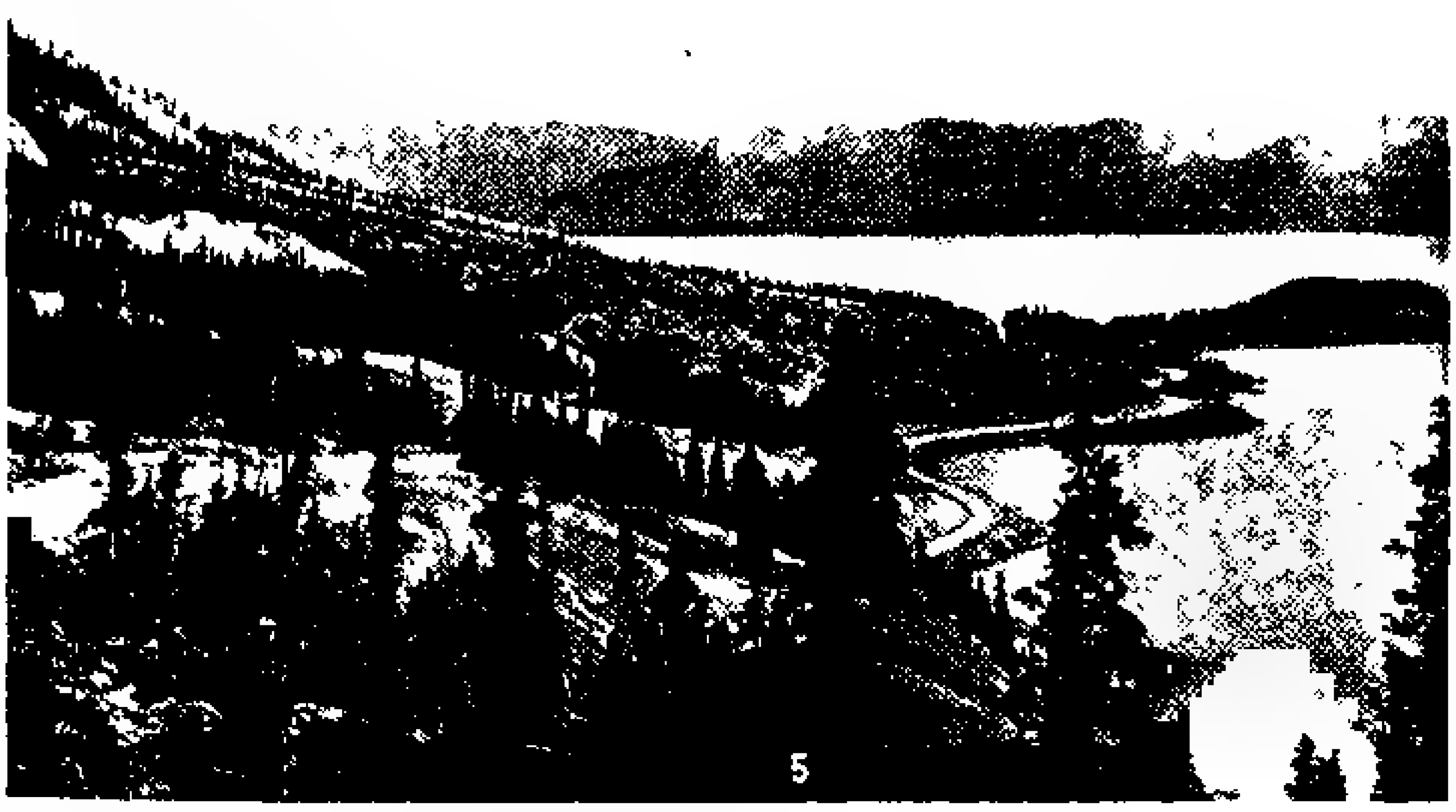

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LAKES AND PEAKS ALONG THE ALASKA HIGHWAY

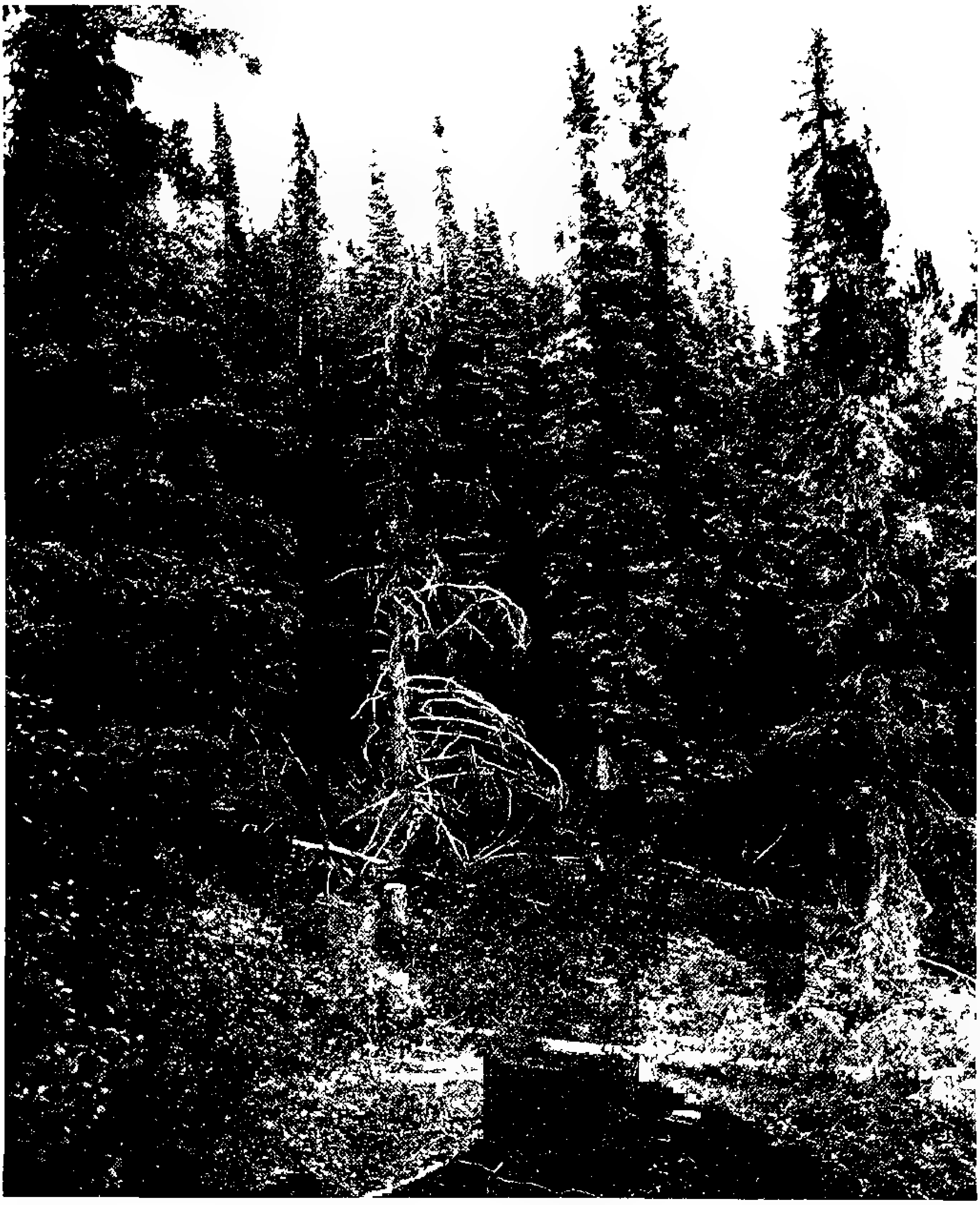
All illustrations used with this article are from photographs taken by the author while he was making a scientific survey of the Alaska Highway. The first four and the sixth (omitting this page of lake scenes) have appeared in the January 1945 number of the *Geographical Review*, and are used here by courtesy of that magazine. The cover picture appeared in *Arnoldia* for December 29, 1944. It shows the author's camp at Pine Creek in the Alsek River valley, about 100 miles west of Whitehorse, with the Dezadeash Mountains rising across the prairie.

From the standpoint of their usefulness to man, the forests of the Alaska Highway show promise only in a few places. The only timber of much commercial value is on river flood plains and on some of the foothill slopes. On the flood plains of the Prophet, Musqua, Liard, Rancheria and Tanana Rivers the white spruces grow to heights of 100 feet or more, with breast-height diameters of 18 to 24 inches. On the foothills the alpine firs and spruces attain similar dimensions and are of good quality. Most of the upland timber along the road, however, is much smaller and will produce only small and scattered quantities of good lumber.

Prairies and Alpine Tundra

Although the immediate borders of the highway are nearly all forested, there are many points at which the bizarre and colorful arctic-alpine vegetation of the mountains can be reached by a little climbing. In crossing the Rockies the highway ascends to Summit Pass by way of the north fork of the Tetsa River, and then traverses a series of valleys and minor passes for a distance of about 120 miles. Summit Pass is scenically one of the most charming spots on the road. The height of land is about 4,200 feet above sea level, and is occupied by two small lakes with steep mountain slopes rising on both sides to altitudes of 7-8,000 feet. There are beautiful camping places at the margins of the lakes in open, park-like timber of small spruces and pines. The alpine timberline is only about 300 feet above the road, and between the lakes and the steeper mountain slopes are massive ridges and tablelands of old glacial moraines. One has to climb only a short distance, therefore, to come out on long, tundra-covered slopes over which he can walk all day amid a grand and ever-changing succession of views to the surrounding heights. In July the tundra is ablaze with alpine flowers: yellow cinquefoils, blue arctic lupines, louseworts in various shades of yellow, reddish brown and magenta, creamy white narcissus anemones, cassiopes and dryads. A climb to the top of one of the nearby mountains gives a clearer idea of the setting of the Pass. High, snow-covered peaks rise behind these mountains, with distant glaciers and snow fields coming into view, in a huge area of the northern Rockies yet to be explored.

The scenery throughout the Rockies, from the Tetsa valley to the Liard, is grand and awe-inspiring. Rugged limestone mountains hem in the narrow valleys, where rushing streams make a network through rough flats of sand, gravel and boulders. In leaving Summit Pass the road descends rapidly into the valley of MacDonald Creek which it follows for several miles to a junction with the Racing River. Then it turns up the valley of the Racing, crosses to the Toad River and follows the latter up through a rocky canyon to a pass through which it reaches the valley of the Trout River. On the walls of the Toad River canyon the folding and faulting



On the divide between the Morley and Swift Rivers, in the Cassiar Mountains east of Whitehorse, there are forests of white spruce, alpine fir, lodgepole pine, and black spruce.

of the mountain rocks are exhibited with a perfection rarely seen outside of textbooks. At the head of the Trout is Muncho Lake, a beautiful expanse of water some eight or nine miles long, margined by high mountains.

The highway crosses to the north side of the Liard just above the mouth of the Trout, then begins its long traverse westward across the intermontane plateaus. After the breath-taking scenery of the Rockies this part of the journey might become monotonous were it not for other attractions of a quite different sort.

A few miles from the crossing is a hot spring which flows from the lower slopes of a steep hill north of the road. The spring has been a mecca for travelers since the construction of the road was begun. The Army Engineers built a board walk across some swamps at the base of the hill, and a bath house over a part of the spring. The whole area is an eldorado for naturalists, for it contains plants that are rare or non-existent in the surrounding country. Even the common plants of the region have a strange appearance, for they are nearly all "out-sized" in the neighborhood of the warm water, and are apt to be found in blossom at unusual times. Legends of "tropical valleys" in the north country have all originated in places like this.

Lower Post is an old fur trading establishment along the Liard near the mouth of the Dease River. Once one of the most isolated posts in all the Northwest, it is now transformed at one leap to a mart of trade beside a busy highway. Watson Lake affords good fishing and, in the warmest months, swimming. There are delightful camp sites in the park-like pine woods that border its eastern shores.

West of Watson Lake are the Cassiar Mountains. After recrossing the Liard west of the lake, and after traversing a low plateau for a few miles, the road enters the valley of the Rancheria River by which it ascends to a continental divide in the Cassiars. These mountains are not nearly so rugged as the Rockies, and are composed of igneous rocks with some intrusions of basalt. The divide, here separating the waters of the Rancheria from those of the Swift River, is scenically rather unprepossessing. It lies at about 3,000 feet and contains extensive muskegs. Although most of the alpine summits in the Cassiars are distant from the road, there are a few near the divide that can be reached without much difficulty. Between the Cassiar Mountains and Whitehorse is the great lake region of the upper Yukon basin. In threading its way westward the highway skirts the picturesque shores of Teslin, Squanga, Little Atlin and Marsh Lakes. At one place, between Squanga and Little Atlin Lakes, it passes through a narrow valley between two mountains whose alpine summits are rich collecting grounds and easily accessible.

Although the highway does not cross the Coast Range, it comes up to its very base in the country west of Whitehorse. Between the Pine Creek district in the Alsek valley and the White River the high slopes of the mountains can be reached in several places by comparatively short trips from the road. This is especially true in the neighborhood of Kluane Lake, where the mountains rise abruptly from the water's edge. As previously noted, the forests here are greatly reduced in number of species. Another distinguishing vegetational feature is the semi-open prairie country in the

Dezadeash and Alsek valleys. The grasslands appear to be entirely natural, in openings in the woods that range in size from a few yards to a couple of miles in length. Besides an abundance of grasses there is a rich growth of other herbaceous species which, in mid-summer, turn the prairies into colorful gardens. They would be beautiful alone, but set as they are in borders of spruce and aspen against a background of lofty snow-covered peaks they are magnificent.

Kluane Lake is about 40 miles long, with a narrow, fiord-like northern arm some twenty miles in length. It is set in a deep trench between the high coast ranges at the south and some lower mountains to the north. For both naturalist and tourist this lake and its environs will be exceedingly attractive. There is splendid scenery on every hand, with the best of photographic light by which to record it. The botanist and zoologist will find a remarkable array of habitats, from lake shores of many sorts to rich alpine meadows, high ledges and scree slopes. For the geologist there are complex problems of stratigraphy in the up-ended bedrock of the mountains, and abundant material for the study of both ancient and modern glacial history.

The alpine flora of the Alaska mountains seems to differ considerably from that near Kluane Lake, for it shows an increase in plants characteristic of the Bering Sea region and western Alaska. It is not easily accessible from the road except in the Tanana valley between Tok and the Robertson River, where the route lies along the northern base of the Nutzotin Range.

From these brief notes it seems clear that the men of our armed forces in the far Northwest have lived and worked among varied and often attractive surroundings, as unique in their way as those of Europe, north Africa and the Pacific. Many of the men, especially those with leanings toward natural history, have derived enormous benefit from their experience. To future naturalists the country presents a wide variety of attractions, and a compelling challenge to make use of the new facilities for travel and study that the war has made available. This is particularly true of the Alaska Highway. A vast wilderness that has been known only to a few trappers, traders and surveyors has suddenly been opened for examination and exploitation. The distribution and history of the forests are filled with unsolved problems, and the same is true of the whole flora of the region. Floristic elements of the Bering Sea region, the Arctic, the Coast Ranges, the Yukon plateaus, the Rocky Mountains, and the northern interior plains are here interlocked in a complex pattern. Their migrations and vicissitudes in Glacial and post-Glacial times, and their significance in the development of the vegetation, the animal life, and the history of man in the Northwest afford a host of intriguing problems the pursuit of which will lay the foundations for a sound geographic knowledge of the region as a whole. It is only upon such a sound basis that wise and far-seeing plans for human exploitation can be built.

Notes on a Wax from Calathea lutea

By E. C. Higbee and A. F. Sievers***

WAXES are used for making polishes of many kinds, for electrical insulating compositions, for coating and impregnating paper, for making candles, fruit and plant coatings, phonograph records, carbon paper inks, leather finishes, protective coatings for machinery and for military and other equipment, for the molding of plastics and dental waxes, for cosmetics, and for various other purposes.

In many cases, more or less of the hard vegetable waxes of high melting point, such as carnauba, ouricury and candelilla, are required for blending with other waxes in order to produce the desired results. In view of the increasing demand and the limited quantities of these vegetables waxes available, it is obvious that a market already exists for similar materials from other sources.

It is probable that the leaf wax from *Calathea lutea*, which melts at a temperature but slightly below that of carnauba wax, if produced on any commercial scale, would find a ready market in this country.

GEORGE S. JAMIESON.

Dr. Jamieson is author of the book, "Vegetable Fats and Oils," and is Principal Industrial Specialist of the War Food Administration.

THE vegetable waxes that are suitable for use in the industries are few in number and it is of interest, therefore, to learn of possible new sources. It is the purpose of this paper to report briefly on the properties of a wax obtained from *Calathea lutea*, of the Marantaceae of tropical America, mention of which has previously been made by others but the general physical and chemical constants of which have not been previously reported.

The white film of wax which covers the under-surface of the mature leaf of *Calathea lutea* is referred to by Paul LeCointe in his book "A Amazonia Brasileira"[1] (*The Brazilian Amazon Region*). He reports that the fusion point of this wax is 75° C. but makes no other statements regarding its physical or chemical constants. In "As Cêras no Brasil" (*The Waxes of Brazil*), Gregorio Bondar[2] mentions the desirability of studying the waxes produced by plants of the genus *Calathea*. However, he gives no specific data about these particular waxes. In a number of the locali-

* Office of Foreign Agricultural Relations, U. S. Dept. Agric.
** Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Dept. Agric.

ties where *C. lutea* is native its leaves have long been used, as LeCointe remarks, for thatching shelters and as a crude wrapping material in market places.

The wax of *C. lutea* was first brought to the attention of the writers in 1942 by Dr. Carlos Estavão, Director of the Museu Goeldi in Belem, Brazil. A note regarding Dr. Estavão's interest in the wax was published in *Agriculture in the Americas* in 1944.[3] *C. lutea* has been observed by

Calathea lutea, a new source of wax, growing wild at El Recreo, Nicaragua.

the senior writer in the rain forest areas of Peru, Ecuador, Panama, and the Central American countries as well as in the Brazilian Amazon region. The first illustration shows a clump of plants at El Recreo, Nicaragua, from which leaves were cut to make herbarium specimens and to obtain the wax for the analyses reported below.

In clearing brush along a creek bank at El Recreo, some of these plants were cut down. Later it was noted that when the leaves dried, the films of wax separated from the leaves and crumbled into flakes which were blown about by the wind. To obtain a small quantity of this wax for analysis, some fresh leaves were cut and dried by spreading them on the floor of a porch where they were protected from strong winds. Within 24 hours the leaves were dry and crisp. They were taken into a closed room where, free from disturbing drafts, the wax was brushed from the under-surface of each leaf onto a large cloth from which it was easily collected later. A small, stiff-bristled hand brush was used for the purpose. The wax came off with a single sweep of the brush, as shown in the picture below.

As removed from the leaves by the method described, the wax occurs in small, very thin flakes which give it a white, fluffy appearance. Specks of dirt and leaf fragments are scattered through it. The sample worked with appeared to be quite clean, but upon melting it a considerable amount of foreign material was found to be present. Since it was difficult to

Brushing the flakes of wax from a dried leaf of Calathea lutea.

remove this by filtering the melted wax, it was necessary to dissolve the wax in warm benzene and then filter it. After evaporation of the solvent, the wax remained as a hard, shiny, light brown product with a sharp fracture.

The wax thus purified was used for determining those physical and chemical constants usually reported, namely, the melting point, specific gravity, acid number, saponification number, and iodine number. The results are shown in the following table in comparison with the constants of several commercially important waxes as recorded in the literature.[4,5,6]

Comparison of some physical and chemical constants of the wax from Calathea lutea and some commercial natural waxes.

Wax	*Melting Point*	*Specific Gravity*	*Acid Number*	*Saponification*	*Iodine Number*
Calathea lutea	78-80°C.	.9735[1]	11.8	20.6[2] 24.5	13.4[3]
Carnauba	83-86°C.	.99[4]	1-4	68-84	13-13.5
Candelilla	68-70°C.	.95-.99	12-21	50-95	14-36
Beeswax	63-65°C.	.95-.97	17-21	92-103	6-13

1 25°C.
2 Results by different analysts.
3 Determination (Wijs method) by Lawrence Zeleny, Grain Products Branch, Office of Marketing Service, War Food Adm.
4 15.5°C.

The solubility of the wax in a number of organic solvents at water-bath temperature is as follows: Soluble in benzene, chloroform, carbon-tetrachloride and xylol; fairly soluble in toluene and amyl acetate; slightly soluble in ether and petroleum ether; very sparingly soluble in acetone, methanol, ethanol and isoamyl alcohol. The melting point of the wax is not much lower than that of carnauba wax and it may therefore be useful in some of the products in which the latter is used. The quantity of the wax available was inadequate for a more detailed analysis.

Calathea lutea is found most commonly along stream banks or ditches which are occasionally flooded. In eastern Nicaragua the flooding usually occurs during an annual rainy season which lasts from June until December. During the dry season the soil in some localities where *C. lutea* grows is well drained; in others it is not. The soil at El Recreo where the plants were found is a heavy yellow clay. The plants commonly occur in compact clumps from which competing vegetation is crowded out. Measurements of mature leaves at El Recreo showed that one of the largest had a blade 21 inches wide and 44 inches long. One of the tallest leaves measured 7 feet from the base of the petiole at the ground to the tip of the blade.

A State Department consular report by Fred Godsey[7] indicates that a calculation of the wax yield from one *C. lutea* leaf was made by the Industria Vegetal do Baixo Amazonas Company at Belem, Brazil, with the following results:

Total weight of one green leaf (blade and petiole)	31.93 grams
Weight of blade of green leaf	21.87 grams
Weight of petiole of green leaf	10.06 grams
Weight of wax obtained	0.68 grams

As Godsey remarks, this calculation indicates that nearly 670 leaves would be necessary to provide one pound of wax. At El Recreo 18.5 grams of the wax were obtained from 40 leaves. On this basis 980 leaves would be required to produce a pound. The yield from a leaf depends not only on the size of the leaf but on the thickness of the film of the wax, which varies considerably.

Judging from the senior author's experience in preparing the sample, one man with a machete would be able to cut approximately 600 leaves in an hour. The time it would take to transport the leaves to a drying shed and to spread them out to dry would depend upon distances and facilities. To remove the wax from 600 dried leaves with a hand brush would take approximately 6 hours.

Should the characteristics of this wax indicate that it has industrial possibilities, more careful studies of its yields and methods and costs of production would have to be made. Wild stands could perhaps be exploited in some localities. The plant is a perennial and new leaves begin to develop as soon as the mature leaves are cut down. It can perhaps be propagated successfully. Methods of removing the wax from the leaves more economically than by hand brushing will be necessary to make a low production cost possible.

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P. J. van Melle Speaks at Graduating Exercises

SEVEN students who have completed two-year courses at the Garden were given their certificates at graduation exercises June 21. After brief remarks by Dr. William J. Robbins, the principal address was given by P. J. van Melle of Poughkeepsie, N. Y., who is a nurseryman, horticultural writer, and an instructor at the New York Botanical Garden. Some excerpts from Mr. van Melle's talk, which he introduced by calling gardening "the sanest and most delightful" avocation or profession on earth, are given below.

Those who were graduated in the Two-Year Science Course for Gardeners are Bernard Freyland of Woodhaven; Viola A. Hafner of Jamaica; Gove B. Harrington of Katonah; and Bernice Skokut of New York City, employed as a temporary gardener at the Botanical Garden. In the Two-Year Course in Practical Gardening the graduates are Gertrude D. Howe, Joanna McCarthy, and Berry Schilling, all of New York City.

Gardening For Beauty

By P. J. van Melle

AT ITS best the creation of a home landscape is no mere matter of applied gardening aesthetics. It is a much more complex and greater sort of project —one of the accommodation, not merely of plant life, but, above all, of human life. It amounts to the molding of a shell in which the life of a household is to be adequately and happily accommodated. Therefore, if we would work at this sort of thing to good effect, we must know not only about gardening aesthetics—not only about plant life—but also something about human life, about dramatic values in general, and about the particular people who are to live in the shells—about the Joneses, the O'Reileys, the Schmidts. *They* are the most important factors in the project, and for us, as gardeners, the most difficult to cope with. For, in our schools we learn all about plants and about the aesthetics of gardening—but little about the Joneses, the O'Reileys and the Schmidts. For all we know, dramatic values are something pertaining to theaters.

So, what do we, newly fledged gardeners, do about this human, this dramatic factor? We do either one of two things. *Either,* we apply that which we have learned and ignore what we haven't. We contrive genteel landscapes, according to our books—such as would do as well for the Joneses as for the O'Reileys, and look as well in Sag Harbor as in Seattle. They will be smart-looking layouts, but they will amount to a dead loss, for the most important factor in the project has become obliterated. We have substituted for it a trite and unimportant factor. We have projected, not the Joneses, the O'Reileys or the Schmidts, but ourselves—our very limited learning.

Or else, please God, we sense that we have come up against something we haven't learned or thought much about: a human element—a dramatic factor—something very different from the things we have studied. It may dawn on us that these things, after all, are not equal to dealing with this factor.

If perchance this should be *your* reaction, then let me comfort you—then you have the makings of great gardeners. And that you will be, if you will set yourselves to learn all you can about dramatic values—about human life in relation to the arts. As you do that, you will come to revaluate much of what you have learned about the aesthetics of gardening, and become humbler about it. You may come to learn to portray the lives of the Joneses, the O'Reileys and the Schmidts—and not to substitute your own image for theirs.

I would say to you what one might say as well to a graduating class of interior decorators or landscape designers: The things you have learned are pure gardening, or pure design. They are good things, and you have had the best of instruction. But do not think that, having graduated, you are now qualified to do justice to—to interpret adequately—the spirit of the American home—that, within the things you have learned, you have its true and full measure.

That is the error into which fall nearly all who specialize in one or another of the home-making arts and skills. The exercise of their specialty is and remains to them an end, rather than a means—a contribution to the greater end—of the expression of life. The mold of the shell must be entirely of their making—a work of their particular art or skill. Beyond that lies, for them, only darkness. They never acquire the grace to see that the ultimate dignity and beauty of a home lie beyond the ken of their specialties; nor that their renderings, in terms of their specialties—devoid of dramatic values—are travesties; that the ideal expression of the genius of a worth-while home is *self-expression*, humbly assisted by artists and craftsmen.

When occasionally we see this achieved, the results, though containing elements of horticultural and artistic refinement, breathe beauty, in the main, of a very different order:—beauty in the idiom of qualities of life—of dramatic values. We see that life, when it wants to, laughs at the conceits of beauticians.

Let me remind you, and myself, that there exist, about homes and in communities, two kinds of visual beauty. One is that which we, beauty specialists, dispense, or which people themselves, worried over their artistic salvation, woo and pursue and ensnare with all the known tricks of applied aesthetics.

The other is a kind that is not bought or sold and is, so to say, not made with hands. It blossoms forth, of itself, like a flower. It is seen mostly about the homes of simple folk—abundantly in rural parts—perchance in a fishing village; and, in other lands, in cottage dooryards tended by illiterate peasant women, mostly in ignorance of all lore of applied aesthetics; but it is found not rarely, also, in lordly contempt of applied aesthetics, about the homes of enlightened people.

Of the two, this is to me the more dignified and stirring kind of beauty.

One day there came to King Solomon the clever Queen of Sheba, to try his wits. She brought two flowers: one, real; the other, an imitation. She asked: Which is the real one? Solomon placed them by an open window; and the honeybees came with the answer.

So it is with the efflorescence of life and the imitations. The real thing draws honey-bees; and *these* are the honey-bees: poets and painters and novelists. Theirs is an unfailing sense. Wherever life, however artless or unconcerned about beauty, asserts itself and blossoms forth in the distinct manner of its kind, they gather 'round. Their business is with the unadorned qualities—with the nude of life.

You graduates must make up your own minds as to which ideal of beauty in the environment of man you will prefer: that of the beauty experts, or that of poets and painters and novelists.

I, for one, acknowledge the competent and detached authority of poets and painters and novelists in matters of beauty in the environment of man. I do not mean to deprecate the potential contributions of beauty experts to that environment, if they were so minded. But I would have no more from them than mere contributions. I would not have them take over the molding of the shell, for, in that process, life itself becomes degraded—reduced to a sort of neutral background for the wanton display of humorless, extraneous perfections.

When you think of gardening for beauty—keep out of beauty's way. Find the chief source of beauty in the dwellings of man: the life of man. Study it. Defer to it. Learn from poets, from novelists—and particularly from painters. Do not try to squelch life, to mask it, or to make it over. Serve it, humbly.

Soils and Fertilizers For Roses

By George A. Sweetser
Executive Secretary
New England Rose Society

IN SPEAKING on the subject of soils and fertilizers at the annual Rose-Growers' Day at the New York Botanical Garden, June 13, Mr. Sweetser warned that he would attempt to give basic principles and practices only, leaving each grower to apply them to the conditions under which he is growing roses. Each soil, he pointed out, represents more or less an individual problem, and it is difficult, he said, to lay down any general rule that applies to all soils. His complete address is given here.

DANIEL WEBSTER made a statement about agriculture that has always interested me. "Let us never forget," he said, "that the cultivation of the soil is the most important labor of man. Unstable is the future of any country that has lost its taste for agriculture. If there is one lesson of history that is unmistakable, it is that national security lies very near the soil."

Stop and think of it! The food of the animal is produced in the soil. The food of man is derived from the soil and from animal products. Human existence therefore is *absolutely dependent* upon the soil.

What I have heretofore said concerns the food of the body—but the soil does something more. In it are grown the flowers of the garden and that great world of ornamental plants which, because of their varied form and hue and beauty, minister to our enjoyment. Thus the soil not only produces the food for the body but also food for the soul.

Good Loam Best for Roses

The best soil for roses is a fine soil. A fine soil is best because the rose roots are woody with a limited number of fine hair feeding roots through which the soil water with the nutrient elements dissolved in it is drawn up into the leaf and there manufactured into the food of the plant. Generally speaking, the best soil is a good loam.

There are four kinds of soil particles—gravel, sand, silt, and clay. Gravel is the largest and heaviest and clay the smallest and lightest, and they range in size and weight in that order, from gravel, the heaviest, to clay, the lightest. You and I can see the particles of gravel and sand with the naked eye, but we cannot see the particles of silt and clay except through a microscope. A good loam is made up of approximately 15-20% sand, 60-65% silt, and 15-20% clay. These figures are merely rough figures but are not very far out of the way. Thus a good loam is a fine soil.

If I should take a given volume of a good loam such as a shovelful, and attempt to give you its component parts, they would be something like this: 40-45% would be soil particles, 5-10% organic matter, these two making up one-half the soil volume. Believe it or not, the other is the space between the soil particles. Stated in terms of the whole, 30% would be occupied by water and 20% by air. If the volume of water should be reduced to about 15%, you would be very near the wilting point, and the importance of water can hardly be overestimated. Air is vital because it plays quite a part in the chemical reactions of the soil by which the plant foods therein are changed to a form that can be dissolved in the soil water. Only the substances that are in a salt form can be dissolved in the soil water and thus taken up by plants. Nitric acid for instance must be changed by chemical action ultimately to a *nitrate* which is a nitrogen salt. The soil particles, of course, represent the soil structure. Strange to say, the most important part of the entire mass is the small amount of organic matter above mentioned. It gives the soil vitality. It is the one substance that has more to do with the fertility and productiveness of the soil than almost any other thing. I cannot stress too strongly its importance and the continuous maintenance of an adequate supply of it.

Value of Organic Matter

What does it do? And why is it so important? Let me point it out to you.

(1) It improves the physical condition of the soil. It prevents it from getting hard, compact and tight and thus makes possible the better circulation of air through the soil.

(2) In the soil organic matter, or coming from it, is practically all the nitrogen that is utilized by plants. Nitrogen is the growth element. Without growth you can have no good plants, or good flowers. It is one of the most vital elements in all plant life. When organic matter in the form of the animal manures or composts is put into the soil, it is promptly attacked by the bacteria and other organisms of the soil and broken down to simpler forms that can be dissolved in the soil water. These organisms therefore play a very vital part in the work of the soil and in plant life in general.

(3) It supplies sort of a sponge to hold water and give it up to the plant as it needs it.

(4) In the soil organic matter there is practically every mineral element needed to support plant life. Years ago our grandmothers gave their children sulphur and molasses. They knew that it was a good product, as indeed it was, though they did not know why. Modern chemistry has told us that the old Porto Rican molasses, which was common in grandmother's day, contained virtually every mineral element needed to support the human body. The organic matter of the soil is to the plant life what the old Porto Rican molasses was to the human body.

(5) In the decomposition of organic matter, weak acids are produced. In the soil there is a vast storehouse of plant food in what are called fixed or insoluble forms. That is, this plant food is locked up in compounds that are not soluble in water any more than starch is soluble in water. We all know that we cannot dissolve starch in water. Neither can we dissolve this vast storehouse of plant food in the soil water. But these weak acids that are produced in the decomposition of the organic matter attack it, break it down slowly from time to time to simpler forms that are soluble in the soil water. Thus, by indirect action, the organic matter is causing some plant nutrients to trickle into the soil water all the time, and these constitute a great reserve of food which probably is one of the principal sources of the nourishment of plants, yet one that receives little attention from man.

This is the soil picture I would paint for you—soil particles plus organic matter plus water plus air.

Results from Virgin Soil

How often have you and I heard of an unusual yield from some soil and then were told, "But that was virgin soil." Perhaps it is worth while to consider what virgin soil is. Thousands and perhaps millions of years ago the great glaciers moved over the eastern section of this country and ground up the rock into soil particles. Mingled with those particles was the decomposed animal and plant life of the past and of course in that mass there was water and air, so that after all, virgin soil, which we naturally think of as a soil that is highly fertile and productive, is nothing more than soil particles plus organic matter plus water plus air.

But there is this difference between virgin soil and the soil which too many of us maintain. Nature, wisely and annually, deposits on the surface of the soil the dead leaf, dead or decomposing wood, and dead or decomposing animal products, forming a continuous supply of soil organic matter. Man, however, has too often failed to follow nature and has not maintained the soil organic matter but has allowed it to be depleted, thus its fertility and its productiveness have been reduced.

But the picture that I have tried to paint for you and the one that you should keep constantly before you in dealing with your garden soil for growing roses is: soil particles, plus organic matter, plus water, plus air. There is absolutely nothing that will maintain the fertility and productiveness of the soil better than that smallest part, by volume—namely, its organic matter.

There is some difference of opinion as to the depth that the soil should be prepared. Generally, I think that a depth of two feet is enough. In the lower six inches there should be manure or compost or even old sod only, a good base of organic matter. On top of this there should be *eighteen* inches of good loam. This should enable anyone to grow good roses. In the upper eighteen inches there can be put a small amount of organic matter if desired, in the form of well decomposed cow manure or compost.

Acidity of the Soil

I suppose that I ought to say a word about pH. As you know, it is the scale upon which is measured the intensity of the acidity or alkalinity of the soil. The figure 7 on the scale represents a neutral state. Everything below 7 is acid and above 7 is alkaline. Each unit, however, does not represent a one-fold change, but a ten-fold change. That is, pH 4 is 10 times as acid as pH 5 and 100 times as acid as pH 6.

Soil pH was for some years a veritable fad, very much exaggerated, and its importance greatly overestimated. Mr. Raber in his excellent work on plant physiology refers to this situation and says that it has been suggested that those who graduate in the course in plant physiology be given the degree of pH D.

In one or two situations, pH may be important. If the pH of the soil is too acid some of the elements, principally phosphorous, may not be as readily available to plants. Please notice that I said "may be" and not "will be." If the soil is too acid, it is possible, if there is much aluminum or much iron in the soil, that these two elements *may become* available. Aluminum is toxic to plant life in any quantity. Iron, except in very small quantities, is injurious to plants, though a small amount of iron is important, as it is one of the constituent parts of chlorophyll, the green coloring matter of the leaf. If your plant troubles cannot be explained in any other way, it may be that some attention should be given to the pH of the soil. Where soils however, are strongly alkaline, such as obtain in certain sections of the country, some consideration may have to be given to the soil pH, but generally speaking that is not true of the eastern United States where the soils are usually acid.

As one of the evidences that the fertility of the soil is the important thing, we may consider the fact that when directions are given about the quantity of lime needed to change a given volume of soil one pH, it is often stated that *if there are ample supplies of organic matter in the soil, the quantity of lime must be doubled or even more than doubled.* That is one way of saying that a soil well supplied with organic matter resists changes in pH. Generally speaking, at least in the eastern part of this country, if you will maintain the organic matter of the soil and thus its fertility and productiveness, and its good tilth, you will find that pH will become a minor matter. I know a garden in the state of Massachusetts in which there are more than 10,000 roses and as beautiful roses as anyone can grow. No thought has ever been given to the pH of the soil in this garden, but the fertility of the soil is always maintained.

Nutrients for Roses

When we come to the matter of plant nutrients, we are often told that nitrogen, phosphorus and potash are the major elements that require consideration. While this may be true, I like to think of them from a different point of view.

In the life of a plant there are three periods: the first is the period of growth and development, when it is forming its structure. In this period the element *nitrogen* is invaluable; it is the growth element. It not only is an essential factor in the development of the plant, but it aids in the assimilation of the other elements.

The second period I call the reproduction period—the period when the plant is forming its flower and producing its seed or grain or fruit. It is during this period that it is endeavoring to maintain its existence on the earth: to reproduce its own species. To do this, *phosphorus* is an essential element. It develops a good root system, an essential factor in the plant's life. It also enters very definitely into the flower structure and aids in the production of good flowers, the predecessor of the seed or the fruit. This element also has much to do with the normal maturity of the plant as to time. If the plant should bloom normally about June 15 and that blooming period should be delayed a month, a lack of phosphorus might be the cause. If the seed or fruit is to be produced at its normal time, there must be an ample supply of phosphorus in the soil.

The plant structure, as well as the animal body and human body, are all made up of myriads of little cells, seen only through a microscope. The health and the vigor of these cells thus becomes very important. *Potash* seems to have a great deal to do with the building up of strong cell walls and thus much to do with the health and the vigor of the plant. Thus, these three elements become the more vital elements in the life of the plant, though there are certain other elements, often called minor elements, which are quite essential in small quantities—some of them in very small quantities.

The third period is the period of disintegration, decadence and death. This may be prompt or it may cover a long period of time. We are not, however, concerned with this period this morning.

How Different Fertilizers Act

There are two kinds of fertilizer: the organic and inorganic. The more common organic are cottonseed meal, bone meal, and hardwood ashes. I have already referred to the animal manures and composts and need not refer to them here. The inorganic fertilizers are those which are commonly known as "commercial fertilizers," such as those designated as 4-8-4, 5-8-7, 4-12-4, and many others. It must be borne in mind that the organic fertilizers are slow-acting and must be broken down to simpler forms by the organisms of the soil so that they can be dissolved in the soil water. Their effect therefore extends over a rather longer period of time than the inorganic fertilizers, which are generally soluble in the soil water and rather promptly available to plants.

There is this one thing which must be kept in mind in reference to phosphorus. In the form of bone meal, phosphorus is a tri-calcium phosphate: that is, there are three units of calcium in the compound. In this form it is not available to plants and not soluble in the soil water. On the other hand, superphosphate is a mono-calcium phosphate and contains only one unit of calcium, but it has this peculiar quality: when put into the soil it begins to take up more calcium, and while the effect of quite a little of it may be immediate, yet it will slowly revert to the tri-calcium form and must be broken down by the weak acids of the soil before it is again soluble and available. Do not, therefore, be disappointed if you do not get all the response from superphosphate that you expected. Moreover, phosphorus only penetrates slowly into the soil and does not penetrate very deeply, so it is desirable to work it well down into the soil to secure its best effect. While superphosphate is quite acid in itself, yet it should be remembered that when put into the soil it has no effect one way or the other on the pH of the soil. Quite a group of our commercial fertilizers are today physiologically neutral in their pH and thus have no effect upon the pH of the soil.

In applying fertilizers, it is well to work them well down into the soil so as to be sure that they will reach the feeding roots of the plant, and when commercial fertilizer is applied to a rose bed, it is wise to give the soil a thorough watering. The need for working fertilizers well down into the soil is that often there is a marked difference between the nutrient elements in the surface soil and those in the soil at the depth of the rose roots.

I believe that the best combination to use in fertilizing a rose garden is a mixture of the organic and inorganic. However, I know one rose garden that has used nothing but cow manure and bone meal for many years, and in this garden are grown some unusually fine roses.

Generally speaking, the amount of nitrogen should not exceed 4 or 5% in an inorganic fertilizer mixture. While good growth is needed, too much nitrogen too often produces a weak, lush growth, which is undesirable.

Good combinations are sheep manure, plus bone meal, plus wood ashes; or cottonseed meal, bone meal, and wood ashes. Superphosphate may be used in place of bone meal and sulphate or muriate of potash in place of wood ashes. Some of these substances, like cottonseed meal and bone meal, or even wood ashes, may not now be readily available, because of the limitations of the war period, but everyone should use wherever possible, the animal manures, preferably cow manure, or the composts, as part of the fertilizing of the rose garden. Or use some of the organic fertilizers, or a mixture of these with some of the inorganic fertilizers. It should be borne in mind that the inorganic fertilizers do not accomplish their functions fully unless the soil is well supplied with organic matter. Of course it is obvious that there must at all times be maintained in the soil a normal supply of the nutrient elements. The method of ascertaining whether this exists is generally by a soil test. Testing soil, however, is by no means an exact science and should be regarded as a guide only.

A great many years ago, a gentleman by the name of Xenophon, who lived in Athens—as long ago as about 400 B.C.—wrote a book on economics. He wrote more or less about the farm and agriculture, and one thing that he said might have been applied to horticulture, or floriculture, or even rose culture. And what he said over two thousand years ago is as true today as then. "Agriculture," he commented, "is an art which will richly reward those who diligently practise it—*provided they understand it*—but if they do not understand it, it matters not how hard they may labor at it, it will leave them in poverty."

What I have attempted to do this morning is to present to you some general principles and practices which should enable you to understand your soil and fertilizer problems, so that when you meet with them you may be able to solve them, for it is only as we understand our problems that we *can* solve them. And if you will diligently and intelligently apply the principles and practices which I have endeavored to present to you, you should be able to grow the rose in all its beauty—a beauty which is one of the stimulating and one of the uplifting influences in the life of every one of us.

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.)

Only One Botanist

MEN OF SCIENCE IN AMERICA. The Role of Science in the Growth of Our Country. Bernard Jaffe. 600 pages, illustrated, indexed. Simon & Schuster, New York, 1944. $3.75.

This is a series of biographical sketches of nineteen selected individuals in all fields of science from Thomas Harriot (1560-1621) to E. O. Lawrence (1901-), in which botany fares very poorly; botanically it can only be placed as belonging in the class *horribilia.* The one individual selected to represent this field was the very erratic Constantine Samuel Rafinesque, who, while publishing voluminously, contributed very little of permanent value to the science, and botany would have been in an infinitely better position had he published nothing.

The Rafinesque sketch, forming Chapter Five, pages 104-129, is excellent, but adds nothing that was not already known regarding this prince of erratic authors. In his bibliography of Chapter Five, the author overlooked certain significant publications, particularly those of Dr. Pennell.

One wonders at the selection of Rafinesque, for clearly no panel of botanists would ever have chosen him in competition with such outstanding pioneers as John Torrey or Asa Gray, to mention only two of many scores of botanists who contributed extensively to the science. Both Torrey and Gray were not only eminent in North America, but can only be classed as among the great botanists of all time. Perhaps such men as Walter, Barton, Muhlenberg, Eaton, Torrey, Gray, Britton, Coulter, and numerous others weren't as colorful figures as Rafinesque, but nevertheless, it was they, their associates, and successors, who built American botany and not Rafinesque, for the latter's contributions were, for the most part, insignificant.

E. D. MERRILL,
Arnold Arboretum,
Jamaica Plain, Mass.

From an Experienced Gardener

PERENNIALS PREFERRED. Helen Van Pelt Wilson. 256 pages, indexed; illustrated by Kathleen Voute. M. Barrows & Company, New York, 1945. $2.75.

This is a good book. Miss Wilson has worked with this material, knows varieties, blooming times, likes and dislikes of the flowers, and the pests which may trouble them. She suggests many delightful combinations and it would be worth a study by the grower of a new garden, saving perhaps many disappointments.

Warnings are abundant, as they should be, of pests and diseases. Another warning is a most useful one—that which advises the owner of a new garden not to accept all offered gifts, lest she rue the day. A clear memory comes back of a plant offered to all who would accept it by an enthusiastic new gardener. What merciful instinct warned this reviewer, then equally new and ignorant, to refuse it, no one knows. Perhaps some trace of the teaching of a botanical father. It happened over forty years ago. In every spot in that town where that miserable plant was set, it flourishes to this day, despite herculean efforts to destroy it. It is probably a polygonum but it is hard to be sure, for from soon after that gift-day to this present one, it has always been known by the descriptive but fatally regretful name of *Neveragainibus.* We do well to be careful.

Miss Wilson gives excellent lists of many kinds: plants divided by colors, ones for sun or shade, for fragrance or night enjoyment, for drought, for seashore and other situations. There is a good chapter on edgings, so important to give a dressed-up look to a garden, with a side-slap at the hideous burlap covers endured by people who must have box in their gardens, though it necessitates a winter eyesore.

She is almost too hopeful about delphiniums and tree-peonies. They do well for the happy ones but not for all. She tells how to increase baptisia, which needs no help, and does not warn of the predatory habits of *Eupatorium coelestinum* and *Boltonia asteroides,* which, useful as they are, need watching if you want anything else in your garden. Is *Dianthus Heddewigii* fragrant? *Campanula pyramidalis* is a cranky creature in most gardens. Why is it given and the lovely, fool-proof *Campanula persicifolia* with its varieties left out?

A chapter on church gardens touches the heart of one who has grown a church cutting garden for six years on the grounds of a suburban church.

This book will be helpful to beginners as well as to more advanced gardeners.

SARAH V. COOMBS.

Amaryllis Volume

HERBERTIA. Vol. 10. Hamilton P. Traub, editor. 198 pages, illustrated. The American Amaryllis Society, Salinas, Calif. 1944.

Volume 10 of Herbertia, the year book of the American Amaryllis Society for 1943, contains 82 topical items which include reports and contributions dealing with descriptions, classification, phylogeny, breeding, and culture of various members of the Amaryllis family. The volume is dedicated to Elizabeth Lawrence of Raleigh, N. C., who is the Herbert Medalist of the year, "in appreciation of her outstanding contribution to our knowledge of the use of amaryllis in our gardens."

A. B. STOUT.

Camper's Guide

WILDWOOD WISDOM. Ellsworth Jaeger. 491 pages, illustrated, indexed. Macmillan, New York, 1945. $2.95.

This book might appropriately be subtitled the Camper's Guide, or an Encyclopaedia of Woodcraft. It contains detailed and apparently accurate information about nearly every conceivable subject of interest to campers and outdoor vacationers, even to fire-by-friction and moose-calling. Numerous, sometimes humorous, line-drawings are used to illustrate various points. A comprehensive index adds to the book's general usefulness.

ARTHUR CRONQUIST.

(*Continued from inside front cover*)

of growing them most successfully. But it is indeed astounding that early man, without knowledge of the processes of reproduction and heredity in plants, succeeded in many remarkable developments in cultivated plants. In fact, most of the important cultivated plants, and especially of food plants, were in cultivation when the era of written history began, and at that time these plants were already very different from their wild ancestors in horticultural characters such as vigor of growth, and size and quality of their fruits and seeds.

We know now that, throughout the ages of man's struggle to succeed in agriculture and horticulture, Nature was producing mutations, hybrids, and polyploids which showed as variations among the plants of his crops. Early man seems to have developed the ability and the good sense to see such variations and to employ the simple arts of seed selection to preserve them. When continued over a long period of time these methods conserved, isolated, developed and perpetuated such remarkable plants as wheat and maize.

But the learning of the Middle Ages was chiefly introspective and concerned with man's personal status and future. Views about Nature were beclouded with mysticism and magic and this dominated an extensive use of plants in medical practice.

It seems that the beginnings of a science of plant life were made in classification. But ecclesiastical views of creation dominated and the different forms of plant life were considered static since the original creation. This conception was in rather complete control in seats of learning at the time of Linnaeus. It was held that plants are so static that they could not be changed by breeding and that when man undertook to hybridize he was perverting Nature.

Charles Darwin, less than 100 years ago, was the first to assemble, to interpret, and to present with success the information that living organisms are plastic, and that cultivated plants had been developed from wild plants by natural processes of hybridization and selective breeding. This greatly stimulated the efforts in practical plant breeding in the period between 1865 and 1890.

Gregor Mendel was a contemporary of Charles Darwin. He made a series of purely scientific experimental studies of heredity and formulated certain laws for the segregation and recombination of hereditary units contributed in reproduction by both parents. Evidently Darwin never knew of Mendel's studies. In fact botanists and zoologists generally did not know of them until 1890—only 55 years ago.

The New York Botanical Garden was established soon after this date. We may say that most of the technical and scientific knowledge regarding the processes, mechanism, and effects of reproduction and heredity has been gained during the life of the New York Botanical Garden. But all other lines of botanical science have made similar progress and particularly have there been practical applications of value to agriculture and horticulture.

It has indeed been a golden age for the progress of the science of botany.

GARDEN WEEK REPORT

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A RECORD OF THE FIFTIETH ANNIVERSARY CELEBRATION

OF THE NEW YORK BOTANICAL GARDEN

MAY 1945

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GARDEN WEEK REPORT

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1945

137,000 Visitors Attend the Celebration Of New York Botanical Garden's Fiftieth Anniversary

GARDEN WEEK BECOMES A MILEPOST TOWARD THE FUTURE AS PLANS FOR POST-WAR DEVELOPMENT ARE ANNOUNCED

Discovery of Six New Antibiotics Made Public As Culmination of the Season's Events

FOR eight days in May, the New York Botanical Garden celebrated—celebrated in a way it had never done before; and on the Sunday which culminated the observance of the institution's fiftieth anniversary, more than 90,000 men, women and children were clocked in at the gates. The previous Sunday, May 13, had brought 13,000 visitors, and the crowds on the six intervening week-days totaled 34,242. The figure of 90,285 on May 20 nearly doubled the previous high total of 46,421 for a single day, which was recorded on April 30, 1944.

There was no doubt that the week's most popular feature was the trio of World's Fair trains, borrowed from the New York Zoological Society and repainted for the occasion, which carried visitors on a half-hour ride around the grounds for a ten-cent fare. Members of the Garden were permitted to ride free. So were the 1,500 children who came on Children's Day, May 16, and the wounded veterans, and other Service personnel who attended as special guests of the Garden on Army and Navy Day, May 17. The trains carried their passengers from a point near the main gate to Range 1, then over the Boulder Bridge, to the magnolia display, past the Bronx River Gorge and the Rose Garden, along Pelham Parkway, up the Snake Road through the woods, and back to the Museum Building, showing many people picturesque parts of the grounds that they never knew existed. There was a constant waiting line, and on the closing Sunday, after about 2,800 people had been given rides, the line was broken at 8:30 P.M., and the trains were put away until a day when they or some similar conveyances can perhaps be made a part of the Garden's permanent equipment.

The people enjoyed the music too, which filled the air at intervals throughout each day. Even on Monday, after the celebration was over, crowds of people patiently sat on the benches that remained in front of the Museum Building, apparently waiting for music or for an announcement that another program would be given soon. The amplifying system that broadcast the music from the treetops in the vicinity of the Museum and also inside the building itself, served likewise to keep the public informed throughout each day of the forthcoming events.

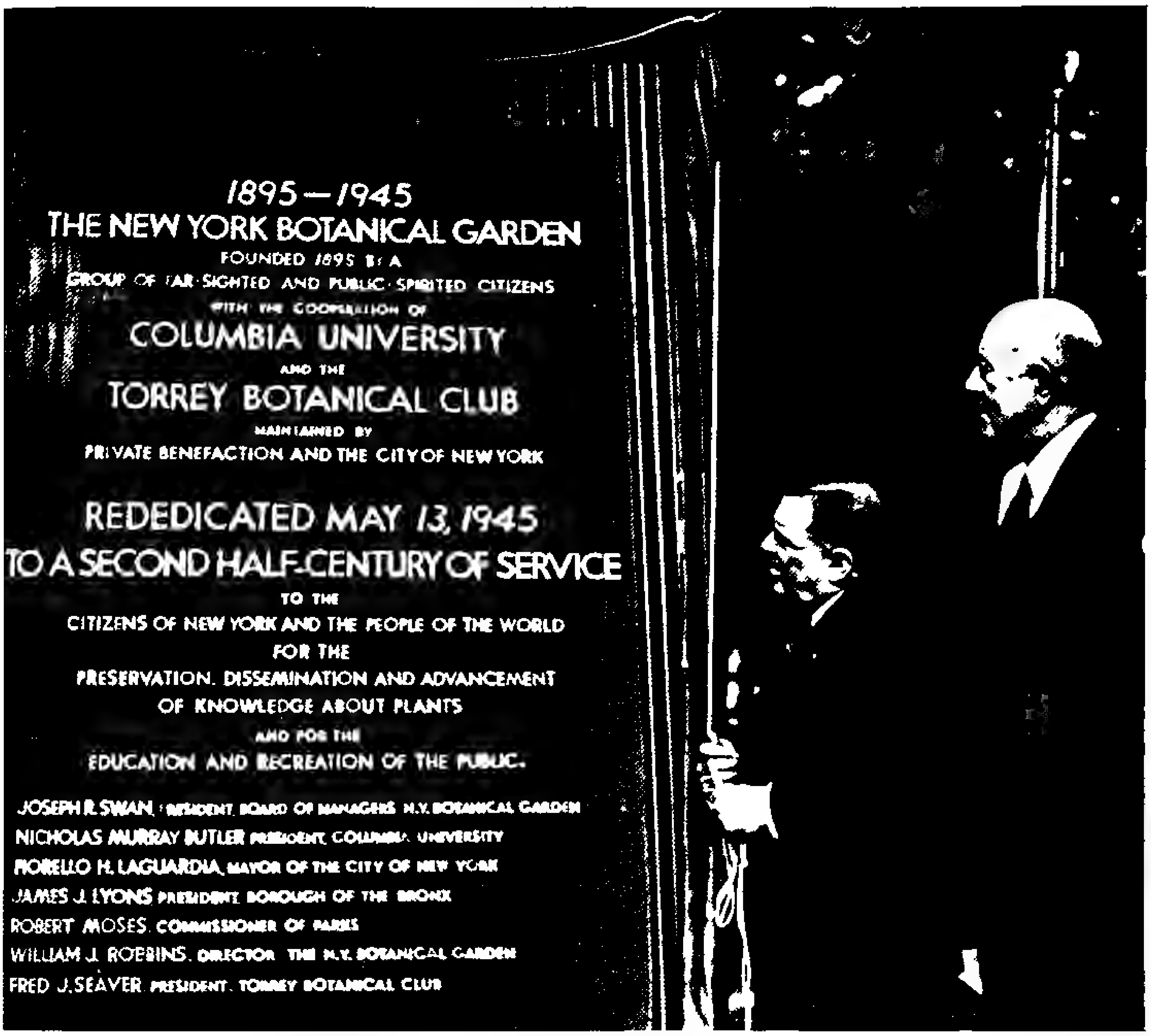
Daily Tours, Talks, and Motion Pictures

While more than 137,000 people enjoyed the New York Botanical Garden during the week for the beauty of its lawns and flowers and trees, a fair proportion became more closely acquainted with the institution by taking part in the guided tours each day. Morning and afternoon throughout the week, groups of visitors were conducted through the conservatories while other groups were taken through the Museum Building, where they were shown the library, laboratories, and herbarium, and given explanations and demonstrations of some of the work that is carried on. Following the afternoon tour each day, a 20-minute motion picture of the Botanical Garden, entitled "Plants and the Life of Man," was shown in the lecture hall, and this was followed in turn by an informal talk by a member of the staff on some phase of the Garden's work. These programs were attended by approximately 3,000 persons. In addition, several groups which came to take advantage of the Garden's anniversary celebration (such as an unexpected contingent of 500 school children) were given special motion picture programs in the lecture hall.

Rededication for Another Fifty Years

The Fiftieth Anniversary celebration opened with Mayor F. H. La Guardia rededicating the New York Botanical Garden to another fifty years of useful service. The program, which included the unveiling of a plaque, took place in front of the Museum Building, where a large platform and benches had been placed. Nearly 2,000 persons witnessed the ceremony, at which other speakers were Park Commissioner Robert Moses, Bronx Borough President James J. Lyons, Dean George B. Pegram, representing President Nicholas Murray Butler of Columbia, and Dr. William J. Robbins. The Garden's President, Joseph R. Swan, presided. Dr. F. J. Seaver was presented as President of the Torrey Botanical Club, which, with Columbia University, aided in the founding of the New York Botanical Garden. Because the day, May 13, had been set aside as a day of prayer by President Harry Truman, the Garden's rededication ceremony was opened with a prayer by the Rev. Arthur V. Litchfield, Rector of St. James Church at Fordham.

The City officials and other speakers and special guests were taken on the first tour of the grounds in the World's Fair trains immediately after the program. At 4 o'clock tea was served in the Members' Room — the first of a series of eight such teas that were given during Garden Week for the Garden's members and invited guests. Among the guests at tea on Tuesday were members of the New York unit of the Herb Society of America; on Wednesday, members of the Special Libraries Association; on Thursday, officers of the New York Park Association, who first made an extensive tour of the



Mayor LaGuardia unveils the plaque for the rededication of the New York Botanical Garden to a second half-century of service. With him is Joseph R. Swan, President.

grounds; and on Saturday, consular representatives from a number of foreign countries, as well as the dancers who had performed in the afternoon.

Garden Week itself began officially on Monday, May 14, with the tours, movies, programs, and train rides for the public and, in the rotunda of the Museum Building, flower arrangements created by recent prize-winners, on which all visitors were allowed to vote. Some historical pictures of the Garden and the people who have been connected with it through the years occupied the museum cases to the left of the rotunda.

Special Events Scheduled for Each Day

Members of the Garden and the descendants of founders were the special guests on Monday. Honors for the day went to Mrs. Andrew Carnegie, who, so far as is known, is the only living wife of one of the Garden's founders. Among the descendants of founders who attended that day were:

Mrs. Andrew Carnegie, guest of honor on Founders' and Members' Day, receives an orchid from Dr. William J. Robbins.

Mrs. Roswell Miller, who attended with her mother, Mrs. Carnegie; Mrs. B. Tappen Fairchild, a descendant of Samuel W. Fairchild; Ruth Draper, representing Charles A. Dana, and Mabel Choate, a niece of William Choate. Mrs. Charles Dickey, Jr., of the family of Samuel Sloan, was kept away by the demands of her Red Cross hospital work.

Probably the oldest member present was Mrs. Theron G. Strong, 94, who has been a member of the Garden since 1916, and who in the early years was active on the Advisory Council — then known as the Women's Auxiliary. She came with her daughter, Mrs. Harold McL. Turner, a member since 1930.

On Tuesday, the New York unit of the Herb Society of America co-operated with the Garden in presenting Mrs. Gladys M. James of Oxford University in a lecture, illustrated with a motion picture, on "The Growing of Digitalis and Other Herbs in Wartime Britain."

Wednesday was Children's Day, arranged in co-operation with the Board of Education. From nearby schools in the Bronx, at least 1,500 kindergarteners and first-graders came with their teachers and some of their parents. Each of the youngsters had a turn at riding on the trains, and while some were riding, others watched a performance by two clowns, Ernest Stebbing and Frank Parish. In between times, children's songs were broadcast over the amplifying system. Most of the children ate a picnic lunch on the lawn before going back to school or home.

Halloran General Hospital on Staten Island and St. Alban's in Queens sent a group of World War II veterans in cars to the Garden for Army and Navy Day, Thursday, May 17. A contingent from the Women's Army Corps, which likewise was celebrating an anniversary that week, also came, and the Red Cross Canteen Service served lunch to the group under the trees after tours had been made in the trains.

No special program had been planned for Friday, but the guided tours were well attended, several schools sent classes to the Garden, and the grounds were crowded all day long.

Saturday was the only day of rain, so the folk-dancing program which had been planned for outdoors was presented in the lecture hall. Mr. and Mrs. Michael Herman, directors of the Community Folk Dance Center, arranged the entire program of entertainment for the Garden's International Day, and from a hundred dancers who appeared in the costumes of many different countries, they presented eight groups — Scottish, Irish, Russian, Polish, Italian, Balkan, Philippine and one general group, each in several character-

AMONG THOSE WHO HELPED

THE periodic announcements which were heard over the amplifying system during Garden Week were made by Dr. E. E. Naylor. Conservatory tours were conducted by G. L. Wittrock and museum tours by Dr. F. W. Kavanagh.

Dr. H. A. Gleason arranged the daily programs which the members of the staff presented for the public. The five talks given on consecutive afternoons immediately after the motion picture were:

Monday: "Plants and their Significance in the Life of Man" by William J. Robbins
Tuesday: "A Collection of Plants and How it is Used" by Fred J. Seaver
Wednesday: "Information, Please, for the Public" by Elizabeth C. Hall
Thursday: "Better Plants for Human Needs" by A. B. Stout
Friday: "Gardening as a Profession" by T. H. Everett

The tea each day was managed by Mrs. William J. Robbins, with Dr. Frances E. Wynne assisting her.

General chairman for the Garden Week program was Mrs. Robert H. Fife.

Garden clubs whose members assisted on various days included organizations from Newburgh, White Plains, Southampton, and Easthampton, N.Y., besides the City Gardens Club, Little Gardens Club, Men's Garden Club, and Horticultural Society of New York, also the Central Garden Club of Brooklyn; Morristown, Plainfield, and Montclair, N.J.; Ridgefield, New Canaan, and Salisbury, Conn., besides the Hortulus Club from Greenwich. Among them were members from several Federated Garden Clubs of New York State, including Mt. Vernon, New Rochelle, and Scarsdale, with Mrs. Horace Marsland as chairman of hostesses.

istic dances. The lecture hall, which holds 700 people, had scarcely a vacant seat, and the spectators were loath to leave, even as six o'clock approached. The dancers were among several hundred persons who were guests of the Garden for late tea that afternoon.

At the opening of the program, Dr. Robbins, introduced by Mr. Swan, gave an address on "The International Aspects of the Botanical Garden's Work." Incidentally, the Garden received messages of congratulations on its fiftieth anniversary from 57 institutions and individuals in 27 foreign countries.

The closing event for Garden Week was a program Sunday afternoon, May 20, called Commemoration Day, at which representatives of the three principal faiths each gave a talk on a theme concerned with plant life. The speakers were the Reverend Eugene C. Carder, General Secretary of the Protestant Council of the City of New York, the Reverend J. Harding Fisher, S.J., Rector of Fordham University; and Dr. Samuel H. Goldenson, Rabbi of the Congregation Emanu-el.

Post War Plans Announced

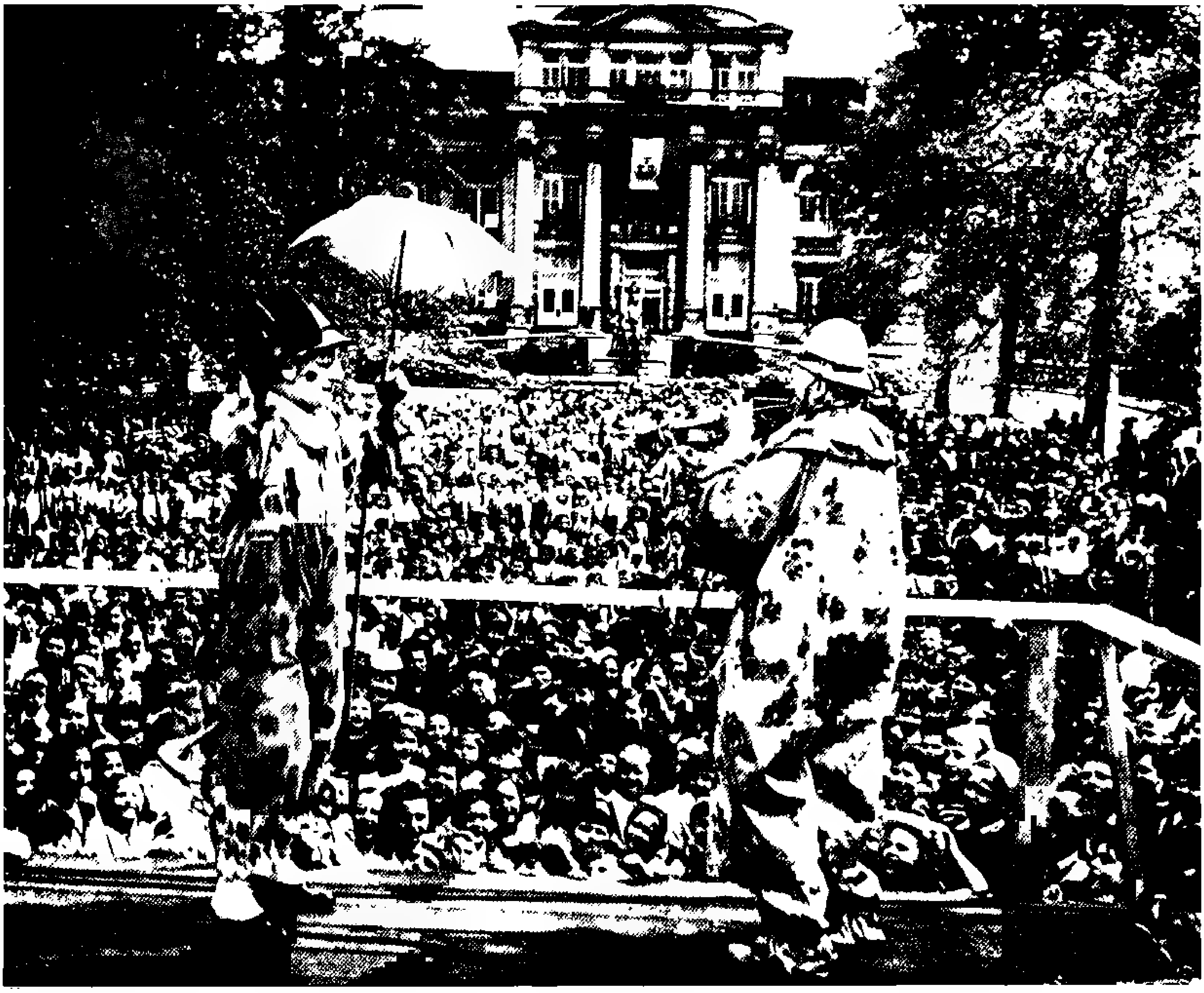
The conclusion of the Garden's springtime celebration of its fiftieth anniversary was made the occasion for announcing in the press on Monday, May 21, of the Garden's future plans, including the post-war program of the City of New York, which involves the construction of a new Museum and Administration Building for the Garden at a cost of $977,500. The Garden's share in this and other physical improvements planned by the City will be $300,000, which it is planned to raise by private subscription. But this is only a small percentage of the sum of money contemplated by the New York Botanical Garden for its future plans. Details are given on pages 22 to 25.

At Rockefeller Center

Two other events were closely connected with Garden Week, in that they were part of the fiftieth anniversary celebration. One was the planting of two holly trees by the New York Botanical Garden at Rockefeller Center, which is the site of the first botanical garden in the City of New York. This took place on May 10, with Joseph R. Swan presenting the trees to Barton P. Turnbull, President of Rockefeller Center.

Honorary Degree

The second event was the conferring of the honorary degree of Doctor of Science on Dr. William J. Robbins by Fordham University in a ceremony the evening of May 24. The Very Reverend Robert I. Gannon, S.J., President of Fordham University, in his message of greeting, told of the history of the land which is now occupied by the two adjoining institutions, from the time 300 years ago when it was purchased as a single farm from the Indians. Other speakers were Henry de Forest Baldwin, oldest member of the Board of Managers, whose subject was "Fifty Years of Service to the Public," President Joseph R. Swan on "The Next Fifty Years," and Dr. William J. Robbins on "The Functions of a Botanical Garden." Dr. Robbins took the occa-



Fifteen hundred five- and six-year-olds from schools in the Bronx were entertained with train rides, music, and a continuous performance by two clowns on Children's Day.

sion to make the first announcement of the discovery in his laboratory of six new antibiotic substances, all derived from the Basidiomycetes, a group of fungi from which antibiotics have never before been described.*

Greetings from Archbishop Francis J. Spellman and the benediction were spoken by the Most Reverend Joseph P. Donahue, D.D., Auxiliary Bishop of New York. Also on the platform were the Reverend Gustave Dumas, S.J., Dean of the Fordham Graduate School, who read the Latin eulogy preceding the awarding of the degree, and the Reverend Charles J. Deane, S.J., Vice-president of Fordham, who placed the stole over Dr. Robbins' shoulders, besides Dr. Charles A. Berger, S.J., Head of the Fordham Biology Department.

The ceremony, which was followed by a reception in the Tower Room of Keating Hall, was attended by members of the staffs of Fordham, the Botanical Garden, Columbia University, Hunter College, the Boyce Thompson Institute, and members of the Torrey Botanical Club, and others.

* For details, see the Journal for June 1945.

SPEAKERS AT THE REDEDICATION CEREMONY MAY 13

The Mayor is shown in two of his moods in the two upper pictures. President Swan, Director Robbins, and Park Commissioner Moses appear, left to right, across the center. Below at the left is Bronx Borough President James J. Lyons and at the right, Dean George B. Pegram, representing Columbia's President Nicholas Murray Butler.

REDEDICATION

Sunday, May 13

GARDEN WEEK at the New York Botanical Garden was auspiciously preceded on Sunday, May 13, by a ceremony in which Mayor F. H. LaGuardia rededicated the institution to another fifty years of service. The plaque illustrated on page 3 was unveiled at the close of the program.

Below are the addresses given on that day, with some of the introductory remarks made by Joseph R. Swan, the Botanical Garden's President.

Mr. Swan:

WE are here today, after fifty years of accomplishment, to rededicate the New York Botanical Garden to the cause of mankind. While the Garden is probably best known to this community as a beautiful park and playground, it has a world-wide reputation as a great scientific institution. You see around you this extraordinary beauty, but there goes on here continuously, behind the scenes, constant intense study of plant life.

How seldom do we stop to consider the importance of plants; that they are the source of all life! They supply the food we eat, the oxygen we breathe, the artificial heat we use. Without them we would starve, suffocate or freeze to death. And that is only a part of it. They are responsible for many of our diseases and many of our cures, for our clothes and a multitude of our commercial products. Are they not worth studying? What a wonderful thing it is that while we have them for study they can at the same time furnish such beauty, recreation, rest, and repose for soul and mind and body! God grant that we at this time can help those who greatly need such restoration.

* * *

The New York Botanical Garden is a private corporation founded by private citizens of initiative, vision and generosity. Like a number of other institutions it receives for its support and maintenance large appropriations from the City, but its research and educational work are dependent primarily on private gifts, bequests, endowment income and memberships.

If the Garden is at all to approach its potentialities of service it needs such private support in a much greater measure than it is now receiving. We need gifts, bequests and memberships. We need them so that we can better serve not only you, the people of New York, but the nation and mankind generally.

* * *

Men make institutions great. The New York Botanical Garden has been very fortunate during the past fifty years in the calibre of the men and women who have comprised its staff. It is still fortunate. In Dr. Robbins, a member of the National Academy of Sciences, we have a man not only eminent as a scientist, but also as a constructive and able administrator. The Garden has greatly developed under his guidance. I take real pleasure in introducing Dr. William J. Robbins.

* * *

Dr. Robbins:

THE New York Botanical Garden was incorporated in 1891 by the Legislature of the State of New York, but its initial endowment was not subscribed and land was not available for its location until 1895. The year 1945 represents, therefore, the fiftieth anniversary of the active existence of the New York Botanical Garden but the fifty-fourth year since its incorporation.

Although the New York Botanical Garden is but fifty years old, the idea of a botanical garden in the City of New York and efforts to found one date back to the beginning of the last century.

The Elgin Botanic Garden, which occupied the area roughly bounded by 47th and 51st Streets and by Fifth and Sixth Avenues, where Rockefeller Center now stands, was established in 1801 by Dr.

David Hosack, Professor of Botany in the Medical School of Columbia College. This garden was purchased by the State in 1811 and was then known as the Botanic Garden of the State of New York. It was subsequently given to Columbia College, but funds for its maintenance were not provided, and it ultimately ceased to exist as a Garden, though Columbia University still owns the land.

About twenty years later another botanical garden was established in New York, though this appears to have been largely a commercial venture. A catalog, published in 1834, lists plants for sale by Thomas Hogg at "The New York Botanic Garden in Broadway near the House of Refuge."

In 1877 the Legislature of the State of New York passed an act to facilitate the establishment of a Botanical Garden in the City of New York. The charter was granted to Samuel B. Ruggles, Robert L. Stuart and William E. Dodge. Shares in the corporation were offered at $25 each, but apparently the funds subscribed were not enough to meet the $350,000 thought necessary for founding this garden.

I mention these earlier efforts to establish a botanical garden in this city to demonstrate that the present New York Botanical Garden was not an accident but the final product of thought, effort and interest spread over nearly a hundred years.

It is interesting to note how the various agencies and individuals concerned during the period of nearly a century in obtaining a botanical garden for New York City were represented in the founding of this Garden. The Elgin Botanic Garden of 1801 was started by David Hosack, Professor of Botany in Columbia College, and the New York Botanical Garden was largely the result of the vision and initiative of Nathaniel Lord Britton, also Professor of Botany in Columbia College. Thomas Hogg, son of the proprietor of the New York Botanic Garden in 1834, was a member of a special committee of the Torrey Botanical Club which was so influential in arousing interest in the establishment of this Garden. William E. Dodge, one of the three men concerned with the attempt to start a botanical garden in 1877, was one of the original incorporators of the New York Botanical Garden in 1891.

Much as I should like to do so, time does not permit me to pay tribute to the many individuals and agencies responsible for founding and developing the New York Botanical Garden. They are represented in part on this platform. May I, however, express for you who enjoy and use the Garden, and for the staff and employees who have the privilege of working here, our indebtedness to the City of New York, which set aside the land occupied by the Garden and has contributed so largely to its buildings and its maintenance; to Columbia University, with which throughout the years we have had such intimate and mutually valuable associations; to the Torrey Botanical Club, which played an important part in founding the Garden; and to the many far-sighted citizens who have given of their time and substance to this institution. With such support we may look forward to a second fifty years in the confident expectation that the New York Botanical Garden will continue to discharge its obligations and utilize its facilities as a public trust.

* * *

George B. Pegram

Dean of the Graduate School
Columbia University

MR. CHAIRMAN; Your Honor, Mr. Mayor; distinguished friends and guests of this Garden:

The President of Columbia University, who to his regret is unable to be here, has asked me to represent the University and to read a brief message from him.

Before reading this, may I comment upon that part of the activity of the New York Botanical Garden that ties most closely with the work of the University. I refer, of course, to the advancement of botanical knowledge through scientific research. It is obvious that the future of man's existence on this earth will be largely conditioned by the results of researches on plants, and consequent improvements in the supply of our food and of many comforts.

Any reference to botany or botanical studies most naturally brings thoughts of gardens, fields and forests, mountain flora and jungle quests, rather than of hard paved city streets and urban structures. Nevertheless, it is a fact — too little known — that metropolitan New York is one of the great centers of botanical researches, both with respect to the number and eminence of its botanical scientists, and with respect to its facilities for research. In few other places anywhere can be found the companionship of so many able botanists and such active work on fundamental problems of this science.

Columbia University takes pride in having its part, in close relation with this Garden, and together with the Brooklyn Botanic Garden, the Boyce Thompson Institute for Plant Research, Fordham University, New York University, and the City Colleges, in maintaining staffs of investigators and teachers, gifted and eager in the extension of our knowledge of plant life and of the widening possibilities of its control and development for human needs and satisfactions.

I shall now read the message from the President of Columbia University.

* * *

Nicholas Murray Butler:

WE at Columbia University take great pleasure and pride in joining the New York Botanical Garden in its rededication to public service. The relationship of the two institutions has been long and close.

The University's interest in Botany is deep-rooted. It goes back to the appointment of Dr. Samuel Latham Mitchell as Professor of Botany in old Columbia College in 1792. The rolls of the University contain among others such names as Torrey, Hosack, Britton, Underwood, Rusby, and Harper, many of them identified also with the Garden. That the University had some part in the founding of the Garden and that close co-operation between us has continued for the public good is a profound satisfaction to us all.

The University's efforts in that direction will not lessen. May the Garden ever increase its service to science and to the entertainment, the recreation, and the instruction of the people.

* * *

James J. Lyons
President, Borough of the Bronx

MAYOR LaGUARDIA, Mr. Swan, ladies and gentlemen:

I am very happy to join in the celebrating of the fiftieth anniversary of the finest Botanical Garden in the entire world. We all love flowers, whether they be little ones or big ones. Flowers are symbols used on joyous occasions and are the symbols used to bring comfort in grief. We cannot count the joy and pleasure that these flowers have brought to over a million people for the past fifty years, and we hope they will continue to bring joy and pleasure for many years to come.

The Mayor said on his way here, "This is one of the institutions that never gives me any headaches."

I want to congratulate the vision of the founders in displaying the wisdom they did in locating in the great Borough of Culture — the great borough where our climate is such that things grow that could not grow anywhere else. They displayed great efficiency in locating in the Borough of Universities. Of course, I know that a tree may grow in Brooklyn, ragweed in Queens, hops in Staten Island, and Manhattan has given us a very effective little flower; but here in the Bronx we grow the loveliest of the lovely flowers — the most beautiful women in the world — I salute you.

* * *

Mr. Swan:

New York City has cause to be thankful for its parks and playgrounds. Most of their development has occurred during the tenure of the present City Administration. The relations of the Botanical Garden with the City are carried on through the Park Department. The Commissioner of Parks is a member of our Board of Managers, and, needless to say, a very valuable and respected one. It is a very great pleasure to have Commissioner Moses here today and to introduce him as one of New York's greatest public servants.

* * *

Mr. Moses:

MR. SWAN, ladies and gentlemen:

In most of the melodramas I used to see as a boy the landlord was the villain, but the landlord was not nearly as unpopular as the fellow who represented him to collect the rent.

My job is to be sort of a representative of the landlord from City Hall and the Municipal Building to various institutions in the city. The relationship between public officials and institutions is a very interesting one and we have learned a great deal from it. Those people who regard botany, zoology or art as their particular hobby have brought to the city a kind of talent and a kind of culture which couldn't possibly be obtained in any other way. We ex-officio members of the boards of such institutions are around a short time at best. We either contribute or we do not, and then we are on our way; our services are actually an instant in our lives. Of course, sometimes we are a little bit closer to the people than the trustees are and in that way we make our contribution. But you have to look to the trustees to carry on the traditions of an institution. The enthusiasm of the people is the most important thing that these institutions have today — whether it is this particular institution or not.

At the end of this period of fifty years, the trustees of this institution [the Board of Managers] have come to the conclusion that they will take advantage of the post-war period to rebuild, modernize, and bring up to date the buildings and grounds — and that is a very intelligent thing to do, as it is not a question of modernizing the grounds but it is the question of a new point of view. Some of you are looking at and others have their backs to the building that I am facing. It is very impressive but it has outlived its usefulness — there has to be a new building. There are going to be more people visit here than have ever been here in fifty years — more people will have cars — there is going to be better transportation — new roads — and you have to think in large numbers. All that is being considered in connection with the post-war program.

I for one have the honor of being part of the New York Botanical Garden — through Mr. Cormier who represents me - and thus of being in close touch with the institution, and we are determined that these plans shall be carried out, that they shall not be just a blueprint or another one of those rainbows. I hope that in the carrying out of these plans a great deal of attention will be given to exhibition, a large part used for recreation, especially for those people who can't all have knowledge of the details of science, and a large part also for the facilities of research work.

* * *

Mr. Swan:

It is a very strong statement to say that no one has done more for the City of New York than its present Mayor, but when one hears him discussed the question is not, is he a *good* mayor; the question is, is he our *best* mayor, and most people say yes. Mr. Mayor, your recent announcement* is a blow to this City and to its institutions. We are very glad to welcome you here today and wish your time had permitted more frequent visits. If you are determined to become a private citizen, perhaps you will have more time and we should look forward to welcoming you here. I have the great pleasure of introducing to you His Honor, the Mayor of The City of New York.

* * *

Mayor LaGuardia:

LADIES and gentlemen:

All this is so different from the many many meetings and the many many places I have been to in the last few years. The setting, the beautiful surroundings, the cultural background, the anniversary we celebrate — all make it so different, particularly in contrast to our daily lives down at City Hall. Fifty years of service — still young with vision for the future — that is certainly a fine commentary for the New York Botanical Garden, and I want to congratulate its President, its Trustees, for the fine work they are doing.

Commissioner Moses spoke on the contributions of this institution. In its popular sense it is exhibitive of beautiful plant life. I have no doubt that this part of its service will always be understood. I do not doubt that future administrations will provide for it, but to me the greater usefulness is the scientific side of this great institution, in a practically new science that has developed during the last two generations.

As the President stated in his opening remarks, plant life is the very essence of human life in everything we do and live for, yet the scientific approach to plant life is relatively young in comparison with other branches of science. Had today's knowledge about plant life been available fifty years ago or one hundred years ago, hundreds of thousands of lives and billions of dollars could have been saved. Much more progress has been made in botany than in government or economics.

Many, many times in Congress I couldn't help thinking — when we would have a Mediterranean fly destroying fruit or when the corn borer and other pests and diseases of plants would strike, that the New York Botanical Garden and like institutions would find the cause and protect the plant — so that we could increase our production until we wouldn't know what to do with the surplus. Don't you see how the science of botany has gone way ahead? — Why, in the next fifty years the New York Botanical Garden could rest and the government and economics would still have to hurry to catch up. It is that part of the institution that we want to survive and

* That he would not again become a candidate for the mayoralty at the end of his present term.

grow. Just put a seed in this ground and watch it grow!

Now we know how to improve plants and how to increase their production. But we haven't yet fully learned how to utilize them for the benefit and enjoyment of the people of the world. We have also learned that we can make synthetic substitutes, and yet we do not know whether that is wise or not — whether making anything synthetic is better than what we can grow naturally. That is why I would like to see a closer relation between scientific institutions and government — and we are going to see a great deal of that in the near future. During my time I have seen many scientific institutions arise, and New York City has established close ties with these institutions, but some of my political friends can not understand the purpose of such a relationship. However, I hope that future administrations will continue our approach. We have provided research work for nearly all of our city hospitals and in the post-war program that Commissioner Moses mentioned we have made plans for scientific work in all our medical institutions in the United States. The government is now considering, in Congress, appropriations for research. There are now some very excellent scientific agencies maintained by the United States Government. The relationship between institutions and government must be such that research can always remain independent of outside influences.

I think that this institution did not happen by accident — there are no accidents in science, but there are a great many accidents in politics. Therefore, as time goes on and we go into a new era, will you please pass on to my successor and successors the idea that all scientific institutions must be left aside and apart from the influence of politics? There is no such thing as a Republican or Democratic scientist. If he is, he is neither.

Let my message on your Fiftieth Anniversary to my successor be that here is a New York City institution of great value, continuing its studies, which has such great relation not only to the people of our City but also to the people of the world; and while mayors may have to select park commissioners to work out the exhibitive end of it and the police to police it, please leave the scientific end of the institution to the scientists. We are very hopeful that before long this institution may make a great contribution to humanity.

I thank Mr. Swan for his very friendly remarks, which are part of his great hospitality, but let us hope that each mayor who follows may be known as the best, so that fifty years from now when my successor stands here your President will say that *he* is the best mayor of New York City. I now take pleasure in unveiling the plaque.

The first official rides on the World's Fair trains were made after the rededication program.

INTERNATIONAL DAY

Saturday, May 19

CONSULAR representatives from nearly a score of foreign countries accepted the New York Botanical Garden's invitation to attend the program on International Day, Saturday, May 19. The international aspects of the Botanical Garden's work and their significance particularly in a world at war were the theme of remarks by Joseph R. Swan, who presided at the gathering in the lecture hall, and of Dr. William J. Robbins, Director, who addressed the audience of nearly 700. The two talks are published below.

They were followed by a program of folk dancing by members of the Community Folk Dance Center, under the direction of Mr. and Mrs. Michael Herman of Flushing.

Mr. Swan:

TO the members of the various consulates and their families who honor us with their presence here today — and to all of you who have joined with us to celebrate International Day of our Fiftieth Anniversary Garden Week — I bid a hearty welcome.

Considering all that is happening in this country and in the world today, it seemed more than appropriate to designate one of the days of this Anniversary Week as International Day. With a population for many years composed of peoples from every quarter of the globe, it has taken our entire lifetime and two wars for this nation to achieve the international point of view which we have now attained.

Botany has always been international. Mankind the world over depends on plant life for sheer existence — as well as for much of civilization's progress scientifically, economically, and culturally — and for those important elements of living, the inspirational beauty and the aesthetic and recreational values of plants and flowers, which all men enjoy.

In the New York Botanical Garden not only our own nation, but every nation, has an institution which, by its research and educational work in the past fifty years, has done much to benefit the peoples of the entire world.

At this very time, in the laboratories of this institution, research projects are being carried on which may mean great advances in the relief of suffering for mankind everywhere.

Just as all other scientific advances ultimately cut across all geographical boundaries, so, too, do the results of the fundamental investigation of all phases of plant life for which this institution has become known throughout the world.

President Butler of Columbia University, a few weeks ago, referring to the war's devastation in Europe, pointed out that a century or more may pass before the nations of western Europe regain their pre-war standards of civilization.

Because of Europe's terrific losses of materials and personnel, both the Old World and the New, we can perhaps assume, will in various fields look increasingly to the United States for leadership in the years immediately ahead. This is true, I believe, of medicine and the physical sciences, and it is also true of botany and horticulture.

I am sure you will appreciate the spirit in which this is said. It serves merely to emphasize the fact that an institution as outstanding in the field of botany and horticulture as the New York Botanical Garden — with its long-standing tradition of service and achievement in the cause of mankind — must look ahead to still greater opportunities for service and achievement in the future for the benefit of our own and of all nations.

For such reasons, therefore, as well as the fact that a love of plants and flowers is in itself a common bond between all civilized men, this International Day is a fitting one to observe in connection with the Golden Jubilee of the New York Botanical Garden.

Dr. Robbins:

IT is peculiarly appropriate for the New York Botanical Garden to include an International Day in the celebration of its Golden Jubilee. The Garden is an institution devoted to the preservation, dissemination and advancement of knowledge about plants and to the display of flowers, shrubs and trees for the recreation and education of the public. Plants do not recognize national boundaries, and the love of their beauty and interest in their culture, uses, and enjoyment is not confined to any country or to any race. Flowers, trees and shrubs and the pleasures and benefits they bring belong to humanity at large.

Because of the nature of the material with which it deals, because of its unique facilities, and because of its location in New York City, the influence, interests and associations of this Garden are international as well as local and national.

The international character of the New York Botanical Garden can be demonstrated in various ways. For example, the more than 12,000 kinds of plants growing on its grounds and in its greenhouses come from all parts of the world. You can see here in a morning plants from more countries on the earth than the average person would see on a trip around the world — plants from Australia and New Zealand, from South Africa, Mexico, Chile, Peru and Brazil, from the Mediterranean and the Near East, from Sumatra, Borneo, and the Malay Peninsula, from China, Japan, Russia and Europe.

Our herbarium, which includes more than 2,200,000 specimens, also is drawn from all parts of the world, from the Arctic and the Antarctic to the equator.

The staff of the Garden maintains an active interest in the plants of foreign countries. During the past year members of the staff have collected in British Guiana, Surinam, Ecuador, and Mexico. By these explorations they have increased our knowledge of the flora of those regions and brought back to us plants which may be of interest and of economic importance.

Former students have gone to many foreign countries to which they carry the training and knowledge of plants obtained here. One of them, Charles Budd Robinson, lost his life in the island of Amboina, Dutch East Indies, in December 1913 while pursuing comparative studies of the floras of the Philippines and the Dutch Islands. We have in his memory a Charles Budd Robinson Fund, the income from which is used to aid botanical explorers in difficult regions.

The Garden's publications go to 45 foreign countries, and our library receives under normal circumstances more than 400 periodicals from abroad. Under present conditions this number is 110.

We exchange plants and seeds with botanical and horticultural institutions in foreign lands. Last year our seed exchange list went to 292 institutions in 58 countries.

In normal times this institution is a center for horticulturists and botanists from this country and abroad. Just before the war a botanist from Australia visited my office on his way to England to see a famous English botanist and plant explorer. I had the pleasure of introducing this Australian botanist to the Englishman whom he had planned to see in London and who also happened to be visiting us at the New York Botanical Garden.

Two or three months ago I received a letter from a resident of that little but heroic island of Malta. It was addressed to a member of the President's cabinet in Washington (whose name I shall not mention) and marked "Care of New York Botanical Garden, please forward." We sent the letter on, and I am sure the gentlemen in Malta who knew us so well, but did not know the address of a cabinet member, received an acknowledgment from Washington in due course.

For some years before the war one of our best student gardeners was sent annually to the Royal Botanic Gardens at Kew, one to the Royal Botanic Garden at Edinburgh, and one to the Montreal Botanical Garden, Canada, in exchange for one of theirs. This international exchange we found mutually advantageous and it was discontinued only because of the war.

Even in these days of difficult communications, congratulatory messages on the occasion of the fiftieth anniversary of the New York Botanical Garden have already arrived from more than forty institutions abroad, including the Royal Botanic Gardens at Kew, the Royal Horticultural Society of London, the Royal Society of London, Cambridge University, the Linnean Society of London, the British Association for the Advancement of Science, the Chelsea Physic Garden, the Royal Botanic Garden in Edinburgh, the famous Botanic

Folk dancers dressed in the costumes of many nations entertained the Garden's visitors with eight groups of dances on International Day, May 19.

Garden in Geneva, Switzerland, the Institute of Natural Sciences in Bogotá, Colombia; and also from Belgium, India, British Guiana, Finland, Canada, Argentina, Costa Rica, Peru, Sweden, Venezuela and Cuba. We are still receiving messages from others of our friends abroad. It is heartening and encouraging to have this evidence that international relations between those who work with plants are being re-established so quickly after the dislocations caused by the war. In addition, we have received 168 messages from this country representing 34 of the 48 states as well as from Hawaii, the Canal Zone and the District of Columbia. The language of flowers is truly an international language, and the science of botany and horticulture extends wherever men live and plants grow.

* * *

COMMEMORATION DAY

Sunday, May 20

As an appropriate conclusion to Garden Week, three talks were given on Sunday afternoon, May 20, to an audience gathered on the lawn in front of the Museum Building, by leaders in the three principal religious faiths of this country. Each was asked to choose a theme concerned with plant life, "To emphasize," as Joseph R. Swan remarked in introducing the speakers, "how plants help to restore souls — a thing which perhaps more than anything else the world needs." The three addresses are given here in full.

The Reverend Eugene C. Carder

General Secretary of the Protestant Council of the City of New York

THE leader of the Christian religion, Jesus of Nazareth, was a man of very wide interests and of a keenly alert mind and heart. He walked through the all too brief span of His life with eyes that were wide open to what was going on about Him, even as He was responsive to the prophetic voice that spoke from within Him — the "still, small voice of God." Among the sons of men there had not arisen then, nor has there arisen since, a soul more sensitive to the currents of life about Him than was Jesus.

In the Chancel Screen of the Riverside Church the life and influence of this man are presented in seven panels representing seven areas of His primary concern. Standing with Him there are men and women from seven categories of life who have followed in His train, each in his or her own way. If one turns to the realm of medicine and runs down the list of leaders of that profession from Hippocrates, Hipparchus, Pasteur, Lister, Koch, and Walter Reed it is immediately apparent that the "Great Physician," along with St. Luke, belongs in that group. To think of the great teachers of all time is to think of Jesus as standing rightfully in their midst, as is the case with the lists of missionaries, prophets, and humanitarians.

Today we who gather in this marvelous garden spot of the City of New York may well ask ourselves to what theme for His prayer would this Jesus turn in this garden today, were He to repair to it as, long ago, He did turn aside in His extremity to visit another garden associated with another city — the Garden of Gethsemane.

Were He to talk here He would take deep and abiding satisfaction in the sheer beauty that He would find. He would appreciate the reverent care with which here the flowers of the field are nurtured. It is particularly gratifying to New Yorkers to discover that these men who are experts and specialists in the realm of horticulture and who are responsible for the development of the City's Botanical Garden as a place of beauty and a sanctuary for the soul have also sensed their unparalleled opportunity and responsibility to carry on effective experimentation and research in every department of their science. The New York Botanical Garden is projecting itself into every area of modern life and into every corner of the world through the influence it is having upon the imagination of the men who will rebuild the cities of devastated Europe; upon the industrialists, economists and agriculturists who will feed, clothe, and house the people of tomorrow.

One tribute that should be paid here today should go to all who are responsible for the policies by which their Garden is governed. It is a remarkable example of a well-balanced sense of responsibility. The New York Botanical Garden realizes that New York is a city of people and that people enjoy beauty. If the people were not welcomed here all the beauty and the inspiration would be wasted, as is all effort that spends itself in a vacuum where people do not live. This isolation would be easy to accomplish unless the scientist and the research man were also a humanitarian and a sincere lover of beauty. The Botanical Garden is to be congratulated upon having brought about so happily this remarkable marriage of science and of a very uncommon sense.

I am confident that if the Sage of the Christian faith were to look in upon this garden today and were to see us here, a group of human beings of the vintage of 1945, He would say to us what He said to others two thousand years ago:

> *"Consider the lilies of the field, how they grow; they toil not, neither do they spin: and yet I say unto you that Solomon, in all his glory, was not arrayed like one of these."*

The Reverend J. Harding Fisher, S.J.

Rector of Fordham University

MAN is the high-priest of creation. His feet are set on the earth but his head reaches up to heaven. Everything of a lesser dignity than man's own, functions to serve him in body and soul — in both. To this the world of plants is no exception. Plants provide man with food, clothing, shelter, and comfort. They also minister to his spiritual needs. Possessed as they are of being and existence, and therefore of their share in the true, the good, and the beautiful, plants make their way through man's senses to his intellect, his will, and aesthetic sense, and come to exercise an influence on his soul. It is not easy to explain how mere matter crosses the bar that separates the material from the spiritual. The manner of this process has vexed psychologists of all times. Of the fact, however, there is no doubt. It is a thing of universal experience. It would be folly to deny it. Besides, it has the warrant of Holy Scripture. Isaias, speaking in the name of God, testifies to the fact of it:

> *"I will plant (he says) in the wilderness the cedar and the thorn, the myrtle and the olive tree. I will set in the desert the fir tree and the box tree together. That they may see and know and consider and understand that the hand of the Lord hath done this, and the Holy One of Israel hath created it."*

St. Paul accepts this truth as obvious, so obvious indeed that he can find no excuse for those who do not rise from the things that God has made to the God who made them. And nowhere has the divine message been written more clearly than in the mysterious ways of plants, in their life and death and resurrection, and in the unremitting ministry which they render unto man.

One of the noblest of these ministries is what may be called the sacred ministry of worship. Plant life has always been the handmaiden of religion. Monastery gardens are a legend and a fact. Stately trees have always loved to cast their shadows on the gray walls of cathedrals. Evergreens inevitably make their way to religious cloisters. Flowers mingle their fragrance with the hymns and prayers of men and women in liturgical service. And worshippers of every creed, as they turn their steps to their churches and chapels, are chastened to the spirit of adoration by the growing things that surround the House of God. The leaves of the acanthus, graven in imperishable stone, have been almost the only decoration permitted in minsters, old and new. Evidently, beauty in the world of plants is a link between the human and the divine.

Another ministry exercised by plants is the ministry of joy. One of the most pleasing gifts that a kindly providence has bestowed on man is the gift of beauty. Beauty charms and gladdens the heart of man. The laughter of little children, the gentle wisdom of a mother's smile, the courtesy of a man's love for his wife — these are miracles that take place on the borderline of matter and spirit, and fill the mind with gladness. Other things also delight the soul: golden mists of sunlight, the chaste radiance of the stars, the majesty of mountains, the might of oceans. These suggest the splendor and the grandeur of the infinite, and give us joy.

Humbler than this heroic splendor of inanimate nature, less noble than the imprint left on matter by the soul, but more widespread, more within the reach of everyone, and more capable of setting aglow the spark of artistry that is part of every personality, is the gracious beauty of the world of plants. A snowdrop smiling above a bank of ice, arbutus trailing its shy loveliness in secret places of its own, friendly violets half hidden in their nests of leaves, are among the lowlier instruments of pleasure that spring from the earth. They are so delicate that a careless touch will mar their fragile bloom, so inflexible in nature that no force can make them swerve from their appointed plan; and yet they are sown broadcast by the Divine Sower among the rocks and thorns. Who has not felt a stab of sweetness at the spectacle of springtime's clouds of blossoms, summer's fields of waving wheat, autumn's riot of gold and crimson, and the gray woods of winter etched against a cloudless sky? Yes, and by the myriad patterns of the trees, each leaf unlike and like its fellows? Thus Nature puts her gracious pleasures at the feet of all.

Still another ministry of plant life is its power to minister to minds diseased. This is the ministry of healing. Trees and shrubs and lawns and flowers, no less than music, have charms to soothe the sick at heart. Passion in revolt seems very cheap in the serenity of gardens. Sanity reasserts itself when caressed by the gentle peace of flowers. Trees that have bowed before a thousand storms, but still surviving, firm-rooted, speak hopeful words of reassurance to souls in doubt.

Something of this blessed influence is wrought in the spirits of the multitudes who visit the gardens that you have made. Careworn, tired in soul and body, it may be they are discouraged by the past and frightened of the future; it may be their present is an unequal struggle for mere existence, and they are depressed and sad. Then they have a holiday, and for a few hours they escape from their slavery and from the city, the stern symbol of their toil, and they come to this haven of rest. They stroll beneath the trees, they walk upon the lawns, they drink in the color and the form and the fragrance of the flowers. Peace comes back to their souls, and they return to their tasks with a smile on their lips, a lilt in their voices, and a song in their hearts. Beauty that you have cultivated and fostered has done its beneficent work.

Your visitors to this Garden may not — and in all probability, do not — understand the source of their healing, but their healing has been accomplished. The truth is that they have heeded the invitation, "Come to me all you that labor and are burdened," and they have been refreshed. They have not found God in Person, but they have found the temples in which His majesty resides, they have wandered amid the footprints of infinite tenderness, and they have sensed the promise of ultimate happiness which He has sealed with His seal in the beautiful things of earth.

Dimly, subconsciously, men realize that a kindly power has passed through the way of gardens, that it is God who has clothed the lilies as not even Solomon in all his glory was clothed. They remember — vaguely, it may be — that God is mindful of His children, and watches over them no less than over the flowers; that finite beauty is a pledge of infinite beauty; that the fugitive glimpses that they have caught of His veiled presence are a token of the full vision they shall have of Him, face to face. They have a feeling of comfort that this life is not the end but only the beginning, and that there is another world awaiting them, where there shall be no more labor, or weariness, or worry, but only happiness beyond their dreams.

Such are the ministries of plant life: the ministry of worship, the ministry of joy, and the ministry of healing. These, surely, are spiritual influences worked in the souls of men by the bounteous beauties of plants.

* * *

Dr. Samuel H. Goldenson

Rabbi of Congregation Emanu-el

WE have come together to celebrate the fiftieth anniversary of the establishment of the New York Botanical Garden. I am happy to be able to observe with you a precise celebration that one can really enjoy — enjoy without any reservation — without a divided mind — without any hesitation — and I can say that, having in mind the unfortunate contrast that one naturally thinks of in these days.

We are celebrating the fifty years of ministry through plant life. We could hardly celebrate without reservation the fifty years of ministry to human life - that is the prevalent tragedy of our world.

Plant life has been carrying on its business of usefulness and of healing, as was said a few moments ago — an inspiration without stint, without hindrance, without suspicion. Human life, during the last fifty years, has exuded much of the ugliness human beings are capable of. We are still within a world of global war; the most damaging and destructive, the most horrible in the world's history.

Compare then plant life with human life. I was asked to say something about plant life from the standpoint of the Old Testament. To find my text relative to plant life I turned to the Thirty-third Psalm and I find these verses:

> *"The work of the Lord is upright, all His work is done in faithfulness."*

Sometimes this word "faithfulness" is translated as "truth." All His work is done in truth. The earth is full of the loving kindness of God. Look about you and see how full the earth is of the loving kindness of God.

I celebrate with you this day because I would like to have you think of plant life and the nature and use of it to mankind. I would like to have you emulate nature. If we could only emulate nature, how much better off you and I would be. In what sense should we emulate nature? In the first place, nature is always true to itself. I have never found an oak tree with maple leaves — nor a maple tree with oak leaves. Everything in nature blends itself to its inner consistency and is always the same. The oak tree has the same form, same kind of trunk, same covering, same coloring. Unfortunately, man does not emulate nature in its faithfulness and in its truthfulness, and when we depart from nature's faithfulness and truthfulness we have all kinds of difficulties. We have stress, complications, misunderstandings, wrongs and evils.

The first prerequisite of a good life is truth and faithfulness and the second characteristic of nature that you and I might well emulate is its spontaneous reaction to beneficence. Have you noticed how quickly nature responds to the sun and the rain? Ofttimes we marvel at the miracles of nature. We go to bed feeling the winter season still upon us. We rise in the morning to an early spring, and lo, nature has already changed itself. The immediate response to the new season is wonderment. Nature never holds back its bounty, never holds back its beauty, never holds back its coloring, never holds back its lavishness to give . . . never holds back its abundance, too, for the fortunate or unfortunate. Nature never holds back its providence. Remember when I say "providence" I express in a word God's connection with nature, the God who provides only through nature. When you go to the country grocery store and see the words "Groceries and Provisions" you see words that bring you in contact with God's providence. Provisions, the things that can provide for you — are the things God has provided for you — and they are the work of nature.

Nature, in its fullness — its beneficence — is always immediate and always instantaneous. Would that you and I were as good as nature! Would that kindness and love and generosity flowed as freely — as freely as nature's!

Nature does not say: I will bear fruit for this one — and not for that one; I will emit fragrance for one and not for the other; I will be bountiful for one and not for the other. Nature does not discriminate — has no prejudices — it gives to all. Give something to nature and immediately it will answer in entirety and generosity.

We are living in a world where most of our troubles arise from the fact that human beings have more than one standard of goodness; they are good to their own class and kind and not to others. They are good to those who belong to their own churches and synagogues — but not to others. All of these variations and exclusivenesses have brought on all our troubles — and so I say we may as well emulate nature in regard to others.

For this reason I am very happy I have been able to talk to you — and draw a lesson from nature and all her benefits and inspiration while living in the most terrific period of history. There is more worry and suffering than ever before. Would that we knew nature, followed her word above everything — would that we followed nature as the work of God's providence and God's love.

MEDICINAL PLANTS IN ENGLAND

HOW England conquered the problem of drug production during the war, at least in part, was told by Gladys M. James, Lecturer to the Oxford Medicinal Plants Scheme, in a program at the New York Botanical Garden May 15, arranged for Garden Week in co-operation with the New York unit of the Herb Society of America. Members of the society were afterwards guests of the Garden at tea.

Early in the war, Mrs. James explained, the supply of foxglove from which digitalis is derived was cut off. It had formerly been supplied by central Europe. The Oxford Medicinal Plants Scheme conducted research on increasing production in England. As a result, through county hub committees, foxglove leaves were collected from various places where they grew wild. Women and children assisted in the collection, being transported to the remote sections where the foxglove usually grew, with the aid of the Women's Voluntary Services. Leaves were dried, chiefly by utilizing conservatories, old stables, bake shops, laundries, and pot kilns, and sent to manufacturing chemists. Seeds were saved and home production was encouraged.

"This year," she said, "we were told that there is enough digitalis on hand for current needs, so collection has been halted temporarily, as the product is perishable."

Eighteen other varieties of medicinal herbs, the most important of which was belladonna, were collected by county committees in much the same way.

Mrs. James also told how rose-hips from the hedgerows and gardens of England were used to supplant the vitamin C of oranges and lemons, when the supply of citrus fruit was cut off. They produced a syrup richer in vitamin C than citrus fruit, she said.*

While some families made syrup at home by pressing the rose-hips through two layers of flannel and boiling the puree down to produce the syrup, more satisfactory results, she said, were obtained by sending the fruits to manufacturing chemists, as much as the vitamin value was lost if the syrup was cooked too long.

Black currant puree also was used to supplement orange juice as a source of vitamin C.

Mrs. James, who is a member of the Botany Department at Oxford, came here to study medicinal plants in America for the Oxford Medicinal Plants Scheme, and at the same time to visit her children who had been here for safety since the start of the war, and to take them back to England.

Elizabeth Remsen Van Brunt, President of the New York unit of the Herb Society of America, introduced Mrs. James to the Garden's audience.

* See the Journal for February 1943. "New Sources of Vitamin C" by Virgene Kavanagh.

PLANS FOR THE FUTURE

Plans for Garden's Future Announced At Conclusion of Garden Week

Fiftieth Anniversary Fund of $4,900,000 Goal of Greatest Financial Campaign In the Institution's History

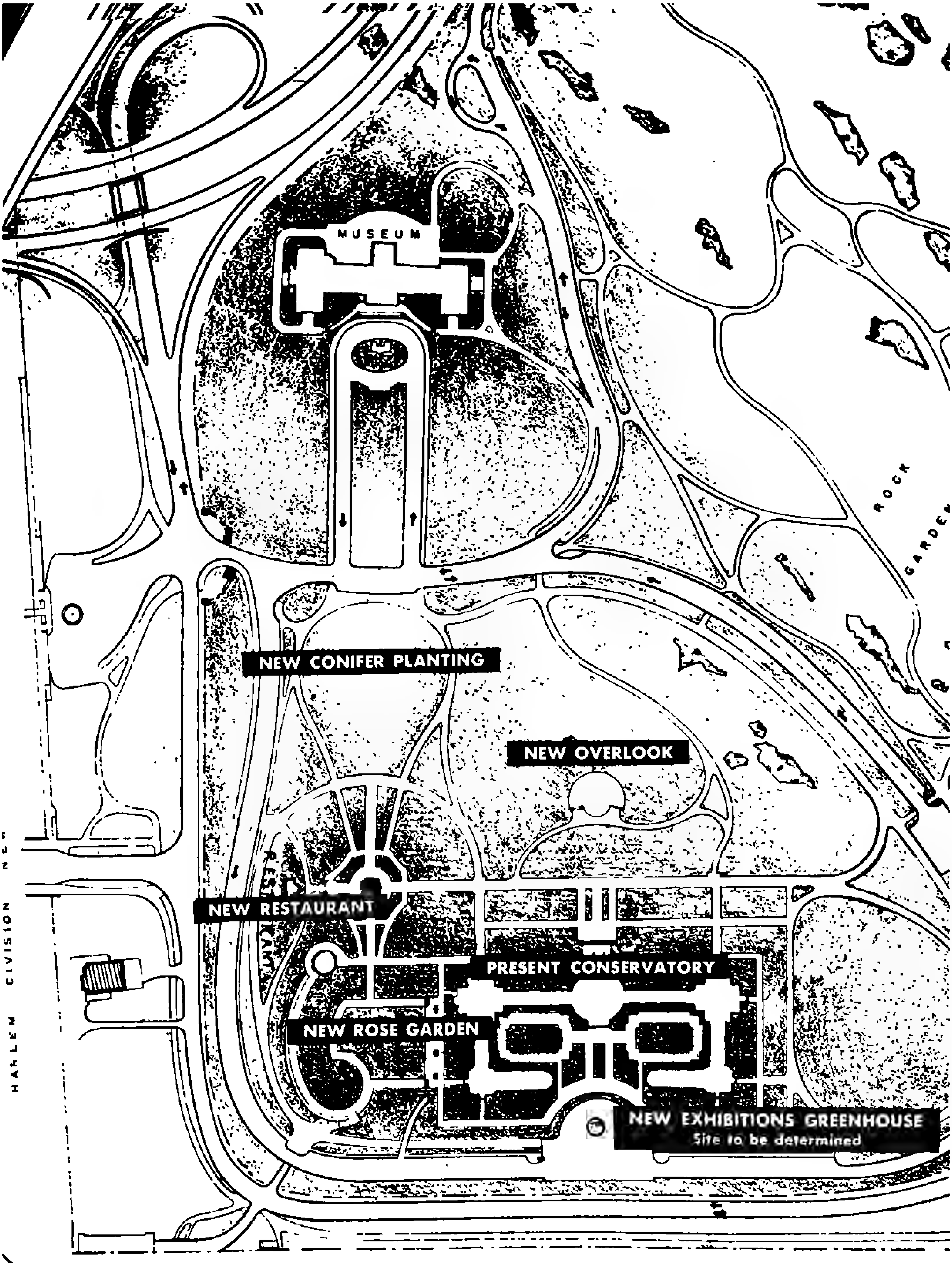
AS a climax to the Garden's fiftieth anniversary celebration, Joseph R. Swan and Mrs. Harold I. Pratt, Co-Chairmen of the Garden's Committee on Plans and Development, which was organized in the spring, released a statement to the press for publication May 21 announcing post-war plans which will involve a minimum of $6,580,000 in capital expenditure and new endowment for the development of the New York Botanical Garden.

Of this sum, $1,680,000 is included in the post-war capital budget of the City of New York. The balance of $4,900,000, which includes $300,000 to enable the Garden to participate in the City's expenditure, will be sought through private subscription. The money thus raised will be designated as the FIFTIETH ANNIVERSARY FUND. The Honorable John W. Davis, former Ambassador to Great Britain, has accepted the chairmanship of a national committee of sponsors for the raising of this sum.

A new museum building to cost $977,500 is one of the major items in the post-war scheme. Plans for the structure have already been drawn by Aymar Embury II and Skidmore, Owings & Merrill, associate architects. A new design for the grounds has been prepared by Major Gilmore D. Clarke, landscape architect. This design includes, besides relocation of roads and construction of new bridges, a new rose garden on the west side of the grounds adjacent to the other plantings and a new exhibition greenhouse to enable the Garden to present more effective displays and to accommodate the Sunday crowds, which frequently tax the capacity of the present conservatory.

A restaurant and a public rest-room also are among the plans; likewise the rehabilitation of the Lorillard snuff mill to make it a functional part of the Garden's physical equipment. The numerous other additions and improvements include enlarging the size and scope of the Garden's monthly Journal.

This vast program of development, greater than any in the Garden's his-



Some of the new features planned for the New York Botanical Garden are shown on this sketch map prepared by Major Gilmore D. Clarke.

tory, involves the capital expenditure of $2,305,000 for improvements to physical plant, grounds, and equipment.

The balance of $4,275,000 in new permanent funds is desired for the following projects:

To expand the Garden's laboratories for research in plant diseases, plant breeding, and plant physiology.

To establish seven new curatorships and two assistant posts on the scientific staff.

To create a scholarship fund to foster the advanced training of potential leaders in the plant sciences.

To develop, through more effective display, greater interpretative use of the museum, which is the only public museum in this country exclusively devoted to botany.

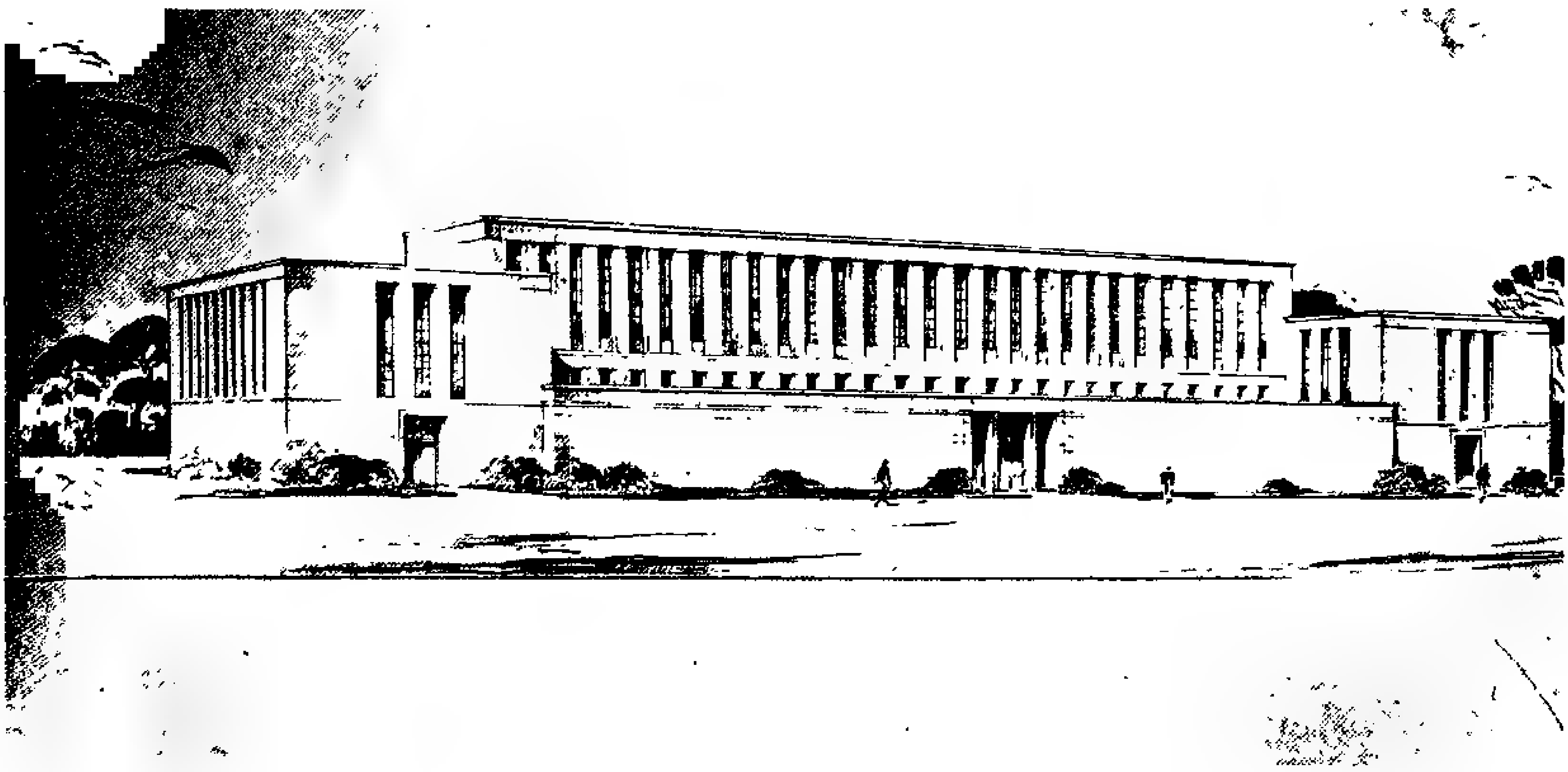
To enhance the series of special outdoor gardens and displays of such plants as azaleas, rhododendrons, irises, dogwoods, peonies, roses, dahlias, and hardy asters and chrysanthemums, of which the Garden already has exceptional collections, and of others which might be established.

The curatorships contemplated include chairs in *South American Tropical Botany*, a field in which many new plants remain to be discovered and also in which major commercial developments are certain to arise in the near future; *African Botany*, another promising field both botanically and industrially, yet one so far scarcely touched in this country; *Plants of Eastern Asia*, already the source of many ornamental and useful plants for American culture and a field in which the Garden has extensive herbarium collections; *Economic Botany*, to be concerned with the thousand different kinds of plants now utilized in nutrition, medicine or industry and with the botany and potential uses of the many plants as yet unknown; *Fossil Botany*, in which the Garden is recognized as having one of the world's finest collections of specimens; and *Cryptogamic Botany*, where both an additional Curator and an Assistant Curator are desired to work on the ferns, mosses, liverworts, algae, and fungi — a taxonomic field larger than that of the flowering plants.

Other positions called for include a *Curator of Education* to plan, co-ordinate, and expand the Garden's entire program of formal and informal public education and information services, and an *Assistant Custodian* of the Herbarium of more than two million specimens.

In a statement issued with the public announcement of the new plans for the Garden and the campaign for funds with which to carry out the program, Mr. Swan pointed out that although the annual maintenance costs of the Garden are largely met by City appropriations, the Garden's educational and scientific work is chiefly dependent on private support. "Since 1930," he remarked, "its annual income has shrunk about $75,000 a year, necessitating sacrifices of essential personnel and other economies which cannot be continued without deterioration of invaluable botanical materials and permanent impairment of its basic work.

"To meet this situation, and at the same time enable the institution to fulfill its obvious responsibilities to science, education and the public, the Garden's permanent endowment funds must be increased $4,275,000 to at least



The Garden's new Museum Building, as designed by Aymar Embury II and Skidmore, Owings & Merrill, scheduled for construction as part of the City's post-war plan soon after peace is settled.

$7,000,000, and urgent physical improvements made to the extent of $2,305,-000 in its plant, grounds and equipment.

"The Managers have confidence that when the Garden's plans and needs are known, the generous response necessary to the success of the Fiftieth Anniversary Fund appeal, first of its kind in the history of the institution, will be forthcoming.

"Such success is urgent if the Garden is to maintain its present high standards; essential if the Garden is to make minimum preparations to meet its opportunities for greater service to science, industry, medicine and the people generally; vital if this already world-famous institution is to be the foremost center of horticultural and botanical science in the Western Hemisphere, for which its men, materials and traditions of service commend it.

"The Managers are sincere in their conviction that this Garden and its Fiftieth Anniversary Fund constitute a national enterprise of the highest importance, and ask the generous support of all who would invest in their own and in mankind's future."

Besides Mr. Swan and Mrs. Pratt as co-chairmen, the members of the Committee on Plans and Development include Arthur M. Anderson, William Felton Barrett, Edwin De T. Bechtel, Mrs. Robert H. Fife, Mrs. Elon Huntington Hooker, Clarence McK. Lewis, Francis E. Powell, Jr., and Dr. William J. Robbins.

THE FORDHAM CEREMONY

TO signalize the fiftieth anniversary of the New York Botanical Garden, Fordham University on the evening of May 24 conferred the honorary degree of Doctor of Science on Dr. William J. Robbins. A brief report of that part of Dr. Robbins' address in which he announced the discovery in his laboratory of six new antibiotic substances, is given in the Journal for June. The address of Henry de Forest Baldwin, who characterized himself as "in years the oldest member of the Board of Managers, and in length of service, next to the oldest," appears below. His subject was "Fifty Years of Service to the Public." Joseph R. Swan's prophetic address on "The Next Fifty Years" is also given; likewise a summary of the historical part of the message of greeting by the Reverend Robert I. Gannon, S.J., President of Fordham University, and a translation of the Latin greeting which preceded the conferring of the degree.

Mr. Baldwin:

IN speaking of the past fifty years of the Garden, I must begin with Dr. Nathaniel L. Britton. Dr. Britton was a professor of botany at Columbia College. His wife, Mrs. Elizabeth G. Britton, was also a botanist. When they visited Kew Gardens in England in the summer of 1888, they had the vision to start a botanical garden in New York City. On their return to this country, Mrs. Britton addressed a meeting of the Torrey Botanical Club, and suggested the possibility. The Club took up the matter of establishing a botanical garden in New York and sought to secure an endowment.

Long before this, in 1801, Dr. David Hosack, a professor of botany in the Medical School of Columbia College, established at his own expense the Elgin Botanic Garden, which occupied roughly the area between 47th and 51st Streets and Fifth and Sixth Avenues, where the Rockefeller Center now stands. In 1811, this garden was purchased by the State of New York, and was known as "The Botanic Garden of the State of New York." It was subsequently given to Columbia College, but funds for its maintenance were not provided and it ultimately ceased to exist as a Garden, though Columbia University very wisely still owns the land.

Various other efforts were made to establish a garden, but they fell through for lack of financial support.

In the late 1880s, when I was attending the Columbia Law School, which was given space in Columbia College, then located at 49th Street and Madison Avenue, we students were very much made aware of the fact that some aggressive members of the Columbia faculty were seeking to make Columbia College into a real university. And Columbia, doubtless stimulated by recollection of the source of a part of its wealth, became interested in furthering the efforts of Dr. Britton and the Torrey Botanical Club to establish a botanical garden in New York.

Incorporation of the Garden

The Legislature of the State of New York in 1891 passed an Act incorporating the Garden. Forty-eight incorporators were named in the Act. The Corporation was authorized to receive gifts, grants and devices of real and personal property. The affairs of the Corporation were to be managed and controlled by a Board of Managers to consist of the President of Columbia College, its professors of botany, of geology and of chemistry, the President of the Torrey Botanical Club, and the President of the Board of Education of the City of New York, and their successors in office, to be known as the "Scientific Directors." They were given the management and control of the scientific and educational activities of the Corporation, and the appointment of a Director-in-Chief of the institution, and the Director was given power to appoint his first assistant and also the Chief Gardener. All other business affairs were to be under the control of the Board of Managers, which would consist of the Scientific Directors, the Mayor of the City of New York, the President of the Board of Commissioners of Public Parks, and at least nine other managers to be elected by the members of the Corporation.

I call your attention to this rather peculiar setup and to the fact that for many years prior to this time the government of New York City was under very serious criticism, and the effort was evidently made to put the control of this new corporation, as far as possible, outside of political management.

This was the more necessary because it was to the Board of Estimate and Apportionment of the City of New York that the Garden must turn for its real estate and for its appropriations to construct its buildings and to carry on its activities. There has never been any interference by politicians. This peculiar setup was changed by the legislature a few years ago.

Endowment Fund Raised

It was only after the new corporation had succeeded in raising an endowment fund of $250,000, that the Commissioners of the Department of Public Parks were authorized to set aside a portion of Bronx Park, not exceeding 250 acres, for "A Botanical Garden and Museum, including an herbarium and arboretum." The Commissioners were also authorized and directed to construct and equip, within the said grounds so allotted, according to plans approved by them and by the Board of Managers, a museum and herbarium, with lecture rooms and laboratories for instruction, together with other suitable buildings for the care of tender or other plants, at an aggregate cost not exceeding bonds to be issued therefor by the City in the sum of $500,000.

The initial endowment fund of $250,000 was not subscribed until June, 1895 — just about fifty years ago. There were seven subscribers for $25,000 each: — Columbia College, Addison Brown, Andrew Carnegie, D. O. Mills, J. P. Morgan, John D. Rockefeller and Cornelius Vanderbilt; three subscribers for $10,000 each: — William E. Dodge, William C. Schermerhorn and James C. Scrymser; eight subscribers for $5,000 each: — Arnold Constable & Co., Charles P. Daly, George J. Gould, Helen Gould, James S. Kennedy, Oswald Ottendorfer, William Rockefeller and Samuel Sloan; one of $2,500: — Morris K. Jessup; two of $1,000 each: — Melissa P. Dodge and Tiffany & Co.; and one of $500, Hugh N. Camp, a resident of the Bronx. There was also a subscription of $5,000 by James A. Pitcher to be paid in plants.

I have given you the list of subscribers; most of them were named among the 48 incorporators. They were among the most distinguished citizens of New York at that time.

It was also in 1895 that Columbia College became Columbia University.

The Bronx Half a Century Ago

I think I should call your attention to the political situation in what is now the Borough of the Bronx fifty years ago. The City of New York at that time consisted of Manhattan Island and what was then known as the "Annexed District," which afterward became the Borough of the Bronx in Greater New York. This district after its annexation in 1874 was treated for many years as a stepchild. It got very little consideration from the Democratic party, which for most of the time governed the City and County of New York. For many years it had been crying for public improvements. There were no final maps of the district. And you have to have a map of the streets before you can condemn them and build sewers, and regulate and grade them. The people in the Annexed District revolted in the late 1880s and, regardless of party, went in for local self-government. After getting through the necessary legislation in Albany, they elected their own Commissioner of Street Improvements, and then commenced a great period of public improvements. They obtained what they called then the "final" maps of the district. After adopting the maps, they built sewers and graded and regulated streets. They also acquired large tracts of land for parks. This was in the late '80s and early '90s.

Thus you see that the proposition to establish a Botanical Garden in the Annexed District came at a very good time. Columbia was interested in expanding; the Annexed District was interested in improvements. There was plenty of land in the new parks and, as soon as the $250,000 was subscribed, there was no trouble about picking out the 250 acres which was authorized by the Act incorporating the Garden.

The Botanical Garden's Executives

Progress in public affairs requires the happy combination of the right men, with the right ideas, appearing at the right time.

The first President of the Garden was Cornelius Vanderbilt. In June 1895 he was authorized by the Corporation to notify the Board of Commissioners of Public Parks of the fact that the endowment of $250,000 had been subscribed and to request that the Park Commissioners set apart 250 acres of land in Bronx Park for the use of the Garden, and to request the Board of Estimate and Apportionment to authorize the Comptroller to issue $500,000 of City Bonds for the purpose of erecting suitable and adequate buildings thereon. The Scientific Directors, of whom Seth Low, President of Columbia, was Chairman, were given power to agree with the Department of Parks as to the land to be assigned, and a special committee, consisting of the President, the Secretary, the Chairman of the Board of Scientific Directors, and William E. Dodge and Judge Brown were appointed with power to agree with the Park Board as to plans for laying out the Garden, and as to plans for the buildings.

Dr. Nathaniel Lord Britton was the Secretary of the Corporation and of course he was the guiding spirit of the whole affair. He was appointed Director-in-Chief by the Scientific Directors, and he continued to be the Director-in-Chief and the Secretary for over thirty-three years. His wise counsel and advice in laying the proper foundations in the early days, and his efficient and zealous administration were the most important factors in making this new enterprise a success. The Garden is a memorial to his unselfish devotion.

During his term of office, the following were presidents of the Garden:

1895 to 1898	Cornelius Vanderbilt
1898 to 1910	D. O. Mills
1910 to 1913	Addison Brown
1913 to 1923	W. Gilman Thompson
1923 to 1927	Frederic S. Lee
1928 to 1937	Henry W. de Forest

In 1929, during Mr. de Forest's presidency, Dr. Britton resigned. Dr. Marshall A. Howe, who had served on the Garden staff for many years, was Acting Director for a short time pending the installation of Dr. Elmer D. Merrill, who was appointed Director-in-Chief by the Scientific Directors to succeed Dr. Britton. Dr. Merrill served as Director-in-Chief with great benefit to the Garden until Harvard University in 1935 took him away from us, and he has remained as one of our elected managers ever since. Dr. Howe, who had succeeded Dr. Merrill, lived only a little while after his appointment. He died in December, 1936, and Dr. Gleason served as Acting Director during the next 13 months.

Our present distinguished Director, whom you are honoring today, was appointed in 1937, and took up his duties in February 1938.

The Present Administration

Dr. Robbins' administration, which has now continued for over seven years, has been worthy of his remarkable predecessors'. He has made remarkable improvements in all phases of the Garden's activities. Endowed with creative imagination, sound judgment, and rare ability as an executive, he has planned for the future as well as handled the innumerable details of administration. Under his guidance, noteworthy advances and improvements have been made in botanical research at the Garden; in the exhibition of ornamental and economic plants and decorative horticulture; in educational work, lectures and public relations, and in the recreational and aesthetic features of the Garden. Within a short time after his assuming the duties of Director, the World War started. Under his leadership, the Garden was able to make valuable contributions to carrying on the war. It was able to do this because it had developed an unusual and somewhat unique botanical collection of both living plants and a herbarium world-wide in its scope, a library of high quality and a competent staff whose collective training covers all aspects of botany and horticulture.

A Fifty-Year Survey

The New York Botanical Garden has grown during its first fifty years of existence and has become one of the important botanical gardens of the world.

The amount of its endowment has increased from the original $250,000 to over $2,600,000. A substantial part of this increase is due to notable gifts from John D. Rockefeller, Jr., Edward S. Harkness, and Margaret Olivia Sage. Its land, buildings and contents have an estimated value of nearly $16,000,000 — land $12,200,000; buildings $1,380,000; contents $2,355,000.

Its grounds, somewhat trimmed for streets, now consisting of 230 acres, have been fenced, furnished with roads and paths, and decorated with special plantings and floral displays.

Greenhouses for growing purposes and for display, a museum building and other structures have been built.

Some 12,000 kinds of tender and hardy plants are growing in its greenhouses and on its ground. It is possible to see, in the Garden, in the course of a morning, more kinds of plants, from more countries on the earth, than the average person would see on a trip around the world.

Its museum includes thousands of specimens of plant products of artistic, cultural, or economic importance.

Its herbarium has grown to include more than 2,200,000 specimens.

Its library of nearly 52,000 bound volumes and over 200,000 pamphlets has become one of the most useful and used libraries on botany and horticulture in this country.

The publications of the Garden have now run into the thousands and total 120,000 pages or more of printed matter. Besides its publications, the Garden has disseminated knowledge about horticulture and gardening and botany through conferences and through its library and through informational services.

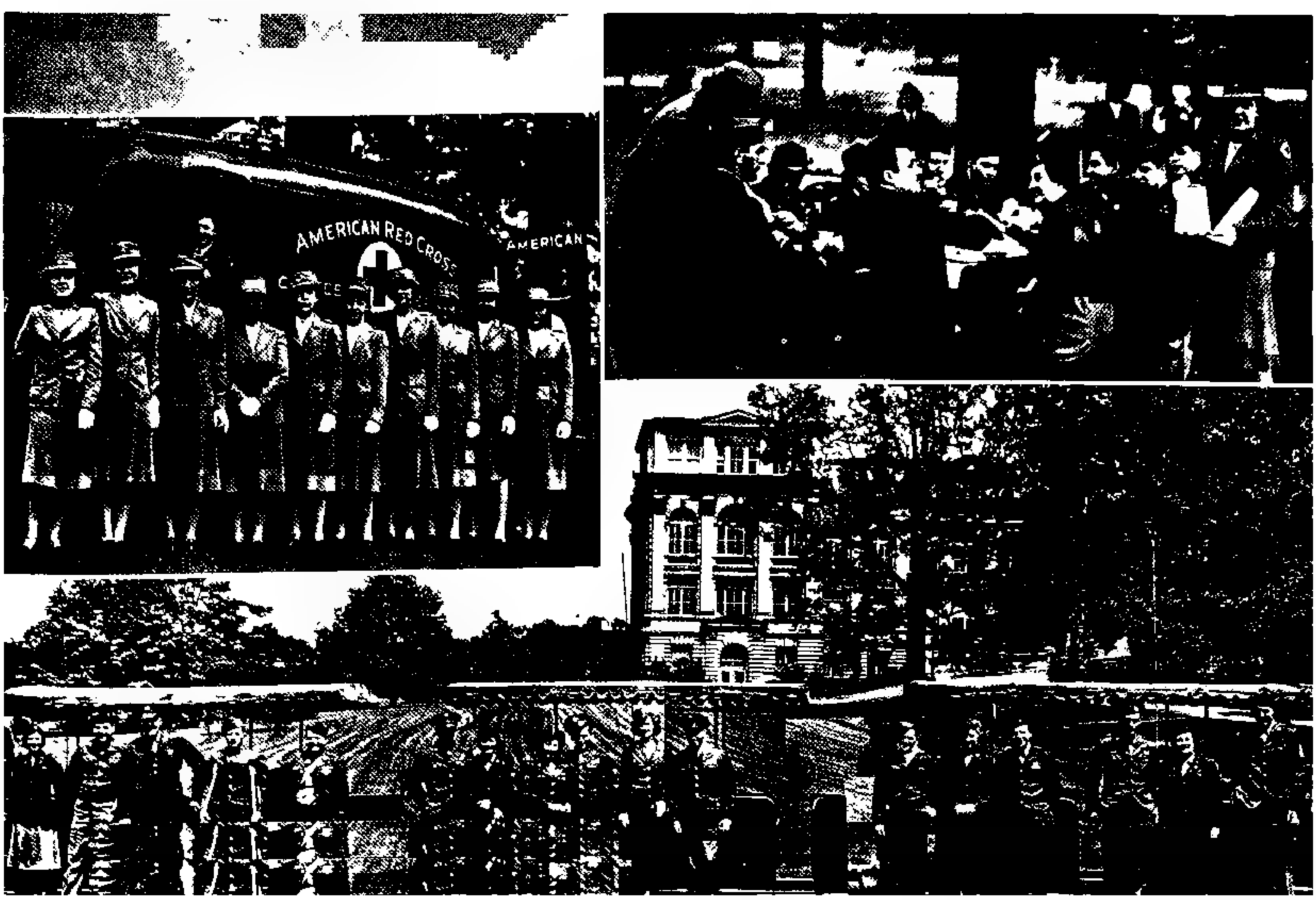
The Garden has conducted a school for professional gardeners and many young men and women trained at the Garden are following their careers in this country and abroad.

Through co-operation with Columbia University and with Fordham University, the Garden gives work for the master's and doctor's degrees in botany.

Scientific Accomplishments

Perhaps the most outstanding accomplishment of the Garden has been in research. Through its scientific staff it adds to our knowledge of the many aspects of plant life. Who can measure the influence on our economic and social life of the studies of Britton, Rydberg and Small, who

Army and Navy Day brought wounded veterans of the present war to the New York Botanical Garden, with Red Cross canteen workers to serve them a picnic lunch.



surveyed and described the native plants of the northeastern United States, of the plains and prairies, and the south; of Degener of the flora of the Hawaiian Islands and other Pacific areas; of Merrill of the plants of the Far East; of Britton, Wilson, Gleason, Smith of the plants of South America; of Mrs. Britton, Williams, Howe, Underwood, Merrill, Seaver and others on the algae, mosses, ferns, liverworts, and fungi? Who can state in facts and figures the effects of Gager's studies on the effect of radium on plants; of MacDougal on the action of light and darkness on plant growth; of Stout on the fertility of plants, or of Dodge on the genetics of the fungi and on plant disease?

During the past seven years the scientific researches and many publications of Dr. Robbins on the role of vitamins and penicillin-like substances in plants, with their important bearing on human nutrition and medicine, have brought prestige to the Garden and won him fame as a leader among the world's botanists. His scientific achievements have been recognized in his election to membership in the National Academy of Sciences and in the American Philosophical Society, to the presidency of the Botanical Society of America and of the Torrey Botanical Club, and to the vice-presidency of the American Association for the Advancement of Science, and the chairmanship of the Section on Botanical Sciences, and he has been entrusted with the Chairmanship of the National Science Fund.

The Garden's Reputation

Sufficient to say that the additions made by our Directors and our able staff to our knowledge about plants have given the New York Botanical Garden in the course of fifty years an enviable standing among the botanical institutions of the world.

It has served as a botanical and horticultural center at which a definite and planned educational program has been conducted, and to which amateurs and professionals have come from this country and abroad for information, for help, and for the materials for research. It has been a place of resort and a source of inspiration for those who delight in the beauty of plants and are interested in the pleasures of growing them. That this is so, is attested by nearly 2,000,000 visitors each year.

After fifty years of constant progress, due to wise support of a comparatively few citizens and of the taxpayers of the City of New York, we can boast of a substantial financial setup, the support of distinguished citizens, the leadership of a distinguished scientist and proved administrator. More than that, our Director has qualified as a good neighbor, as your gracious recognition today demonstrates.

Unlike Britton's and the Torrey Club's situation, when they were asking for support as an act of faith, with no substantial achievement to point to, we can, as the politicians say, "Point with pride."

As with most important institutions which have demonstrated their worthiness to exist, their managers would fail in their duty if they did not ask for more and more support. We are no longer a speculation. An investment in the New York Botanical Garden is a sound and seasoned investment. It is something that New York City and the country can be proud of, and its particular field is one that is almost inexhaustible.

Institutions are built from the lives of men. The New York Botanical Garden is the dividend of the lives of many individuals which were invested in whole or in part in its development during the past fifty years. There will be many to follow the path which has been so well laid.

* * *

Mr. Swan:

MR. BALDWIN, the Dean of our Garden Board, has told you of the history of the Garden. I have been asked by your President to tell you of its next fifty years.

It is a rash man, particularly in this unsettled time, who makes prophecies, but we all of us have the right to dream, and I think the duty. In the study of plant life our scope is infinite, for plants are the source of all life — food, oxygen, fuel. They also provide clothes, shelter, commercial commodities. They are the primary sources of vitamins, and they produce disease and cures for disease. From their study has come knowledge of many principles of life applicable alike to man and to all other living things.

And with all of these functions goes the beauty of plant life, the restorative powers of trees, shrubs, and flowers, as displayed in our own and our neighbors' gardens and, more particularly, in such beautiful public parks as the New York Botanical

Garden. What a field to challenge the imagination!

But that is not enough. In any institution such as yours and ours we need a leader and a band of enthusiastic followers — some with the capacity to dream, some to administer, some to do both, and all to work. Now we have this leader who is dreamer and administrator, to which this action of yours this evening bears witness, and we have this band of eager followers. They and their predecessors have achieved all that could be expected of such a small group with limited resources, and more. In its field the New York Botanical Garden occupies a very high place, but our accomplishment is far short of our potentialities. We greatly need additional resources. If we are to expand as we are going to try to do, we shall need more of everything we have of which we now have so little.

We shall need new buildings and laboratories and equipment, and space properly to house our library and herbarium in which are vast amounts of botanical knowledge accumulated over the years. Such knowledge, of course, is the foundation of any institution of learning. We shall need lecture halls and classrooms where we can instruct the specialist and the layman in botanical and horticultural knowledge so they can take home and use the knowledge and produce the beauty which exists in plants and flowers. Putting it in the briefest possible terms, we need what probably all institutions such as yours and ours always need — more facilities and more endowment. We need a restaurant and rest rooms so that people can come and spend the day away from the turmoil of city life, in the beautiful surroundings which we can even now provide, but which should be much more developed. If we have one building of this sort, I hope and thoroughly believe that the attendance at the Garden will so increase that we shall need another and still another.

We need an adequate exhibition house for our winter displays which today are very fine, but shown under conditions so inadequate that very often hundreds of people are turned away or are so crowded that they cannot see and enjoy the flowers. We have the staff and growing facilities to enable us to produce all winter, one after another, such flower shows as would be hard to imagine. Is it too much to dream that our grounds in summer and our exhibitions in winter might be a real influence in restoring peace and beauty to this torn world and giving much to the spirit as well as to the mind and body?

I remember once going to Assisi. We were shown around by a reverend father who gave me the impression of being the holiest man I had ever seen. He breathed spirituality. During many years before the war I used often to go to France and I almost never failed to visit Chartres and sit — just sit — in that magnificent cathedral. Those visits did something for me. And I like to think, and do think, that something of the same spiritual regeneration can be gotten from nature — from trees and shrubs and flowers and fresh air and a blue sky.

What I have said perhaps indicates a very busy fifty years immediately ahead in building and developing a great university of botany set in a most beautiful hall of nature.

And as we are building and developing, what else shall we be doing? Well, we shall be doing more broadly and more intensively just what we are doing today. You all know of penicillin, a product of one of the molds — a plant product. For the last several years Dr. Robbins has been studying other molds because it is fair to assume that the mold which produced penicillin is not the only useful one. He has so far been able, with his limited staff, to cover partially four hundred molds from a few of which he has obtained more than interesting results. He tells me that there may be 30,000 molds worth studying, or maybe 100,000. At the present rate it would take us perhaps several hundred years to cover this field and even then our research would not have been exhaustive.

Perhaps you have all heard of *Solanum tuberosum*. Or if you don't recognize it by that name, I expect that if I just call it an Irish potato it will be very familiar to you. You see we botanists cling very hard to our Latin nomenclatures. As a matter of fact, I have it on the highest authority that it isn't an Irish potato at all but comes from Peru. Well, many of you, but perhaps not all, recall the fact of the Irish famine of 1845, when the potato crop of Ireland completely failed because of a fungus disease which attacked it, and 250,000 people died and many thousands more were forced to come to this country.

Present day research, the research we are interested in, would have prevented that great calamity — and I don't mean, Father Gannon, the coming of many thousands of Irish to this country. I have a bit of Irish in me myself. What I am trying to say is that through our staff we shall be carrying on study and research which may be of infinite value to human welfare.

Another phase of our work to which we wish to give emphasis is plant exploration. It is estimated that there are perhaps 150,000 undiscovered plants — many doubtless of great medicinal or economic value. Even in this country are large areas where plant life is unexplored. South America and Africa present tremendous fields for exploration. Who knows but that we may find somewhere a plant which, economically, will rival wheat or cotton or corn or potato, or, therapeutically, rival the foxglove for digitalis, cinchona for quinine, or the poppy and its morphine for easing insufferable pain?

And if we have a curator of economic botany, a man and of course a staff who devote themselves to increasing and improving the uses of plants, what might we not accomplish? Barely a thousand out of 350,000 known plants today have economic uses. It is not difficult to imagine the importance which a department of economic botany might assume in an institution such as the New York Botanical Garden.

I hope that perhaps I have given you suggestions of where our path lies during the next fifty years. As Dr. Auchter, a former member of our Board of Managers, has recently said:

> *"It is well recognized today that research of all kinds will have to be enlarged and accelerated in every nation that hopes either to retain or to advance its present standard of living.*
>
> *"Science truly is one of the great frontiers of a much shrunken world, and any nation that neglects the exploration and development of this frontier is almost certainly hazarding its future."*

With my banker's mind I look upon the New York Botanical Garden as a business concern dealing in fundamental products potentially more important than any of our large corporations — a business concern which, despite the achievements of fifty years of service to community, nation and mankind, is only at the beginning of its career. Its opportunities for still greater service to industry, medicine, science, and human welfare are as great as the potentialities of botany and horticulture themselves and they are almost unlimited. Given the means and the facilities with which to fulfill its founders' vision as a great botanical university, this institution, whose Director you honor tonight, is a gold mine which can pay dividends without measure to body, mind and soul of mankind.

* * *

Father Gannon

IN his message of greeting, the Reverend Robert I. Gannon, S.J., President of Fordham, reviewed the history of the land which came eventually into possession of the two neighboring institutions, Fordham University and the New York Botanical Garden. Quoting from "A History of St. John's College, Fordham, N. Y." by Thomas Gaffney Taaffe, he pointed out that Fordham, with the rest of old Westchester County, was once a portion of the domain ruled by the chiefs of the savage tribe of Mohegans. In 1639, three Indian sachems, Fecquemeck, Rechgawac, and Packanarieus, sold to the Dutch West India Company the lands of Kekesheik, which included all the land between the Bronx and the Harlem, and as far north as the present City of Yonkers. Seven years later that portion which is now known as Fordham, together with the "Yoncker's land," then known as Colen Donck, was sold to a young Dutchman named Adrian Van der Donck. A few years later his widow, Mary, who had in the meantime married Hugh O'Neale, of Patuxent, Md., conveyed the property to her brother, Elias Doughty, of Flushing, L.I. Mr. Doughty, in turn, sold the land to John Archer in 1667.

Two years later John Archer evidently extended his purchase, and the deed, in which the names of several Indians appear, shows that this "certaine Tract of upland" was granted to him ". . . in consid. of 13 coats of Duffells, one halfe anchor of Rume, 2 cans of Brandy, wine w^th^ several other small matters of ye value of 60 guilders wampum."

The name of Fordham, coming from two Saxon words, FOORD (a ford) and HAM (a mansion), is first mentioned at this time.

It was probably soon after this that John Archer's "Fordham Manor" was parceled out into farms, and the property just to the south of the line that now divides the University from the Botanical Garden became known as Rose Hill Farm. The estate passed through several hands during the next century and a half, until in 1836 Horatio Shephard Moat bought it from Elias Brevoort. The stone house which Mr. Moat built is part of Fordham University today. Only three years after his purchase, Mr. Moat sold his land for $30,000 to Bishop John Hughes, and in 1841, St. John's College, which later became Fordham University, was formally opened.

Meanwhile the land which lay to the north of Rose Hill was being partly farmed, partly left to run wild, and partly used for an important industry. On the banks of the Bronx River, near the gorge with its waterfall, the Lorillard family erected a snuff-mill which marked the beginning of the Lorillard tobacco millions. That old stone snuff-mill remains today as part of the Botanical Garden's equipment.

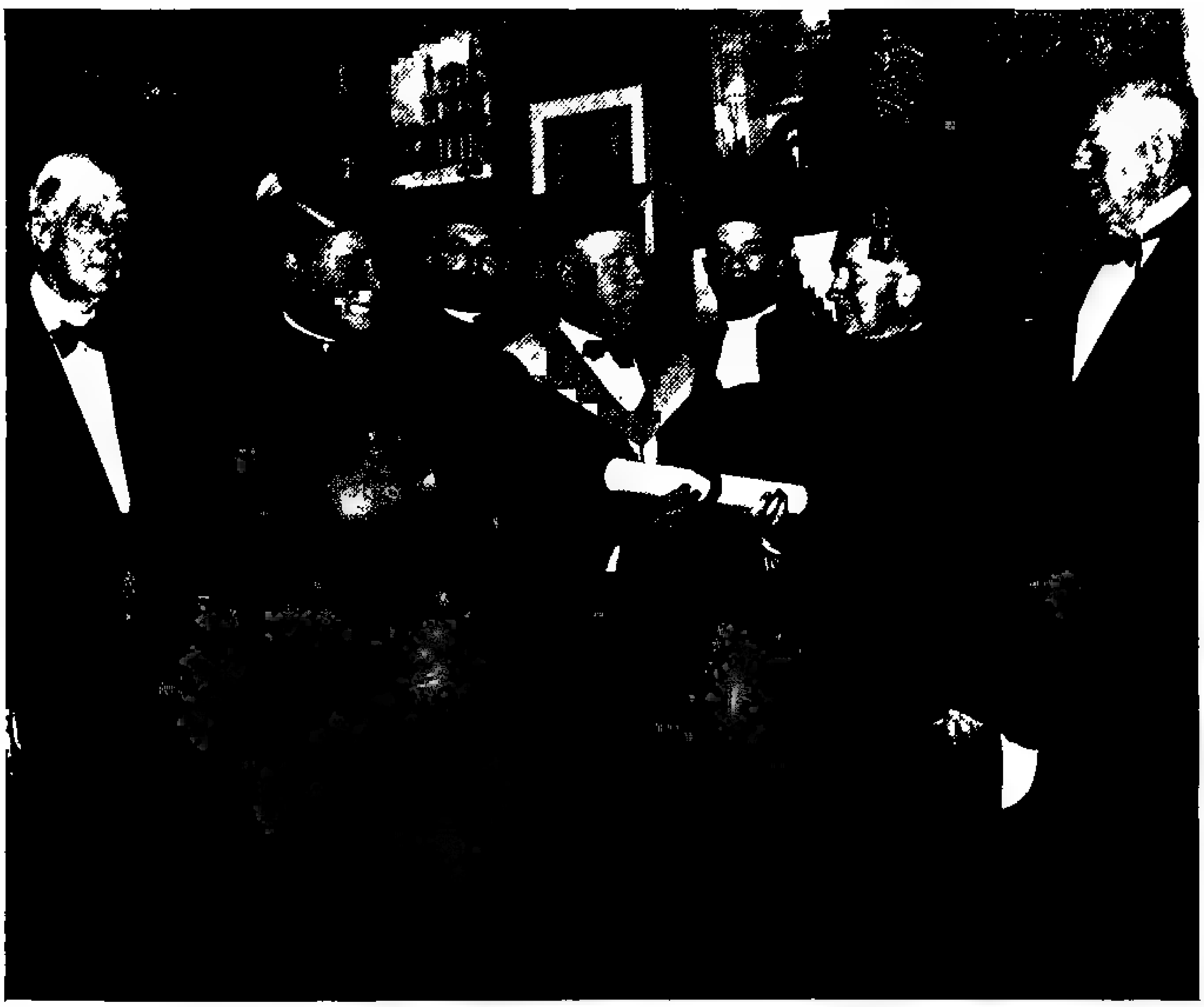
Translation of the Awarding Of the Honorary Degree

Doctor William Jacob Robbins

TO all who view these presents the Trustees of Fordham University and of Fordham College give greeting in the Lord.

With jubilee this year the people of the City of New York hail the Golden Anniversary of the establishment of the New York Botanical Garden. It is the pride of our people, a thing of living beauty which for fifty years has filled their lives with the visible harmony of trees and plants and flowers.

Fordham University, as next-door neighbor of the Garden and its greatest



Dignitaries of Fordham University and the New York Botanical Garden at the awarding of the honorary degree of Doctor of Science to Dr. William J. Robbins. Left to right they are: Mr. Baldwin, Bishop Donahue, Father Deane, Dr. Robbins, Father Dumas, Father Gannon, and Mr. Swan.

beneficiary, has special reason for marking this occasion, and as an expression of its joy and gratitude bestows its laurel wreath of honor on the present distinguished director, William Jacob Robbins.

This noted scholar has been recognized as an authority in his chosen field through twenty-six years as teacher and administrator in various institutions of learning before assuming his present important post eight years ago. Here he has labored with marked success. Many a volume of botanical lore during all these years has come from his tireless pen; many a learned Botanical Society has claimed him as its Director or President.

Accordingly, by these presents we, the Trustees of Fordham University and of Fordham College, authorized to that purpose by the supreme power of the State, bear witness that William Jacob Robbins has been advanced by us to the Honorary Degree of Doctor of Science and endowed with all the rights and privileges pertaining thereto.

And in proof thereof we have issued these presents under the seal of our Corporation and the signature of the President of this College.

Fordham University, New York, the twenty-fourth day of May, in the year of our Lord, nineteen hundred and forty-five.

FLOWER ARRANGEMENTS

EVERY second day during Garden Week, four new flower arrangements were displayed in the rotunda of the Museum Building. All were created by prizewinners at recent flower shows.

Visitors to the Garden were invited to vote on their choice for first and second honors in each group of four arrangements. No prizes were offered. Each flower artist contributed her composition in the interest of the Garden's fiftieth anniversary celebration. Those who took part in the display and competition are listed below, with their garden club affiliation and a list of the principal materials used.

Monday and Tuesday

Mrs. E. Kirk Haskell, Morristown, N.J., first place. An all-white composition featuring *Spathiphyllum.*

Mrs. Walt Thomas, Hortulus Club, Greenwich, Conn., second place. Leaves and fruits of *Monstera.*

Mrs. Edward Emerson, Hortulus. Dried palm fruits and other materials mostly in tones of brown.

Mrs. Erik A. Thomee, Hortulus. *Celosia* heads, *Pandanus* fruit, and other materials.

Wednesday and Thursday

Mrs. James Coyle, Douglaston, L.I., first place. Flowering branches of *Feijoa Sellowiana* and leaves of *Dracaena.*

Mrs. George J. Hirsch, New Rochelle, second place. Red gladiolus.

Mrs. F. M. Legler, Scarsdale. Bronze tulips.

Mrs. Innis Brown, Manhasset, L.I. "The White Cliffs of Dover," with stock and other flowers in white, interspersed with blue iris and flanked by white painted cypress knees.

Friday and Saturday

Mrs. Dunham C. Jones, Brooklyn, first place. Peonies and pink horsechestnuts.

Mrs. Everett Phillips, Scarsdale, second place. Tulips and copper beech leaves.

Mrs. Charles Scholz, Great Neck, L.I. Roses and delphinium.

Mrs. William R. Wheeler. White gladiolus.

FLOWER ARRANGEMENTS WINNING FIRST AND SECOND PLACE AT THE NEW YORK BOTANICAL GARDEN

Upper left: Mrs. E. Kirk Haskell's composition. Upper right: Mrs. Walt Thomas. Center: Mrs. James Coyle. Lower left: Mrs. Everett Phillips. Lower right: Mrs. Dunham C. Jones. Right center: Mrs. George J. Hirsch.

Excerpts from some of the talks given by staff members on the afternoon programs during Garden Week are being printed in the Journal of the New York Botanical Garden. Under the title of "What Is a Herbarium and Why?", part of Dr. Seaver's address on "A Collection of Plants and How It Is Used" is being published as the editorial for July, inside the front cover. The introduction to Dr. Stout's speech, "Better Plants for Human Needs," is planned for the August editorial. Dr. Robbins' address on "The Importance of Plants in the Life of Man" is in the Journal for July.

PRIVILEGES OF MEMBERSHIP

in

The New York Botanical Garden

Admission to Members' Day programs the first Wednesday of each month.

Admission to courses of study without payment of a fee up to the value of the annual membership dues paid.

A subscription to the monthly *Journal,* which contains authoritative articles on horticulture and botany and reviews of the latest books on these subjects.

A subscription to *Addisonia,* each annual issue of which contains eight full-page colored plates with descriptions of plants of exceptional interest.

A share of plants, frequently the Garden's new introductions into horticulture, when available for distribution.

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

Free announcement of special floral displays, lectures, radio programs, and other events.

Free conferences with staff members on problems in horticulture and botany.

A membership card which gives admittance to the Members' Room and serves as identification at special functions at the Botanical Garden and at similar institutions in other cities.

THE NEW YORK BOTANICAL GARDEN

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

CHRYSANTHEMUM DISPLAY
AND PROGRAM

FRIDAY, SATURDAY, SUNDAY

OCTOBER 26, 27, 28

at

THE NEW YORK BOTANICAL GARDEN

Bronx Park

arranged in co-operation with

The Eastern States Chrysanthemum Society

Dr. Ernest L. Scott, President

* * *

Inspection of the Garden's outdoor plantings of hardy chrysanthemums Friday at 11 a.m.

Box luncheon (each person bringing his own) at noon.

Program of brief talks and demonstrations Friday afternoon, followed by tea in Members' Room.

"Culture of Outdoor Chrysanthemums"—Lecture by T. H. Everett, Saturday at 3 p.m.

Public inspection of indoor and outdoor displays Sunday from 10 until 5.

COMPETITIVE EXHIBITS OF CUT FLOWERS AND POTTED PLANTS IN THE ROTUNDA OF THE MUSEUM BUILDING, FRIDAY AFTERNOON AND ALL DAY SATURDAY, AND SUNDAY.

* * *

A complete program will be mailed upon request.

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September 1945

The Journal is published monthly by The New York Botanical Garden, Bronx Park, New York 58, N. Y. Printed in U. S. A. Entered as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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Fruits and Seeds of the Lily-of-the-Valley

By *A. B. Stout*

IT is a frequent and general observation of gardeners that colonies of the lily-of-the-valley (*Convallaria majalis*) in cultivation may bloom profusely but produce very few or no fruits or seeds. These plants are herbaceous perennials that multiply rapidly by underground branches (rhizomes) both naturally and in horticultural propagation. Also these plants are grown in gardens and forced in greenhouses solely for their flowers. Hence their failure to produce fruits and seeds is not a matter of concern except to those who wish to grow seedlings in breeding. Yet there are probably gardeners who will be interested in the condition that is responsible for the sterility and what it illustrates in respect to Nature's methods of self- and cross-fertilization and reproduction.

Over a period of about thirty-five years the writer has inspected colonies of the lily-of-the-valley during summer and autumn rather widely in the northeastern states, and to some extent elsewhere. In some of the colonies no fruits were found; in others only a few fruits were present.

In only one garden has the writer seen fruits in abundance on plants of the lily-of-the-valley and this was first observed in 1927. In a large planting at Hillcrest, the estate of the late Marion Roby Case in Weston, Massachusetts, the majority of the flower scapes bore fruits and on some there was a berry for nearly every flower. It was learned that members of two different types, or clones, one white-flowered and one pink-flowered, were present and that many fruits were produced year after year by plants of each type. Here there was a demonstration that the members of this colony were able to produce fruits and seeds. But it is to be noted that there was opportunity for interclonal cross-pollination by insects. Also it is quite probable that seedlings had developed from self-sown seeds which provided further opportunities for compatible cross-fertilization.

Beginning in 1923 living plants of *Convallaria majalis* were obtained from various sources and grown at the New York Botanical Garden for tests of fertility and sterility. Of these, fourteen different individual rhizomes with one or more buds or "pips" were selected and each was planted alone in an earthen pan. These selections included members of two true varieties and one clonal variety as follows:—

1. The variety first called *"Fortinii"* and later named *"grandiflora."* This is a large white-flowered type found in a garden in France and first exhibited and described in 1884. It has been stated that this variety bred true from seeds. Many of the clones now grown in gardens and forced for the flower trade are no doubt selections of this horticultural variety.

2. The variety *rosea*, which grows wild in Central Europe and has rather small flowers of pink and lavender shades of color. Plants of this wild type have been distributed by nurserymen for at least seventy years, and also pink-flowered seedlings with larger flowers have been obtained by breeding. Without doubt there are many clones of this type in cultivation.

3. The so-called *"Convallaria majalis foliis aureo striatus,"* which has white flowers and striped variegated foliage. Of this there is presumably one original clone in cultivation, but the variegation is transmitted to certain of the seedling offspring derived by cross-breeding.

Results of Controlled Self-Pollination

The flowers of the lily-of-the-valley are perfect; each one has a set of short stamens and a slightly longer pistil. They are very simple in structure and there are no marked structural adaptations or differences in maturity (dichogamy) that prevent or even restrict adequate self- and close-pollinations by insects or by one who wishes to make controlled pollinations. There are noteworthy differences among the various plants assembled for study in the size and shape of the flowers. But on every plant each flower had a pistil that was longer than the stamens. There was among these plants no condition of dimorphism—with one form having short pistils and another form having long pistils as briefly mentioned by Schulze[1] in 1899. In species of flowering plants which have definite dimorphism and trimorphism, the incompatibilities are correlated with "illegitimate" pollinations, but such a relation was not indicated in the convallarias of this study.

Over a period of several years a total of 358 of the flowers produced by these 14 plants were "self-pollinated" by hand under control. An entire pan with the various scapes of a single individual was taken into a greenhouse and enclosed in a cage made of fine-mesh copper screening. From day to day the pollen of freshly and naturally dehiscing stamens of fully open flowers was placed on the stigma of the pistil of the same flower and on pistils of other open flowers on the same individual. Usually at least a few cross-pollinations were also made to determine if the flowers are able to function in seed production. For most plants the self-pollinations were made in each season of bloom during two or more years. Only five of the 358 flowers produced fruits and in these the numbers of seeds were 1, 1, 2, 2, and 3. These few fruits may have been due to stray or accidental cross-pollinations. But often self-incompatible plants will

[1] Morphologie und Anatomie der *Convallaria majalis* L. Inaugural Dissertation, by Wilhelm Schulze. 1899.

produce a few seeds especially when self-pollen is placed on a stigma that has not yet formed secretion.

These results indicate that each of the fourteen individuals which were tested rarely produce fruit and seeds when self-pollinations *only* are made. The failure to produce fruit is *not* due to lack of *any* pollination.

Results of Cross-Pollinations

In making cross-pollinations, the pollen of *one* individual was transferred to flowers of *another individual,* and the plants were so handled that there was no chance of any other pollinations. Each of the fourteen individuals tested produced fine and well-developed fruits containing viable seeds in one or more of the cross-relations. In most of these tests each cross-pollination involved two individuals readily recognized as different.

Thus combinations of white-flowered with pink-flowered were all cross-compatible. For example: A white-flowered individual was crossed with a pink-flowered one; 18 flowers were pollinated, 14 fruits developed and the seeds per berry ranged from 6 to 12. In another case a pink-flowered

Pan with propagations of a pink-flowered individual of Convallaria majalis rosea. All self- and close-pollinations of flowers on the two scapes marked with a round tag failed. The well formed berries that are shown were all obtained from cross-pollinations. The failures on the scapes above the fruits were of flowers that were not pollinated by hand. The definite results in (a) failure and (b) success in the production of fruits here demonstrated are typical of all the plants studied.

plant was crossed with a white-flowered plant; 9 flowers were pollinated, 7 fruits matured and the seeds in the berries ranged from 4 to 14. Three self-incompatible white-flowered individuals obtained in gardens in the Bronx were highly cross-compatible in relations with the clonal variety which has variegated foliage. One white-flowered propagation from a garden in the Bronx was highly cross-compatible with another white-flowered propagation obtained in another garden about one mile distant. Each was self-incompatible. Since the two were somewhat different in the size of the flowers it was evident that the two were not members of the same clone.

Incompatibilities in Seedlings

It usually requires from five to nine years to grow seedlings of *Convallaria majalis* to flowering age and after that several years are needed before all the cross-relations can be determined, even for a progeny of as few as 25 plants. Of the seedlings that have flowered at the New York Botanical Garden and been tested by controlled pollination, 76 were fully self-incompatible and 8 produced berries and seeds to self-pollination. Cross-incompatibilities seldom occur in the relations between clones of such diverse parentage as were the clones of the lily-of-the-valley used in the tests reported above. But they become evident in the cross-relations of the seedling progeny of any two plants. Of the cross-relations between sister seedlings that have been tested there were 18 that were cross-fertile and 27 that were cross-incompatible.

Self-Incompatibility and Clonal Propagation

The results of the tests fully demonstrated that each of the individuals involved in the pollinations is fully able to function both as a seed parent and as a pollen parent when there is proper compatible cross-pollination. But of the clones and seedlings tested, only a small proportion of the seedlings are able to produce fruits to self-pollination.

The individuals studied by this writer constitute a very small segment of the vast population of wild and cultivated plants of this species. But it is probable that this type of sterility exists quite generally in the wild plants of this species.

Vegetative propagation of the lily-of-the-valley automatically extends the condition of self-incompatibility in an individual seedling to all members of the clone derived from it. Thus an entire colony may be members of one clone, which in reality is only *one individual.* In this case the pollinations from flower to flower (intra-clonal pollinations) will fail to produce fruits, the self-pollinations of individual flowers will fail, and the pollinations from flower to flower on the same scape will fail. Also a single clone may become widely distributed and in time grown in many gardens.

The fruits shown here were obtained from chance open-pollination by insects as the plants grew side by side in a coldframe. The front row shows individual propagations that were previously tested and found fully self-incompatible, and these are from left to right: Convallaria majalis Fortinii, a white-flowered clone from a garden, and a white-flowered clone from Miss Case's garden. At the rear are three pots of seedlings.

Incompatibilities in Clones Grown for Their Fruits

Sterilities of the general type seen in *Convallaria* are now known in many other plants, both wild and cultivated. Some of these are fruit plants that are grown as clones and in these the matter of fruit production is important. In the apples, pears, sweet cherries, and plums, various clones are self-incompatible and also there are inter-clonal cross-incompatibilities. The ***Napoleon*** sweet cherry is not only self-incompatible but cross-incompatible in relations with the ***Bing*** clone and the ***Lambert*** clone. The ***Bartlett*** and ***Seckel*** clones of pears are cross-incompatible. Among the cultivated European clones of plums some are self-incompatible (***Italian Prune, Reine Claude,*** and ***Stanley***), others are self-fruitful (***Grand Duke, Jefferson,*** and ***Imperial Epineuse***). Of Japanese plums in cultivation in America only two (***Beauty*** and ***Climax***) fail to produce fruit to self-pollination. Of the native plums selected or developed from the wild species (*Prunus americana*), all but the clone ***Robinson*** are self-incompatible.

In the orchard culture of these fruits the production of good crops by many of the clones depends on a proper interplanting of two or more cross-compatible clones which provides opportunity for adequate cross-pollination by insects. Further and more detailed information on this matter is provided in a bulletin [4] which is based on several years of study and experimentation at The New York State Agricultural Experiment Station at Geneva, N. Y.

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[4] Bulletin 577. Pollination of Fruit Trees, by Richard Wellington, A. B. Stout, Olav Einset, and L. M. Van Alstyne.

There are only two reports [2,3] of selective breeding in *Convallaria* known to the writer. But in neither of these publications is there mention of any self- or cross-incompatibilities. Both investigators obtained seeds and grew seedlings of various cross-breedings but were evidently not concerned with self-reproduction in any of their plants.

The type of sterilty that operates in plants of *Convallaria majalis* involves selective fertilizations in the processes of pollen-tube growth in pistils. These reactions occur *after pollination.* Unless there is pollination of a compatible relation there is no fertilization and no fruits or seeds are formed.

It should be mentioned that these incompatibilities are determined by hereditary factors of which at least one is transmitted from each parent to each member of the offspring. In a population of seedlings that are closely related, as a progeny of any two self-incompatible individuals are, there will also be cross-incompatibilities. It has been fully demonstrated in the simpler hereditary determinations that the seed-grown progeny of two self-incompatible but cross-compatible plants will usually consist of either two or four groups and that the members of each group will be intra-cross-incompatible. The formula representing this condition may be given as follows:—

> Parents; Class I (*ab*) x Class II (*ac*) = Progeny; Class II (*ac*) and Class III (*bc*). In such a relation only the *c* pollen of the pollen parent functions. When there is no common factor in the constitution of the two parents the formula is as follows:— Parents; Class I (*ab*) x Class IV (*cd*) = Progeny I (*ac*); III (*bc*); V (*ad*); and VI (*bd*).

In an entire population the recombinations of only three different hereditary factors give six classes or genotypes. For all members of each genotype there will be failure of fertilization to both self and intra-cross pollinations. But any member of a group will be cross-compatible with any member of any other group. When this condition exists in a species or population, reproduction depends not on *any* cross-pollination but on the cross-pollinations between two inherently different genotypes. Each new seedling has two parents, each of which belongs to a different genotype, but all are members of one species. Self-reproduction is eliminated and also intra-reproduction or in-breeding is eliminated.

When some of the progeny of self-incompatible plants are able to produce seeds to self-pollination there may be either mutational loss of hereditary factors for incompatibility or more complex genetical conditions in which case the progeny may be self-incompatible.

Since this type of sterility operates *within* the population of a single species and is not a relation of hybridization between individuals of two different species, it can be designated intra-specific incompatibility. It should not be confused with the sterility that often occurs in hybridization.

[2] Nouveaux Muguets Hybrides à Grandes Fleurs, by Attilio Ragionieri. Révue Horticole. New Series 17:294-295, 1920-1921.

[3] Mughetti, by Abate Souillet. Il Giardino Fiorito. 5:125-129, 1935.

Self- versus Cross-pollination and Reproduction

An early plant hybridizer, Dr. Joseph G. Koelreuter, was the first to observe and record in publications (from 1761 to 1766) that the visits of insects are necessary for the pollination of many flowers. Koelreuter states that he was amazed that Nature had left so important a matter as reproduction in flowering plants to a mere chance, to a fortunate accident. A few years later (1793) Sprengel published accurate and detailed illustrations and descriptions of flower structure, of dichogamous developments, and of unisexual flowers which indicated that insects effect cross-pollination between plants rather than self-pollination. His observations led him to the conclusion that Nature is unwilling that any flower should be fertilized by its own pollen.

Both the popular and the academic interests (a) in the facts and (b) in the significance of cross-reproduction were greatly stimulated when the volume on "The Origin of Species" by Charles Darwin was published in 1859. There followed a period of lively popular discussion and of intensive and extensive studies by numerous investigators, including Darwin. The studies of structural adaptations in hermaphrodite flowers and of developments of dichogamy and unisexualism supported the earlier conclusion of Sprengel that the agents which effect pollination, especially insects, make many cross-pollinations and effect relatively few self-pollinations. Also Koelreuter had observed that in some plants self-pollination does not yield seeds, and Darwin and others found other plants which fail to produce seeds to self-pollination.

The recognition of these facts soon led to the consideration of the direct advantages and benefits that cross-reproduction may have. Darwin himself made experimental studies in which he grew and compared self-bred with cross-bred progenies. His evidence and conclusions [5] were briefly as follows:--

1. In the majority of the hermaphrodite species that were studied, the selfed-flowers yielded fewer seeds than did flowers that were fertilized with pollen of another individual.

2. The offspring of self-reproduction were weak both in vegetative and reproductive vigor in comparison to cross-bred progeny.

3. When flowers exhibit no adaptations for cross-pollination there is often "self-sterility," or failure in the functioning of the self-pollen.

Some Advances in Knowledge since Darwin

Since Darwin's time noteworthy advances have been made in the knowledge of the processes of reproduction and heredity. It is now certain that, genetically at least, close-pollination (from flower to flower on the same plant) is exactly the same in its relations and effects as are self-

[5] Cross- and Self-fertilizations in the Vegetable Kingdom. 1876.

pollinations of individual flowers on the same plant. This point was, evidently, not realized by Darwin and at least certain of his contemporaries.

Also it is to be recognized that any condition that limits or prevents self-reproduction will also prevent cross-reproductions between the individuals that are alike in respect to this condition. For example, the numerous seedlings or clones of the avocados whose flowers are all in the pistillate condition in the forenoon and in staminate maturity in the afternoon (synchronous daily dichogamy of female-male sequence) are limited in inter-clonal cross-pollination as well as in self- and close- and intra-clonal pollinations. This condition favors and even compels pollination between members of the two classes, one that has the male-female sequence and one that has the female-male sequence.

Equally selective are the physiological incompatibilities in which the individual that is self-incompatible is also cross-incompatible with the other members of the same class. This fact was not recognized by Darwin and his contemporaries. He believed that a "self-sterile" (self-incompatible) plant would produce seed in cross-relations with any other plant of the same species.

Furthermore, a condition of weakness, such as reduced vigor, which exists in many plants is inherent and hereditary and soon becomes the condition of all the members of an inbred race, and the cross-breeding of sister plants has the same result as self-reproduction. Then in accord with the general doctrines of Darwin, the inter-cross breeding of the intra-weak strains will often result in offspring that are much superior to both parent strains in vegetative and reproductive vigor. The application of this principle in the growing of cross-bred corn which gives increased yield per acre has now become very general in agriculture.

An Evaluation of the Modes of Reproduction

The various aspects of reproduction, (a) self-reproduction in pure line breeding, (b) in-breeding or intra-breeding among the members of a race or variety, (c) intra-specific breeding within a population of a species, and (d) hybridization, all have values and disadvantages, a scope of action, and limitations. In breeding plants and animals and in the practices of agriculture, horticulture, and animal husbandry it is important to utilize each type of reproduction when it is possible and desirable. In Nature and under the competition of natural conditions each of these aspects of reproduction has played, and still plays, an important role in the evolution of new species and in the stability and instability of each species that arises. A general survey of these methods of reproduction leads to the recognition, in agreement with Darwin and others, (1) that in relatively few cases does Nature enforce repeated self-reproduction and (2) that the adaptations in hermaphrodites and the differentiations of sex provide for and even compel the co-operation of two different individuals for most of the reproduction that occurs. This principle operates very

One of the lily-of-the-valley clones tested—a medium-sized, white-flowered clone of the type commonly grown in gardens.

universally in the reproduction of successive generations which together comprise the dynamic mass reproduction of a species. One of Nature's most effective methods of compelling bi-genotypic reproduction is exemplified in the hereditary incompatibilities, both self- and cross-, which operate in many species such as *Convallaria majalis.*

Insect Pollinations of Convallaria

The simple structure of the flowers of *Convallaria majalis* with the absence of structural features which restrict self-pollination led to the conclusion by Knuth[6] that insect help is not essential for pollination of flowers of this species. He noted that self-pollination is possible merely by the falling of pollen from stamens onto the stigma of the same flower. But that such pollinations may not yield fruit was not known for this plant at that time.

There seems to be no information regarding the particular insects that visit the flowers of members of this species as they grow wild extensively in parts of Asia and Europe and also to a limited extent in the mountain area of eastern United States. In his volume on "The Fertilization of Flowers" (1873) Müller states that flowers of the lily-of-the-valley do

[6] Handbuch der Blütenbiologia. 1898-1904.

not have nectar but that hive bees visit the flowers of plants in cultivation to collect pollen and that when they flit from plant to plant they effect cross-pollination. Evidently he did not know of the condition of self-incompatibility in this species and of its extension to the members of a clone.

In the author's home garden over a period of 24 years a large colony of one white-flowered clone has produced only 15 berries, and these were all formed in the same season. Four years ago about fifteen pips each of two clones, one the variety *rosea* and one the variety *Fortinii,* were planted in the border of this colony. In the experimental tests all three of these clones were mutually cross-compatible. During the four years that have passed there have been no fruits on any of these plants. Hence it appears that in my home garden during these years insects have not made cross-pollinations between members of these clones of *Convallaria.*

But each year since 1923 there have been fruits in abundance on plants of clones, individual propagations, and seedlings grown for experimental study at the New York Botanical Garden. The plants not used for controlled pollinations were in earthen pots which were placed side by side in a coldframe and left to chance cross-pollination by insects. The continued heavy crops of fruit and seeds year after year may be considered evidence that insects effected many compatible cross-pollinations among these plants.

In such plants as *Convallaria,* which have incompatibilities both self- and cross-, the chances of successful pollinations are greatly limited. (a) The self-pollinations fail, (b) the pollinations from flower to flower on the individual plant fail, (c) pollinations from one ramet to another of a single clone fail, and (d) cross-pollinations between members of each genotypic group also fail. Seed reproduction depends on the cross-pollination between plants of two different constitutions in regard to the hereditary factors which determine incompatibility and in regard to self-pollination of those few plants that may produce fruit to selfing.

Among wild plants the members of different genotypes will be more or less intermingled and there will be opportunity for compatible cross-pollinations by insects. But in garden culture all plants of a colony may be members of one self-incompatible clone in which case there is no opportunity for effective cross-pollinations among the colony. In the operations of incompatibilities in plants like *Convallaria,* Nature not only depends on the "fortunate accident" of insect pollination but she restricts effective pollinations by heredity to only certain of the cross-pollinations that are possible. The results insure that reproduction is continually between *different* individuals. In the reproduction of unisexual individuals the bi-genotypic relation involves male and female individuals, only one of which produces offspring. In the regulation of reproduction by incompatibilities in hermaphrodites, both parents are able to bear seeds and the chances for reproduction are thereby increased.

A Botanist Looks at a Rose

By H. A. Gleason

Presented on Rose-Growers' Day at the New York Botanical Garden, June 13, 1945.

IT IS a fact, and well known to all of you, that the cultivation of the rose for ornament extends far back in time, long before botany as a science had started its development. Several species of roses were brought into cultivation and numerous varieties were developed without any help from the botanist for the very easy reason that there were no botanists.

The Beginnings of Botany

Botany as a science began in a very small way in the sixteenth century, about four hundred years ago. It grew very gradually for two centuries, more rapidly for another hundred years, and then at a continually increasing pace down to the present time.

The development of botanical science introduced a new attitude toward plants. The average man had been concerned only with those aspects of the plant which led to his own interest or pleasure or profit. Even today the farmer seldom wants to know anything about his potatoes or his corn; he merely wishes to grow more and better crops for his own profit. The rosarian merely wants to grow prettier or hardier or more adaptable roses for his own pleasure or, if he is a commercial grower, for his own profit. The botanist, on the other hand, looks on the plant as an object of interest for its own sake. He has a deep curiosity about how many kinds of plants there are, where they grow, how they are built, how they live, how they behave, and when he strives to find an answer to his numerous questions, we say that he is doing botanical research.

Cataloguing the World's Known Plants

The first general problem which attracted the attention of botanists, some two hundred years ago, was the discovery and cataloguing of the various kinds of plants. That meant, at the same time, that a distinctive name must be given to each kind, since many did not -and still do not— have any names in common usage. Since Latin was the language invariably used by all learned men of the time, the names given to plants were naturally in Latin. The rose was fortunate in that it already had a Latin name, *Rosa,* used by the ancient Romans themselves. The various kinds of roses were distinguished by adding a second term, or SPECIFIC name, to the GENERIC name *Rosa.* Thus when the native roses of eastern North America were first brought to the knowledge of the botanists of the eighteenth century, one was named *Rosa palustris,* the swamp rose in English, from the place where it usually grew; another the shining rose, *Rosa nitida,* from the texture of its leaves; a third, *Rosa humilis,* the low rose, from its general size. These names are still in common use by all scientists, and many of them, such as *Rosa rugosa, Rosa Wichuraiana, Rosa Hugonis,* are well known to every rose-fancier.

Another problem that confronted botanists was the further classification of the different kinds of plants into larger groups. It is fine to have a name like *Rosa rugosa,* by which we can talk or write about one kind of rose. It is also good to have a more general term like *Rosa,* by which we can designate all the numerous kinds of roses collectively. But there is often a need to speak of still more inclusive groups and to have a simple term to designate them.

In planning these larger groups, botanists have always tried to place together all those plants which are built in the same general way, particularly in the structure of the flowers and the fruit. Now, careful examination of a rose flower will show some points about its make-up which might easily be overlooked.

The Rose and its Relatives

If one examines a rose flower, he will see that the stalk ends in a pear-shaped or globose green body. If he next cuts the flower lengthwise through its center, he will see that this body is hollow and almost closed at the summit, that the green sepals, the colored petals, and the numerous stamens are attached near its summit around the narrow mouth, and that the several small ovaries, destined to mature into the seedlike bodies within the rose fruit, are located in its hollow interior. This green body is called the HYPANTHIUM, and microscopical study will show that it is really a part of the stem, a part which is expanded so that the actual summit of the stem is in the center of the hollow portion, while its sides extend beyond the summit and nearly close over it.

There are many other kinds of plants, readily recognized, which have a similar hypanthium, with the organs of the flower attached in a similar way. The flower of an apple is much like that of a rose; in the cherry the hypanthium is cup-shaped with a wider mouth; in the strawberry it is saucer-shaped. Similar flowers are found in the peach, the blackberry, the spiraea, and many other familiar fruits and ornamentals.

While all these plants have flowers of this characteristic structure, they differ greatly in the nature of the fruit. In the cherry there is a single ovary; at maturity the hypanthium does not enlarge and the ovary becomes juicy, enclosing a single hard seed. In the blackberry there are many ovaries, each of which ripens into a juicy fruit containing a single hard seed. Each segment of a ripe blackberry corresponds to a cherry in its structure. In the rose the hypanthium enlarges into the familiar rose hip, and the several ovaries each mature into a hard seed-like fruit. In the apple the hypanthium enlarges into the well known fruit completely surrounding the five ovaries. In the strawberry each of the many ovaries ripens into a small but dry fruit, while the center of the hypanthium grows greatly, becomes red and juicy, and bears the seed-like fruits on its outer surface. Still other types of fruits occur in the Rose family, but they all arise from the same general type of flower and are caused by differences in the development of the hypanthium or the ovaries.

Plants with this type of flower constitute the Rose family. It is a huge group of plants, including about three thousand different species. Within the family are about a hundred different genera. The roses are one such genus. The cherry with its relatives, the peach, plum, and apricot, constitutes another genus, and there are about two hundred kinds of them. The blackberry and its close relative, the raspberry, form another genus and there are probably three hundred kinds of them. And there are still more than ninety genera left which space forbids us to mention.

How Many Rose Species Are There?

Now as to the kinds of roses, or as the scientist would say, the species of roses: There are wild roses in Europe and eastward across Asia to Japan and China. There are wild roses in our own immediate vicinity and westward across our country to the Pacific. There are none in tropical regions and none in arctic. Naturally those of Europe were first known to botanists. Later the botanists became acquainted with those of the eastern United States, then with those of eastern Asia and China, and last of all with those of our western and mountain states and those of central Asia. Probably there are still some kinds of wild roses waiting to be discovered.

When botanists first began to sort and catalog and name the kinds of roses, they knew in their own minds, without a shadow of doubt, just what a kind of rose, or as we may better say, a species of rose, was. Every species had been created by the Almighty at the beginning of the world and had propagated its own kind ever since. All that man had to do was to discover those kinds. This belief was gradually discarded during the nineteenth century as a result of the general acceptance of the law of organic evolution. According to it, while species may have been created originally by the Almighty, they were endowed with the ability to vary and change and by their change to produce new species. In the process of this variation, when does a species cease being a single species and as a result of cumulative change start being two species? The question is still unanswered.

The great Swedish botanist Linnaeus knew, or thought he knew, just twelve species of roses in 1753, one from China, one from America, and ten from Europe. The complexity of the rose problem grew rapidly as roses were studied with greater attention to detail and collected in more distant lands. In 1825 the Swiss botanist De Candolle listed 146 species with a great number of varieties under them. Of these, 56 were from Europe, 29 from Asia, 29 from America, one from north Africa, and 31 of unknown origin. Among the latter were some of the commonly cultivated species, such as the cabbage rose. This indicates that botanists were already having trouble in differentiating species.

More and more species of rose were described and named by European botanists until the situation not only became absurd but got completely out of hand. It reached its climax in the publication of a study of the roses of Europe and Asia in 1893 by the French botanist Gandoger, in which he described no less than 5,535 different species of *Rosa.* I leave you to speculate on how many more he would have recognized in America, if he had unfortunately turned his attention in our direction. Gandoger, of course, was an eccentric, and I doubt whether many European botanists could see eye to eye with him.

Even before Gandoger's publication, more conservative European botanists had attempted to bring some semblance of order out of the chaos of supposed species. Thus the Belgian botanist Crépin, who in 1869 believed there were 283 species of rose in Europe, by 1892 was convinced that there were only 31, and other careful observers came to similar conclusions. In 1900 two careful German botanists opined that there were only 70 species of *Rosa* in the entire world.

But, although botanists in general were by this time adopting a saner idea of the number of real species, they were still impressed by the variability within a single species, a variability which led them to describe great numbers of varieties and forms, and we must remember that these varieties referred only to wild plants and never to the horticultural varieties developed in gardens and maintained only under cultivation.

Now the fundamental trouble from which all these students of roses suffered is well known to us, fifty years later, but it was completely unknown to them at the time. They saw the results of variation in roses, but they had no inkling of its cause. In 1900 no one understood the mechanism by which uniformity of structure and appearance is maintained from one generation to the next as a matter of heredity, nor the mechanism by which variations may arise. The science of genetics, which deals with such problems, has accomplished great results since 1900, but there is still much to be found out. The roses have received careful attention from several competent geneticists and we now know more about conditions in *Rosa* than in most other plants, but we still do not have the whole story before us. Chief among these workers on the rose problem have been the English botanist, C. C. Hurst, and the American, Mrs. Eileen Erlanson.

Hurst arrived at the startling conclusion that there were only five different kinds of roses in the entire world. He admitted that some of these kinds included subspecies which looked quite unlike each other, but affirmed that any and all of these would hybridize with each other, but would never hybridize with any of the other four. This is setting up an entirely new definition for a species. If all organisms that will hybridize belong to the same species, then the cabbage and the radish are one kind of plant; the cow and the bison are one kind of animal. Hurst's conclusions, recognizing only five species, are just as extreme in one direction as those of Gandoger in the other, with his 5,000 species. It is a fact that there is no exact, hard-and-fast definition of a species, no accepted rule for determining what constitutes a species. But the term has been in use among scientists for more than 300 years and its meaning has been defined by usage. This common and general usage is rarely violated except by ultra-radicals like Gandoger or by some botanists who attempt to set up a private definition of their own, like Hurst. Certainly, in the minds of all thinking botanists, the species of roses are much more than five, and much fewer than 5,000. I may also add that the assumptions on which Hurst based his startling conclusions were later stated to be invalid.

The Roses of America

Along the eastern coast of North America we have relatively few kinds of roses, but as we go westward we find more and more of them. As exploration of our country proceeded from east to west, these roses were gradually discovered and studied by botanists. The number of known species grew steadily. Fortunately we have never had a Gandoger in America, but we nevertheless saw or thought we saw more species than we should. The last general summary of our wild roses was published in 1918 and described 115 native species for North America. A few years later Mrs. Erlanson began her study of the genetics of our wild roses. Almost the whole 115 were cultivated in the botanical garden at the University of Michigan. She made crosses between various species and saw that the hybrid offspring, whose parentage was definitely known, were often duplicated in nature, always in the vicinity of the same two parents, indicating that crossing also took place in nature. She examined carefully the mechanism of the plant which insures that the progeny resembles the parent, the source of the adage that like begets like, and found in many roses complicated conditions, so complicated, in fact, that a geneticist rather than a taxonomist would be needed to explain them. In general, her results are as follows:

Instead of 115 native species of rose there are only twenty. Some of these twenty are quite uniform in their structure throughout their whole geographic range; others are quite variable. They fall into three different general groups and members of different groups will probably not hybridize with each other. One group is represented by a single native species, the prairie climbing rose of the Middle West. Having nothing to hybridize with, it is uniform in its appearance and always easily recognized. In the southwestern states are three roses which represent another section of the genus and which probably will not hybridize with any of the other seventeen. The remaining sixteen species belong to a third section of the genus, and among them artificial hybrids may usually be made without difficulty. But since nine of them live only in the western states, two in the central states, and five in the east, the opportunity for natural hybridization is greatly reduced. Anywhere in the eastern states, if one will find a place where two species of rose are growing reasonably near each other, he can probably find in the same vicinity roses which mingle the characters of both and thereby suggest a hybrid origin. One of these hybrids, between *Rosa carolina* of the East and *Rosa suffulta* of the Plains States, is especially interesting. The natural ranges of the two species overlap from Indiana to Iowa, and in many parts of this region the hybrid is more abundant than either parent. One can scarcely escape the conviction that repeated back-crossing has effected the disappearance of pure stock of both parents and that future continued back-crossing may extend the range of the hybrid farther west and east with still further restriction of the original pure stock. We can assume then the possibility—I will not say the probability—of the eventual complete merging of two species into one.

And in conclusion let me say that this ability to hybridize and to vary, which has made the genus *Rosa* a figurative thorn in the flesh of the taxonomic botanist, is the very reason why horticulturists have been able to breed roses so well and to produce from the single-flowered wild species the beautiful garden forms of the modern cultivated rose, the Queen of Flowers.

American Gardeners Receiving Holland Bulbs this Fall

HOLLAND bulbs—25,000,000 pounds of them –have been grown for shipment out of the Netherlands this fall, and of these it is estimated that close to 18,000,000 pounds will be coming to the United States. These will be the first to be received from the Netherlands since 1939, just before the invasion of Holland in 1940. The first of them have already arrived.

With such determined and meticulous care have the bulb growers of Holland looked after their industry during the years of the German occupation that not only will standard varieties of tulips, hyacinths, and daffodils be ready to send over here, but there will also be many new types of these flowers that have been developed under the eye of the enemy. Also, some of the expensive types that were seen only as show pieces before the war will now be available in large quantities and at reasonable prices, according to word received from the Netherlands Information Bureau in New York.

Hopeful predictions that were made before the liberation of Holland thus are being more than fulfilled. In a bulletin issued last January by the Netherlands Chamber of Commerce, Jan de Graaff says, under date of December 1944:

"It is by no means premature to give some thought to the post-war rehabilitation of the Dutch bulb industry.

"Physical conditions in the bulb industry in Holland are serious but far from fatal. The Allied advance towards Arnhem has cut off an important supply of fuel—the Netherlands coal mines of Southern Limburg, and coal shipments from the German Ruhr are also at a standstill. Without a liberal supply of fuel the industry meets with two major obstacles. It cannot give its products the proper curing that is essential to modern production methods, and it will be increasingly difficult to control accurately the water level in the bulb fields. Both tulips and hyacinths require a great deal of heat during their curing period, and many of the modern warehouses that are spotted all over the bulb district had elaborate heating, ventilating, and even air conditioning machinery to give the bulbs ideal conditions during storage. Without proper curing a good crop can hardly be expected.

"The drainage of Holland's agricultural areas is performed by means of an intricate system of canals and ditches, all interconnected and controlled by locks and pumping stations. In districts of highly specialized horticultural production, the traditional windmills proved themselves too undependable for the accurate and instantaneous control of the water level that is essential to optimum production. Long before the war almost all of these windmills were torn down and replaced by mechanical plants, driven by steam, gas or diesel engines or electricity. It must be remembered that normally during the winter months the weather provides an overabundance of rain and that without mechanical means this excess water cannot be absorbed by the low-lying fields. It is only rarely and under particularly favorable circumstances that some of this water can be drained off naturally into the main rivers and the sea. It is even more seldom that this can be done at exactly the right time. Without fuel it is difficult to see how the essential machinery can be operated."

After mentioning the additional danger of the deliberate flooding of some of the bulb lands, Mr. de Graaff points out that the old bulb district of Holland—that centered in the towns of Sassenheim, Lisse, and Hillegom—lies on land that is well above sea level, hence not susceptible to damage.

"The conclusion that we must draw," he says, ". . . is that the bulb industry must have suffered immense losses in stock, equipment and personnel. Yet, it would be a great mistake to assume that the Holland bulb industry has suffered such losses as to make it impossible to stage a comeback soon after the liberation of the Netherlands."

The same confident tone was expressed in a letter received last January from J. A. Schuurman, Consul General of the Netherlands in Chicago and a member of the New York Botanical Garden, to whom we had written for information about the bulb situation.

"Fortunately," he wrote, "it is not as bad as one would expect. Up to the end of 1943 the area of nurseries had not been reduced to any considerable extent, and in view of their geographical situation it may be assumed that the industry has been able to stand the very great difficulties of the year just ended. We may, therefore, reasonably expect that the physical conditions for the continuation of bulb growing still exist and that, as soon as trade is resumed, Dutch bulbs will soon be marketed again in fair quantities, including quite a few new varieties developed during the occupation by the enemy.

"The bulb area in the Netherlands was restricted as far as hyacinths and tulips are concerned in the year 1939 by about 50 percent. From 1939 to 1943, no drastic change in the area planted with bulbs has taken place. No figures are available on the plantings in the fall of 1943, but reports indicate that the area under bulbs did not greatly change at that time either. It is not known what effect the inundations had on the bulb industry, but as stated before, the geographic situation of the main bulb centers make it reasonable to assume that the bulb culture has escaped any major disaster. The exports through 1942 to various European countries have been maintained and, in some cases, have even been extended.

"It is true that some bulbs have been used for cattle feed but it is not likely that this has been done to any great extent considering the prices that were paid for bulbs, according to the official list.

"I do not think it will be necessary to start new tulips 'from seed' in order to bring the business back to normal, although it is impossible, of course, to forecast at this time how the further course of the war will affect the bulb industry or, for that matter, any other industry. It is known the bulb growers were required to raise a proportionate area of vegetables, but apparently they have managed to do so without decreasing the area under bulbs.

"Newspaper reports from the occupied Netherlands indicate that many new varieties were developed and exhibited. In some cases very high prices were paid for new varieties, reminiscent, in fact, of the famed 'Windhandel' (wild speculation) of days gone by."

Principal exports of Holland bulbs during the years of the war have been to Sweden. Before the war, according to the Netherlands Chamber of Commerce, the United States imported some $5,000,000 worth of seeds, roots, bulbs, and nursery stock annually. In 1939 tulips formed the most important bulb purchases of the United States, and practically all of the $1,682,353 worth imported came from the Netherlands. Hyacinth-bulb imports were of sizable importance in the United States in 1939, totaling more than $750,000 of which the Netherlands supplied $728,106. Narcissus bulbs were formerly the practical monopoly of the Netherlands, and in 1939 more than 11,000,000 bulbs were shipped to the United States.

With faith in the soundness of Holland's bulb industry, which has brought the country an annual income of $20,000,000, immense amounts of capital are reported to have been invested in it in recent months, by both Hollanders and outsiders. The possible competition from the new American-grown bulbs, it is believed by Netherlands authorities, will merely serve to fill the needs of an increased bulb market in the United States.

Dr. (Sir) Alexander Fleming appears at the left, with Mrs. Reid, Dr. Robbins, Mr. Swan, and Dr. Cameron, on the day of the famous British scientist's visit to the Garden.

Penicillin Discoverer Visits the Garden

SIR ALEXANDER FLEMING of London, who is spending several months in the United States studying American methods of penicillin production and other aspects of the drug which he discovered 17 years ago, was a visitor at the New York Botanical Garden August 2. Accompanied by Dr. J. Cameron of the Rockefeller Foundation, Mrs. Ogden Reid, and Joseph R. Swan, he was shown the plant physiology laboratory where Dr. William J. Robbins has under investigation a number of substances similar to penicillin.

Returned from West

DR. BASSETT MAGUIRE arrived back in New York late in August after four months of exploration in the Intermountain Region of the West. This, the second expedition he has made to that part of the country since he came to the New York Botanical Garden in 1943, marks the fourteenth summer he has spent collecting in that region. Results of the expeditions, which are now being made on a co-operative basis by the Garden and by Utah State College, will eventually be published by the two institutions. They will include the flora of Utah as well as of the Intermountain Region—an area covering 350,000 square miles, extending from the Columbia River to Death Valley and from the Rockies to the Sierra Nevadas.

During the summer just passed, Dr. Maguire, in company with Arthur Holmgren, Professor of Botany at Utah State College, made his principal headquarters at Tonopah, Nevada, and at the Reese River Ranger Station near Austin, Nev. Among the areas he explored are the Quinn Canyon and Silver Peak Ranges, out of Tonopah; the Monitor, Toquima, and Toiyabe Ranges on a three-weeks' pack trip arranged by Basil Crane, District Ranger for the Forest Service at the Reese River Ranger Station; and White Mountain and the White Pine Range, before returning to the college at Logan, Utah, and New York.

The season's work netted him 8,000 specimens.

C. D. Mell's Botanical Library Is Presented to the Garden

THE botanical section of the library of Clayton D. Mell, a forester whose principal interest was in tropical hardwoods, has been presented to the New York Botanical Garden.

Mr. Mell, who died in Yucatan last February at the age of 69, received a Master of Forestry degree from Yale in 1905. He then entered the Forest Service of the United States Department of Agriculture, changed to the Bureau of Chemistry there in 1914, and remained until 1917, when he joined a commercial concern in New York dealing in tropical hardwoods. Between 1911 and 1921 he traveled extensively in the West Indies and Central America and the northern part of South America, collecting botanical specimens and wood samples from every region and also making photographs of important tropical tree species. For many years he carried on correspondence with Dr. John Hendley Barnhart at the New York Botanical Garden, and some of his plant specimens were deposited here.

His gift to the Garden, made through his estate, consists of 50 books on botany, forestry, and allied subjects; 36 unbound volumes; more than 1,000 photographic negatives and about 2,000 prints, mostly of tropical trees; an index to the photographs; also other indexes; a file of approximately 600 clippings; 30 maps, mostly of Mexico, and other items. The Garden's library already contained more than a score of papers written by Mr. Mell, chiefly on tropical woods, some in collaboration with G. B. Sudworth, H. S. Betts, and Samuel J. Record.

Garden Receives Reprints From Dr. R. A. Harper

APPROXIMATELY 15,000 reprints, tear sheets, separates, and bulletins have recently been added to the New York Botanical Garden's library as the *Robert A. Harper Reprint Collection.* Dr. Harper, Professor Emeritus at Columbia University, where he was Executive Officer of the Department of Botany until he retired in 1930, has had his lifetime collection of botanical papers sent from his home in Bedford, Va., as a gift to the Garden. While they seem to cover every conceivable phase of botany, there is particular emphasis on the subjects in which Dr. Harper was especially interested: physiology of the lower plants, cytology of the fungi, fertilization of the mildews, cell and nuclear division in the slime-molds, and morphogenesis in the algae.

Notes, News, and Comment

Service Resumed. For the first time since the start of hostilities in 1939, the New York Botanical Garden has received a shipment from Europe. Three packages, containing 311 specimens in all, arrived August 13 on loan from Stockholm, Sweden.

Visitors. During the early part of August, Dr. Lewis H. Flint of Louisiana State University arrived at the Garden to spend two weeks working on algae.

Dr. Ronald Darnley Gibbs of McGill University, Montreal, who is working on the biochemistry of plants, Mäule reaction, arrived during the latter part of August for a two-week stay.

H. G. Seyler of Farr Nursery Company, Weiser Park, Pa., made two visits to the Garden during August in connection with the selection of seedling daylilies.

Dr. Naomi Mullendore, Professor of Botany at Franklin College, Franklin, Ind., spent several days studying species of living trees on the grounds at the Botanical Garden, especially the kinds that have been introduced into this region.

Enrique C. Clos of Buenos Aires, Agronomist, and Chief of the Division of Plant Exploration and Introduction for Argentina, came to the Garden the last day of August.

Other visitors to the Garden during August were Dr. and Mrs. J. C. Griffiths of Trinidad; Dr. Robert T. Clausen of Cornell University; Dr. B. H. Davis of Rutgers University; Dr. William Beebe of the New York Zoological Society; Mrs. Lee Krauss of Philadelphia; Dr. Cynthia Westcott of Glen Ridge, N. J., and Mrs. Hazel P. Dunlop of Detroit, author of "Let's Arrange Flowers."

AUTUMN PROGRAMS AT THE GARDEN

Courses in Gardening, Botany, and Nature Study

Field Botany—A Saturday class in the identification of plants of the local area. Seven sessions to be arranged, commencing Sept. 15 at 1:30 p.m. *Fee*—$5; to teachers, $2.50. Single trip—$1. Alertness credit may be arranged for New York City teachers. *Instructor*—G. L. Wittrock.

Nature Study—A Wednesday class especially for teachers, arranged in co-operation with the New York City Board of Education. Fifteen sessions, 4 to 6 p.m., commencing Sept. 19. *Fee*—$5; to teachers, $2. *Instructor*—E. E. Naylor.

General Botany I—*Part of the Two-Year Science Course for Gardeners.* A Monday evening class meeting for 12 consecutive weeks from 8 to 8:50 p.m., commencing Oct. 1. *Fee*—$10. *Instructor*—H. W. Rickett.

Systematic Botany—*Part of the Two-Year Science Course for Gardeners.* A Monday evening class meeting for 12 consecutive weeks from 9 to 9:50 p.m., commencing Oct. 1. *Fee*—$10. *Instructor*—Arthur Cronquist.

Upon the successful completion of eight subjects in the Two-Year Science Course for Gardeners, a certificate is offered by the New York Botanical Garden.

Fundamentals of Gardening—*Part of the Two-Year Course in Practical Gardening,* upon the successful completion of which a certificate is offered by the New York Botanical Garden. A Thursday evening class meeting on alternate Thursdays from 8 to 10 p.m., commencing Oct. 4. *Fee*—$10. *Instructor*—T. H. Everett.

Descriptions of these and other courses will be found in the Educational Program booklet, copies of which will be sent free upon request. Members of the New York Botanical Garden are entitled to a reduction in the fees for courses, as described in this booklet.

Members' Day Programs

Occurring the first Wednesday of each month at 3:30 p.m. in the Members' Room, and including refreshments and horticultural displays

Oct. 3 THE FAIRCHILD TROPICAL GARDEN
Colonel and Mrs. Robert H. Montgomery

Members' Day Programs (continued)

Nov. 7 MOLDS, BACTERIA, AND YEASTS ARE PLANTS TOO—With Demonstrations — Dr. William J. Robbins

Dec. 5 REPORT ON THE GARDEN'S EXPEDITION TO SOUTHERN MEXICO — E. J. Alexander

Free Saturday Afternoon Programs

3 o'clock in the Museum Building

Sept. 22 ACTION FILMS OF GARDEN FLOWERS—*A lapse-time motion picture in color.* — Allen K. White

Sept. 29 HOW AND WHEN TO PLANT FLOWERING BULBS — Ethel Anson S. Peckham

Oct. 6 THE WINTER WINDOW GARDEN — Bessie Buxton

Oct. 13 FOR YEARS TO COME—*A motion picture from the United States Department of Agriculture*

Oct. 20 THE BOTANY OF GARDEN FLOWERS — E. E. Naylor

Oct. 27 CULTURE OF OUTDOOR CHRYSANTHEMUMS — T. H. Everett

Nov. 3 PREPARING THE GARDEN FOR BETTER PLANTS NEXT YEAR — Ralph Bailey

Nov. 10 A PROGRAM OF GARDENING FOR THE BLIND — Hugh Findlay

Nov. 17 PROPER CARE OF TREES AND SHRUBS FOR WINTER — R. R. Fenska

Nov. 24 THE AMAZON AWAKENS—*A motion picture from the office of the Co-ordinator of Inter-American Affairs.*

Radio Programs

Alternate Fridays, 3:30 *p.m.,* WNYC (830 *on the dial*)

Sept. 7 LESSONS I HAVE LEARNED IN THREE YEARS OF VICTORY GARDENING — Mrs. Harry Fisher

Sept. 21 MAKING MOLDS WORK AS MANUFACTURERS — Dr. Vincent Cochrane

Oct. 5 ONIONS IN EDUCATION AND RESEARCH — Dr. C. A. Berger, S.J.

Oct. 19 HOW TO GROW HARDY CHRYSANTHEMUMS — Dr. Ernest L. Scott

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.)

Plant Scientists Discuss Latin America's Most Valuable Resources

PLANTS AND PLANT SCIENCE IN LATIN AMERICA. Frans Verdoorn, Editor. 37 plus 381 pages, illustrated. Chronica Botanica Co., Waltham, Mass. 1945. $6.

Through monumental labor, Editor Verdoorn has gathered contributions, lists, illustrations, and summaries that make of his book a small library. It can hardly be overvalued by the plant scientist who has an interest in the world, in Latin America, in geography or soils, in agriculture, or even in plants alone. There are 89 scholarly essays and articles, not the least of which is Verdoorn's own stimulating and thoughtful introductory "The plant scientist in the world's turmoils." The book is largely in English, but contains a good amount of writings in Spanish, Portuguese, and French, underlining, if it were necessary, its truly international character and purpose.

To those who have worked in Latin America, in whatever language, it must occur that in future centuries it will be one of the greatest food-producing places of the world. There are still vast untouched areas in that land, and although plant science has progressed well in some places it has only begun in others. It is of more than academic interest to have such a broadly constructed book as Verdoorn's. The plant science student in Latin America must have interests far beyond the specialized fields which it is so much more easy to work with in the long established institutions in centers of research of Europe or North America. With few exceptions, the professional technician working in agriculture in Latin America must stand as a one-man experiment station, carrying an unfortunate but stimulating extra load of responsibilities. Verdoorn knows this, and the make-up of his book shows the realization. Through this book he will bring assistance to many.

There may be found in this book the names and official positions, and an indication of the main interests, of at least most of the important and serious workers on plant sciences in Latin America. There are extensive bibliographies, and bibliographical notes, as well as numerous literature lists. At the end of the book is a special supplementary list of plant science institutions, stations, museums, gardens, and societies of Central and South America. This volume has, not only compilations and reviews of past work of both historical and present-day importance, but it also has in it original contributions appearing for the first time. Not the least attractive feature of the book is the large number of maps and the numerous illustrations, many of which are reproductions from fine old classical works.

The book has some disadvantages, but with reason. The editor says, "It was not feasible to prepare a subject index for our polyglot volume," and in these days of shortage of manpower, this is truly understandable. However, the reader cannot help but feel that it would have been fortunate indeed if it had been possible to have a subject index to use with the book. It is likewise true that the type is small, and some readers' eyes may tire after prolonged reading. Here again, however, was shortage of paper, and the needed condensation of so much material into a conveniently handled and reasonably priced volume. It is after all a student's book, and not for light reading.

The book is attractive and especially worth having for every plant scientist in Latin America. It would seem to be that in the future, this book will be considered a bench mark in the history of science in the Western Hemisphere.

FREDERICK L. WELLMAN,
Office of Foreign Agricultural Relations, U.S.D.A., Washington, D. C.

Quinine Interests

CINCHONA IN JAVA. Norman Taylor. 87 pages, illustrated. Greenberg, New York. 1945. $2.50.

This is a readable and reasonably accurate, though very brief, illustrated account of the history of the cinchona industry, with introductory chapters on the disease which quinine, the product of the industry, cures. The excellent brief popular summary of the occurrence, cause, importance and treatment of malaria is one of the best things in the book. Also, an introduction by Pieter Honig consisting of an essay on agriculture in the Netherlands Indies is of great interest. As a brief non-technical discussion of some of the problems and methods of tropical agriculture the book should possess considerable appeal to the lay reader.

The standard of accuracy, important in popular as well as technical science, is marred somewhat by such things as repeated reference to "quinine sulfate" content of bark (quinine is actually converted to the sulfate after extraction from the bark), and the statement (p. 60) that for cinchona culture "There must be no dry season of more than a month's duration." Of course, an absolutely dry season of several months might be serious, but in most parts of the tropics, as Mr. Taylor should well know, "dry season" is a purely relative term. Certainly in most parts of the 2,500 mile sweep of the Andes where cinchona grows naturally there is a dry season of substantially more than a month's duration, and yet, even without the encouragement and protection of man, the trees have succeeded in growing for many thousands of years.

It may well be that the dismissal of Latin America as a possible region for the establishment of the industry results from the propaganda nature of the book.

Considering that Mr. Taylor's job is to carry on propaganda for the Dutch cinchona growers, there is actually remarkably little distortion of fact in the book. Certain misconceptions with which the reader is left, such as the idea that quinine is the only specific for malaria, are due mostly to omissions rather than to misstatements.

The book would probably have been better without the brief discussion of "economic considerations" at the end. The impression of undiluted benevolence of the Netherlands Indies cinchona monopoly is, of course, what one expects to find in such a book, but it would be much more convincing to the critical reader if more supported by economic facts of the industry rather than by economic generalizations.

F. R. FOSBERG,
Falls Church, Va.

Bacteriology Text Revised With New Material

FUNDAMENTALS OF BACTERIOLOGY. Martin Frobisher, Jr. 3rd edition. 824 pages, illustrated, indexed, references, W. B. Saunders Co., Philadelphia and London, 1944. $4.

This textbook on general bacteriology is clearly and well written and holds the attention of the reader throughout. The third edition includes new material on electronic and fluorescent microscopy, penicillin, sulfonamid drugs, and other bacteriostatic substances. Considerable information on the use of chick embryos for cultivation of viruses and rickettsiae is also included. There is also a brief section on dermatophytes.

The book covers a wide variety of topics related to bacteria, and also contains, as does the second edition, chapters on filterable viruses, rickettsiae and pathogenic protozoa. The separate chapters on the bacteria of soil, milk, and water are an improvement over the second edition. References are placed at the end of each chapter rather than at the back of the book. This is a better arrangement as it brings them to the attention of the student, and encourages further reading on the particular subject.

Many of the old illustration have been kept, and a number of new ones, including several in color, have been added.

CORNELIA L. CAREY,
Barnard College, Columbia University.

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

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

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

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

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

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

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

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

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

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

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

Periodicals

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

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1 a year; single copies 15 cents. Free to members of the Garden. Now in its 46th volume.

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

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

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 100 parts now issued. Not offered in exchange. Prices of the separate parts on request.

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

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

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

A PROBLEM IN WOOD ALLERGY

This editorial continues the series which ran from September 1944 through last January, giving examples of the unique services furnished the public without cost by the New York Botanical Garden. These services in many instances consist in locating and interpreting specialized information not readily available to the average person.

* * *

A MEDICAL research center laid before the New York Botanical Garden a problem in wood allergy which concerns musicians. A staff member wrote to the Garden:

"It is known that some adults become hypersensitive and develop reactions on the face and lips from playing wooden flutes, and we understand from a flute maker that this is attributed not to the stains used but to the wood itself, which is said to be 'coco-bolo.' It would appear from the Funk and Wagnalls' dictionary that several West Indian woods are so called. Would you be able to tell me what woods are known as coco-bolo and whether any one variety is sold in commerce more than others? Also we should appreciate suggestions as to how we could get samples of these woods for preliminary testing so as to locate the one containing the active material."

In its library the New York Botanical Garden had reports of exhaustive studies of cocobolo wood made by the late Professor Samuel J. Record and Professor G. A. Garratt. Thus the Garden was able to give the medical research center the botanical names of the various woods called "cocobolo" and also to suggest places where they might be obtained. The Garden's answer read, in part:

"Cocobolo wood is produced by three species of trees growing in Panama, Costa Rica, and the Pacific sides of Nicaragua, Honduras, and southern Mexico. The three species all belong to the same genus, *Dalbergia*, which includes other species of valuable woods. *Dalbergia retusa* and *D. hypoleuca* occupy the southern part of the range, while the Mexican tree is *D. Granadillo*.

"So far as is known, most of the cocobolo is exported to the United States. The imports to this country were estimated in 1923 as 2,500 million tons annually. .

"The telephone Red Book lists several dealers in tropical hardwoods. Because of the importance of cocobolo it is likely that most of these firms handle it. In order to get samples of all three species, it may be advisable or necessary to get in contact with several importers."

There has not yet been time to learn the results of the study of this toxic wood by the medical research center, but the very fact that the problem was attacked and that the Garden was able to furnish useful information may mean that in the future, hypersensitive flute players may be saved the irritation that results from their allergy.

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Plants of the Surinam Coastland

Some Observations on the Littoral Vegetation of Dutch Guiana

By D. C. Geijskes

WHEN a piece of land is under consideration for a new project of development, such as agriculture or forestry, a study of the plants that grow there normally may be of great practical value. Understanding their natural habits and habitats may save time required for extensive surveys and examinations of soil and water samples, and may also avoid grave errors in the use to which the land is put.

This was recognized some years ago by a group of workers in the United States Department of Agriculture, who in 1914 published the results of a survey made in an agricultural valley in Utah, showing how the plants of the region served as indicators of the several types of soil.

In the following article, Dr. D. C. Geijskes of the Agricultural Experiment Station in Paramaribo, shows how his own studies of the flora of the coastal regions of Surinam (Dutch Guiana) can be of aid in the prospecting of large areas of land, and thus suggests how comparable knowledge could be made of economic value in other regions, too.—C.H.W.

IN Surinam there is a remarkable difference, from a biological point of view, between the coastline and the interior. It is not just the plants and animals, however, but the soil too which differs in these two sections of the country. For instance, in the coast belt for the most part a tough clay has been deposited through the years by the ocean and the larger rivers. Adjacent to and often on top of this clay in several areas may be found strips or streaks of sand bottom which, as they frequently contain layers of sea shells and their remnants, are to be regarded as old natural sea walls.

This formation, known as sand reef or shell reef, invades the clay-land in small bands, mostly parallel to each other and more or less parallel to the present coastline. The width of one sand reef varies from 25 to more than 100 yards, while its length varies from one to more than 10 miles.

The coastland in general is very flat, lying at sea level or some feet below this level, whereas the larger sand reefs arise a few feet above this lowland.

As in other parts of Surinam, the coastland is covered with a dense vegetation, but in contrast to the interior the aspect of this vegetation is very irregular. Generally speaking, here we find bush and wet savannah—that is, marshy land without trees. This latter type of land is very characteristic of the coast belt and gives the country the non-tropical aspect of a grass swampland, somewhat like certain coastal regions in Holland.

Fresh-water—First of the Three Kinds of Swamps

Let us consider these swamps first. From the interior of the territory to the ocean, we meet fresh-water, brackish-water and salt-water swamps. The fresh-water swamp shows a well varied type of vegetation, although it is generally dominated by one species, which locally forms a uniform stand as long as the same water level and soil persist. An example of this kind is *Eleocharis interstincta,* found in the swamps near the village of Onverwacht 30 km. south of Paramaribo. This sedge covers the lowest places of the swamps in that region as a green screen.

In the swamps near Coronie, large areas are covered with two dominant plants—the grass *Leersia hexandra* (*Homalocenchrus hexandrus*) and the sedge *Rhynchospora corymbosa,* forming a vegetation cover just strong enough to bear the weight of a man, though it is better not to stop too long on this unstable "ground."

In deeper water (1—2 meters) plants with long stalks and floating leaves appear, such as waterlilies (*Nymphaea* species), cabomba (*Cabomba aquatica*), and bladderwort (*Utricularia* species), alongside of free-swimming plants such as duckweed (*Lemna*), water-lettuce (*Pistia*), water-hyacinth (*Eichhornia*), and the two fern-relatives, *Salvinia* and *Azolla.*

In still deeper water (2 meters and more) there is no surface vegetation, but the open ponds or lakes are mostly surrounded by the extraordinary long-stemmed and large-leaved aroid, *Montrichardia,* and waterlilies. This type of surface is seen in a very few places in Surinam, but occurs in the Nanni Lake area, at some spots in the large Coronie swamp in the western part of Surinam, and in some widened places in Wane Creek near Albina on the eastern side, not mentioning the artificial canals on the estates.

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* See also Lanjouw J. "Studies of the vegetation of the Suriname savannahs and swamps" (Ned. Kruidk. Arch., Dl, 46, pp. 823-851).

Brackish-water swamp with the tree-like aroid, *Montrichardia arborescens*. The trees in the middle and at the right are *Pterocarpus officinalis*.

Vegetation of the Brackish Swamps

The brackish-water swamp is characterized by a smaller number of plant species, but because of the space occupied they appear more abundant than they are able to do in the fresh-water swamp, where these same few species may also be found. Furthermore, it is interesting to note that those species which dominate in the fresh-water swamps are developed on only a small scale in the brackish-water swamps, if represented there at all. The community in this biotope is consequently partly selected by the presence of salt in the soil and in the swamp water.

A typical dominant species in brackish-water swamps is *Montrichardia arborescens,* a plant commonly met with all around Paramaribo; in other places there appears the large sedge, *Cyperus giganteus,* or the fern

Blechnum serrulatum, mixed with species of *Jussiaea* and a few other plants that will tolerate brackish conditions.

More Varied Species in Salt-water Swamps

The salt-water swamps are found of course nearer the seashore. The original number of fresh-water plant species has decreased once more, but in the place of these, salt-water plants or halophytes appear, the occurrence of which depends upon the content of salt in both the soil and the swamp water. An example is the large fern, *Acrostichum aureum,* which locally covers large parts of the swamps in and outside of the mangrove woodland along the coast.

To a greater extent than in the brackish-water swamp, there is in the salt-water swamp a dominance of one species, with the result that there are areas of almost monotypical vegetation. Such types are *Cyperus articulatus,* a sedge; *Typha angustifolia,* the cat-tail; and *Eleocharis mutata,* another sedge, which form miles and miles of uniform swamps, arranged in this order from brackish to salt water.

Conversely, the vegetation in these salty swamps is not to be regarded as homogeneous, but as highly varied. This variation, caused in the first place by the degree of salt, fluctuates with the distance from the seashore. In accordance with it we see a zonation of distinct dominant plant species from the brackish-water area to the coastline.

In this way we find in the salt-water swamps north of Paramaribo a succession of *Typha angustifolia, Anona palustris* mixed with *Chrysobalanus icaco, Acrostichum aureum, Avicennia nitida,* and *Rhizophora mangle.* In the Commewijne district, east of Paramaribo and north of the plantations lying along the Commewijne River, there grow as dominants first *Eleocharis mutata* and secondly a small grass, *Cynodon dactylon,*

Sand-reef forest arising from a salt-water swamp, covered in the foreground with cat-tails. The two palms on the reef are *Maximiliana maripa;* the large two-armed tree at the right is the silk-cotton, *Ceiba pentandra.*

Salt-water swamp in the Commewijne district, covered almost exclusively with the sedge, *Eleocharis mutata*. The lone tree is *Avicennia nitida*; the grass in the foreground, running along the creek, is *Cynodon dactylon*.

which enters the large *Avicennia* bush. In this wood we encounter as ground vegetation first *Talinum racemosum* (a species of purslane), next *Acrostichum aureum,* and last *Batis maritima* before reaching the high-water line. Outside this line a dense shrub bush of *Avicennia* saplings occupies the mudflats for more than half a mile into the sea.

In the western part of Surinam, other combinations of plant species are found in the salt-water swamps. Here we may notice, besides *Typha angustifolia,* large areas overgrown with *Cyperus articulatus,* a small brown-headed sourgrass, often running into the cat-tails in spots with the very prickly shrub, *Drepanocarpus lunatus.*

Among the swamp woods, which are arranged more or less as islands in the grass swamps, we observe some variation too. A typical member of swamp wood species is *Erythrina glauca,* the well known immortelle, which is used as a shade tree on the plantations. This tree occurs in Nickerie and Coronie commonly, but curiously it is not known as a wild tree in the swamps in the middle part of Surinam, whereas it appears again on the east side of this country near Moengo north of the Cottica River. Sometimes other tree species dominate, such as *Pterocarpus officinalis* and *Triplaris surinamensis,* or *Tabebuia longipes* and *Inga vera.*

Upon what these differences in vegetation are based is not yet exactly known. We have to bear in mind that those plants are affected not only by the amount of salt present in the soil and in the swamp water, but that they are dependent also on a number of other factors, such as the water level—that is, the depth of the swamp—the season of drought when the swamp may dry up, and the struggle of competition among the plants themselves.

Plant Life of the Surinam Sand Reefs

Let us turn our attention to the vegetation of the sand reefs, which are normally covered with a dense forest composed of a large number of species. On the reefs north of Paramaribo we noticed more than 100 different kinds of trees and shrubs. It is noteworthy that many of them will be found again in the interior, so that we can say that the bush of the sand reefs forms the northern outskirts of the Surinam lowland forest. Some of the characteristic species on the reefs are the silk-cotton or kapok tree (*Ceiba petandra*), balata (*Manilkara bidentata*), and several palms, such as *Maximiliana maripa, Astrocaryum segregatum, Euterpe oleracea,* and *Desmoncus polyacanthos,* the last one a climbing species, resembling the East Indian rattan palm. They all prefer the higher sand reefs—that is, those reefs which even in the heavy rainy season do not become inundated.

In other places—for example, in Nickerie along the Nanni Creek—the reefs frequently contain, besides the above named plants, *Triplaris surinamensis, Cordia tetrandra,* and a wild tree called "birambi." Here the soil of the reefs mostly consists of a large quantity of clay and a small portion, if present at all, of sand. This observation indicates that most of the characteristic sand-reef trees are affected more by the water table (or, in other words, by the elevation of the ground above the surrounding swamp) than by the kind of soil.

A different situation exists on those sand reefs where the level does not differ from that of the surrounding clay swamp. In such types we come upon a kind of swamp bush, built up by one very characteristic species, *Hura crepitans,* the so-called possentrie (poisontree), the name deriving from the poisonous milky sap in the stem and the leaves. This tree, which we would vainly look for in the interior, is found only on sandy soil in brackish-water swamps.

Appraising the Terrain

After a study of the above-mentioned observations, it becomes obvious that each of the swamp types includes a number of plant species which come into prominence according to suitability of environment. In the salt-water swamps we met with a smaller number of plant species than in the fresh-water and even in the brackish-water areas, but here we find a much greater variation of the communities in relation to different ecological conditions, the most important of which is the degree of saltiness of water and soil.

The conditions favorable to the plant, especially on the spot, are matters of interest to us. For a few species we know some data: *Batis maritima,* a typical halophyte, grows here on a clay ground with a salt content of at least 2,000 milligrams of chlorine per liter; *Typha angustifolia* occurs in swamps with a clay ground base where the water holds 800 to 1,500 milligrams of chlorine per liter; *Montrichardia arborescens* tolerates less

Sand reef with a large silk-cotton tree. The palms are *Maximiliana maripa* (left), and *Astrocaryum segregatum* (right).

salt and needs also clay ground; *Hura crepitans* is to be found on sand bottom only, but in brackish-water swamps.

From these data it is evident that one with some knowledge of botany is able at the first glance to appraise the country from different angles. The plant species here tell him something about the content of salt in the swamps or in the soil, about the depth of the water, about the soil itself—whether clay or sand or what. It is not necessary therefore to be a professional botanist to answer these questions, although an accurate knowledge of the identity of the characteristic plant species is required.

Clay reef in Nickerie along the Nanni Creek, occupied, besides many other species of trees, with *Triplaris surinamensis* (at right) and *Cordia tetrandra* (in the middle with umbrella-like crown).

Furthermore, it is evident that the study of these fundamental ecological facts is of prime importance in selecting new grounds for cultivation or forestation or projects for irrigation. In this way it is possible to prospect a large area in short time, without taking soil samples and water samples and without making extensive measurements both in the field and in the laboratory. Moreover, the plants themselves generally give a much better notion of the present environment in its extreme and average phases than can an analysis of a sample taken on a certain spot at a certain time. For this purpose the characteristic (indicator) plants should be used as living measure instruments, provided we know exactly the value of their measurements. However, our knowledge of all such plant reactions to environment is limited.

If these data and observations are to be made use of and put into practice, it will be necessary to continue the research work on the vegetation of the coastlands in a sociological, ecological sense, after a physical-chemical analysis of the soil and of the swamp water.

For cartographical study from the air it is advisable also to pay attention to the floristic peculiarities of the country, not only from the point of view of science, but also from the standpoint of utility for cultivation or forestation.

A Forest Rover in the Caribbee Islands

IV. The Cloud-Capped Wilderness of Dominica

By J. S. Beard

ON Sunday, November 3, 1493, Christopher Columbus, sailing northward along the Caribbees, sighted a great mountainous pile which he named *Dominica* or Sunday Island. It appeared as a towering, inaccessible wilderness, its mountains rising often sheer from the sea with thousand-foot cliffs, up until their heads were lost in the clouds. Dense forests covered the whole of the interior of the island, and only around the coastal fringe stood the scattered villages of the fierce, warlike Caribs. Dominica's inaccessibility made it a Carib stronghold and the savages not only resisted European colonization for over two centuries but carried their cannibal raids far up and down the islands, to the terror of white settlers. Gradually, by the middle of the eighteenth century, the Carib power was broken and sugar estates were opened up by French aristocrats and their African slaves.

Dominica became British in 1783. Today the degenerate remnants of the Caribs still inhabit a small reservation on the windward coast. More negro than Carib now, they have lost their language and almost every trace of their culture, but live in a state of cheerful squalor, still clinging to the shadowy tradition of their Carib origin.

In two hundred years of their occupation, the newcomers have wrought relatively little change in Dominica. The land is so excessively broken that communications are difficult and cultivation often impossible. The island measures 29 miles by 16, within which small area there are at least five peaks over 4,000 feet high, the highest—Morne Diablotin—almost 5,000, and legions exceeding 3,000 feet. Some of the peaks attain their height of 4,000 feet in four horizontal miles, so that their sides slope often at startling angles. Off the coast, the bottom plunges at the same slope down to a sea floor 4,000 feet deep. Because of their great height the mountains are nearly always clothed with clouds and draw a prodigious rainfall. In the interior the annual precipitation commonly exceeds 25 feet, which means that in twelve months 30,000 tons of rain water fall upon every acre and pour down the mountainside. Dominica's ever-flowing, rushing, cascading streams are one of her most beautiful features. Every visitor is immediately told that Dominica has 365 rivers, one for every day of the year—a pleasant fiction, for it would mean a river every 400 yards round the coast! But it is not a very great exaggeration.

While the interior is very wet, the leeward coast is curiously quite dry. The interior mountains are so high that a "rain shadow" is set up. The moisture is condensed on the peaks and little rain falls to leeward. The arid appearance of the leeward coastal margin with its cacti and thorn bushes is in marked contrast to the luxuriance of the interior.

About two-thirds of Dominica is still Government land, only one-third having been "alienated" or sold out for agriculture. So many difficulties have continually obstructed agricultural development in this island, that it is at present estimated that only 12% of the area of the agricultural holdings—or 4% of the whole area of Dominica—is permanently cultivated in crops such as citrus fruits or bananas. Many valiant attempts have been made to establish crops on the remainder but at the present day many estates have reverted wholesale to bush. King Sugar abdicated early in the nineteenth century, for the country does not favour sugar cultivation except on a basis of inflated prices and slavery. Since that time the island has depended mainly upon citrus—limes, oranges and grapefruit—with sporadic booms in bananas, vanilla and bay rum. Extraction difficulties in the largely roadless, mountainous country, market depression and, worst of all, devastating plant disease and destructive hurricanes have time and again reduced the people's painstaking efforts to nothing.

In view of this lack of development an unusually high proportion of Dominica is still covered with forest growth. Not all of this is fine primeval forest for no attempt is made, unfortunately, to restrain the peasantry from plundering the forests on Government land or from felling and burning them to plant "provision gardens" as they are called—little subsistence plots of food crops. All the same, Dominica is certainly the most happy hunting ground for the plant enthusiast in all the Caribbees. The flora, even now, has been only moderately well collected and any visiting botanist who cares to penetrate the remote interior can well hope to discover several endemic new species. No proper flora of the island has ever been published: in fact the only applicable work is Grisebach's *Flora of the British West Indian Islands,* dated 1864! The variety of plants is large for an oceanic island and the flora only yields perhaps to Guadeloupe as the richest in the Caribbees. The proportion of endemics is known to be high and undoubtedly many more will be discovered. The number of endemic species listed from Guadeloupe and Martinique, which neighbour Dominica to north and south, is considerably higher than those yet known from Dominica and while some of us think the French taxonomists have been a shade too enthusiastic in their endemism, it is still true that an oceanic island may be expected to be rich in this direction.

Owing to the lack of a flora, the intending student of Dominica's forests must laboriously delve into all sorts of scattered records. The writer's researches are not yet complete but records have already been unearthed for upwards of 220 trees and large shrubs of which some 60 are endemics of the Lesser Antilles. A comprehensive ecological survey of Dominica has not yet been made, though the writer hopes to undertake it. Forest

Dominica's ever-flowing, rushing, cascading streams are one of her most beautiful features.

types and forest composition are as yet imperfectly understood and we still do not know what is meant botanically by very many of the creole names for trees. A most interesting short description of the vegetation of the island by W. H. Hodge has appeared in *The Geographical Review* for 1943, published by the American Geographical Society.* Dr. Hodge divides the various types into four main categories, namely:

1. The vegetation of strand and seashore (littoral woodland).
2. The xerophytic vegetation of dry coastal areas (which we may term seasonal forests).
3. The rain forests.
4. The elfin or mossy woodland of the high mountain peaks.

This is an essentially sound classification and is based, under local conditions, primarily upon climatic differences. Details are as follows:—

Littoral Woodland

Developed principally on the windward coast under the influence of a strong salt-laden trade wind, the littoral woodland consists of a dense "hedge" fronting the sea, in which the chief species are, first, the sea-grape, *Coccoloba uvifera* (RAISIN BORD DE MER), and coco-plum, *Chrysobalanus icaco* ('ZICAQUE). Behind this is a straggling and windswept thicket sometimes up to 30 or 40 feet high, containing *Tabebuia pallida* (POIRIER) with *Terminalia catappa* (ZAMANDIER), *Calophyllum antillanum* (GALBA), *Coccoloba uvifera* again, and *Citharexylum spinosum* (BOIS COTELETTE).

Seasonal Forests

The former seasonal forests are now entirely ruinate. At one time they formed a very narrow transitional band along the windward coast between the littoral woodland and the rain forests of the interior. To leeward, in the rain shadow, they were probably better developed and showed a good transition of types down to deciduous seasonal forest.

Relict woodlands along the windward coast today show a dominance of *Licania ternatensis* (BOIS DIABLE) with the allspice relative, *Pimenta racemosa* (called here BOIS D'INDE), also *Manilkara bidentata* (BALATA), and species of *Chione* and *Guettarda*, indicating a close affinity to xerophytic rain forest, which is typical of a windswept area with steep slopes and shallow soil. In the south at Grand Bay the woodlands are drier and more open, the dominants being *Tabebuia pallida, Pimenta racemosa,* and *Inga laurina* (POIS DOUX).

Along the leeward coast the woodlands are mainly a degraded deciduous seasonal forest—a variable, low and open bush, continuously decimated by fellings for cordwood and growing on shoal soil mostly eroded to bedrock.

* See also "Plants Used by the Dominica Caribs" by W. H. Hodge in the Journal of the New York Botanical Garden for August 1942.

At one time the resinous *Bursera simaruba* (GOMMIER ROUGE) must have been dominant, as it still is in undisturbed places. The principal species today is the introduced logwood, *Haematoxylon campechianum,* with many species of *Croton* (BALAI-FOUR), *Pisonia* (MAPOU), and the large-leaved sea-grape, *Coccoloba* (RAISIN GRAND'FEUILLES), besides *Tabebuia pallida* (POIRIER), *Tecoma stans* (BOIS FLEUR JAUNE), *Plumeria alba* (FRANGIPANI), *Calliandra purpurea* (BOIS RAVINE), and *Pithecellobium unguis-cati* (GROS SUREAU), as well as others.

At the Grand Savanna, to leeward, burning, grazing and erosion have converted a part of this area into grassland. It might be supposed that, as this is a gently sloping or flat area with rock at or close to the surface, the savanna might well be natural, but there is nothing to support this view. The vegetation does not contain any typical savanna elements. The Grand Savanna consists partly of open grassland of *Sporobolus indicus,* often with scattered logwood trees, and partly of patches of very low bush containing *Haematoxylon campechianum, Croton, Bursera simaruba,* and other species. It is swept by fire annually.

Rain Forests

The rain forests of Dominica are very rich both in composition and in form. To study them one must of course ascend into the interior and the

The Grand Savanna, leeward coast, with logwood trees and grass.

The view from Mr. Knowlton's house at Sylvania commands the whole central plateau. Below, the orange fields. Left, Morne Couronne, right background Morne Grand Bois, and behind all, cloud-capped Diablotin.

best route is provided by the Imperial Road, so called because it was constructed from 1898 onwards with funds provided by the British home government. This road leaves Roseau, the capital town, and runs northwards along the coast for a mile or two, after which it strikes inland into the mountains and winds up onto the central plateau 1,800 feet high. This is properly a high valley rather than a plateau, being the result of the filling up of a trough between two parallel rows of volcanoes whose peaks still hem it in on all sides. The "plateau" is drained by the Layou River which bursts out to the sea midway on the western side. The Imperial Road was built in order to open up the central plateau for agriculture and as the government land was offered for sale at the equivalent of only two American dollars per acre (a price which still obtains in Dominica, suckers please note!) many settlers came, cleared the forests and planted citrus, but alas, nearly all were ruined and their plantations have gone back into the forest. Only a few, by care and good management, have overcome the losses of disease and hurricane and poor markets and braved the inhospitable climate, which for the greater part of the year brings low grey clouds in a dense overcast and continual, driving rain.

Just at the point where the Imperial Road gains the central plateau, 1,800 feet above the sea, is "Sylvania," the well kept orange plantation of a New Englander, Mr. J. E. Knowlton. He has settled there with his family in a charming house which, perched on a knoll, overlooks the whole length of the great valley, a truly magnificent outlook. On the right towers the 4,000-foot Morne Trois Pitons, a not long extinct volcano the fragments of whose crater rim form the three conspicuous peaks from which the mountain is named. To the left stands Morne Couronne; to the right appear a succession of lesser peaks till the valley is blocked by massive Morne Grand Bois and behind the northwest corner rises mighty Diablotin with his cap of clouds. Below, in the foreground, lie the orange fields—those Navel oranges are truly luscious! At the end of the fields stands the primeval forest, which stretches away into the furthest distance.

From Sylvania, therefore, the rain forests are at one's doorstep for study. We find that the primary type of the rain forest belongs as usual to the *Dacryodes-Sloanea* association of the Caribbees, though *Dacryodes excelsa* (GOMMIER BLANC) is not at all so clearly dominant as in other islands and does not exceed 10 percent of the crop. Associated species are of greater number and the *Sloanea* trees (CHATAIGNIERS) are more abundant. There are at least three species of the latter, *S. truncata* (CHATAIGNIER GRANDES FEUILLES), *S. caribaea* (CHATAIGNIER PETITES FEUILLES) and *S. Berteriana* (CHATAIGNIER PETIT COCO).

A characteristic feature of these "chestnut" trees is their buttressing. Hugh plank buttresses, of which there are usually three main ones per tree, rise many feet away from the base and do not disappear into a normal round stem below a height of sometimes thirty feet from the ground. Their fruit gives them their name for it superficially much resembles the chestnut. GOMMIER, or *Dacryodes,* on the other hand, is never buttressed but always cylindrical. It exudes a whitish aromatic gum.

At its best this forest is a very fine one, 120 and more feet high. The principal trees in addition to those above are *Tapura antillana* (BOIS COTE) with its abnormally fluted stem, *Sterculia caribaea* (MAHOT COCHON), *Ormosia monosperma* (CACONIER), *Byrsonima spicata* (MAURICIF), *Guarea macrophylla* (BOIS PISTOLET), *Micropholis chrysophylloides* (CAIMITE), *Licania ternatensis* (BOIS DIABLE), *Pouteria hahniana* (BALATE) and numerous others of the Sapote family, and of the Laurel family also—*Nectandra, Ocotea, Acrodiclidium*—(LAURIERS). The graceful palm *Euterpe dominicana,* an endemic, is occasionally seen.

The principal sub-types of this rain forest are two in number and are related to special soil conditions. Rain forest proper is found on well drained sloping land with a deep soil, but the sub-types indicate one to be a poorly drained flat and swampy area and the other a shallow soil with rock or ironpan or otherwise obstructed subsoil. The former type is the "mangle" forest, in its finest development an almost pure stand of the two stilt-rooted species, *Symphonia globulifera* (MANGLE BLANC) and *Tovomita Plumieri* (MANGLE ROUGE). In local parlance this is miscalled "man-

Mr. J. E. Knowlton gives the scale in this view of the rain forest interior, between winged Sloanea and cylindrical Dacryodes.

grove" forest because of the stilt-roots present. It occurs on plateaus wherever for various reasons swampy conditions obtain. The second type is the "carapite" forest, so called from the dominance of that tree (*Amanoa caribaea*). It occurs principally on the Layou flats, gently sloping areas of the central plateau, where the loamy topsoil is underlain at 2 to 3 feet depth by unweathered rock sealed by an impermeable ironpan. Conditions may be intermittently waterlogged, but are probably not so continuously swampy as in the mangle forest. The ironpan reverberates when one stamps upon the ground. There is an exceedingly thick surface mat of

The incredible "mangle blanc" (Symphonia) with its aerial roots.

raw humus and little ground vegetation. The carapite forest has more or less the structure of lower montane rain forest. There is an upper storey reaching 90 feet, in which the trees have narrow crowns, so that light penetrates to the lower storey at 40 feet. There is a sparse shrub layer of bushes and tree ferns.

The commonest trees in carapite forest, after *Amanoa* itself, are much the same as in the *Dacryodes* forest, though they yield in numbers to the former. One may mention also *Richeria grandis* (BOIS BANDÉ), with its red, ropy bark, and *Simaruba amara* (BOIS BLANC). Carapite is one of the finest timbers in the Caribbean—strong, tough, durable, of fine appearance—but it is restricted to Dominica and Guadeloupe.

A montane rain forest is found as a transition between the rain forest proper and the elfin woodland. Generally it occupies a somewhat localised distribution, on ridges and upper slopes between 2,500 and 3,500 feet. Typically the forest is from 40 to 60 feet high with fairly slender, low-branching trees much decked with moss. The commonest tree is *Podocarpus coriaceus* (RESOLU MONTAGNE), the solitary coniferous tree in the Caribbees. It looks like the yew of northern latitudes and is probably a relic of some ancient Mesozoic flora. Other trees are *Richeria grandis*, species of *Freziera, Sterculia caribaea* and *Tovomita plumieri.*

The impenetrable interlacing thicket of the elfin woodland.

Elfin Woodland

Elfin woodland is the formation of highest altitudes and takes the form of a low, dense and windswept thicket, densely matted with moss. The principal component is *Clusia venosa* (CACLIN) which forms almost pure thickets in places. Associates are *Charianthus coccineus, Didymopanax attenuatum, Ilex sideroxyloides, Hibiscus tulipiflorus, Euterpe globosa, Freziera* species, *Endlicheria sericea,* and many others.

At the actual summits of the highest peaks for a few square yards the elfin woodland gives way to páramo with lobelia and bromeliads predominating.

Secondary and Sub-seral Types

Some of the very steepest, most exposed upper mountain slopes above 3,000 feet are clothed with a palm-brake or "hurricane forest" which is similar to that in St. Vincent and Grenada, except that the palm in Dominica seems a different species from that further south. It is usually described as *Euterpe globosa,* but this is not a name with absolute taxonomic significance.

Land abandoned from cultivation begins to revert to forest as soon as it is deserted by man. In due course the original vegetation of the area will be faithfully recreated by nature unless human interference has permanently altered any of the conditions of the locality. Erosion of shallow soils may have this effect. The speed of the process of reversion will vary according to the intensity of the interference. Gardens thoroughly cultivated for a long period are usually slow to revert to bush, whereas a clearing made and at once abandoned grows up in forest very quickly. Certain definite stages in the process can be readily recognized and presumably lead one to another. The chief of these are:—

1. Tree-fern brake: Pure groves of tree ferns (*Cyathea*).
2. Cré-cré bush: Groves of the cré-cré (*Miconia guianensis*).
3. Advance forest: Pioneer species of the climax association.

Stage 3 can frequently be observed in the field succeeding stage 2, but the relationship of 1 and 2 is not yet clear. In the case of rain forest the principal pioneers in the "advance forest" stage are *Simaruba amara* (BOIS BLANC), various members of the Lauraceae (LAURIERS), *Chimarrhis cymosa* (BOIS RIVIERE), *Sapium caribaeum* (LA GLU), *Symplocos martinicensis* (GRAINES BLEUES), and *Pithecellobium jupunba* (PIPIRIE).

The Valley of Desolation

Volcanic activity in Dominica is not yet dead. The mighty eruptive cones which were in magnificent activity in Pleistocene times have quieted and died and the craters of a few only can still be seen. But the subterranean fires are not far below and manifest themselves in numerous "soufrières" which are awe-inspiring, sulphur-encrusted places with boiling springs and vents smoking with evil, sulphurous fumes, surrounded by dead and blasted vegetation. Some of these are quite mild, just warm springs. The lovely waterfall which is shown in the first photograph in this article is icy-cold for bathing: but at its very foot warm springs cascade out of the rock. After a cold bath a warm one, and just the right temperature!

High up in the interior, however, lies the truly spectacular Valley of Desolation which contains the famous Boiling Lake. Here a mediaeval churchman would find his fears of hell amply confirmed. Here the crust over the bottomless pit is thin indeed. To visit the spot one takes the road up the Roseau valley behind the town. Becoming a bridle path this route crosses over the main watershed of the island and gives access to the windward coast, passing on the way the pretty Freshwater Lake in the forest, probably an old crater basin. The Boiling Lake, however, lies off this trail and at the end of a wet and difficult track winding up and over Morne Nicholls and abruptly down into the famous valley. It is filled with the smoke of the sulphur vents and indistinctly below one can see the gushing springs of cloudy grey steaming water and the rocks incrusted with yellow, green, and whitish mineral deposits. All normal vegetation has been blasted by the fumes on the surrounding hills and the red soil shows bare between clumps of ferns and bromeliads. Descending, one walks gingerly down the valley between the boiling springs and treacherously spongy deposits of tufa. Dead trees stand weirdly here and there. Dead logs litter the ground, their wood softened and pulped by the sulphurous water. Sparse plants of *Pitcairnia* dot the ground, with tussocks of an *Ischaemum* grass, the trailing *Gleichenia* fern and occasional shrubs of *Clusia* and *Ilex*. All these plants must be strongly sulphur-resistant.

At the very end of the valley lies the Boiling Lake itself. It is a seething cauldron, 50 yards across with abrupt walls 10 feet down to water level. The surface of the water simmers and boils and dense clouds of vapour rise continually. In the midst of this barren desolation the lake is a unique experience, but it must be approached with caution for fatalities have occurred in its waters and in the asphyxiating fumes of the valley.

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.)

Ancient Civilization To the South

THE AZTEC AND MAYA PAPERMAKERS. Victor Wolfgang von Hagen. 120 pages, with 39 plates and other illustrations, notes, appendix, bibliography, index. Introduction by Dard Hunter and a chapter on "The American Fig Tree" by Paul C. Standley. J. J. Augustin, Publisher. New York. 1944. $6.*

This slender, exceedingly well printed book of only 101 pages of text is packed with information. Primarily it discusses the art of papermaking in ancient Mexico and points south; in so doing it takes in the whole vast panorama of Aztec and Mayan civilization and cultures. Even apart from its main theme it makes fascinating reading.

Sometime around the fifth century the Mayan civilization was at its peak, and, parallel with the development of huge architectural undertakings, the people invented a material upon which they could record their annals, calculate their calendars, and draw the plans for their temples. In the tenth century they began to put their records into book form, in the manner of the Chinese, in rolls up to 30 feet long.

After the Aztec and Mayan civilizations merged, the tradition was carried on ". . . libraries were established. At Texoco as at Alexandria of the Ptolemies, a stone building housed thousands of manuscripts, religious, magical, and historical." Later, Cortés' learned friars had the satisfaction of piling them "mountain high" and putting the torch to them. Of the thousands of books, only fourteen survived. Thus characteristically, began the reign of the white man's culture.

Paper was endowed with a religious quality (as with the Chinese), and it played an important part in ceremonial festivals. In the remoter parts of Mexico it still does. But the Aztecs used it also as a form of currency for paying tribute. Thousands of rolls and sheets were collected from the papermaking districts and sent to the imperial storehouse, all carefully marked with the district's or town's symbol: the author reproduces and explains many of these curious trade-marks.

Dr. von Hagen has traveled extensively among the paper-making Indians, and has watched the processes still in use. The American indigenous paper was made by the same process as is employed in the manufacture of tapa cloth in Oceania, that is, by beating and spreading the soft inner bark of various species of mulberry and *Ficus*, the latter being the chief source of this type of paper in America. The Aztecs used the same word to express the tree and its product. They called them both AMATL.**

ADRIAN VAN MUFFLING.

Fifth Volume

ADVANCES IN ENZYMOLOGY. Vol. 5. Edited by F. F. Nord and C. H. Werkman. Interscience Publishers, Inc., New York. 1945. $5.50.

Volume Five of the "Advances" maintains the standard set by the preceding volumes. Of the eight reviews, the following have particular interest for plant physiologists: Physical and Chemical Properties of Tomato Bushy Stunt Virus and the Strains of Tobacco Mosaic Virus by N. W. Pirie; Alcoholic Fermentation of the Oligosaccharides by J. Leibowitz and S. Hestrin; and Recent Progress in the Biochemistry of *Fusaria* by F. F. Nord and R. P. Mull.

F. W. KAVANAGH.

* This book has also appeared in a de luxe edition, containing actual samples of each kind of paper mentioned (referred to in the edition here reviewed, but inserted only in the other), also published by Augustin and priced at $36. Early this year a Spanish edition appeared in Mexico, translated by Javier Romero and published by Editorial Nuevo Mundo at 50 Mexican dollars a copy ($10.25 U.S.A.).

** See the Journal for January 1943, in which Dr. von Hagen has written on "Mexican Paper-making Plants."

History and Future Of the Seed Business

THE FIELD SEED INDUSTRY IN THE UNITED STATES. Frank Victor Beck. 230 pages, illustrations, references, appendix, index. University of Wisconsin Press, Madison. 1944. $3.

For the first time old and new data and information regarding a highly complex and important enterprise have been brought together in a lucid presentation effectively implemented with graphic illustrations and simplified tabulations. The author has given a historical background of the development of the field seed industry and statistics relating to it; the economics of production, distribution and consumption of field seeds; and seasonal and geographical patterns of sales and price trends. Especially now when shortages of field seeds of such critically significant legumes as *Medicago* and *Trifolium* species continue to exist this book will be of unusual interest and value in providing perspective to workers in the field of plant science as well as to economists, seed producers, and the seed trade in general.

The new data on seed consumption in various states are highly revealing. They not only indicate the magnitude of the enterprise but the extent to which utilization of field seeds is essential for the maintenance of hay and pasture acreages at productive levels. Such information will play no small part in stimulating plans for much needed basic and developmental research on field seed production. The text is an excellent source of material for undergraduate and advanced students. It represents a painstaking and productive effort on the part of the author.

L. F. GRABER,
Wisconsin College of Agriculture.

Bryophyte Guide With Pictured Keys

HOW TO KNOW THE MOSSES. Henry S. Conard. 166 pages, illustrated, indexed. William C. Brown Company, Dubuque, Iowa. Cloth bound $2.50, spiral bound $1.50.

If proof is needed that all mosses do not look alike and can be distinguished one from the other, this book with its simple keys and complete illustrations provides it. Because a microscope is needed to identify most mosses, it is part of the equipment necessary to use Dr. Conard's keys. But the beginning moss student may feel confident that with these tools and a pair of observant eyes he is on the way to knowing the mosses and liverworts.

The plan of the book is excellent. A description with illustrations of each species is incorporated into the key and a reference to an explanatory picture occurs with each statement in the key. The index serves also as an illustrated glossary. The format of the book eliminates many needless cross-references and many of Dr. Conard's ideas could profitably be adopted in other guide books.

FRANCES E. WYNNE.

Australian Methods

SOIL AND PLANT ANALYSIS. C. S. Piper. Photo-offset reprint of the 1942 edition. Interscience Publishers, Inc., New York. 1944. $4.50.

This book is a valuable addition to the literature of plant and soil analysis because it gives methods that are applicable to a wide variety of soils and plants. Most of the methods of analysis have been used for many years at the Waite Agricultural Research Institute and at other Australian laboratories. The chapters on the collection and preparation of samples emphasize especially the large errors that can be introduced into the determination of certain trace elements by seemingly insignificant details of manipulation.

F. W. KAVANAGH.

Forest Lives

ONE DAY ON BEETLE ROCK. Sally Carrighar. 196 pages, illustrated by Henry B. Kane. Alfred A. Knopf, New York, 1945. $2.75.

This is the story of one day in an animal world. In successive chapters we read how the deer passed that day, what the weasel did with it, what happened to the chickaree and to the jay and to the lizard, and so on. The author has a rare faculty of observation and an almost uncanny knowledge of her wild neighbors. Moreover, like Hudson, Jefferies, Muir, and other naturalists born, she has the gift of the smell and color of words, of the living phrase. She writes of "the scents that lay like vines across the forest floor," of how "the wind continued to polish the grasses. And a purple finch unfurled his song." But this is the icing on the cake. Underneath, in the simple narrative, we learn to hunger like a weasel, to fear like a mouse, to exult in the treetops like a squirrel; not only are the animals alive, but we share their lives, momentarily.

In short, this is literature—almost. But every now and then we are brought up short by some tiresome bit of information, which might come from the lecture of a Park Naturalist: the jay's blue is not true pigment; his wings beat only 3 times a second, while "the sparrows flapped thirteen times in the same interval." And the grouse's ability to foretell the weather arouses a suspicion already whetted by an over-dependence upon "instinct" for an explanation. Nevertheless, if you like woods and winds and their dwellers, here is a treat for you.

H. W. Rickett.

Bacteriology Manual

LABORATORY MANUAL FOR GENERAL BACTERIOLOGY. Department of Bacteriology and Immunology, University of Minnesota. 54 pages. W. B. Saunders Co., Philadelphia and London, 1945. $1.

This is a manual of 29 exercises in general bacteriology with several work sheets for diagnosis of unknown pure cultures. The exercises are arranged to cover about 30 two-hour laboratory periods in elementary bacteriology. They include routine staining and media making, pure culture technique, and cultural characteristics of various bacteria. Exercises on soil, water, and milk bacteriology, actinomyces, common fungi, and yeasts are also included. Each exercise contains questions on the work.

Cornelia L. Carey,
Barnard College,
Columbia University.

Notes, News, and Comment

Bulbs as Food. Shortly after the September Journal went to press, a letter was received from J. A. Schuurman, Consul General for the Netherlands in Chicago, adding to the information which he had already provided for the article on Holland tulip bulbs. "Since I wrote you," he stated, "we have heard that a great many people in Holland during the starvation period have been able to keep alive by eating flower bulbs. I think this is the first instance of flower bulbs being used for human consumption." Doubt had previously been expressed over the report that the bulbs were actually being eaten.

"Renascence" in England. The regions of London ruined by bombs have become spontaneously covered with flowers, many of them unfamiliar to the metropolitan scene. Ninety percent of the plants are of the common fireweed, *Epilobium angustifolium,* better known as willow-herb in England, where it has previously been seen more often in gardens than in the wild. So cheerful are these vivid flowers against the blackened rubble of the city that the transportation system of the City of London has seen fit to bring the color down into the subways. Posters showing brilliant stalks of fireweed among some ruins adorn the walls of the tube stations. No advertising appears there, merely the word, "Renascence." One of these posters now hangs in the library at the New York Botanical Garden, brought back from England by Lt. Col. Leslie S. Pearl, who before the war was a student of G. L. Wittrock in the Garden's class in Economic Botany.

Mrs. Harold McL. Turner. Mrs. Martha Strong Turner, the daughter of Mrs. Theron G. Strong and wife of Harold McL. Turner, died at New York Hospital September 27. She had been a member of the Advisory Council of the New York Botanical Garden since April 1925 and a member of the Corporation of the Garden since 1931. Sharing her mother's lifelong interest in plants, she had been as active in the affairs of the Garden as her health would allow. During the first World War, Mrs. Turner served in the Women's Motor Corps, and when this country entered the second World War, she undertook special studies to enable her to serve in a new capacity. Besides her husband and mother, she is survived by two daughters and two sons.

Staff Appointment. Dr. Ilda McVeigh has been appointed Technical Assistant at the Botanical Garden, to work in the laboratory of Dr. William J. Robbins. Dr. McVeigh studied under Dr. Robbins at the University of Missouri, receiving her Ph.D. degree in 1937. She continued there as an instructor until she went to Northwestern State College in Oklahoma as an assistant professor. She then spent a year each at Yale and at Connecticut College, returning to Yale in

1943, to work on vitamins as assistant to Dr. P. R. Burkholder. She remained there until her present appointment, which brought her to the Garden September 1.

Board Member. Sidney J. Weinberg of 30 Pine Street, New York, has been elected to the Board of Managers of the New York Botanical Garden.

Radio. T. H. Everett appeared as guest speaker on the program of Fred Waring and his Pennsylvanians over WEAF the evening of Sept. 27. More than 500 letters have been forwarded to the Garden asking for more information about the house plants he mentioned when he was interviewed.

Dr. E. E. Naylor described the opportunities for mothers and their children at the New York Botanical Garden during the summer, on the program "Have Fun with your Children" over WNYC July 31.

Groups. Among the numerous classes of school children who have visited the Garden recently have been large groups from P.S. 126 in Queens and P.S. 33 in the Bronx.

Visitors. Dr. Florencio Bustinza, Professor of Botany at the University of Madrid, visited the physiology laboratory and discussed antibiotic substances with Dr. William J. Robbins Sept. 13. A visitor Sept. 18 was Dr. C. Chester Stock, Executive Secretary of the Insect and Rodent Control Committee for the National Academy of Sciences. L. Narodny of Roseau, Dominica, British West Indies, was at the Garden earlier in the month. Other recent visitors have been Robert Bloch of Yale University; Mel T. Cooke, Honorary Professor of Botany at Louisiana University; the Very Reverend Robert I. Gannon, S.J., President of Fordham University; Conrad B. Link, successor to Montague Free as Horticulturist at the Brooklyn Botanic Garden; Norman C. Fassett, University of Wisconsin; Theodor Just, Notre Dame University; William Beebe, New York Zoological Society; R. T. Clausen, Cornell; R. Kent Beattie, U.S.D.A. at Beltsville, Md.; Leroy P. Baker of Portland, Ore.; Vladimir C. Asmous, Arnold Arboretum; David Gottlieb, University of Delaware; M. A. Johnson of Rutgers; and Robert Cassidy of Altamount, N. Y.

Grape Breeding

During the last two weeks of September, Dr. A. B. Stout was at the State Agricultural Experiment Station at Geneva, New York, for further studies of his research on seedless grapes. He reports that a total of 307 individual seedlings which bear seedless or near-seedless fruits have been obtained by breeding. The fruits of 22 of the best of these were displayed at the annual meeting of the New York State Cooperative Fruit Testing Association held at Geneva on September 20. A day was spent in the grape-growing region along Lake Erie where some of the new seedless grapes are being tested in vineyard culture. Also Dr. Stout spent one day at Cornell University where he inspected the test garden of the horticultural clones of daylilies.

Folk Dancing at Garden

IN the interest of the overseas services supported by the New York National War Fund, an International Folk Dance Festival took place at the New York Botanical Garden the afternoon of Sunday, September 30. More than 55,000 visitors attended, watching the dances given by 150 costumed performers, representing 11 nations. They were under the leadership of Michael Herman, Director of the Community Folk Dance Center, who also presented the program of folk dances in the museum last May 26, on International Day of Garden Week.

Dr. William J. Robbins addressed the audience before the program of dancing began, and introduced Col. Charles E. Keegan, a veteran of all the theaters of the recent war and at present Associate Director of the Bronx Division of the New York National War Fund.

American Legion posts of Bronx County took part in the day's events by marching together, led by Commander A. F. Voelker through the main gate of the Garden and past the reviewing stand, where the flags of many nations were massed.

After the program the audience was invited to join in additional dances, and many persons did so, instructed before each one by Paul Hunt.

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

Membership in

THE NEW YORK BOTANICAL GARDEN

and what it means

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

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

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

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

A subscription to the Journal and to Addisonia.

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

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

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

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

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

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

* * * *

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

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

* * * *

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

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

Contributions to the Garden may be deducted from taxable incomes.

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

A legally approved form of bequest is as follows:

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

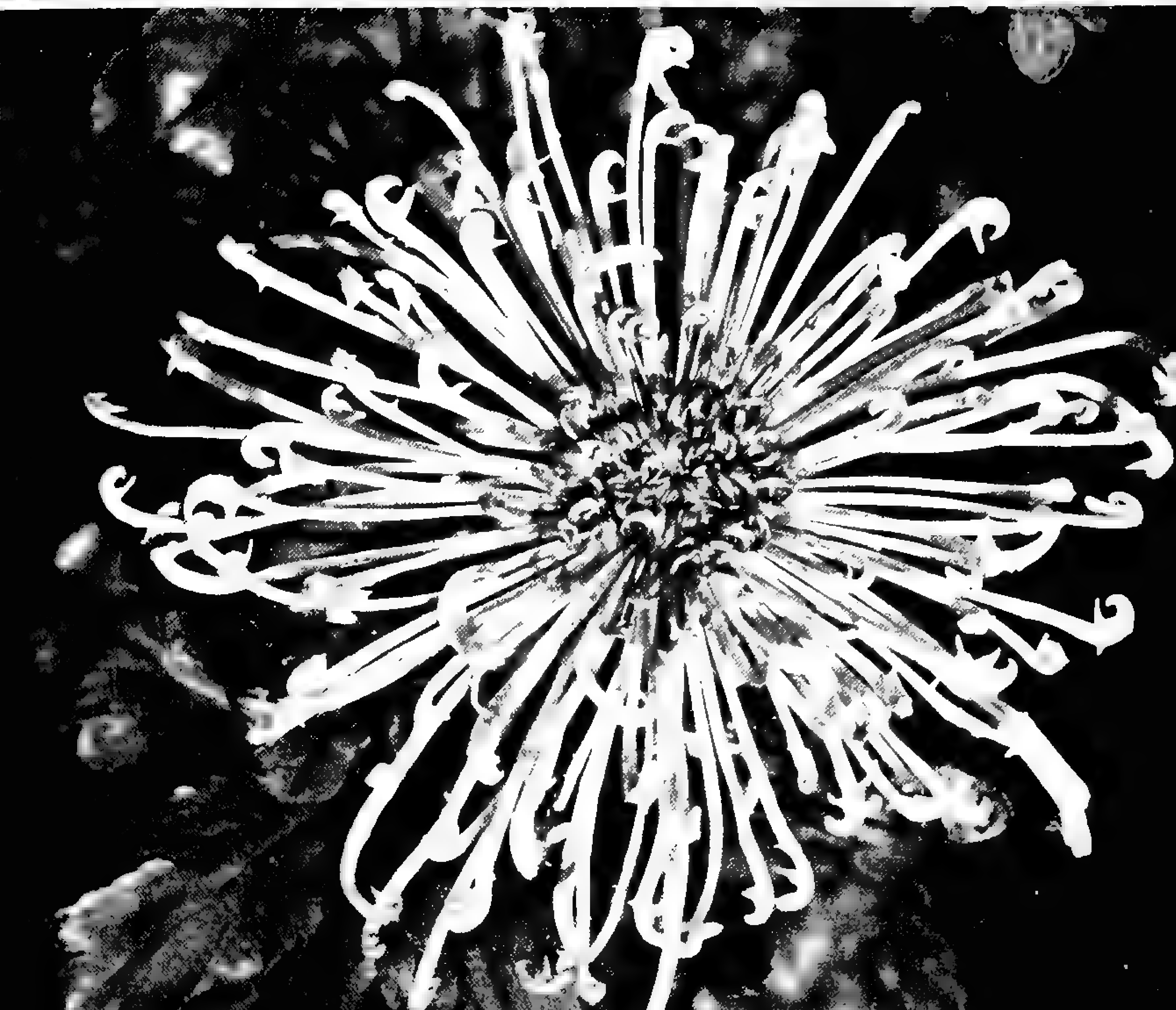
Gifts may be made subject to a reservation of income from the gift property for the benefit of the donor or any designated beneficiary during his or her lifetime.

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

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN



VOL. 46 NOVEMBER PAGES
No. 551 1945 253-276

JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

THE LIVING PLANT COLLECTIONS MAKE A CONTRIBUTION

This is the concluding editorial in the present series designed to show some of the unique and specialized services furnished by the New York Botanical Garden to the public without cost.

THOUGH the war is over, the New York Botanical Garden continues to give aid to Government, industry and individual. Through the 15,000 kinds of plants it cultivates on the grounds and in the greenhouses, and also through its contacts with other institutions and with growers and collectors here and abroad, the Garden is uniquely prepared to respond to requests for plant material that is impossible or difficult to locate in the usual trade channels. In the past two years, especially, inquiries for plants of possible economic importance have been numerous.

More than 20 years ago a male and a female specimen of the rubber-producing tree, *Eucommia ulmoides*, were set out in our arboretum. This native of China proved hardy in our climate, and the trees, now well grown, are producing a crop of seeds every year. In fact, the New York Botanical Garden is one of the few places in the country where seeds of *Eucommia* have been obtainable, and during the war we furnished a supply of them to the Office of Rubber Investigations of the U. S. Department of Agriculture, for experimental purposes.

For many years the New York Botanical Garden has grown in its tropical houses various species of *Amorphophallus* because of their interesting and curious nature, but with never a thought of their having economic uses. It was therefore a surprise when we received an urgent request from one of the large food companies for corms of a certain species for chemical examination and for propagation in Brazil. Though we were unable to supply this particular species, which is native to the East Indies, we sent related plants and suggested other sources from which the desired material might be obtained.

A southern experiment station wrote: "In connection with a project to determine the possibility of the growing of *Sansevieria* species as a source of a domestic substitute for Manila hemp we are trying to collect as many species as possible. We should like to have *S. Kirkii* and *S. Ehrenbergia* and any other large type other than *S. cylindrica* or *S. trifasciata*."

We replied by sending eight species of *Sansevieria*, including the two asked for, and by giving the name and address of a correspondent of ours in Los Angeles who has a large collection of this genus and who might be able to supply additional material.

These are but a few examples of the way in which a world-wide collection of plants, accumulated through the years and maintained by a public institution, can be of service, and frequently in unexpected ways.

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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 as Second Class Matter, January 28, 1936, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Annual subscription $1.00. Single copies 15 cents. Free to members of the Garden.

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of

THE NEW YORK BOTANICAL GARDEN

VOL. 46 NOVEMBER 1945 No. 551

The First Botanical Exploration Of Table Mountain In Surinam

A Report of the New York Botanical Garden's Tropical Expedition of 1944

I

By Bassett Maguire

WHEN, on the tenth of July, 1944, the first stake was driven into the ground to indicate the definite start of our trek toward Table Mountain, a previously unexplored elevated land mass far in the interior of Surinam, we still did not know exactly which way the mountain -or that particular part we were seeking -lay. It was therefore not without some hesitation and doubt that we marked the stake with the direction of our trail and set our compass for a southwesterly route.

From preliminary air reconnaissance, it had seemed a simple matter to establish camp on Tafelberg Creek, then to cut a line directly through to the mountain, which lay, we knew, only a short distance away; but from the ground, with views obscured by the dense jungle foliage, there was no way of telling where we were with respect to the mountain, no way of judging how far upstream we had come; and though we had assumed from our none too accurate maps and air survey sketches that perhaps we were thirty kilometers directly northeast of the mountain, there was no landmark or lookout at hand for orientation.

* * *

To reach this point had required some 300 miles of upstream travel, transporting three tons of gear and equipment, with constantly changing crews of from 14 to 21 men. Four weeks earlier to the day, with all of our supplies, with our original Carib Indian crew, and with my bush-wise assistant, Baas Lodewijk Schmidt (BAAS being the Dutch word for "boss"), we boarded the small government motor launch, the *Wanica*, on the Saramacca. For four days this little boat had pushed upwards

ACKNOWLEDGMENTS

THE entire financial support for the New York Botanical Garden's Tropical Expedition of 1944 was generously furnished by the John Simon Guggenheim Memorial Foundation, the American Philosophical Society, Mr. Pierre Jay of New York City, member of the Garden's Board of Managers, and the New York Botanical Garden itself. The New York Telephone Company donated the use of important tree-climbing equipment.

The greater part of the nine-month expedition was occupied by the first exploration of Tafelberg (Table Mountain), and by the slow, difficult jungle travel to and from the mountain.

A preliminary trip made to the Kaieteur Plateau in British Guiana was skillfully planned and directed by Mr. D. B. Fanshawe, Assistant Conservator of Forests. Study and collection of the plateau's interesting flora, related to that of the still higher sandstone interior tablelands along the Brazilian and Venezuelan border, have proved to be of much help in the interpretation and correlation of the Tafelberg flora.

The Tafelberg expedition could never have accomplished its purpose but for the unstinted help given to us by all in Surinam (Dutch Guiana). To His Excellency, the Governor, to the many officials of the Surinam Government, and particularly to Dr. D. C. Geijskes and Mr. F. H. Schols, grateful acknowledgment is made for assistance and encouragement.

But most of all is the writer grateful to Professor and Mrs. Gerold Stahel. Their gracious courtesies and great material help made my stay in Paramaribo delightful, and the expedition itself an assured success. It gave me much pleasure and satisfaction to give one of the larger and lovelier falls dropping from Table Mountain Mrs. Stahel's name, calling it Lisa Falls.

To the personnel of the United States Army in Surinam, particularly to Colonels L. H. Schonnmaker and W. W. Walmsley, deepest appreciation is given. Access to the Army Commissary made it possible for us to obtain important supplies and medicines otherwise unavailable in the colony. During the entire expedition, we were kept under constant and comforting surveillance from the air by Colonel Walmsley and his fellow pilots. Repeatedly, mail, newspapers, and much needed replenishing supplies were dropped to us by parachute.

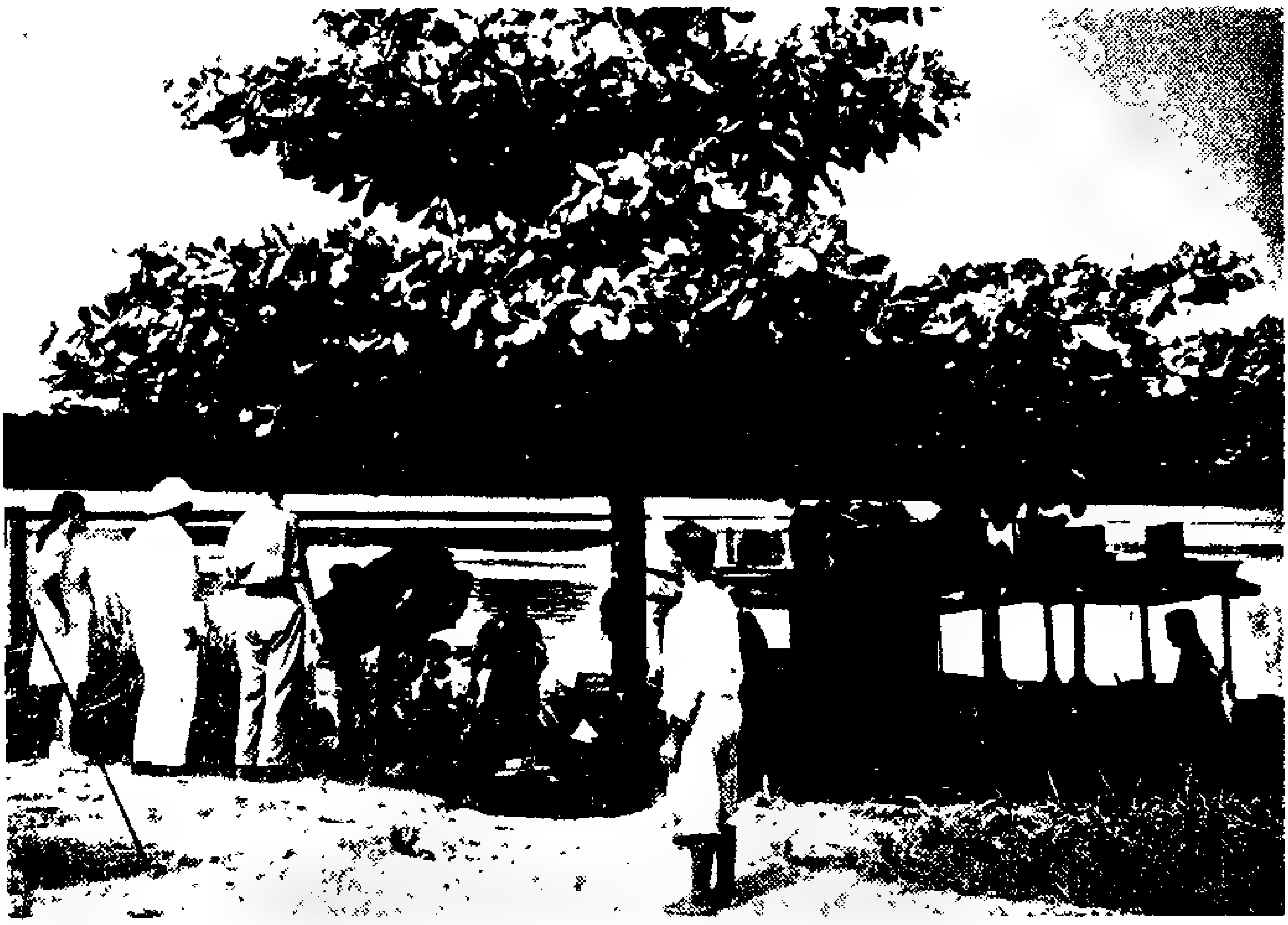
Finally, to my chief assistant, Lodewijk Schmidt, experienced native bushman and explorer; Tempico, competent headman of our crew of Carib Indian porters; the six Indian carriers; and Elmond, son of the bush negro chief of the Saramacca River Djukas, my affectionate thanks are given. All explorers must finally admit that such men are the backbone of expeditions, without whom nothing can be achieved.

Our kind and helpful hosts in Paramaribo, Dr. Gerold Stahel, Director of the Agricultural Experiment Station there, and Mrs. Stahel.

against the powerful current of the river in flood. Part of our gear followed in the three corials that were towed astern—frail-looking but sturdy dugout canoes, hewn from the boles of forest trees, each guided through the murky waters by one of the Indians.

For the first two days the pleasant daylight hours were spent on the top deck with Dr. D. C. Geijskes, entomologist and experienced bush traveler in Surinam. Only three months earlier he had returned from a long trip into the jungle, during which he had reached Table Mountain, objective of the present expedition. The information he gave us was to prove invaluable in our subsequent travel through the jungle. From Kwakoegron, the railway terminus on the Saramacca, Dr. Geijskes returned to Paramaribo and civilization.

It was at this point that we picked up the river Djuka (the bush negro of Surinam) who was to pilot our boat through the swollen, treacherous,



Loading the "Wanica" for the start of the trip up the Saramacca. The boat was furnished the exploring party through the courtesy of Mr. J. Michels, District Commissar of Saramacca. Dr. Stahel supervises the loading, while crew and onlookers wait in the shade of a cashew.

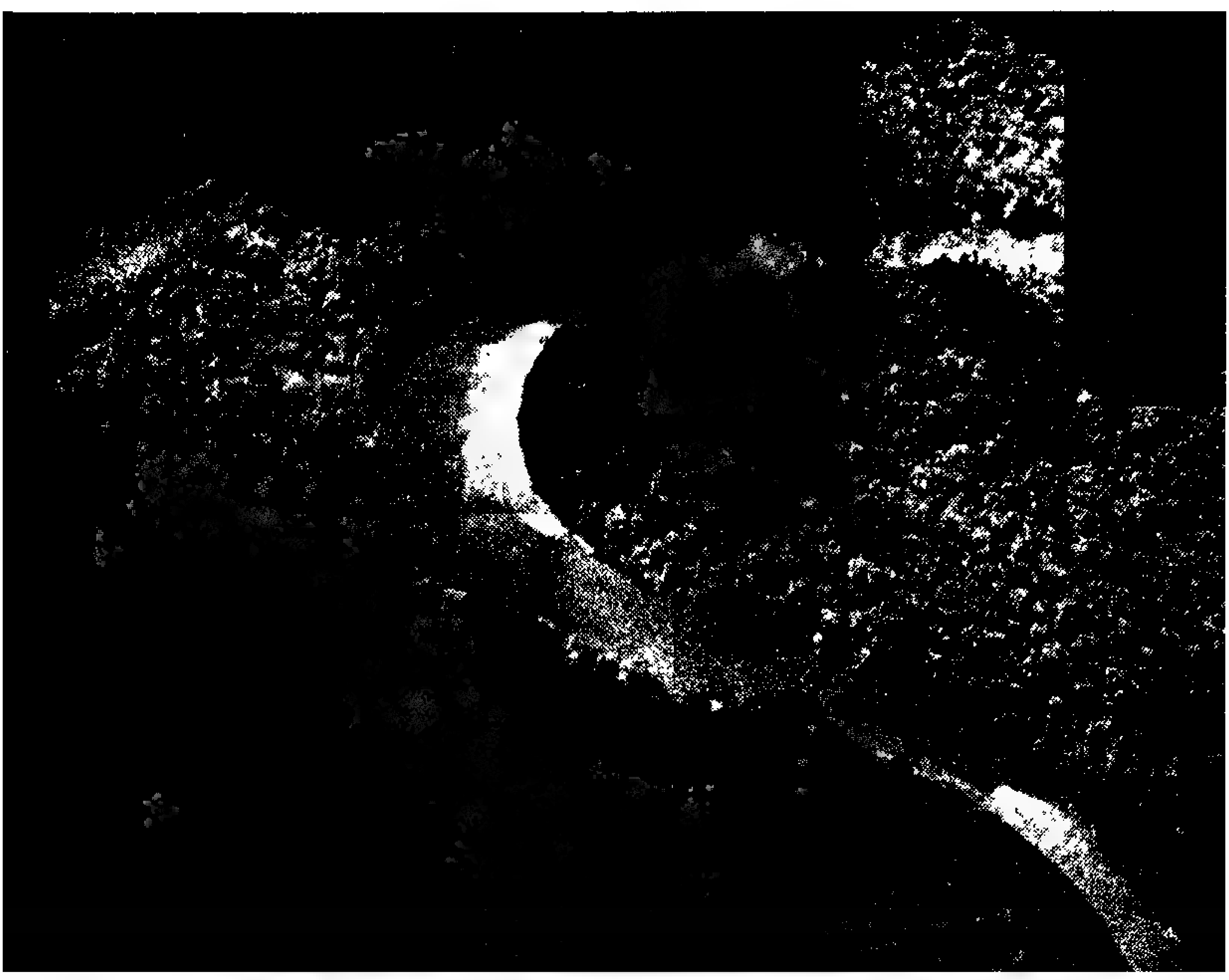
rock-strewn part of the river which we were to follow from there to the first series of rapids 50 miles beyond. My first lessons in "taki-taki"—the common language of the interior here as in other parts of the world—were received from this black, dressed only in loin cloth and shoulder piece, seated proudly behind the wheel of the launch.

Progress was slow because of the high current and the necessity of winding back and forth across the river to avoid, it seemed to me, imaginary sandbars and rocks. Here I was a passenger, able to enjoy the scenery at leisure as a tourist, not as a collector. A continuous wall of dense, impenetrable green rose up more than a hundred feet at the water's edge, completely closing from view any jungle life beyond. From time to time the monotony of this unbroken wall would be relieved by the brilliant bloom of flowering tree or vine. Few of the gaudy birds expected were to be seen, however, perhaps because this was the end of the rainy season.

As we began to approach the rapids, we passed by outlying bush negro villages, inhabited by the descendants of runaway African slaves of 200 years ago. Our pilot would take us as near in-shore as possible to attract the attention of the villagers. They would then rush down to the river, pile into their dugout canoes, and paddle rapidly after us. For a while, we would have a flotilla of native boats in tow and a deckload of wildly excited blacks, the men dressed in breechclout and neckerchief like our pilot, the women in a sort of sarong, bare above the waist, or with a neckerchief over the breast.

At the end of the fourth day, we reached the Djuka village Jacob Kondre (Jacob's Country) at the foot of the lowermost rapids, which was as far as the launch could go. Here we expected to find additional boats and crew ready to take us further upstream, but the village was deserted of men. All were out in the jungle cutting timber, hunting for balata, or panning in the nearby goldfields. Though the Moravian missionary had received letters of instruction from the Governor's secretary, he had failed to realize our needs. It was now necessary to send out runners to bring the headman, the captain, and the absent Djukas back to the village, so that we might bargain for boats and crew to take us on.

The Saramacca River as seen from the air as it meanders through impenetrable jungle a little south of Kwakoegron, some 50 air-line miles from Paramaribo and more than 100 miles above the mouth of the stream. The dense jungle which lines the river on both sides forms solid green walls which often rise 100 feet above the water's edge.



Three days of tiresome waiting finally brought the men in. Then began the inevitable and extended conference and bargaining in "taki-taki." By the next day we were able to set out with four additional canoes and 14 extra river-men, now bringing our party to 22.

Much the same dreary procedure took place at every one of the five villages where we were forced to stop, for none of the blacks wanted to go further away from home than the next village upstream. We took advantage of these long waits to do some collecting in the nearby jungle, and in this manner much fine material was accumulated.

For 75 miles we poled against the rapids, avoiding the main channel because of the height of the many falls, generally edging our way between the numerous islands and the shore, through tortuous passageways that often were completely arched over with interlaced branches of jungle trees. Where the channel was broken by these islands, the river was sometimes half a mile wide. Our boatmen were exceedingly skilled in negotiating these white waters, the standing bowman shoving the boat through the swirling current with a long pole which he rotated end over end.

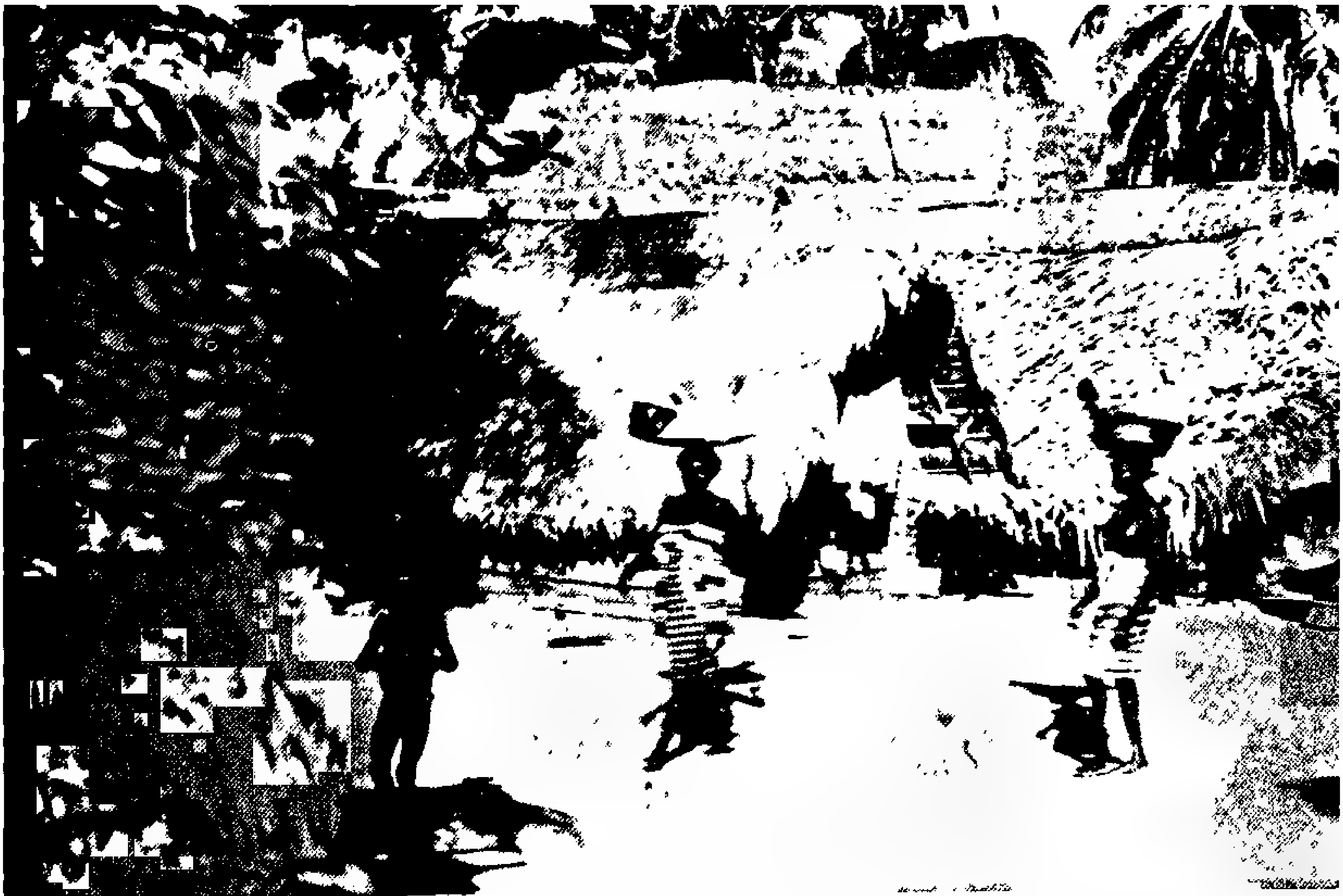
Some of the bush negro villages we passed had been occupied continuously from the time the fleeing slaves settled along the river. They are pleasing places, the native houses, thatched with palm on top and sides, scattered through an open grove of coconut-palm, banana, orange, and breadfruit trees. Most of the houses are simple structures of one or two rooms with hard-packed earth for floors, though the more pretentious Djuka dwellings have floors that are raised on piles of six or eight feet above the ground, and the doorways have elaborately carved lintels—a highly developed art among these people.

Inevitably, the most imposing structures in these villages are the Moravian mission and the home of the missionary schoolteacher. These are well constructed board houses. with windows, roof and floor.

TYPICAL SCENES IN BUSH-NEGRO VILLAGES

(On the opposite page)

Above: A scene at Pakka Pakka. The women walk with the graceful carriage that is characteristic of all who habitually carry large balanced loads on their heads. Below: Everyday activity at Kwatta-hede. Native-grown upland rice is being threshed in large wooden mortars. The girls with the large flat trays are winnowing the threshed rice. The elevated house which appears in the background is one of the more sumptuous homes of the village. The ordinary bush-negro dwelling is built on the ground and the hard-packed earth becomes the floor.



Pakka Pakka, the largest and most attractive of the river villages, a settlement of about 200 blacks, is midway through the rapids. Here, as in all other settlements, I had to treat many ailing natives. Any white man entering a village of this sort is looked upon as a physician, particularly if he is called "Doctor." As a consequence, as soon as we were settled, the sick of the village would begin to arrive, and I would be expected to administer to all who had disorders, fancied or actual. Castor oil, aspirin, and soda tablets usually sent them away satisfied—particularly the castor oil, which was regarded as a special treat.

Occasionally I would have to go to see the pathetically ill and incurable, lying on ragged, dirty pallets on the damp floors of their windowless huts. Refusal was impossible, even though I could do no more than to shake my head and say, "Me no helpi."

Usually on our final night in the larger villages, a big celebration was held—a "dansi" given in our honor. These were fertility dances, apparently little changed from their African forerunners. Primitive movements accompanied the rhythm that was beat out in complicated time on the drums—the drums unfortunately now tin pans and wooden boxes instead of the beautifully toned African tom-toms that had been taken away from the natives by missionaries.

From Pakka Pakka to the Granman country was the most difficult section of the river, and it marked the end of our travel through white waters. At Posoegronoe we were to see the Granman, head chieftain of all the Saramacca. We had letters from the Governor to the Granman, instructing him to lend all aid in providing boats and crewmen for the final lap of the river journey, from here on in quiet water. But the Granman was away on a pig hunt, so, as usual, we spent the next two days in collecting. When he returned, the all-important audience was granted. He received me in state, dressed in bright blue uniform with large golden emblem of authority. Gathered around him were his advisers—captains and bossmen from the nearby villages. The second in command wore a long robe of red and yellow stripes. The sealed and embossed letter from the Governor was examined at length and passed around for the approval of his council, even though none of them could read. It was finally passed back to me to be opened and read, which I did in "taki-taki." The conference continued all morning, most of the time being taken by my attempted descriptions of New York, its big buildings and subways, and of the botanical garden and the reasons for my work. Each statement from me would be punctuated by a low intoned chorus of "Aye, aye-oo, sabi, me sabi." It was finally arranged that we should again have four additional boats and two boatmen for each. When two days later we finally got under way, we found three blacks in each boat. To have protested now would have meant the renegotiation of the entire trip and a possible long protracted postponement.

The social aftermath of the all-important conference with the Granman to determine dates and selection of crews for further travel up the Saramacca and Toekoemoetoe Creeks. Opposite the writer is the Granman. Seated at the far side of the table is Mr. Herenberg, missionary and schoolmaster of Posoegronoe, the Granman Kondre (Country).

Immediately following the conference, as if for theatrical effect, and by careful and prearranged timing, a two-motored Army bomber zoomed low over the village. Colonel Walmsley had been searching for us, so he easily picked up our signal flag set out in the open compound. He repeatedly circled the village and would come zooming close over our heads, much to the frightened delight of all the blacks. But the great excitement came when a note was dropped telling us of parachute supplies to follow.

Two parachutes were released over the village, one coming down in the nearby bush. In no time the excited and happy boys laid it at my feet. The second parachute, caught by a higher wind, floated off over the jungle, across the river and down stream. After a momentary silence of alarm and disappointment, the whole village gave way to voice; all rushed down to the water's edge. Immediately the river was full of canoes carrying men, women, and children, wildly paddling down the river.

Within half an hour, a single corial came in sight, followed at some distance by the other more slowly moving canoes. The three Djukas who had found it proudly brought the parachute and big box up to me.

The boxes contained all sorts of good things: beef, still chilled from the

IN SURINAM

Photographs by Bassett Maguire

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2

3

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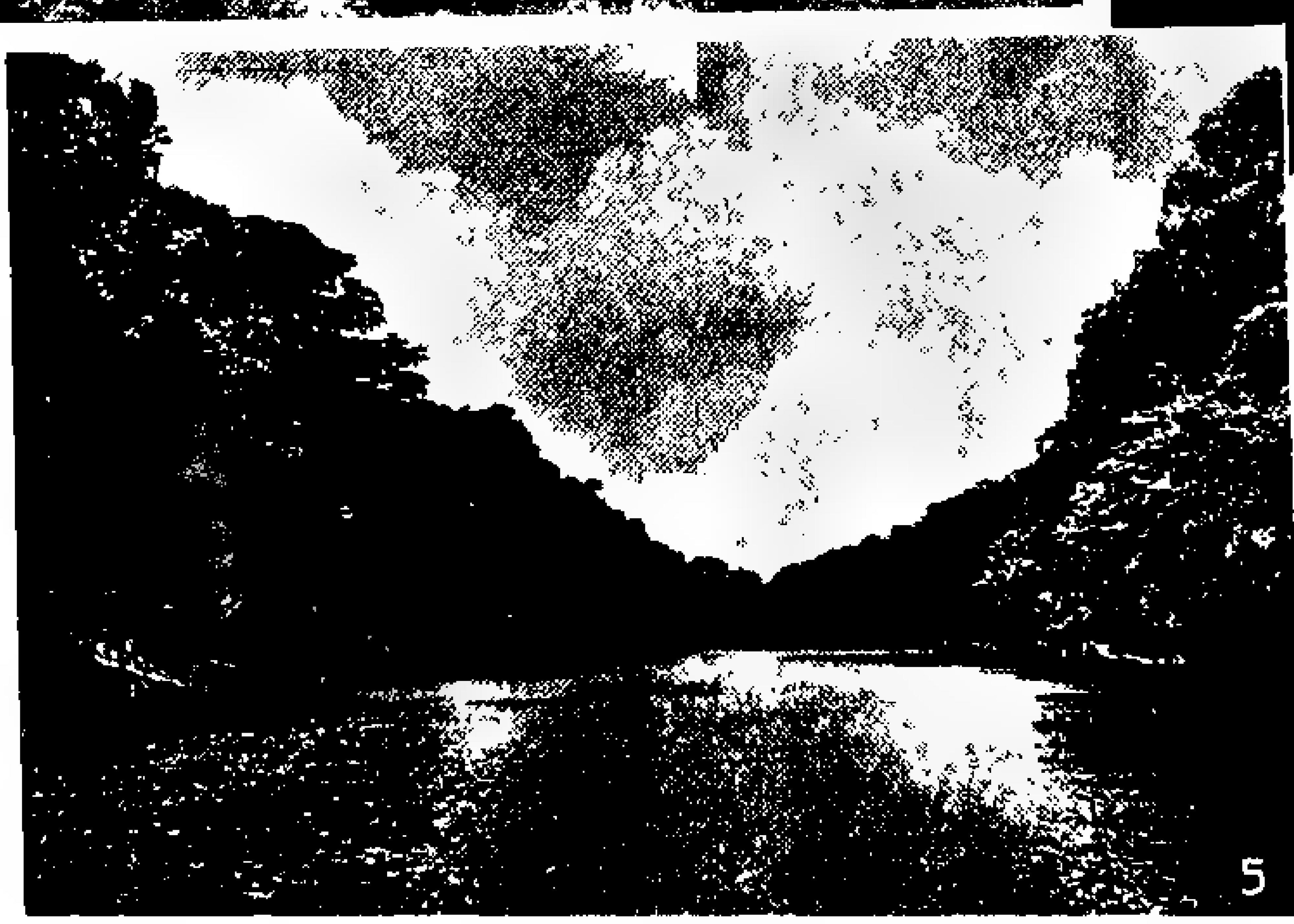

5

Dugout canoes carried supplies and men on the New York Botanical Garden's 1944 expedition into the interior of Dutch Guiana. The base of Table Mountain was approached by way of the Saramacca River and Toekoemoetoe and Tafelberg Creeks. For a further description of these photographs, see the opposite page.

commissary refrigerators, cold hard butter, cold tomato juice, chocolate, fresh baked bread—and two bottles of cold beer! The children looked on in wide-eyed amazement -so did the grownups. The look in their eyes was irresistible—soon all were happily eating or treasuring the chocolate that was to have been our total supply for the following month.

In the future, particularly during our long period on the mountain, like visits by Colonel Walmsley invariably brought welcome gifts of good things to eat that broke happily into the monotony of jungle fare.

The upper reaches of the river were similar in aspect to those below the rapids, still with the high walls of green on either bank. But new plants were constantly appearing along the waterside, as we traveled southward for two days to the main fork of the river. Our route lay in the westerly branch, the Toekoemoetoe Creek, hardly smaller than the "mama" Saramacca. Three days more brought us as far as the negroes would go, because of their fear of unknown territory with its imagined spirits and supposed big snakes and ferocious animals. An Indian had become lame, so it was necessary to augment our party from one of the blacks. Elmond, a handsome strong young fellow, the son of the Granman, was chosen to make the trip. This was done for two reasons—as a compliment to the chief, and also as an assurance that our return boats would be on hand at the proper time. Elmond protested his selection. He declined the honor with great tact—but nevertheless refused to come with us. It became necessary to use all the persuasion at my command. Finally, in great distress, Elmond told me he was simply afraid for his life. I later learned that he was afraid not only of the big snakes and crocodiles, but also was afraid of the white man—afraid he would take him into this spirit-filled place and there destroy him.

TRAVELING BY WATER ROUTES IN SURINAM

(On the opposite page)

1. The flagship of the New York Botanical Garden's expedition loaded for its trip downstream, the canopy removed from over the leader's chair to show the interior. Seven boats of this sort, each from 30 to 40 feet long, were used in the transport of supplies and personnel up and down the river. The smaller corials carry several people easily and swiftly through the river waters, but do not hold the large loads that the freight dugouts carry. 2. Progress upstream through the rapids was slow and tedious. Here the dugout is being hauled close along the bank. Pushing upward directly through the rapids at such a point would have been impossible. 3 and 4. Fallen trees frequently barred the way for the canoes up Tafelberg Creek. On some days progress was limited to several hundred yards because of such barriers. A loaded corial waits at the left (in No. 3) while the men remove a number of trees from across the stream. The prominent figure approaching the camera is Tempico. 5. Above the turbulent falls and rapids of the middle portion of the river, the Saramacca flows placidly.

TAFELBERG
SURINAME
EW YORK BOTANICAL GARDEN TROPICAL EXPEDITION, 1944
Elevations in meters
Primary trails
Direction of slope
Kilometer marker
Secondary trails
Camp site
Unverified stream courses
Low and intermediate bush areas
High bush areas
Rock savanna
Grass sedge savanna
Rubber trees (Hevea Guianensis)
1 2 3 MILES
1 2 3 KILOMETERS
EMMA - KETEN
Schmidt Mountain
White Water Creek
White Water Cr. R. Br.
White Water Cr. L. Br.
Base Camp
Krappa Camp (2)
Kwatta Camp (3)
Pakira Camp (4)
Black
Pinna Swamp
Km. 1-118m
Dakama Swamp
Geijskes Cr.
GEIJSKES TRAIL, 1943
Derby
Toekoe


T A F E L B E R G
Arrowhead Basin
North Ridge Cr.
North Ridge
Geyskes Falls
Augustus Falls
Grace Falls
Grace Cr.
East Ridge
East Ridge Cr.
East Ridge Falls
I
II
III
IV
V
VI
VII
VIII
IX
+800
1091
939
842
776
758
733
727
636
564
552
521
520
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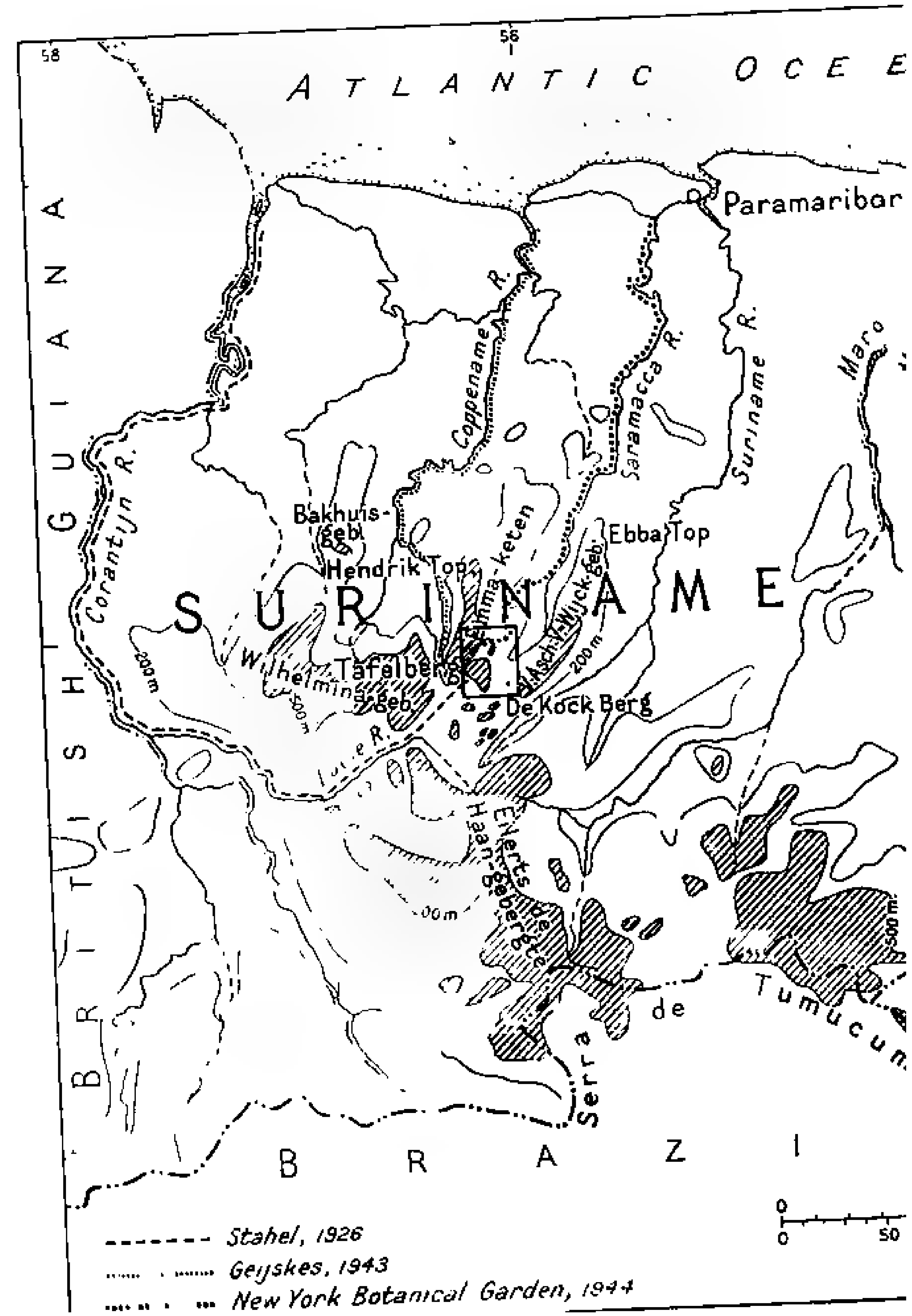
ATLANTIC OCEAN
SURINAME
BRITISH GUIANA
BRAZIL
Paramaribo
Suriname R.
Saramacca R.
Coppename R.
Corantijn R.
Maro
Bakhuis-Geb.
Hendrik Top
Ebba Top
Tafelberg
De Kock Berg
Wilhelmina-Geb.
Eilerts de Haan-Gebergte
Serra de Tumucumaque
200 m
500 m
58
56
0
50
Stahel, 1926
Geyskes, 1943
New York Botanical Garden, 1944

A very serious council had to be called with the Captain, the headman of the party, and the assistant officers of the village. Very gravely I pointed out that this great expedition had come many, many days of travel to reach this unknown mountain, to prove that there were no spirits there, to get importants kinds of plants that might be used as foods, timber, medication, or for decoration, that the great Governor himself had insisted that this work be done, had assumed responsibility to see that this expedition be accomplished. This, I explained, could not be done without the help of one of their men. Therefore, I demanded that this man whom I had selected should join our party. No refusal would be accepted.

Further conferences were held by the blacks. We could hear the dejected moans of Elmond and the responsive groans of sympathy of his fellow tribesmen. Finally, he came to me and said, "Doctra, me go."

With that accomplished, we then arranged to pay our men and dismiss the crew the following morning. One by one the men were paid off. They gravely saluted Elmond and got into their boats, fully expecting never to see him again.

After the Djukas left, we cached the greater part of our supplies and proceeded with our own three boats upstream. By noon of the second day the creek had diminished so in width that the windfallen trees at either side were now bridging and clogging the way. Reluctantly we turned back toward a bluff that we had noticed a short distance downstream. Immediately behind the dense vegetation along the edge of the bluff, we found an opening filled with a grove of cecropia trees. There we built our base camp. It was not a difficult matter to cut out an area some 150 feet across to let in the light and air so that the camp could dry out between heavy jungle rains. My own shelter was put up immediately. One young Indian was left with me while the others were sent back to the caches to return with the remaining supplies.

After we had finished base camp, all men, following accustomed procedure in the jungle, were to work at "cutting the line."

The zero stake had been set in one of the few stretches of comparatively clean open bush. Starting from there, two lead men would cut out the dense underbrush, to provide vision along which aligned stakes could be set at intervals of some 100 or 150 feet. The clean-up crew would then follow, removing the underbrush and cutting away obstructing trees and vines, so that the finished trail consisted of an avenue some four or five feet across, over which the porters could easily carry our entire equipment through the jungle on their backs.

At the point from where we started, large buttressed trees were comparatively few and, except for the low-growing, large-leaved, canna-like plants that covered the dark jungle floor, the woodland appeared more like a northern hardwood forest than part of the tropical jungle fastness. The slender trunks of many small trees in this area seemed to disappear up into the very top of the jungle, where the crowns of the forest giants made a solid canopy of green.

With nine men cutting trail through comparatively open level ground during the first two or three hundred yards, I had become very enthusiastic, expecting that we would surely reach the mountain within a week or ten days, but by noon of the next day I began to realize that this would be far from possible. Only 300 yards from base camp the line lay across a large deep creek, over which a bridge must be laid by felling one of the larger trees. Then in rapid succession numerous small, low, swampy places were encountered—the water in some of them reaching the shoulders of the small-statured Indians.

It had become apparent that we were traveling along east of the Emma Keten (KETEN meaning "range"), a narrow chain of mountains running almost directly south, since we found ourselves crossing alternately low swamps and ridges directly westward toward the high point of the mountain. On the morning of the third day, one short kilometer from camp, we reached the summit of a ridge about 150 feet high. Here I hoped we might be able to get a view of Table Mountain, so we looked around for a tall tree sufficiently near the summit to enable us to peer from its top across the jungle beyond.

We found one with a fine, cable-like liana reaching to its top, so one of the Indians—all of them being remarkable climbers—was sent up the tree. He reported that nothing was to be seen, merely piles of blue clouds in the distance. These "blue clouds" I had to see for myself. Rope-climbing to 100 feet, I then discovered, is not a simple matter. I was near exhaustion when I reached the lower limbs from where finally I was able to climb upward to the top—about 50 feet above. When I gazed at these "blue clouds" on the horizon, I saw what I had hoped to find—not clouds but a blue haze covering the escarpment of the mountain itself, the bold forbidding cliffs on the eastern side. The summit itself was lost in actual clouds.

Spirits buoyed immeasurably. The mountain looked as though it were not more than five miles away so it should be reached in two or three days. The mountain reported, every man had to climb the tree to look for himself—even Elmond, who by this time had become an enthusiastic member of the party. Pictures were taken from this point high in the tree to give us our first photographic record of Tafelberg.

We set to work with a will, now expecting to reach the mountain within a few days, but as we made progress on the far side of the hill, we ran into a number of deep, wide swamps. The first of these was perhaps not more than one and one-half kilometers wide, but it took three days to go through it, for in many places we had to lay causeways from palm trunks in order to carry our necessary materials.

To this point, Elmond had managed to get along without clothes, but

Elmond, son of the Granman, dances with joy at the upper Table Mountain camp on receiving news that he is to lead a party back to Posoegroenoe to get additional rice and other supplies. Below he is shown, dressed in garments made from flour sacks, standing proudly before the palm-thatched magazine at base camp. The sealed tins, resting on a floor of cecropia logs, contain the expedition's stores of food.

the makka palm thorns were so fierce that even the tough calloused skin of his feet could not protect him. He had to have a pair of shoes and he had to have trousers. Elmond's feet were the shape of a delta, literally. The toes were almost as broadspread as the distance between toe and heel. Furthermore, the great toe was directed almost straight outward. The problem of shodding these feet was indeed a difficult one. Selecting the largest pair of shoes in the party, those worn by Baas Schmidt, we had to cut and rebuild them to fit Elmond's feet. By supplying additional soles, sewing, and binding the sides with canvas, he was able to wear them. A shirt and trousers were made from canvas bags. Elmond was very happy in his new garments.

When the line was cut so far that it took too long to reach the end in the morning, and also too long to return to camp at night, it became necessary to move camp. Our second camp was set up along a pretty little white-water stream, to which supplies were relayed in MUTETES (carrying baskets) on the backs of the men.

Progress continued over increasingly difficult hills and broad, deep swamps, until we finally reached a slope that surely, it seemed, would bring us to the mountain itself. Exploratory lines were set out around this hill, which we called Schmidt Mountain, after Baas Lodewijk Schmidt, who was perhaps the most experienced bushman and explorer in the colony. Our third camp, established at the base on the far side, was dubbed Kwatta Camp, because there I had shot our first kwatta, or black spider monkey. From this time on, monkey formed a dependable source of meat. After one's first natural reluctance is conquered, it becomes a very fine-flavored and acceptable meat—though somewhat stringy—which the Indians and bush negroes like exceedingly well.

In like manner, our next was called Pakira Camp, because near there we shot the first of the smaller wild pigs. The pakira run in smaller droves than the big black pingo, which we had found in abundance at our first base camp. The small pig is delectable, entirely recognizable as pork, and it became our most common and welcome bush meat.

The fifteenth day had come—twelve after having thought that Table Mountain was directly within our reach. We had grown considerably discouraged. I had to reconcile myself to a much shorter stay on the mountain that we had originally planned. Then in mid-morning, on this fifteenth day, Tempico, who was ahead, suddenly stopped and excitedly called back to me, "Geijskes line!" We had indeed reached the line that Geijskes had cut at the time of his trip to the mountain. Again we felt elated, because we knew that at that point we were little more than five kilometers from the mountain. Moreover, since our line met his at a right angle, we knew we were still headed in the proper direction, for we wished to gain the mountain some distance to the west of the point where he had reached it.

The next morning, we found ourselves in a new kind of vegetation, one of considerable monotony, dominated, almost to the exclusion of everything else, by large buttressed trees called DAKAMA (*Dimorphandra* sp.) by the Indians. The large roots of these trees covered the ground and were matted and intertwined into a raised, irregular floor which was littered with the big leathery leaves that had fallen from above.

We had been in the dakama swamp only a short time when we crossed a little stream-bed that was filled with red and white fragments of sandstone—evidence that we had come to the outwash of Table Mountain. A little further beyond in the swamp we reached a broad, swift, blackwater stream contained between two high banks, the bed covered with large sandstone boulders. Here we set up Camp No. 5, Blackwater Camp.

During all this time our porters had been constantly on the move, relaying supplies along the trail from base camp on Tafelberg Creek.

On an exploratory trip the following morning, we had our first close glimpse of the dull red face of Tafelberg. It was visible a little more than a mile away, up the second of the several boulder-strewn creeks that we crossed that day.

The talus beyond the last of the black-water creeks was composed of massive blocks of sandstone, some the size of a house, and all of them covered with slippery moss or other dense vegetation which half hid their surfaces from view. Over and around these I climbed, with Tempico as my sole companion, until at noon, breaking through the dense undercover, suddenly we found ourselves against the sheer wall of the mountain, almost close enough to touch it. Up to that moment it had been completely hidden from view by the overhanging vegetation.

Instead of the ten days that had been estimated, we first reached the base of the mountain on the 23rd day, and were still some distance to the east of the break in the scarp that we had seen from the air.

The following morning we cut our line along the talus, following a westerly direction, crossing low ridges, until we again were drawn to the escarpment. Leaving the trail, we climbed the talus to the cliffs, there followed on about a kilometer through dense liana-bound jungle, until we found a fissure in the wall that seemed to break away upward, showing skylight in the dark recesses above.

By means of lianas we pulled ourselves up from ledge to ledge, about 150 feet to the top of the scarp. At last we were actually on the summit of Table Mountain! Here we found ourselves in a low dense bush—quite unlike any that we had pushed through on our way to the mountain carpeted by terrestrial aroids and cyclanthus.

Following along the escarpment to the west and progressing downhill, we shortly broke out onto a very fine stream, later named North Ridge Creek, the cascade from which leaped downward in a series of giant steps. On the far side of the stream we could see a ridge that seemed, with no

The first ascent of Table Mountain was made through the narrow fissure recessed in the cliff shown above. Large cable-like lianas served as ropes for climbing from ledge to ledge. Two of the Carib Indians, one with a vasculum on his back, are making the climb here. The grass-like vegetation on the walls of the cliff is the bromeliad, Navia, which is common on similar sandstone walls at Kaieteur Falls and at Mt. Roraima.

cliff barrier at all, to slope down to the jungle below. This we hoped would prove to be the break in the escarpment which we had been searching for.

The next day we followed along the base of the talus until we met the same stream. It was true—no outcrop of rock impeded our progress up the ridge, and we were able by mid-afternoon to reach the top of the mountain. Word was sent back to Baas Schmidt that we had made the ascent. He was instructed to push the relay of supplies as rapidly as possible. The next day we moved up on the mountain.

Tempico and I remained on top, sending the other men back for more supplies. Quickly we made a shelter and started preparing the evening meal. Darkness was already setting in. No sooner had we finished with our supper than it began to rain. It rained as only it can in the tropics—furiously and continuously, through the night. Both of us were completely soaked. The noise of the rapidly rising stream became alarming. In the intense darkness we were unable to see what was going on, but the noise grew louder. Lying in my hammock, I could hear water below me. We had hung our hammocks five feet above the level of the stream and had left our utensils on a ledge four feet above the stream. By morning the stream had subsided, but we saw that our cooking utensils had been carried away. This was only one of many such experiences on Table Mountain, where the rain comes suddenly and lasts with excessive and prolonged intensity.

Fortunately, the single iron pot that we had and our cache of supplies that had been hung on a tree out of reach of the water (as, of course, an experienced bushman like Tempico would do) were safe. We ate our oatmeal that morning using large flat leaves as plates.

From the air maps, we knew that there were openings on the mountain top, perhaps not more than a mile to the south, so our chief job the first day was to locate one of these for a camp site. Pushing southward rapidly through the exceedingly dense bush, by early afternoon we had worked our way about a mile from the stream. There we found a narrow opening, about 500 yards long, that seemed a suitable place for our home on the mountain. Not far away was a small stream, sufficient to supply us with water. Table Mountain Camp was at once set up at this point. Then we were able to start the serious business of the exploration of Tafelberg and collection of its fascinating flora.

The entire party was now divided into three groups. Three of us, Tempico, Derby, and I, were to remain on top. The other six, in two groups, were to relay supplies continuously from base camp, nine days' pack journey away, to the camp on the mountain.

(Part II will follow in the December Journal.)

Three-Day Chrysanthemum Show at Garden

THE chrysanthemum show and program at the New York Botanical Garden October 26-28 brought nearly 10,000 visitors to the Museum Building to see the competitive exhibits and an additional 20,000 or more to enjoy the Garden's outdoor displays of hardy flowers. This was the second annual show of the Eastern State Chrysanthemum Society, which had been organized the year before with Dr. E. L. Scott of Bogota, New Jersey, as president.

Chrysanthemum fanciers from every nearby state attended the show, and one couple, Mr. and Mrs. E. C. Lehman, came from Faribault, Minnesota, for the occasion. From half a dozen other distant states and from Canada came other visitors, some of whom were in New York for the Navy Day celebration.

Exhibition flowers also arrived from far away. Lucius Bates of Sacramento, California, and the Chrysanthemum Society of Portland, Oregon, Julien Coblentz, secretary, sent displays of cut flowers by air express.

Among the 241 entries for the show, 58 growers, mostly amateurs, took part in the competitive exhibits. First prize among the large displays went to the Garden Club of Mamaroneck, N. Y., Mrs. John Germaine, chairman, for a chrysanthemum garden composed of plants grown outdoors by members. This garden was also awarded the Scott trophy offered for the best exhibit in the show. The Marshall Field estate of Huntington, Long Island, took second prize with an autumn scene arranged by George H. Gillies, head gardener. Third place was awarded to a bank of nearly 50 different kinds of hardy chrysanthemums grown by veterans of Fort Totten Military Hospital at Whitestone, Long Island, as part of the reconditioning program. With P. J. McKenna as horticulturist in charge, the work was directed by the North Shore Flower Auxiliary under the auspices of the Gray Ladies of the Red Cross.

Honorable mention was given to a demonstration of the classification of chrysanthemums by the type of bloom staged by Dr. and Mrs. E. L. Scott. A special award was presented to Totty's, commercial growers of Madison, New Jersey, for a table of cut blooms, and another to the Garden Club of Bogota, Mrs. Clyde Boyles, president, for a large arrangement of chrysanthemums in a weathered log.

Prominent among the many flower arrangements submitted for competition were six lighted niches in the rotunda. Mrs. John Spader of Mamaroneck won the first prize here and Mrs. Harold Brooks of Westfield, New Jersey, second. Other exhibitors were Mrs. Loren R. Dodson, Larchmont, N. Y., third prize; Mrs. C. E. Cyphers, Clifton, N. J., honorable mention; Mrs. Charles Hoffman, Scarsdale, N. Y., and Mrs. William H. Hardifer, Passaic, N. J. Many other chrysanthemum arrangements were on view, as well as many exhibits of cut blooms in different classes. Leading prize winners in number of awards were Mrs. J. Willard Roberts of Mamaroneck; Marie Leary of Greenwich, Conn., Mrs. George E. Andrews of White Plains, N. Y.; E. L. Scott of Bogota, N. J.; Omar Coles of Magnolia, N. J.; Mrs. H. E. Kinkaid, Mamaroneck; Paul F. Frese, White Plains, and Fred Shumaker, Larchmont, N. Y.

Judges for the competitive exhibits were Mrs. George Sand, Esther Grayson Rockwell, F. F. Rockwell, Arthur Herrington, T. A. Weston, George Cowe, Anthony Sailer, and William Seymour. Included on the committees who worked on the show were Mrs. Clifford B. Curtis, Mrs. J. Willard Roberts, Dr. and Mrs. E. L. Scott, Milton Cornell, Prof. C. H. Conners, Ernest Chabot, Mrs. Robert Kearfott, James S. Jack, T. A. Weston, and T. H. Everett.

Two educational exhibits attracted

much attention. Albert Hostek of Setauket, L. I., showed 49 separate blooms, differing widely in form and color, which, he said, were all derived from the seed of one white chrysanthemum which had been open-pollinated by insects.

Diseases and pests of chrysanthemums and their control were the subject of an exhibit arranged by Dr. A. W. Dimock of the Plant Pathology department at Cornell University. Mimeographed leaflets giving detailed instructions to growers were distributed. It is planned to publish the summary of control measures in an early number of the Journal.

While the judges were determining the prize-winners, a program was taking place in the lecture hall in the Museum Building. Dr. E. J. Kraus, Professor of Botany at the University of Chicago, came to New York for the occasion to describe his ten years of work in developing the Chicago strain of cold resistant hardy chrysanthemums.* He showed many fine kodachromes of the chrysanthemums he has developed as a sideline to his teaching, some of them already well established in ornamental plantings.

Dr. Scott spoke on "What the Amateur Expects of his Hybridizers." Between these two talks came a short address in Mandarin on "Chrysanthemums in China," given by the Chinese artist, Wang Chi-Yuan, and interpreted by Dr. Roberta Ma. A translation is printed in this issue of the Journal. Professor Wang, who was formerly head of the faculty for western painting at the Shanghai College of Fine Arts, vice-president of the college, and head of the Shanghai Art Association, then gave

* A detailed account of this breeding program and its results appears in the *National Horticultural Magazine* for April, 1945.

Prize winning display of the Mamaroneck Garden Club.

CHRYSANTHEMUMS IN CHINA

As presented in Mandarin by Prof. Wang Chi-Yuan at the New York Botanical Garden, October 26th, 1945, and interpreted by Roberta Ma.

CHRYSANTHEMUMS have drawn the attention of the Chinese people for years. In many ways they symbolize the philosophy of the Chinese people. Their beauty in autumn and their endurance toward frost can well be used to represent China as a nation whose history of civilization has lasted 4,000 years, and who has just emerged from eight years of war victoriously.

It is well to the credit of the chrysanthemums that the Chinese people have learned lessons from them; that is, the poets write about them; artists paint them; students and teachers read the poems and study the paintings concerning them. The everyday man and woman love to admire them. As a result, beauty and endurance have become part of their well-being.

The Chinese people love flowers. They select queens of flowers for the four seasons. Plum blossoms are known as the Queen of the Spring, orchids of the summer, chrysanthemums of the autumn, and bamboo of the winter.

In autumn, the Chinese people have various ways to show their appreciation of the chrysanthemums: by exhibiting their many unusual varieties in large gardens, by studying their different forms in people's courtyards, and by describing their nature in poetry or prose. Poets often were inspired by them over a glass of wine. The ninth day of the ninth moon is known as "Chung-yang Chieh" or "Double Nine Day" when people celebrate by eating crabmeat and drinking wine while looking at the chrysanthemums. Those who can paint may paint. Those who can write may write. Those who can think may compare the life of chrysanthemums with their own life in order to cultivate the love of beauty and to strengthen the spirit of endurance. I believe this is the basic reason for the Chinese people having had a continuous history of several thousand years.

I hope the peoples of all nations will learn lessons from flowers when they plant them, cultivate them and inspect them. They may formulate their own philosophy of life. They should particularly study the chrysanthemums which can defy the cold wind and heavy frost and at the same time remain beautiful, natural, vigorous, spotless and outstanding. Truly, the chrysanthemum is the Queen of Autumn. I hope the American people will understand the philosophy of the Chinese people in connection with chrysanthemums, that America and China will help to spread such a spirit that the peace of this world may last as the chrysanthemums last through the frost and snow.

a demonstration of painting in the Chinese manner, using chrysanthemums for his subject. He presented the Garden with the picture that he made on the stage. Ten of Mr. Wang's chrysanthemum paintings and two scenes showing bamboo were on exhibit in the Museum Building October 20-28.

Saturday's program was combined with the regular weekly lecture. T. H. Everett spoke on the culture of hardy chrysanthemums as it is practised at the New York Botanical Garden, then led the audience on a tour of the outdoor plantings.

This year, for the first time, the Garden has grown, in addition to its usual collection of hardy chrysanthemums, a trial border of about 60 new varieties provided by eight growers. A number of these, it is planned, will be included in the Garden's display border in the future.

Notes, News, and Comment

Robert Hagelstein. At the age of 76, Robert Hagelstein, Honorary Curator of Myxomycetes at the New York Botanical Garden, died at Nassau Hospital, Mineola, Long Island, Oct. 20. A retired manufacturer, Mr. Hagelstein had devoted the last 20 years to a concentrated pursuit of his lifetime hobbies, which led him to a position of prominence in the study of myxomycetes. An appreciation of Mr. Hagelstein's life and work will appear in a forthcoming number of the Journal.

Returned. Dr. Harold N. Moldenke, Associate Curator, returned to his post at the Garden in early November after a wartime leave of absence.

Members' Days. To build a tropical garden that all the United States can be proud of was the aim of the founders of the Fairchild Tropical Garden at Coconut Grove, Florida, Colonel Robert H. Montgomery, Director, told an audience at the New York Botanical Garden Oct. 3, at the first Members' Day program of the season. Mrs. Montgomery, who serves on the board of the organization, joined him in describing the 83-acre garden with its collections of orchids, cycads, vines, shrubs, and many other plants, the L. H. Bailey Palm Glade, the Noel Chamberlain Hibiscus Garden, and other features. Col. Montgomery said that the New York Botanical Garden, of which he is a member of the Board of Managers, was in large part responsible for the inspiration which prompted him to start the tropical garden in Florida. Credit was also given to George P. Brett, Jr., President of the Macmillan Publishing Company and a member of the Botanical Garden's Corporation, and to Dr. David Fairchild, for whom the garden was named. The Fairchild Tropical Garden was started in 1935 and dedicated in 1938.

At the second Members' Day program, Nov. 7, Dr. William J. Robbins talked on yeasts, molds, and bacteria, describing their life processes and explaining some of the ways in which they function to the advantage of man. He exhibited cultures of a number of these plants in test tubes, petri dishes, and bottles, and gave demonstrations to show their behavior.

A horticultural exhibit was a part of each program, orchids and chrysanthemums being featured in November. The majority of the chrysanthemums shown were cut flowers from the collection of about 60 new varieties which the Garden has grown on trial this year.

Returned from War Assignments

DR. W. H. CAMP, Assistant Curator, who left this country in the spring of 1944 on a quinine-hunting expedition for the United States Foreign Economic Administration, returned to his office Nov. 1. He brought with him more than 15,000 botanical specimens, gathered on a six months' expedition in Ecuador at the conclusion of his F.E.A. assignment. He had been on leave of absence from the Garden since early in the war.

Dr. Camp arrived in Ecuador in May 1944, going directly to Loja in the southern part of the country, where the first quinine was discovered by Europeans early in the 17th century. Later explorations led him to various regions of Ecuador, such as Cuenca, also in the south, and the Cordillera Cutucú, east of the main range of the Andes.

By December 1944, the Government's stockpile of quinine had reached sufficient proportions to meet the current emergency. Explorations for related forms containing other drugs used in medicine continued, however, until April 1945 when Dr. Camp was released officially. From April through September, he collected plants, seeds, and herbarium specimens in various parts of Ecuador on an expedition sponsored by the New York Botanical Garden.

Dr. Camp has been a member of the Garden's scientific staff since 1935. He was on leave of absence, working mainly for the Government, beginning in September, 1942, until April of this year. Prior to his Ecuadorean expedition, he was sent to Haiti, Honduras, Salvador, Guatemala and Mexico, to develop plantation sites and assist in the production of emergency rubber and fiber plants needed in the war.

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

PUBLICATIONS OF THE NEW YORK BOTANICAL GARDEN

Books, Booklets, and Special Numbers of the Journal

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

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

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

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

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

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

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

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

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

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

Periodicals

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

Journal of The New York Botanical Garden, monthly, containing news, book reviews, and non-technical articles on botany and horticulture. Subscription, $1 a year; single copies 15 cents. Free to members of the Garden. Now in its 46th volume.

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

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

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 100 parts now issued. Not offered in exchange. Prices of the separate parts on request.

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

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

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

CAROL H. WOODWARD, Editor

To Our Readers . . .

DURING the past two years and more, a mounting combination of circumstances has made it increasingly difficult for us to get the JOURNAL to our readers early in the month. Now, with the prospect ahead of a gradual return to more normal conditions, it is hoped that in the new year each issue will be delivered close to the first of each month. In an effort to facilitate such a schedule, the December number is being mailed simultaneously with the issue for November. January, we confidently expect, will be ready within a month. We beg the forbearance of our readers for what has seemed remissness during these abnormal years, and we hope, with them, that the JOURNAL from 1946 onward will arrive from month to month without delay.

CAROL H. WOODWARD,
Editor.

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JOURNAL

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THE NEW YORK BOTANICAL GARDEN

VOL. 46 DECEMBER 1945 NO. 552

The First Botanical Exploration Of Table Mountain In Surinam

II

A Report of the New York Botanical Garden's Tropical Expedition of 1944

By Bassett Maguire

FROM the air, the surface of Tafelberg had seemed to be more or less plane with comparatively little relief, gradually rising from the low northwestern rim toward the high point at the apex lying toward the south. Also from the air it had been perfectly clear that there was only one practical approach to the mountain—the one that we so fortunately had been able to reach. Otherwise, Tafelberg is completely rimmed by vertical cliffs that vary in height from one or two hundred feet to perhaps over 1,000 feet. The mountain is a great, somewhat tilted, scalloped, triangular block of sandstone with its face to the north and apex to the south. The talus, product of erosion from the wall itself, slopes sharply downward from the bold escarpment, and is covered by the great sea of jungle that sweeps up to the massive cliffs. The walls themselves are frequently vegetation-clad, shrubs, herbaceous plants, and even trees growing precariously caught in some fissure or lining narrow ledges along the face of the cliffs. Undoubtedly there are numerous places where the escarpment may be scaled. Professor Stahel and his party climbed the very lofty southern walls in 1926. Dr. Geijskes climbed the north escarpment in 1943. We were able to find three places where ascent could be made, but none of these could be used for transport of supplies.

In the center of the mountain there is a great lance-shaped depression, formed, perhaps, by subterranean erosion, and filled with dense high forest. The south end is rimmed by a vertical wall, similar to the outer escarpment but not so high. Water falling over this escarpment is quickly lost in the talus at the foot of the cliff. Criss-crossing the bottom of the basin at the foot of the talus and about six hundred feet below the rim, numerous small streams flow over sandy beds to the center and toward the apex of the basin, gradually disappearing underground. The waters unquestionably find their way to large subterranean fissures that permit escape into the collecting creeks in the floor of the jungle at the base of the mountain.

The vegetation of Tafelberg is greatly diversified, much more than that of the jungle below. We found, as indeed we had suspected, that the many plants of the summit are related to those of similar high sandstone plateaus in British Guiana, Venezuela, and Brazil. This is particularly so of the plants occupying the open rocky areas where the boulder-strewn bed sandstone is plane and checkered with minor fissures that are filled with an accumulation of sand. Bright-flowered annuals pack these sand-filled cracks. At the margins of these rocky outcrops there frequently are zones of sphagnum crowded with yellow and blue-flowered xyrids and bladderworts. Those areas pass into narrow bogs, and these in turn are bordered by thickets of shrubs. For the greater part, the mountain is covered by a dense low bush, exceedingly rich in species but dominated by a number of kinds of *Clusia*. On the mountain the shrubs and small trees are frequently only ecological forms of species that in the low forest areas may develop as vines or high trees.

In low areas, a high forest has developed similar to that which was crossed in the river-drainage basin below the mountain, and is completely dominated by dakama. Numerous delicate ferns grow on the damp shaded rocks at the base of the cliffs around the escarpment and in Arrowhead Basin. Orchids are not very abundant on Table Mountain except on dry rocky exposures, where they were sometimes to be seen in considerable mass. Contrary to our hopes and even expectations, few of them were found in flower. Living specimens were brought back and are now growing in the Botanical Garden greenhouses. We will be unable to identify them until they flower for us in New York.

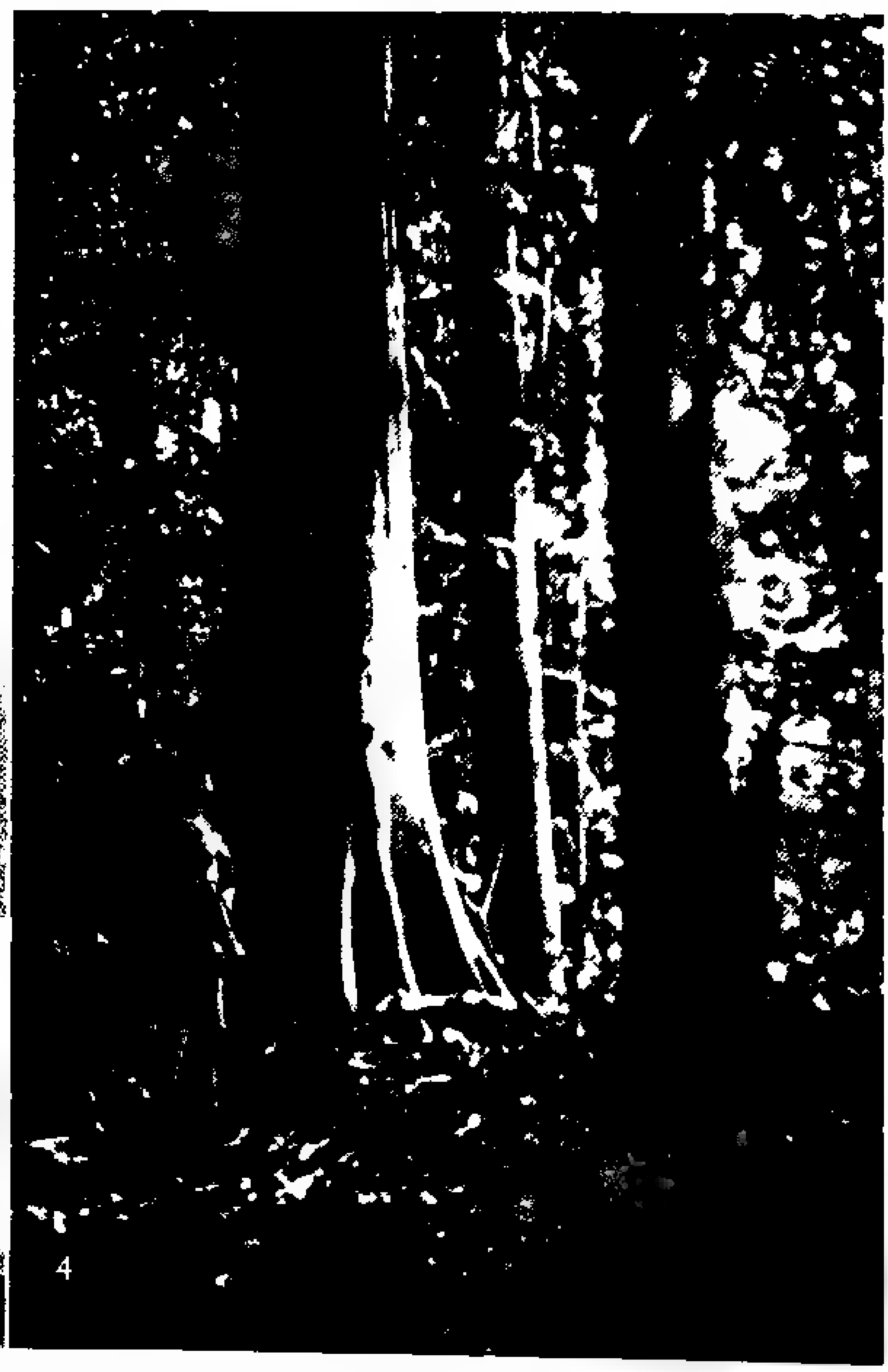
The fauna on Table Mountain, particularly the larger animals, is not very varied. There were the ever-present monkeys, numerous birds, snakes, and lizards, but little else. The snakes were mainly of the harmless kind. The bushmaster was seen, but not frequently, to our regret, for it became one of our table delicacies. Only one other kind of poisonous snake was encountered in our entire two-month stay on the mountain. Because of a scarcity of animals for food, we had to depend most of the time on the hunters in the jungle below for our meat supply.

* * * *

After three weeks on the mountain, work temporarily came to an end. All areas within reach of our first camp had been visited and the plants collected. Usually, both Tempico and Derby would accompany me on the collecting excursions, clearing out trails, locating flowering specimens,

1. Cataract No. 3 at the foot of Augustus Falls, which in total height is nearly 600 feet. 2. Setting up temporary camp in the deep jungle. Palm leaves make a more effective covering than canvas in heavy tropical rains.

3. Through a fairly open stretch of pina swamp in the dry season. During the rainy season en route to the mountain, water reached the height of the prop roots shown on the palms. 4. A beautiful, smooth-barked guava tree in the rain forest. It was possible to make this photograph only because of a windfall which permitted sunlight to penetrate the dark jungle.



felling trees, and helping with the actual collection of the material. Two metal collecting containers were used to hold the specimens and keep them from drying out. When these were filled, the Indians would make extra containers from woven palm leaves. Specimens of wood to be finished in blocks 4 inches square and 12 inches long were taken from trees from which flowers or fruits had been collected. By the end of the day, we would all come in heavily laden, cans and mutetes filled with plant specimens, blocks of wood, and small plants or bulbs to be brought back to this country for greenhouse culture. When camp was reached, all of the specimens would be heavily sprinkled so that they would keep fresh through the night, and the living plants heeled away in a temporary nursery that we had established in the bush nearby.

The following day would be spent in camp making permanent preparation of these materials. The wood blocks would be trimmed to size and stacked in a protected place where they could dry slowly without splitting. The large quantity of flowering specimens had to be carefully pressed in sufficiently large series to enable us later to send duplicates to many of the world's leading plant institutions. In the humid regions of the tropics, plant specimens dry very slowly without the use of artificial heat, so the

Aroids and other conspicuous plants grow out of the thinly laminated sandstone along Augustus Creek on top of the mountain. The linear-leaved plants at the left, above the handsome Anthurium, and at the right are specimens of Cyclanthus.

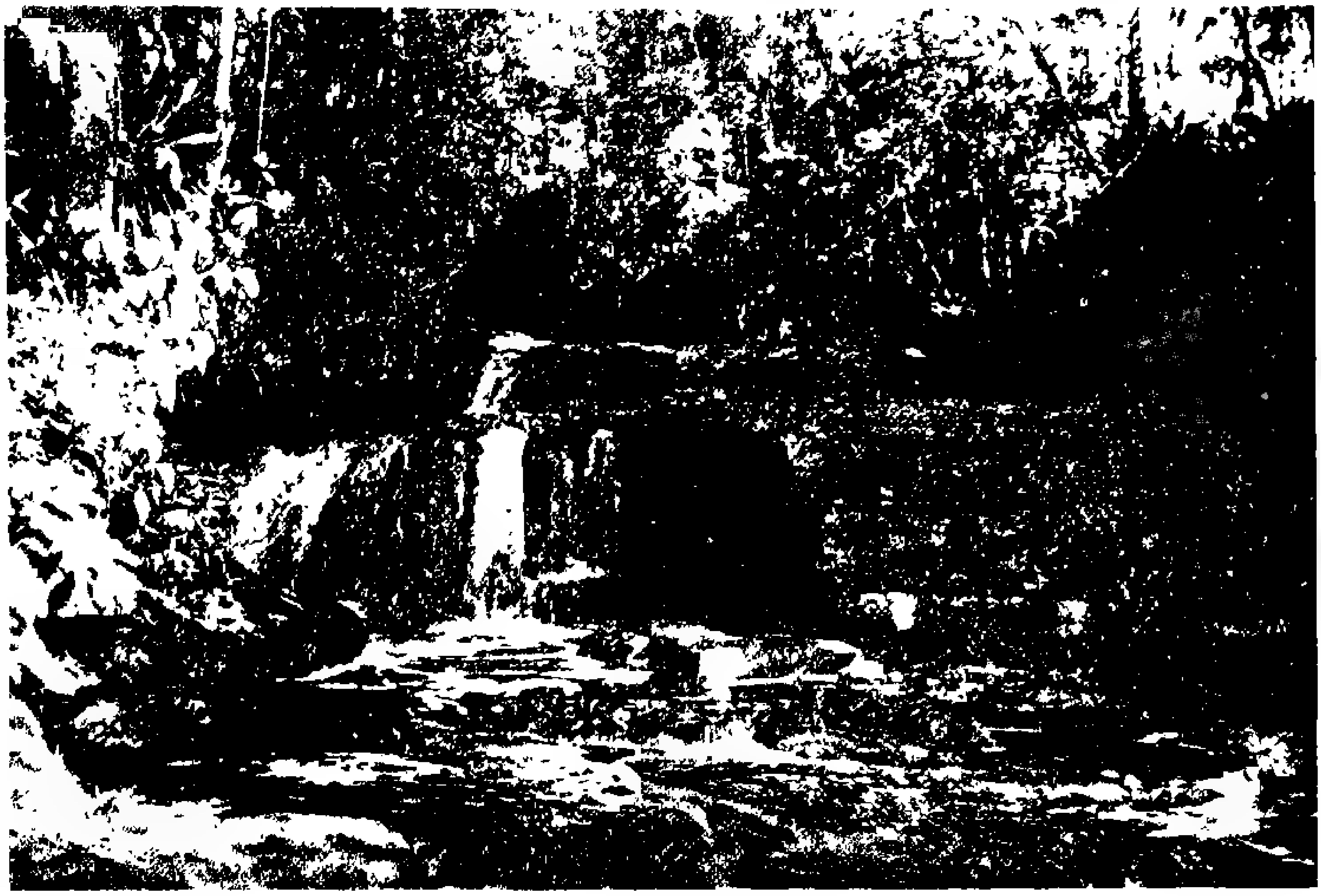
The writer's camp on Tafelberg, which was home for nearly two months during the exploration of the mountain. Below, Derby, Carib cook, camp attendant, and field assistant, is preparing the roof for the work camp. Plant presses and a table stand under the shelter. In the background is the writer's camp.

presses were suspended over kerosene-burning stoves, which would dry the specimens completely in an overnight period.

Storage of collected specimens was always a problem. The wood blocks had to be watched constantly to keep termites from destroying them. Dried specimens left exposed or poorly wrapped or boxed would quickly absorb moisture and soon become mildewed and discolored. As each bundle of plants would be brought out of the press hot and dry, the specimens would be quickly wrapped in heavy manila paper, and then boxed in stout cardboard cartons, and these in turn packed away in heavy waterproof canvas bags. During the hot part of each day in camp when the sun shone most intensely, the boxes would be brought out, opened up, and the packages of specimens again sunned and dried.

By the end of the expedition, we had assembled a large mass of material —about 15,000 specimens, more than 400 blocks of wood, and almost as many samples of living plants and seed. The problem of transport of this material back to base camp and down the river became almost as great as that of getting our equipment and supplies onto the mountain had been. Even while supplies were still being sent to us from base

Thick pigmy bush surrounding open "rock savannas." About the margins are sphagnum bog plants, blue-flowered xyrids, bromeliads, yellow and blue bladderworts, and sparkling little sundews.



Open bush along Augustus Creek immediately above the falls. In a deep pool some distance upstream we twice saw a good-sized caiman (crocodile).

camp, we had begun to return our collections to the storage magazine down on the water's edge. By the time we were ready to leave, much material had already been sent down the mountain. In spite of this, more than two weeks were occupied in the move back from the mountain to base camp.

Our second camp on the plateau was located in the central portion to the south, lying about equidistant between the lower western and higher eastern escarpments. Here, at an elevation one thousand feet above the first camp, the problem of water became acute. It was necessary to use rainwater run-off that collected in shallow little basins at the foot of the sloping rock exposures. Indeed, at one time during the first few days at Camp No. 2 we felt that we might be unable to remain there for lack of water, since earlier—and perhaps more rightful—residents of the area sought the same supply that we did. Each morning as we went down to the little basin we had built, we found it had been visited by tapir. Within a few days, however, our presence was too much for the tapir and he—or they—disappeared, leaving us in sole possession of our small reservoir.

One interesting portion of the mountain lies along the high east escarpment. Each morning before dawn, dense rolls of fog pour down the

All photographs used with the Table Mountain article in the November and December Journals were taken by Dr. Maguire. Those which appear on pages 280, 282, and 283, as well as the map on pages 264-265 in the November Journal, first appeared in the *Geographical Review* in October 1945, to illustrate Dr. Maguire's "Notes on the Geology and Geography of Tafelberg, Suriname." The map was prepared from Dr. Maguire's notes by cartographers of the American Geographical Society, and, with the photographs, is used here by courtesy of the Society.

slopes toward the northwest. The persistence of this dense fog has brought about the development of an exceedingly interesting bush that drips as if with rain until about noon. This continuous moisture produces an amazingly luxuriant and fantastic array of mosses, ferns and other epiphytes. The mosses so encase the tree trunks and branches as to make them appear greatly exaggerated in size and actual thickness.

During one of our trips to the west escarpment, we were conscious of harsh bird calls, sounding not unlike those of crows. As we sat down to lunch, the calls became very numerous. Suddenly there streaked before us an actual bird of gold, coming to rest on a branch not far away. We saw that this shaft of gold was one of the fabulous cocks-of-the-rock in flight. For the remainder of the afternoon numerous cocks were seen among the trees and low bushes about the escarpment, the equally noisy but less conspicuous females as abundant as the males.

In all, nearly eight weeks were spent on the top of the mountain, during which time we were able to visit most of the areas offering rich returns in collecting. However, when the point was reached in which our food supply was getting dangerously low and much of the intended exploration was done, plans were made for return. Our collected materials and precious living plants and specimens were placed in tins and baskets, to be relayed back to base camp.

The return trip was more rapid. It took us only two weeks to reach base camp from the summit. Progress downriver was uneventful. Through the bush negro country, we were again received with great enthusiasm and friendliness by all of the happy blacks. Kwakoegron, the railway terminus on the river, was reached at noon of October 14, four months and two days from the time we had left that point.

The end of the river journey was at hand. There was only one more bend to round before we reached civilization. Suddenly, in front of our canoes two large animals plunged into the river from under the dense wall of green. Thinking they were wild pigs, we paddled rapidly toward

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TABLE MOUNTAIN AND TWO SCENES IN THE JUNGLE ON ITS SUMMIT
(On the opposite page)

This airplane view shows the west escarpment, the plateau top, and the long sloping jungle-clad talus of Tafelberg. The highest point reaches approximately 3,600 feet elevation. At the left is a section of a trail that was cut on Table Mountain through a grove of the native traveler's palm (Ravenala guianensis). Derby, carrying a collecting can, can be seen some distance inside the grove. One method of collecting plant samples is shown at the right. To get specimens from large trees, the tree itself must be felled from a platform built above the buttress. The Mimosa relative above is a moderate-sized tree. On larger trees with more extensive buttresses, the platform must sometimes be built 20 to 30 feet above the ground.

FOOD FARE ON TABLE MOUNTAIN

Fresh meat was seldom a problem in the deep bush. Some of the most dependable of the foods caught in the wild are the wild pig, being brought in by one of the Caribs; the spider monkey, exhibited by Tempico; and the bush turkey, or curassow, shown with a photometer for comparison of size. The large coarse-looking fish being held up by Sepharinus, the camp cook on the trail, is a delicacy, with sweet, white flesh. It is nearly always available in the larger black-water streams except during periods of flood.

them, attempting to head them off. But the two beasts swam strongly and gradually away from us. As the dripping figures drew out of the water some fifty yards in front, we saw that the two "peccaries" were actually handsome full-grown jaguars.

Ten minutes later we were at the railway station.

A PARTIAL LIST OF SUPPLIES AND EQUIPMENT TAKEN ON THE NEW YORK BOTANICAL GARDEN TAFELBERG EXPEDITION

Boats and Equipment

7 corials
21 paddles
Tar and caulking for corials

Food*

Rice—28 tins; 1,110 lbs.
Flour—18 tins; 570 lbs.
Sugar—11 tins; 440 lbs.
Oil—8 tins (40 gal.); 200 lbs.
Beans (dried)—6 tins; 200 lbs.
Meat—25 doz. small tins; 360 lbs.
Milk—12 doz. cans; 100 lbs.
Chocolate—1 tin; 25 lbs.
Salt—2 tins; 90 lbs.
Misc. tinned food (for the leader) 150 lbs.

Total food—3,245 lbs.

Preservatives and Fuel

Kerosene—8 tins (40 gal.); 285 lbs.
Gasoline—2 tins (10 gal.); 70 lbs.
Alcohol—6 tins (30 gal.); 100 lbs.

Total preservatives and fuel—455 lbs.

Plant Collecting Equipment

Plant presses and paper
2 kerosene stoves
1 gasoline stove
Paper and cloth bags and envelopes
Collecting vials
50 empty five-gallon tins
Tree climbing equipment (lent by the N. Y. Telephone Co.)

Total plant collecting equipment—980 lbs.

Miscellaneous Equipment and Supplies

Insect repellents
First aid and medical supplies
Personal effects of leader and party members
8 large tarpaulins
Tent
2 shotguns (400 shells)
2 carbines (400 cartridges)
Camera and films
Reference books and writing materials
Cooking and eating utensils for the party
4 axes
14 machetes (cutlasses)
20 files
1 camp table and chair (for leader)
5 gasoline and kerosene lanterns
3 saws
2 hammers
2 picks
2 shovels
Nails
2 soldering irons
10 lbs. solder (with acid and resin)
3 pair tin shears
Shoe repair outfit
Rope and cord
Surveyor's chain
Compasses
Maps
Paint and brush
Spring balances
Rules and tape measures

Total miscellaneous equipment and supplies approx. 1,320 lbs.

Total weight—6,000 lbs.

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*Considerable food and supplies, in addition to these enumerated were dropped to us on Table Mountain from U. S. Army planes by parachute.

Robert Hagelstein

An Appreciation of his Life and Work

By Joseph F. Burke

ROBERT HAGELSTEIN, a native of New York, lived within the city and its environs for the seventy-five years of his life, engaged in both business and scientific activities. As outlined in an earlier issue of this Journal,[1] he followed a successful business career until he retired to devote the last twenty years of his life solely to science. From 1930 until the time of his death, he was on the scientific staff of The New York Botanical Garden, with the title of Honorary Curator of Myxomycetes.

His interest in science was practically life-long. Science was an avocation during the years he was active in business. Contact with three scientists had a strong influence on Mr. Hagelstein's life and the names of these men occurred frequently in his conversations. The first, Dr. Albert Mann, 1853-1935, diatomist at the National Museum, Smithsonian Institution, Washington, D. C., gave an amateur's interest in diatoms a strong scientific bent. For him and his opinions Mr. Hagelstein had the greatest of respect. The second, Charles Sumner Boyer, 1856 1928, diatomist of The Academy of Natural Sciences of Philadelphia, encouraged and assisted Mr. Hagelstein in a serious approach to the diatoms. The third, Dr. Nathaniel Lord Britton, 1859-1934, made it possible for Mr. Hagelstein to participate in the Scientific Survey of Puerto Rico. Other men of science had influence upon Mr. Hagelstein's scientific career, but the influence of these three was dominant.

Basic in his training was a thorough study of the microscope in its theoretical and practical aspects. This was to be of great assistance when applied to the use of this instrument in his work on the diatoms and the myxomycetes. His interest in the first of these two groups preceded his interest in the second, but for a number of years his studies in both fields proceeded concurrently.

His retirement from business afforded him the opportunity to make three collecting trips to Puerto Rico in 1926, 1928 and 1929, principally for diatoms and secondarily for myxomycetes, which he also collected in some of the other islands of the West Indies. By 1935 he had completed his study and manuscript on the Puerto Rican diatoms and turned his attention wholly to the myxomycetes, each year from then on showing a steady output of scientific publication in *Mycologia* and other botanical journals. In 1944 appeared his book, "The Mycetozoa of North America, based upon specimens in The New York Botanical Garden." For him the publication of this work was a gratifying accomplishment, enabling

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[1] Journal of The New York Botanical Garden, 41: 278, December, 1940.

ROBERT HAGELSTEIN
May 16, 1870 October 20, 1945
Photographed at Gainesville, Florida, in 1941 by G. F. Weber

him to include therein a summarization of his years of study of the myxomycetes. Happy is the scientist who can conclude his labor in so efficient and complete a manner.

Important as had been his work with the diatoms, it was with the myxomycetes that his powers of scientific observation had reached full growth and development. The years during which he spent long hours in the field collecting with his able associate, Joseph H. Rispaud, from Canada to Florida and intensively on Long Island and in Pennsylvania, had much to do with the understanding he had of the latter group. Coupled with this was his almost constant preoccupation with these forms in the laboratory. During the years of his curatorship he reviewed and studied the Garden's collection of the myxomycetes several times, including detailed microscopical examination. This comprehensive and carefully arranged collection was greatly enlarged by his field collecting. So thoroughly a studied and worked-up collection is invaluable to students of the myxomycetes.

In the Cryptogamic Herbarium of the New York Botanical Garden is a special room devoted to the myxomycetes and diatoms. During his lifetime, Mr. Hagelstein incorporated his own collection of myxomycetes in that of the Garden. In this room he also deposited his large and important diatom collection. The formal opening of this room is referred to in the earlier issue of this Journal mentioned above.

Besides his affiliation with the New York Botanical Garden, Mr. Hagelstein was active in the New York Microscopical Society, of which he was past-president, in the Mycological Society of America, especially in the annual forays, and in the Torrey Botanical Club and the New York Academy of Sciences, serving upon its council. He also was a member of the American Microscopical Society, the Royal Microscopical Society and the Quekett Microscopical Club, London.

Mr. Hagelstein passed away on October 20, 1945. He will be missed by his many associates. His magnetic and energetic personality had made for a broad acquaintanceship. He conducted a wide correspondence in connection with his studies. He led many groups into the field, opening up to numerous beginners the fascination he had found in applying the microscope to the study of nature. Willing as he was to engage in friendly banter, especially during the hour of a foray when the morning's collecting had given pause for lunch, he was essentially serious, and serious were his efforts until the end. Well may it be said, "He accomplished much."

New Begonia Name Proposed

By Helen K. Krauss

THE new name *Begonia semperflorens-cultorum* is here proposed for that large group, commonly grown as "wax" begonias, which had its inception in crosses of *B. semperflorens* and *B. Schmidtiana* in 1878. The hybrids of these crosses were successively crossed with *B. Roezli;* also with bronzy-red-leaved mutants which were recorded in France in 1891 as *B. atropurpurea* varieties; with derivatives of *B. fuchsioides;* and with *B. gracilis* and *B. nitida*. Following is a chronological outline of the development of this group.

1. *B. semperflorens* crossed with *B. Schmidtiana* in 1878 gave rise to intermediate and more compact forms.
2. Progeny of the preceding were crossed with each other. (Except for the initial cross, *B. semperflorens* was not used again in the development of the group.)
3. *B. Roezli* was crossed with these early hybrid forms in 1881. (These crosses produced an increased color-range of the flowers.)
4. *B. atropurpurea*, the first bronzy-red-leaved mutants, appeared in France, 1890.
5. *B. atropurpurea* varieties were crossed with each other and with *B. Schmidtiana* in 1891. (The latter crosses provided a wider range of lower growing forms.)
6. *B. fuchsioides* crossed with hybrid forms of the preceding in 1891 produced smaller and still smoother foliage.
7. *B. gracilis* was bred into the multiple-hybrid group in Germany, 1894.
8. *B. nitida* was bred into the group in France, 1900, from which our current double-flowered "Bijou de Jardin" descended.
9. Pompon-like double flowers were introduced in Sweden, 1934, from crosses of *B. "semperflorens-cultorum"* with *B. floribunda*, a variety of *B. fuchsioides.*
10. "Calla Lily," a white-leaved mutant, appeared in America about 1935. Similar ones arose in various nurseries voluntarily. These have single flowers.
11. "Calla Lily" crossed with "Bijou de Jardin" by two different California hybridists about 1938-39 resulted in white-leaved mutants with deep-red double flowers.

The following description covers the group:

B. semperflorens-cultorum. Bushy; stems succulent; leaves ovate to broad-ovate, not as pointed nor as assymetric as those of *B. semperflorens,* glossy, usually smooth, occasionally sparsely hairy, green, bronzy-red to dark mahogany-red, variegated green and white; flowers in small axillary clusters, single and double, white to deep red. This group is exceedingly floriferous and blooms almost continuously.

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.)

The Sage of Cambridge

AMERICAN BOTANY 1873-1892. Decades of Transition. Andrew Denny Rogers III. 340 pages, 3 illustrations, index. Princeton University Press, Princeton, 1944. $3.75.

During most of the years covered in the present volume, the dominant figure in American botany was Asa Gray; and this book deals to a considerable extent with his activities. If a professional botanist were chronicling these two decades, 1873 to 1892, he would probably base his treatment largely on the scientific publications during those years. But we are told that "Most of the material contained in this book has been quoted direct —or obtained from unpublished correspondence which has never before been generally available." In presenting much of this correspondence, the author admits a source of light on American botanical development that would not otherwise be readily accessible. Those who read these pages will be impressed by the volume of material which has been amassed, and by the insight which it affords into academic lives. This is perhaps the outstanding contribution of the book, and a real one.

In the years between the death of his teacher and friend, John Torrey, in 1873, until his own passing in 1888, Gray was unquestionably the dean of American botanists. As the central figure in the taxonomic study of the flora of North America, he was the leader in New World botanical research. It is very unlikely that any one man will ever hold such a place again. The picture of Gray which the reader gets from the correspondence quoted in this book is one of a venerable, kindly, scholarly, but withal forceful man, effectively guiding the botanical world from Cambridge instead of from Olympus.

While Gray is the outstanding scientist, others are mentioned prominently. Several chapters deal largely with the work of Engelmann and of Lesquereux. There are constant references to the activities and accomplishments of Parry, Palmer, Hooker, Pringle, Greene, Watson, Coulter, Trelease, Rusby, Britton, Bessey, Farlow, Arthur, and a host of others. In general one gains the impression that the relationships between these men were remarkably amicable, although one chapter deals with "The controversy of Greene with Gray" and not infrequent differences of opinion are also recorded.

Any book based to a considerable extent on correspondence will inevitably emphasize the journeys of men, such as these, in quest of plants, while their long months of assiduous labors in the herbarium will tend to be much more briefly recorded.

Faults may be found in any volume by those disposed to seek them; in this the style is certainly not continuous nor smooth.

For students of botanical science this treatise offers a historical perspective that could hardly be gained in any other way. A book which accomplishes this is a distinct contribution.

EDWIN B. MATZKE,
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Notes from New Guinea

FRAGMENTA PAPUANA. H. J. Lam in Sargentia, Vol. V. 196 pages, illustrated. Arnold Arboretum of Harvard University, Jamaica Plain, Mass., 1945. $3.

Lam's tales of Netherlands New Guinea, as translated by Dr. Lily M. Perry from Dutch into English, illustrated with two maps and thirty-two quaint drawings by the author, who is now Director of the Rijksherbarium, Leiden, were originally published as seven articles and an appendix between 1927 and 1929. The foreword by Dr. E. D. Merrill explains that, "As a concomitant of this war, the necessity for emergency foods has created a great demand for information regarding the poorly known floras of the Southwest Pacific region." Dr. Lam supplies a good part of this need as well as giving "a great deal of purely botanical information."

Dr. Lam participated as botanist in the first part of the expedition described. This explored the Mamberamo River and its tributaries, northwest New Guinea, for almost two years, beginning in January 1920. It was under the leadership of Capt. A. J. A. van Overeem, its personnel comprising over 400 Europeans and natives, many of them impressed convicts. The trip had its elements of distress and danger, many of the party suffering from disease and some perishing. Thirty-one reached the snowy summit of Mt. Wilhelmina, at 4,750 meters elevation.

By far the greatest number of botanists are primarily human beings and only secondarily scientists. The first 138 pages of *Fragmenta Papuana*, dealing primarily with plant taxonomy and ecology, caters to the scientist. Many of the species of the several thousand numbers collected in the Mamberamo drainage basin -a basin almost 500 km., long and about 100 km., broad—are individually discussed and characterized as to their habitats. As no two taxonomists ever seem to agree in their choice of binomials the reviewer may be pardoned perhaps for wishing Dr. Lam had used the specific name *phaseoloides* with the genus *Entada*, had placed *Crepis japonica* in the genus *Youngia*, and had made a few similarly unimportant revisions.

Passages of real human interest here are mostly subdued except for a few all too brief ones, as when "the melancholy cooing of doves will be heard at regular intervals high up in the tree-tops, frequently also the noisy cry of hornbills, which are hardly seen amongst the mass of leaves and branches until, with the harsh flapping of wings, they fly away." The reader there catches a vivid glimpse of the New Guinea jungle. He likewise learns how the white man, if adaptable, can fare reasonably well when isolated in the jungle, particularly at low elevations. For example, Dr. Lam found that "Sometimes on the table appeared a large bowl filled with fish fresh from the river; then again we had real turtle soup, the thigh of a cassowary, or a fat crown-pigeon. Once while there we tried KOESKOES (*Phalanger maculatus*), and one day the doctor and I even ventured to eat crocodile, which is not as distasteful as tradition says, and strikes a happy medium between fish and veal."

An account of the undoubtedly intriguing and harrowing details of the hardships and dangers involved during the expedition are, unfortunately, conspicuous by their absence during the first three-fourths of the *Fragmenta.* This lack of human interest, however, is supplied during most of the last forty or so pages, which deal with the land and people of the Dika and Toli Valleys. This tale of Dr. Lam is not only of lively interest to the botanist but could be avidly read by the layman as well.

OTTO DEGENER.

The Elements in Wood

WOOD CHEMISTRY. Edited by Louis E. Wise. 900 pages, indexed Reinhold Publishing Co., New York, 1944. $11.50.

"Wood Chemistry" is a monograph of 25 chapters written by 14 specialists. The book is divided into six parts the titles of which give a good idea of the subjects covered. They are: The Growth, An atomy and Physical Properties of Wood; Components and Chemistry of the Cell Wall; Extraneous Substances; Surface Properties of Cellulosic Materials; Chemical Analysis of Wood; Wood as an Industrial Raw Material. The last two chapters are on the decomposition of cell wall components by micro-organisms. Few of the references are to literature as late as 1943. Cytologists and histologists will find much of interest in several of the chapters.

F. W. KAVANAGH.

Three Pocket Guides

GARDEN FLOWERS, WOODLAND FLOWERS, FIELD FLOWERS. T. H. Everett. Illustrated in color by Rudolf Freund. 60 pages each, indexed. Whitman Publishing Co., Racine, Wisc., 1945. 10 cents each.

These three guide-books, which were published early in the summer, provide a full-color illustration, accompanied by a brief description and discussion, for each of 53 species which are common chiefly in the northeastern United States. Both common and scientific names are given. A glossary of garden terms is included in the first booklet mentioned. The color reproduction is reasonably good, except that white flowers tend to appear as pale blue, as in the geranium.

ARTHUR CRONQUIST.

Important Fungus Group Given Comprehensive Treatment

A MANUAL OF THE ASPERGILLI. Charles Thom and Kenneth B. Raper. 373 pages, illustrated, indexed. The Williams & Wilkins Co., Baltimore, 1945. $7.

The fungi comprised in the genus *Aspergillus* form an extremely important part of the fungus flora of the earth. Members of this widespread and diverse group occur literally everywhere—in soil, in water, in the air. Some are pathogenic to man or animals; many are of importance because of their ability to spoil foods or to rot fabrics; still others have found a use in industry, as in the manufacture of citric acid and of fungus diastase.

Publication of the present work has been long awaited by mycologists; the only comparable survey of the group up to now was that of Thom and Church, published in 1926. The present work brings the earlier book up to date and adds new material as well.

The authors devote an introductory section to a careful description of the methods used in cultivation and in identification of the *Aspergilli.* The bulk of the book consists of full descriptions of the known valid species of the genus, with complete synonymy. Keys are presented for the 14 subdivisions of the genus and for the species within each subdivision. Illustrations — both color plates and half-tones—are abundant and well executed.

The authors emphasize that the purpose of the book is to serve as a manual for working mycologists who need to identify isolates of *Aspergillus* encountered in the course of laboratory investigations. This function is performed admirably for a large, variable, and generally difficult group of fungi. Material on the biochemical activities of the *Aspergilli* is restricted largely to presentation of a short bibliography on each of the major topics.

The book is sturdily bound, and is printed on a good grade of paper in a clear readable type; in view of the fact that it was published under wartime conditions, this is a very creditable achievement.

VINCENT W. COCHRANE,
Connecticut Agricultural Experiment Station New Haven.

Notes, News, and Comment

News from Java. Dr. Frans Verdoorn, Editor of *Chronica Botanica,* has received word from Java that the famous Buitenzorg Botanical Garden there has come through the war unscathed. Nothing was taken away by the Japanese, he reports, and the large collections of plants are in relatively good condition. Laboratories and library also were unmolested. Of the staff, 82 members were made prisoners of war and 28 became civilian internees, according to word from Dr. O. Posthumus, former Director of the General Agricultural Experiment Station at Buitenzorg. About a quarter of these men died during the war, some of them having been executed. The Director of the Botanical Garden, Dr. T. H. van den Honert, is reported to be in a camp in Siam.

***Visitor of* 1807.** The famous early 19th century botanist, Frederick Pursh, was a visitor at "the Botanick garden at New York" Oct. 3, 1807, according to an entry in his diary, discovered lately by a member of the present Garden's Board of Managers. This "Botanick garden" was the historical predecessor of the New York Botanical Garden of today. First known as the Elgin Botanic Garden, and established by Dr. David Hosack in 1801 on the site where Rockefeller Center now stands, the 20-acre establishment apparently assumed the name of "the New York Botanic Garden" or "the Botanic Garden of New York" even before the time in 1811 when the property was purchased by the State.

The reference was unearthed in a reprint of Pursh's "Journal of a Botanical Excursion in the Northeastern Part of the States of Pennsylvania and New York During the Year 1807," which was issued by the Onondaga Historical Association in Syracuse in 1923. The reference to the visit is brief, being merely a statement that on his return journey from Rutland, Vermont, back to Philadelphia he arrived in New York on the first of October, and under date of Oct. 3 the entry reads: "Seen the houses of the Botanick garden at New York."

Lectures. Dr. Bassett Maguire reported on his summer's expedition into the desert and mountain regions of Nevada before the Torrey Botanical Club, meeting at Hunter College Nov. 7, and again before the staff and registered students of the Garden Nov. 14. Dr. A. B. Stout addressed the New York Microscopical Society Nov. 16 on "Micro-Examination of Pollen and Pollen Tubes." Dr. F. J. Seaver lectured on fungi in their relationship to man at the Plainfield Garden Club Sept. 19. Elizabeth C. Hall talked before the Chappaqua Garden Club Oct. 17 on recent garden books.

Radio. James G. Esson represented the Garden in an interview on "Putting the Garden to Bed" over the Alma Kitchell hour on WJZ Nov. 14. On Nov. 15, T. H. Everett appeared on NBC's Nancy Booth Craig program, speaking on the subject of house plants.

Groups. The Crestwood Garden Club, with Mrs. Bassett Maguire as hostess, met at the Garden Oct. 22, viewed the chrysanthemums just coming into bloom, saw the Garden's natural-color movie, and had tea in the Members' Room.

A troop of Girl Scouts came to the Garden to study trees Oct. 15. Classes from public schools Nos. 186, 46, 7, and 54 visited the conservatories and outdoor borders under special guidance during the month.

Visitors. Dr. Teresa Alvarez de H. Figueroa, botanist, and Dr. Manual Parea, mathematician, both of the Science Faculty of the University of Havana, were brought to the New York Botanical Garden for a visit in the early fall by Mrs. Carmen Aldecoa de Gonzales of the Spanish department of New York University. Other visitors of the season have included Frank Kern, also L. O. Overholts of Pennsylvania State College with Mrs. Overholts; Alexander H. Smith of the University of Michigan; J. M. Waterston, Department of Agriculture, Bermuda; Adrien Questel, Guadeloupe; B. H. Davis of Rutgers; Lewis H. Flint, Louisiana State University; Fred T. Wolf of Randolf Field, Texas, working on a special Army exhibit at the New York Academy of Medicine; Walter H. Schnell of Brown University, Providence; I. C. G. Cooper of Staten Island, studying algae; Harry Keil, working on dermatitis and its relationship to poison ivy hypersensitivity; Edgar T. Wherry, University of Pennsylvania; Mrs. Isabel M. Grunau, Clawson, Mich.; Jeannette E. Gaustein, University of Delaware; Lambertus C. Bobbink, East Rutherford, N. J.; Arthur Herrington, Madison, N. J., former manager of the International Flower Show; Charles Thom, Port Jefferson, L. I.; Virginia V. White, Pierpont Morgan Library; W. Stephen Thomas, Dobbs Ferry, N. Y.; Richard R. Fenska, White Plains; W. H. Emig, University of Pittsburgh; John C. Wister, Philadelphia, and Mr. and Mrs. George R. Kruppe of Leetsdale, Pa. Mrs. Kruppe is the daughter of J. A. Schafer, and she came to the Garden to look over some of her father's specimens, of which the institution has a large collection in the cryptogamic herbarium.

Fellowship. Captain E. Yale Dawson of the Scripps Institution of Oceanography of the University of California, author of "Botanizing in an Open Boat" which appeared in this Journal for June 1944, is the recipient of a Guggenheim fellowship for exploration of the Pacific Coast of Mexico and Central America for marine algae, and for continuation of monographic studies of the marine flora of that region.

Superintendent. Joseph W. Tansey, who was on the Garden's horticultural staff from 1934 until last spring, serving as Chief Foreman Gardener since 1943, has become Superintendent of the Burden estate at Mt. Kisco, upon being released from the defense job which he undertook last March. At the Garden Mr. Tansey was immediately responsible for the production of the plants for indoor display.

Back from Mexican Trip

E. J. ALEXANDER has returned to the Garden after conducting extensive explorations in Mexico. During the first five months he was accompanied by Thomas MacDougall, who in the past has brought the Garden many living specimens of plants from his own Mexican expeditions. Principal collecting on the Garden's expedition was in the states of Oaxaca, Chiapas, and Guerrero.

In eastern Oaxaca, using the city of Tehuantepec as a center, they first collected on the dry plain, 25 miles wide, on the Pacific side of the isthmus. North of this plain and south of the town of Chivela they then investigated a nameless limestone mountain range. Later they made the first botanical exploration of Guiengola, a mountain ten miles northwest of Tehuantepec, collecting much new material from there during their five days' sojourn. Another five-day period was spent around the coastal fishing village of San Mateo del Mar, a region perhaps explored once about 100 years ago, but not known to have been visited since by any botanist. Along the Trans-Isthmus Railroad they collected in the Malatengo Gorge south of Mogoñé. From the Isthmus of Tehuantepec Mr. Alexander reports that their 422 numbers constitute the largest botanical collection ever made in the area.

Northeast of the city of Oaxaca they spent eight days on foot covering the 25-mile Sierra Juárez from end to end, making many collections, particularly from the pine-heath bald near the northern end of the range. The longest single trip of the expedition with Mr. MacDougall was on the Sierra Tres Cruces in the direction of Pochutla in the south.

In Chiapas, with A. J. Sharp, Mr. Alexander went into the valley of Las Casas, east of Cerro Hueitepec, and on this mountain itself climbed three of the five peaks, finding many species which he believes to be new. Here also was made the first collection from the wild of the new cactus genus *Lobeira,* which Mr. Alexander had named last year from a plant brought from the wild into a Mexican garden and collected there by Mr MacDougall.

Three lakes—Jusnajav, north of Comitán, and Montebello and Tepancuapan, both near the Guatemalan border—were also explored in Chiapas.

In July, accompanied by Charles L. Gilly, formerly with the New York Botanical Garden, and by Efraím Hernandez Xolocotzi, Mr. Alexander explored the southeastern part of the state of Mexico. In August, with Señor Hernandez, he covered north central Guerrero, collecting in the Cañon de la Mano Negra and the Cañon de los Sabinos on the way. East of Mexico City, they spent some time in Puebla and Tlaxcala, collecting in the neighborhood of the fossil volcano, Malinche.

The trip netted 2,400 numbers (the total quantity not yet determined) and 594 lots of seeds.

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Asterisks indicate illustrations. The letter "R" before a page number refers to the Annual Report; the letter "G" to the Garden Week Report, both of which were issued as separately paged sections of the Journal, the Annual Report in May and the Garden Week Report in August. Books reviewed are alphabetized by authors' names at the end of the index.

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BOOK REVIEWS

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

THE CORPORATION OF THE NEW YORK BOTANICAL GARDEN

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

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

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