MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XLIII

1955

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE: $2.50 A YEAR

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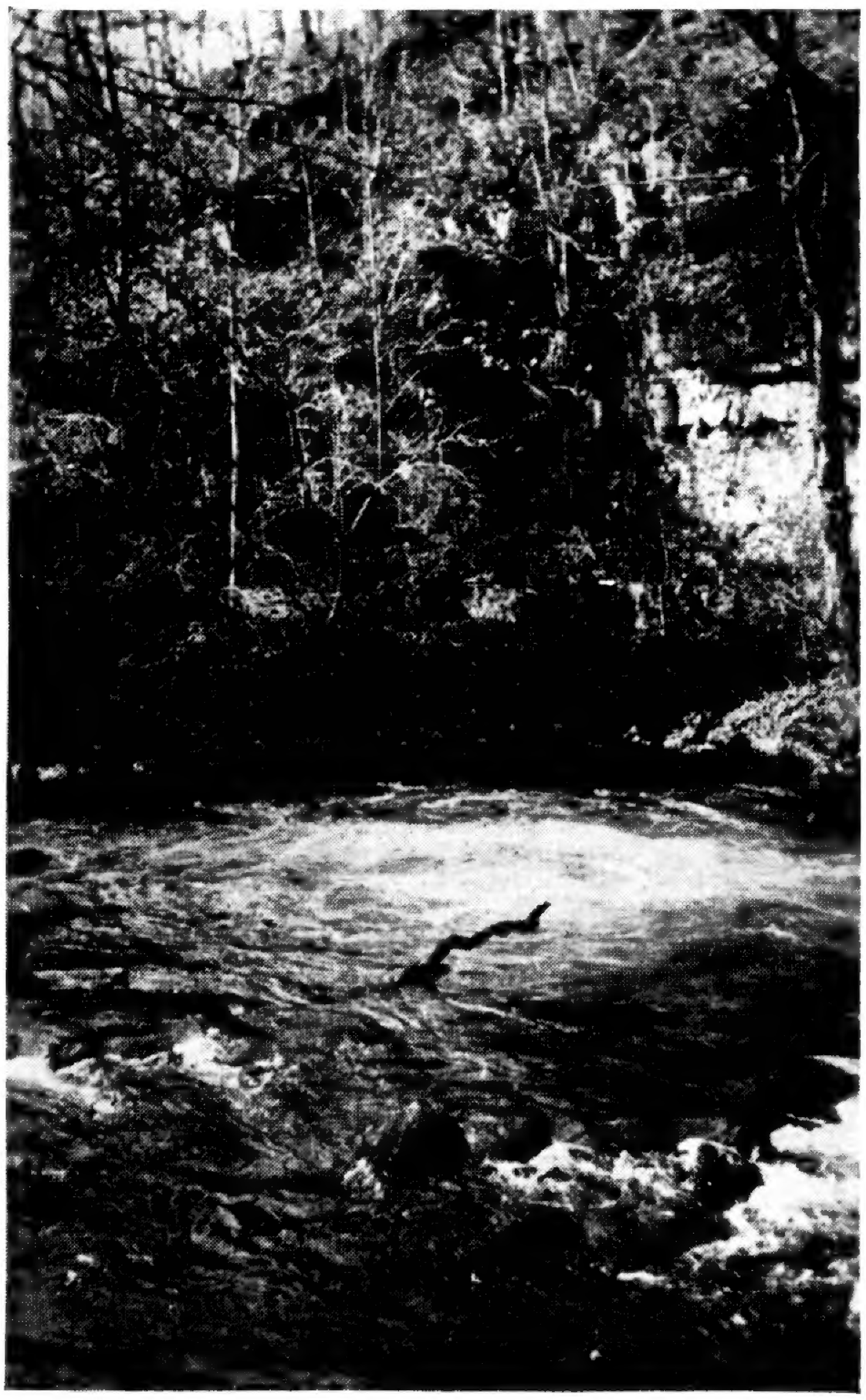

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COVER: Lower outlet Greer Spring. Photograph by Julian A. Steyermark.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

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Missouri Botanical Garden Bulletin

Vol. XLIII JANUARY, 1955 No. 1

A SERIES OF BULLETINS ABOUT THE OZARKS

To a biologist the outstanding thing about St. Louis is that it is the front door to the Ozark plateau. Geographically, this area begins in the edge of metropolitan St. Louis and extends southwesterly almost to the very corner of the state. Most of the plateau is within Missouri, though its southern edge reaches down into Arkansas where it joins onto the Boston Mountains.

In the last quarter-century St. Louisans have become increasingly interested in the Ozarks; the future of this area and the future of St. Louis are now seen to be intertwined and part of one general problem. The BULLETIN is therefore planning to devote from time to time a considerable portion of its pages to the past and future of the Ozarks. Articles by a number of different authors are scheduled, people of different backgrounds and with differing points of view. The opinions these writers express will be their own, uncensored in any way. They will certainly disagree about details, and some of them may even disagree about fundamentals. It will be a healthy thing if they do. Out of this clashing of opinion will come a wider scattering of facts about the Ozarks and a better understanding of the problems of that area.—EDGAR ANDERSON.

Fig. 1. A gravel bar at a bend of Jacks Fork.

THE OZARKS—THEIR PAST, PRESENT, AND FUTURE

JULIAN A. STEYERMARK[1]

Before a bank loans money, an investigation is made of the borrower's past and present background. Before prescribing curative treatments or performing operations, the physician or surgeon inquires into the patient's case history. Detailed study of the earth's strata and structure precedes the discovery of new oil flows and gold or other valuable mineral deposits. In the same manner, it would be foolish to speculate on what may happen to the Ozarks without first inquiring into their past history.

PREHISTORIC

The Ozarks have an earth history that takes us back millions of years. Looking at them now—a highly dissected forested plateau criss-crossed by innumerable streams, springs, v-shaped rugged ravines, high bluffs, and plenty of rocky openings—it is difficult to realize that they were once covered by sea water. Twice since that time (after the close of the Paleozoic era) the Ozark land surface has been worn down to a low, comparatively level plain with swamps and with slow-flowing streams meandering through a largely forested area. Such a prehistoric scene might best be exemplified today by the forested tracts in Big Oak State Park and in other sections of the southeastern Missouri Lowlands. Twice also (once at the close of the Cretaceous period about 100 million years ago, and again towards the close of the Tertiary period about one million years ago) this low-lying Ozark land was gradually raised upwards a few hundred feet to over a thousand feet to become "high and dry."

Such a change resulted in this region taking on a "new look." Instead of the sluggish streams, swamps, poor drainage, and land near or a few hundred feet above sea-level, there appeared clear, dashing, mountain streams, and well-drained land with newly exposed rock strata. The giant forces of weathering and erosion carved and chiselled the rocks and produced new irregularities on the contour of the land. The original low swampy area—covered mostly with a dense and luxurious forest of bald cypress, swamp cottonwood, swamp hickory, water elm, overcup oak, basket oak, cork oak, water locust, swamp red maple, swamp tupelo, and pumpkin ash, some of whose ancestors (generically) can be traced back in the fossil record to the Mesozoic era—gradually changed into one resembling the present Ozark landscape with its diversity of trees and shrubs.

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[1] Dr. Steyermark, of the Chicago Natural History Museum staff, is an authority not only on the Ozark flora but of the floras of Central America and Venezuela as well. He is a native St. Louisan who acquired his strong interest in our native flora as a boy in our city schools and went on to Washington University and to graduate work in the Henry Shaw School of Botany. We are proud to have him as a consulting member of our staff and to assist in a small way with his continuing studies of the flora of Missouri.

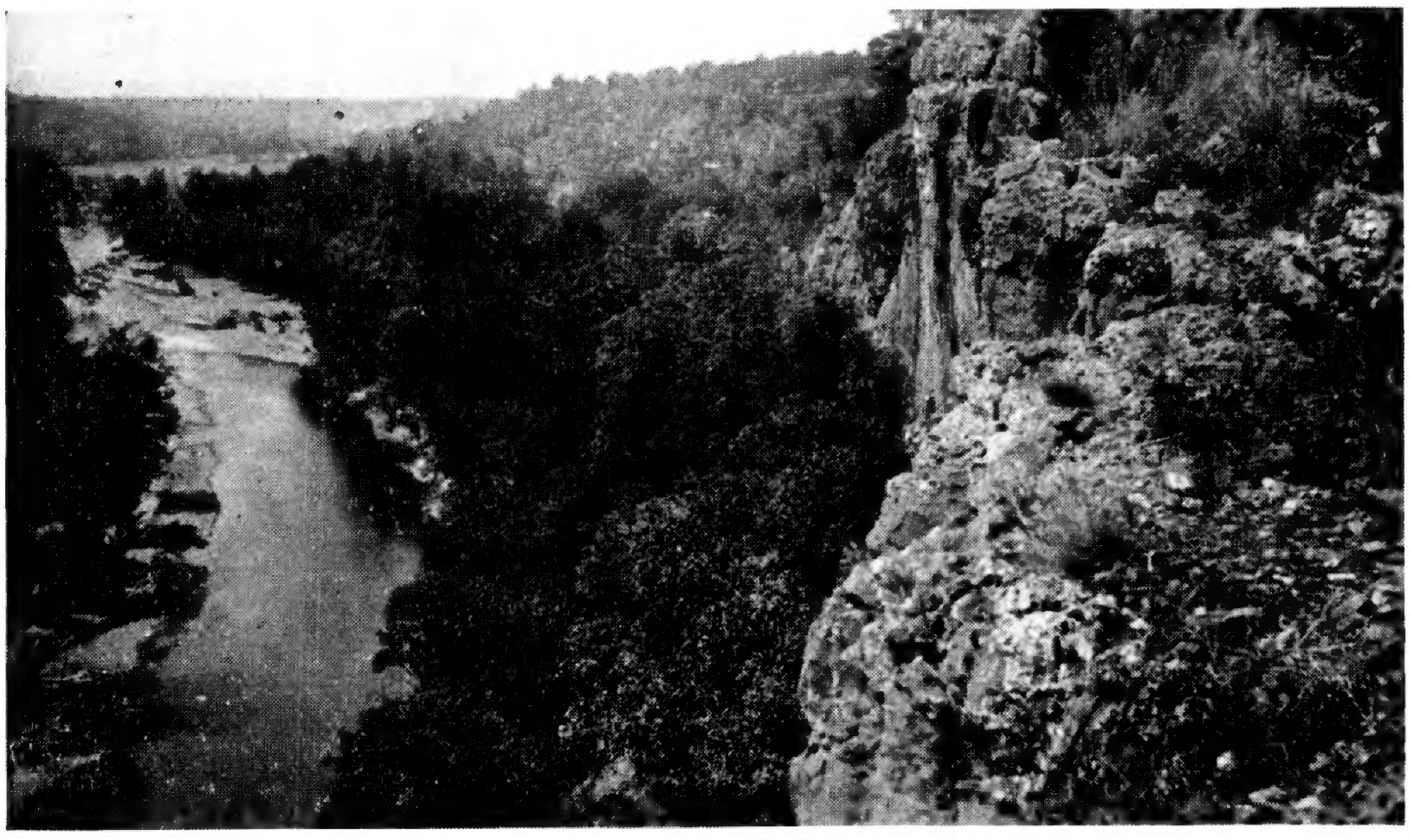


Fig. 2. Huzzah Creek.

The change-over to an upland of rocky drier soils and a dissected well-drained land surface obliterated from most of the Ozark area the dominant vegetation of the low-lying swamp forests, but some of it persisted. Cane *(Arundinaria gigantea)*, southern red oak *(Quercus falcata)*, possum haw *(Ilex decidua)*, carolina buckthorn *(Rhamnus caroliniana)*, supple-Jack *(Berchemia scandens)*, and fringe tree *(Chionanthus virginica)* held out or adapted themselves (over a period of thousands of years) on the higher, drier, and often rocky ground. Refugee plants of some of the swampy areas persisted in depressions of the upland in sink-hole ponds, the vegetation of which is mostly reminiscent of the Coastal Plain. Other survivors of the last uplift that were characteristic of this swampy forest followed the course of the White River and its tributaries in southwestern Missouri and along Eleven Points, Black, and Current rivers in southeastern Missouri.

Then gradually resulted a shifting to and occupation of various soils and habitats. Fresh rock exposures in the form of bluffs, "glades", and "barrens" became available to plant life over a long period of time. The surface soils of the upland, overlying largely a sandstone or chert or granite mantle, supported a much sparser and thinner forest cover than the ravines, valleys, and limestone slopes. Certain species of plants favored the exposed limestone strata, while others took to the more acidic sandstone, cherts, and igneous granites and trachytes. Various oaks and hickories eventually dominated the upland surface. Flowering dogwood and redbud became dominants in the forest understory. Chinquapin oak, blue ash, and sugar maple came to occupy the more limey soils, while southern yellow pine, red maple, and sour gum established themselves along ravine slopes, narrow ridges, and the tops

of bluffs where the soil was acid and where lime had been leached out. Ward's willow, Ozark witch-hazel, alder, and sycamore moved onto the gravel bars and edges of the smaller streams, while silver maple, green ash, river birch, cottonwood, and black willow occupied the deeper, richer, alluvial deposits of the valleys.

What a fascinating bit of evolution had been going on throughout this long period of transformation of the Ozarks! On the rocky upland limestone bluffs and glades developed such distinct species as Ozark cedar *(Juniperus Ashei)*, Trelease's larkspur *(Delphinium Treleasei)*, lead plant *(Amorpha brachycarpa)*, false gromwell *(Onosmodium subsetosum)*, penstemon *(Penstemon Cobaea* var. *purpureus)*, Bush's skullcap *(Scutellaria Bushii)*, and corn salad *(Valerianella ozarkana* and *V. Bushii)*. In the Ozark woodlands of thousands of years ago evolved three distinct kinds of spiderworts *(Tradescantia ozarkana, T. Ernestiana,* and *T. longipes)*, Ozark trillium *(Trillium ozarkanum)*, Ozark chestnut *(Castanea ozarkensis)*, various hawthorns *(Crataegus padifolia, C. Lettermani, C. sicca, C. noelensis, C. dispessa, C. latebrosa,* and *C. nuda)*, a variety of poppy mallow *(Callirhoe involucrata* var. *Bushii)*, yellow foxglove *(Gerardia calycosa)*, bedstraw *(Galium arkansanum)*, and an aster *(Aster anomalus)*. Along the gravel bars and valleys of the Ozarks evolved Ozark witch-hazel *(Hamamelis vernalis)*, amsonia *(Amsonia illustris)*, and ironweed *(Veronia crinita)*. Two distinct species of alum-roots *(Heuchera missouriensis* in Missouri, and *H. arkansana* in Arkansas) developed around crevices of limestone bluffs, while on isolated sandy outcrops emerged *Geocarpon minimum*, a tiny annual found nowhere else in the world, and along wet open ground in southwestern Missouri evolved a certain kind of meadowbeauty *(Rhexia interior)*.

Each of the above species is known to occur in a wild state only in the Ozarks of Missouri or adjacent areas of Missouri and Arkansas. These plants originated in the Ozarks sometime in the dim past during the long history of this region. Botanists call such plants, limited in their geographic distribution to a small circumscribed area, "endemics". The splitting off of the ancestral witch-hazel and chestnut stocks to produce respectively *Hamamelis vernalis* and *Castanea ozarkensis* must have occurred before the last Tertiary uplift of the Ozarks nearly one million years ago, because after this time intervening areas isolated or separated the Ozarks from those regions where the ancestral stock was present. Today the Ozark chestnut is separated by thousands of miles from the nearest stations in the east where its closest relative, the eastern chestnut *(Castanea dentata)* grows. The two regions have been separated from each other before the last uplift, so it can be imagined how long a time has intervened. Forests in which ancestral chestnut trees were existing must have occurred in the Ozarks and elsewhere millions

of years ago. What now remains of the split up into two distinct species (*Castanea ozarkensis* of the Ozarks and *Castanea dentata* of the eastern states) is what has survived this breaking up of the ancestral chestnut strain.

Clinging to north-facing, shaded, moist bluffs along Ozark streams or hiding in sheltered, forested canyons and ravines are numerous kinds of plants which represent relicts or survivors from the Ice Age. During this time of generally reduced temperatures many species of plants migrated southward into the Ozarks and elsewhere and survived in situations favorable to their existence. As the ice sheet melted and withdrew northward, the general climate southward became warmer and many of these species died. Some, however, managed to survive the more adverse warmer and drier situations, and today we find them hanging on in these sheltered spots of moist bluffs and deep shaded ravines, even though surrounded by the otherwise generally drier environment. At the same time, during the Ice Age, many other eastern and northern species migrated into the Ozark valleys and into the forests. Some of them which moved into wet meadows of limey soil kept moist by spring seepage are found nowhere else in Missouri. Similarly, at some time in its long earth history, and prior or subsequent to its last uplift, the Ozarks have been receiving species from the Southwest (such as *Stenosiphon linifolius*, *Andrachne phyllanthoides*, *Pallafoxia callosa*), from the southern Appalachians (*Berberis canadensis*, *Trautvetteria caroliniensis*), and from the southern states and elsewhere.

It is obvious, then, when considering the Ozark region, an appreciation must first be had of the long and diverse geological history together with the many changes that have taken place. After the last uplift and subsequent change to a dissected, well-drained, drier land, the dominant swamp forests gave way to other forest types, including an oak-hickory forest which prevailed over much of the Ozark area. Rocky exposed surfaces and prairie patches were widespread, but in the long period of time have changed their locations, and probably were more extensive in some localities (especially when the rock strata became exposed to erosion following uplift).

It would require a much longer paper to discuss the many lines of evidence that indicate the ancient and continued forested condition of the Ozarks. That forests have long dominated and been associated with the region may be adduced from such evidence as: (1) the survival of some of the original swamp forest species in a drier upland habitat indicating a pre-existing ancestral lowland forest; (2) the natural geographical range of various trees—southern yellow pine, sour gum, scarlet oak, to mention a few—restricted in Missouri to the Ozark region, indicating that their northern limits have been determined primarily by the southern advance of one of the ice sheets during the Ice Age and secondarily by soil acidity; (3) the

segregation of chestnut and witch-hazel stocks into separate eastern and western species indicating a long period of evolution and separation into Ozarkian and eastern forests; (4) the occurrence of yellowwood and American smoke tree, species of disrupted geographical range, on the old land surfaces of the Ozarks, the southern Appalachians, and elsewhere in areas that escaped glaciation of the Ice Age and submergence by Tertiary seawater, are evidence of trees whose fossil ancestry (generically) can be traced back to the Age of Dinosaurs (Mesozoic time). They and other ancient types are surviving mainly in the White River country of southwestern Missouri, but probably were much more widespread in the Ozarks many thousands of years ago; (5) the adjustment of trees and shrubs to various types of environment (exposure, soil acidity) has required thousands of years; (6) the original limited distribution within the Ozarks of a number of endemic species associated with strictly forested conditions.

RECENT HISTORY AND THE PRESENT

Let us picture the Ozarks as, from the beginning, mainly a naturally forested area of remarkable diversity, with certain tree types confined to valleys, others to acid or alkaline soils, others to glades, ravines, or uplands. Over the thousands of years such mainly forest-inhabiting birds, as turkeys, and mammals, such as bears, prospered in the dense Ozark forests. That other game was abundant is testified by records of early settlers. Streams were clear, because there was neither pollution from sewage or industrial waste nor run-off from soil exposed by excessive grazing, cultivation, or logging. The soil was mainly protected by a dense forest cover. The relatively small Indian population did not make any great demands on the forests and land. The result was a definite balance of Nature, Nature and man at that time living more or less in harmony.

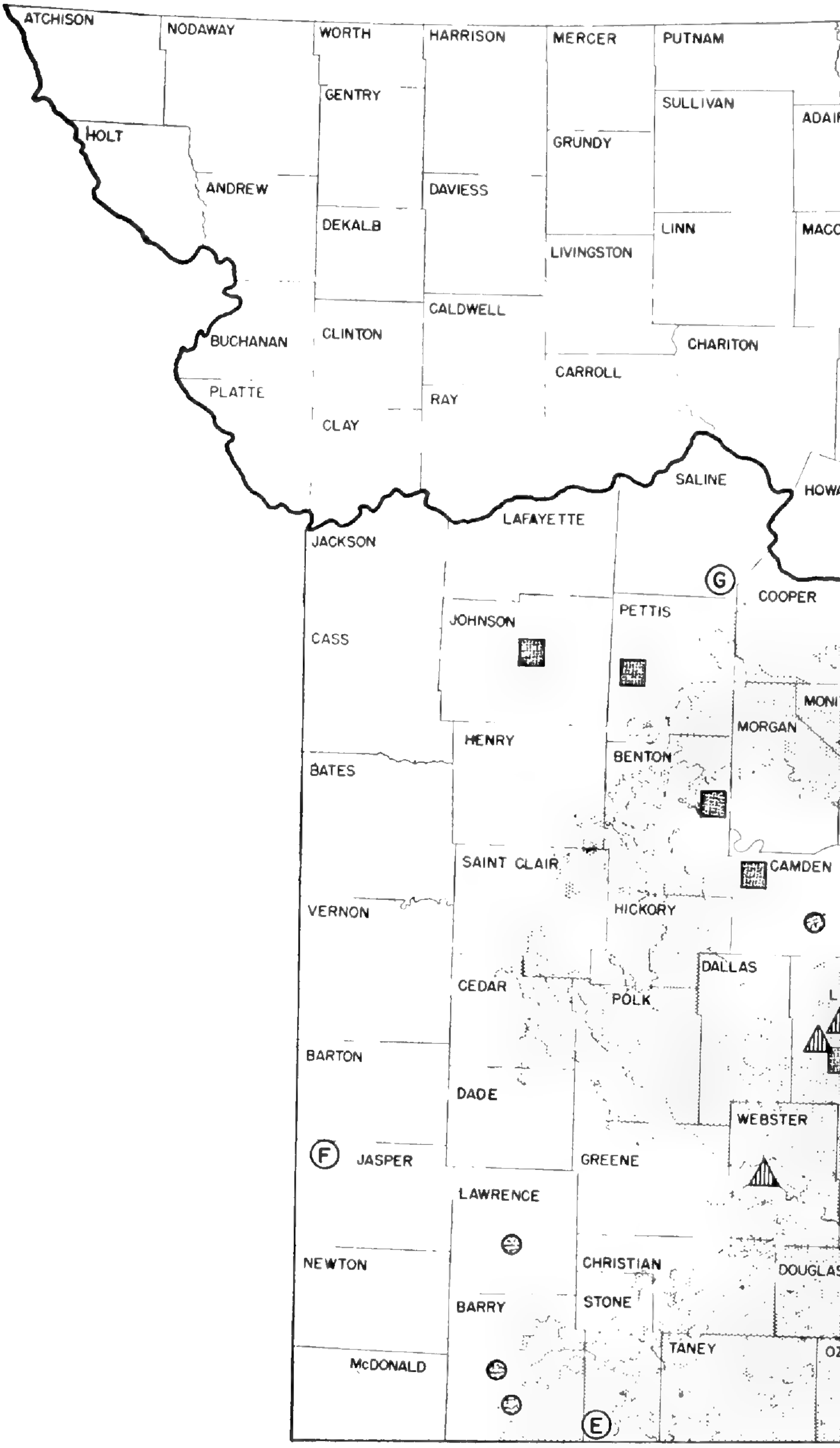
While Ozark forests have been cut since the time of the early white settlers, no appreciable change is perceptible in the type or amount of forest and forest cover since the first known records of Ozark vegetation. This can be verified by a study of the field notes of the original land surveys of Missouri deposited in the Land Vault of the office of the Secretary of State in the State Capitol at Jefferson City, Missouri. These land surveys, made approximately 100–130 years ago, indicate that what at that time was good forest with a certain kind of underbrush is today (except where spoiled by civilization activities) likewise a good forest with the same type of underbrush. Places within and outside of the Ozarks which are prairie today (glades and barrens are included in the prairie category of the surveys) were also prairie in the early part of the nineteenth century.

What has happened during 100–130 years is easily told. The gradual increase in population has brought a conflict between man in the Ozarks and

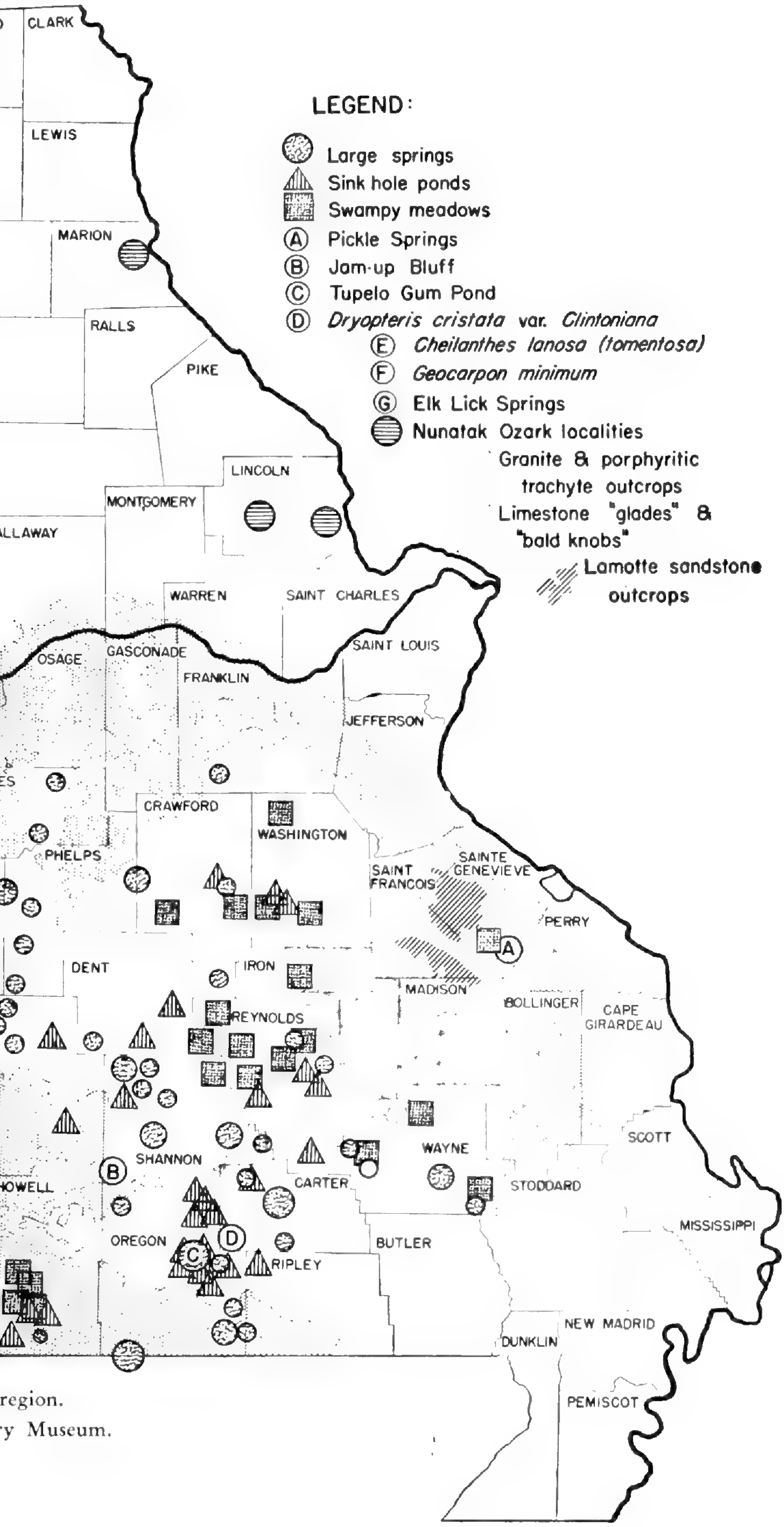
Nature. In his haste to get "rich quick" or make a living off the land, man has often stolen from the natural resources, with the attendant disregard for the laws of Nature. Demand for pulpwood and lumber has increased over the years; more forests each year are being cut indiscriminately; residential and industrial sites are clearing areas once forested; agricultural development is occupying more land; pasturing and grazing of woodlands is on an increase; dams are impounding and destroying large sectors of the Ozarks; and, in general, the American people are losing more and more of their original Ozark heritage. The balance of Nature has gradually been upset and only within the past couple of decades has Ozark man seriously pondered on how he can once more live with and manage Nature.

The establishment of Missouri National Forests under the direction of the National Forest Service and the Missouri Conservation Commission has helped to solve the critical problems posed by man living in the Ozarks. In the meantime, overgrazing and annual burning have continued to strip off the ground cover and the original humus in many sections of the Ozarks. Erosion has set in, carrying away the thin soil and leaf litter and leaving bare rocks exposed. When timber is cut away from headwaters of streams or fire allowed to run rampant over such areas, the absorbent spongy leaf mulch is removed and eventually springs fail to run and streams dry up. The fires, excessive cutting, and overgrazing either kill or drive away the original animal life of the area. Many farmers still burn the woods with the mistaken notion that by so doing they are ridding the brush of chiggers, ticks, snakes, and other vermin, or making grass come back for grazing.

It is obvious that the lack of appreciation for an adequate forest cover, fire protection, good grazing practices, limited cutting, and for reforestation is a failure to maintain a balance with Nature. Man's selfish exploits of Ozark resources with little or no consideration for wildlife, forest cover, and habitat are doing much to worsen the general situation. Only during these recent tragic years of drouth, when streams and wells begin to run dry, cattle and poultry die, crops go to ruin and the livelihood of citizens becomes affected—only then is a beginning of concern shown for the future. During a survey of drought-stricken counties in the Ozarks during 1952 and 1953, the field men (biologists, foresters, and conservation agents) of the Missouri Conservation Commission studied the effects of the drought from various angles and points of view. In general, it was found that wherever good habitat conditions prevailed (i.e. good food, water, and cover), the game population of that area was also good. It was also found that there had been entirely too much grazing for the carrying capacity of the land. The land could not "take it". The overgrazing was as much responsible for poor wildlife habitat as was the drought. Especially was this true of woodlands



Map of Missouri, showing areas of botanical intere
Drawn by Douglas E. Tibbitts, Staff Artist, Chicag



region.

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Fig. 3. The uplifting of the Ozark Plateau has resulted in steep bluffs along all the major streams. This view along Jacks Fork is typical of thousands of scenes in the central Ozarks. Red cedars, blue ash, and chinquapin oak veil the margins of the bluff. Ferns, columbines and other rock-loving plants are here and there in shaded niches. The old weathered limestone is of the sort appreciated for centuries by Chinese artists, and seen from the river in the springtime the bluff reminds one strongly of a Chinese screen painting.

in which grazing and clearing reduced the protective ground cover, thus exposing the land surface to increased evaporation by wind, and an eventual damaging of ground vegetation.

FUTURE

The last two drought spells (1934–1936 and 1952–54) are beginning to sound an alarm and show the ever-increasing importance of water. Since conservation of water is the great problem in times of drought in the Ozarks and elsewhere, it behooves us to realize the most effective means of living under conditions of reduced rainfall. Ozark inhabitants are apt to believe that drought is an unusual phenomenon and are wondering how best to live with the situation. Actually, however, it is likely that in the long period of Ozark history as a land surface, there have been many such dry spells. There have been prolonged periods of drought, such as is believed to have occurred in the Midwest, a few thousand years ago during the so-called "xerothermic period". During such a time the Ozarks may well have become drier and certain species of trees and shrubs may have replaced others less adaptable to the dry weather. Rocky glades may have been common at that time in areas where they are now absent. Nevertheless, notwithstanding the fluctuation of rainfall throughout the past thousands of years, the Ozarks and their forest have come through, surviving in large measure the periodic drought spells.

Perhaps the Ozarks are in for another period of reduced rainfall and for warmer average temperatures. If so, a dweller in the Ozarks, whether he be agriculturist, industrialist, tourist, or what not, will have to adjust himself to the changing situation, or, shall we say a situation that has been repeated many times in Ozark history. The great increase of population has placed a stress and strain on the water, soil, and forest resources of the Ozarks, and during periods of drought, such as the present, the stress is more noticeable. It is apparent that the Ozarks during drought years cannot support continued increased grazing.

By interfering with Nature as little as possible and having consideration for her laws would seem to be our best solution for getting along in and with the Ozarks. The following list of don'ts appears to be in order: (1) don't cut timber, allow grazing, or allow fires to spread around headwaters of streams; (2) don't overgraze anywhere; (3) don't permit fires and grazing to rob the natural absorbent leaf mulch and cover from the soil, thereby permitting erosion to set in and carry away the top soil.

A noted forester with over twenty years of experience in the Ozarks recently noticed that the flow of a stream in a certain wooded section of the Ozark National Forest remained normal during the past years of drought. He explained this and similar situations within parts of the Ozark National

Forest on the basis of sound forestry conservation practice of: (1) retaining a dense leaf mulch over the soil; (2) preserving the undergrowth in its natural state; and (3) preserving the timber in its natural state around the headwaters of the streams. Surely, such elementary principles must be adhered to if we are to conserve our water. A good forested condition with abundant cover for game and all kinds of animals will insure an Ozarks that will continue to harbour abundant wildlife. Keeping the waters free from sewage pollution and industrial waste will improve fishing conditions.

All evidence indicates that the Ozarks are a natural forested area. The extensive forest cover, left relatively undisturbed, insures continued leaf mulch over the soil. The spongy humus absorbs the water which passes into the ground and keeps the streams and springs running. We must learn to live with these forests. To help conserve the water supply, keep out the fires, limit the grazing and cutting, reduce the extensive clearing of forested areas, restore the original tree and shrub cover from areas where it has been removed. Failure to heed such rules will certainly bring disaster a day closer. We must keep the Ozarks a natural playground of clear streams hemmed in by forests, where burning, grazing, and cutting have been kept to a minimum. If agricultural and industrial developments are to continue within the Ozarks, they must be in harmony with the spirit of sound conservation of soil, water, forests, and wildlife.

Fig. 4. "Shut-ins" where the St. Francis River has cut through granite near Old Silver Mine, Iron County.

BOOK REVIEWS:—

The Trees and Shrubs of the Southwestern Deserts. By Lyman Benson and Robert A. Darrow. 447 pp., 84 figs., 34 pls. Tucson and Albuquerque, 1954. $8.50.

It is a pleasure to note that this beautiful book is again in print. Technically a second edition, it differs from the original only in an additional sentence here and there and a few additional plates. In print less than three years after its appearance as a bulletin of the University of Arizona in 1944, it is now republished in somewhat more elegant format (and at a much higher price!) jointly by the University of Arizona and the University of New Mexico. This twin sponsorship more nearly indicates the location of the desert areas treated, although on this score both California and Nevada might equally well have lent support.

It is no wonder that the second edition differs so little from the first, for it is hard to imagine how this book could be improved. It treats of all the woody plants of the southwestern deserts, with keys, descriptions, illustrations, distributional data and maps, and, in many instances, notes relating to the history of the plant, its use by the aboriginal Indians, its economic or medicinal uses, its horticultural possibilities, etc. There is an excellent introduction on the vegetation of the deserts together with notes on adjacent vegetational zones; in giving the distribution of each species the types described in this introduction are consistently used to make precise statements of where the plants are to be found. There are distribution maps for scores of species. These are conveniently uniform in size and coverage so that comparison between species is easy. However, despite their relatively large size, a third of a page, they are less clear than one might wish; the cross-hatched detail in them is very dark while the green overprint showing distribution is so light as sometimes not to be easily seen.

There are many fine photographs, both in black and white and in color, and many excellent line drawings. For those who are novices in plant identification there is a well-illustrated and clearly written introduction to this fascinating art.

No one who cares even a little for the vegetation about him will want to be without this volume when he travels through our Southwest, or for that matter, through Mexico; the international boundary does not delimit biological areas.—George B. Van Schaack

Manual of the Plants of Colorado. By H. D. Harrington. 676 pp., 1 pl. Sage Books, Denver, Colo., 1954. $8.00.

Every one interested in the flora of Colorado will want to have a copy of this book, for it is the only recent complete guide to the plants of that fascinating state. Its nearly 700 pages are almost all devoted to keys and descriptions in a courageous attempt to fulfill its "primary purpose . . . to provide a means of identifying the plants of Colorado". In so far as such devices can accomplish such a purpose the book is adequate; the dichotomous keys, conveniently indented, are moderately detailed with clearly stated characters, and the descriptions are reasonably complete. A meritorious feature, almost an innovation, is the strict parallelism in the descriptions of species within a genus; if the presence or absence of a character is noted for one species it is noted for all. No attempt is made to present a revisionary treatment of any group, and the author has commendably not included a single new species (undoubtedly a record!). In many of the groups the latest monographic treatment has been followed but without trying to equalize the meanings of the terms "subspecies" and "variety" between various writers; one must check the application of these concepts in the original monographs.

Such additional information as there is the author gives, as he says, with the thought that it may be helpful to this one or to that one. The only quarrel one can have with this aim must regard the actual helpfulness of the information. The citations of original publication of names have admittedly not been checked; it is certainly unfortunate to print nomenclatural mistakes in yet one more place. The general distribution of each species is given on the basis of various published accounts; the distribution in Colorado is stated in terms of specimens checked by the author or by specialists who assisted him. But so many of these statements are far from helpful. The author has arbitrarily divided the state into nine rectangles of equal area, labelling them "northwestern", "northcentral", "northeastern", etc. It is scarcely of much help to be told that the new and only collection of *Alisma geyeri* in Colorado is in the northwestern corner at about 6000 feet. A great deal of this area, which covers one ninth of the state, is at about that elevation. The state has counties and towns. It is doubtful that the continuance of *Alisma geyeri* in Colorado would have been seriously threatened by stating its known locality to within, say, ten miles of some town and to within one or two points of the compass.

David F. Costello, range conservationist, has supplied an account of several pages on the vegetation zones of the state. This is well done, and if carefully read in connection with a knowledge of the geography of the state and the identity of the plants, it gives a very excellent picture of the plant

cover. It is a pity that Mr. Harrington did not work more closely with Mr. Costello and integrate his distributional data with the clear descriptions given by the latter. For example, greasewood is stated to grow on "usually flat ground" "over the western part of Colorado". Greasewood is far more uncommon than flat [level?] ground in western Colorado. Much more important is it that the area be semi-desert. With the understanding that Mr. Costello's classification would be used, it would have been much more enlightening to state: "semi-desert areas, chiefly in the 'greasewood' association". (The redundancy is only apparent.) Also, it is not clear whether the habitats given for a species refer to its whole distribution or only to that in the state; to cite *Alisma geyeri* again, "wet places" can scarcely refer to a single collection.

But one must not be too critical, for this book is a labor of love. The flora is large and complex. The 2794 species listed grow from below 3400 feet to above 14,000 feet. The author has had assistance, it is true, but this is his work and it is a monument to ten years' striving. What a shame that after all his devoted labor he had to see his work appear in so inconvenient a format, pages of typewriter-sheet size with the text typed! The book is thus unhandy to use, impossible for the field, and wearing on the eyes. Nor is there a single figure or map to be found in the volume, aside from an outline map of the state. Mr. Harrington's book was "prepared with the cooperation of Colorado A. & M. College", a government institution, but the government as represented there apparently showed no interest in the format of so important a publication.—George B. Van Schaack

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The Pruning Manual. By Everett P. Christopher. 340 pp., 12 pls., 53 figs. The Macmillan Co., New York, 1954. Price $5.00.

Dr. Christopher, head of the Horticultural Department in the University of Rhode Island, has written this book as a successor to the late Liberty Hyde Bailey's book of the same name. In addition to general fundamentals, there are chapters on apple, grape, and rose pruning, a special one on dwarf trees as well as discussions of the special problems of deciduous fruits, subtropical fruits, and nut trees. Shade and ornamental trees, as well as ornamental shrubs and vines, are separately dealt with. There is a short and charming preface by Bailey, one of the last things he wrote. The book is clearly and simply written and should serve the needs of amateur and professional gardeners.—Edgar Anderson.

THE ANNALS OF THE MISSOURI BOTANICAL GARDEN

In addition to this BULLETIN the Garden also publishes the ANNALS OF THE MISSOURI BOTANICAL GARDEN, a conservative scientific journal in dark brown covers which comes out four times a year. In doing so it carries out certain of the provisions in Mr. Shaw's will which provided for "scientific investigations in Botany" and for the dissemination of such knowledge among men. The final number for 1954 recently appeared; its seventy-five pages are given over to papers by two of Dr. Andrews' students, Charles J. Felix and Burton R. Anderson, who received their doctorates last spring in the Henry Shaw School of Botany of Washington University. Though the titles look forbidding with their mentions of "Arborescent Lycopod Fructifications" and "American Petrified Calamites" they summarize a fascinating field of science in which the School of Botany has taken the lead in this country, the modern study of coal balls.

Coal balls are nodules of fossil remains, frequently as large as a man's head, which are found in great numbers in certain types of coal. By ingenious techniques, paper-thin slices can be prepared and studied in detail under the microscope. Thousands of such sections have been accumulated in Dr. Andrews' laboratory, and they are as fascinating as they are baffling; fascinating, because most of the microscopic details of leaves, stems, roots, and seeds are so beautifully preserved that it is difficult to imagine that they are indeed millions of years old; baffling, because they are made up of incoherent litter. Each ball is composed of thousands of fragments, big and little all jumbled together like a scientific fruit cake. The sections just cut down through everything, stem, roots, leaves, seeds, spores; most of them fragmentary, all of them packed together hit or miss. One gets to know the leaves as well or better than he knows the leaves of modern trees and to understand in the greatest detail the construction of certain types of stems. But which stems go with which twigs and which leaves go with which stems, and can any of the spores or seeds be certainly identified as belonging with any of the stem or leaf types? It is like trying to reconstruct the life of a city from its pulverized bombed fragments. Dr. Felix's paper deals with coal-age plants related to our ground pines, and among other things he makes a beginning at identifying the various kinds of spores. Dr. Anderson's paper is concerned with the calamites, close relatives of our modern horsetails and scouring rushes.

Dr. Felix is now with the Federal Bureau of Mines where such information and such techniques as those he acquired here are of great practical as well as theoretical importance, while Dr. Anderson has gone on to serve his term with the U. S. army.

THE MISSOURI BOTANICAL GARDEN

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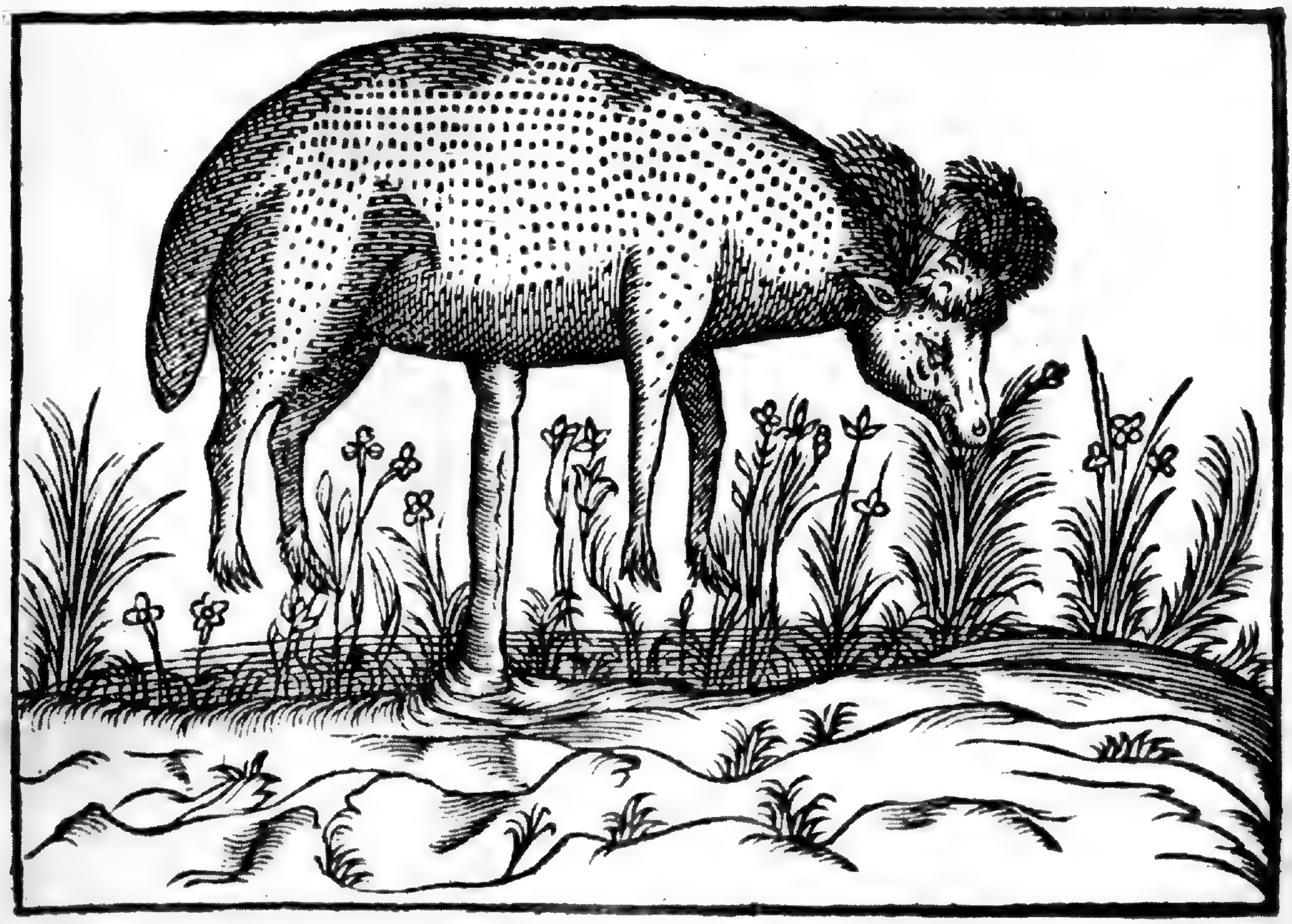


Volume XLIII February, 1955 Number 2

COVER: "Of all the strange and marvellous trees, shrubs, plants and herbs which Nature, or, rather, God himself, has produced, or ever will produce in this Universe, there will never be seen anything so worthy of admiration and contemplation as these Barametz of Scythie or Tartarie, plants which are also animals, and which browze and eat as quadrupeds" . . . . This passage and the cover illustration are from *Histoire Admirable des Plantes*, by Claude Duret written in 1605—a charming little volume on curious plants in the Garden's collection of Herbals.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

Vol. XLIII FEBRUARY, 1955 No. 2

TREES AND SHRUBS FOR ST. LOUIS

JOSEPH P. HOULIHAN[1]

The past few summers have certainly taught all of us the lesson that plants must have better care than our home-owners have been giving them. With this in mind, a group of us decided to do something to remedy this situation by instituting a program of training our public in what to plant, how to plant, and how to take care of the plants after installation. Surely, if one is contemplating planting something it means he is going to have an outlay of money, and he wants the best of that particular kind of plant or plants for his money; so let us start with the purchase of the plant.

What is one going to look for, in order that he or she may get the best of any prescribed plant or plants for the purchase? One has two types of purchases, bare-rooted or balled plants. Let us consider the bare-root plants first. Ask to have the plants freshly dug. This is true for both bare-root and balled plants. Examine the roots; see that they have not been cut off too short or that there is sufficient root in proportion to the size of the plant. Ask that they be kept from over-exposure to both hot or cold winds. Wind helps to set the sap in the roots, on account of which plants frequently do not leaf out until late summer. If the plant is balled and burlapped, the size of the ball should be one foot in diameter to each inch of the trunk in width. As an illustration, a 2½ inch tree should have a 30-inch ball of earth.

Next, look at the conformation of the plant. Is the trunk straight or

[1] Mr. Houlihan, the veteran St. Louis nurseryman, gave the opening lecture for the training course for horticultural consultants described elsewhere in this issue of the BULLETIN. His lecture was so informative and so direct, so much of it was the result of Mr. Houlihan's extensive experience in the St. Louis area, that every one present wanted a copy. With Mr. Houlihan's permission we are accordingly sharing it with the readers of the BULLETIN, printing it virtually in the form of the original lecture.

crooked enough to suit your particular needs? Sometimes a crooked trunk on a tree may be far more desirable than a straight trunk for your location. Are the limbs low enough, or high enough, or full enough or wind-blown enough to suit the particular location? All these characteristics are entirely up to the purchaser, just as if he were buying a suit of clothes. He should be the final judge of what he wants; in the case of a plant having been over-exposed to wind, the purchaser is entirely at the mercy of the seller, but why buy from some one when you have no confidence in his honesty?

Now for the planting. The hole should be dug 6 inches wider than the root spread, all the way around, and the depth should be from 12 to 18 inches deeper than the plant had been growing. This extra space is to allow for drainage. I would suggest filling this 1 or 1½ feet with 1½-inch broken rock or large gravel. To prevent the soil from entering into the drainage area and filling the interstices, I would suggest that you place one-half inch packed-down straw over this rock or gravel. The plant should be set about one inch deeper than it grew in the nursery. If the plant is burlapped, the burlap need not be removed entirely, but it should be cut at the top, particularly if it is tied around the neck of the plant. Any thing tied around the neck of the plant has a tendency to choke off the sap flow, and sometimes could kill the plant. The burlap will eventually rot, but usually the roots will have gone through the material long before that happens. Some one may feel that this straw and burlap would have a tendency to encourage fungi, but I doubt if any fungus that may develop would be injurious to the plant. Broken roots should be pruned in order to allow new rootlets to grow from the cut ends. Mix the soil with well-rotted manure or commercial fertilizer, but be careful in using commercial fertilizer that you do not use too much, as there is a grave chance of burning. You will get no burning from the rotted manure.

It is my belief that mixing fertilizer with the soil dug from the hole where the plant is to be planted is better than using all new soil. All new soil has a tendency to sour. However, this point may be debatable. After the hole is completely filled with loose soil around the plant roots, fill the hole with water. After all the water has been absorbed add the balance of the soil, allowing about two inches for settling. Then create a saucer-like basin around the plant for future watering. Mulch the plant with from two to four inches of manure, which will keep the roots cool during the summer and also prevent the sun from pulling the moisture from the soil. The plant should be cultivated about three times during the summer and not deeper than three inches. Before cultivating, remove the mulch, then replace it afterwards. I would suggest that on the last cultivation you spade the manure into the soil, but do not spade deeper than three inches. When

watering, water from the top, allowing moisture to penetrate slowly into the soil. Do not remove the mulch. If the soil is too rough, mix some sand into it at the time you mix the manure with the soil.

Now the big question comes as to what shall we plant. First I would say that the plants you select should be things that do well in our climate. Planting many exotic things is taking too many chances; however, I do think you should try some of the things that are just a little harder to grow, yet require so little extra attention. The number of exotic plants used would, of course, depend upon the size of your garden and the number of plants used. I am going to submit my list which is not entirely complete. I think it would be impossible for one man to make a perfect list, yet most of the things on this list have proven very satisfactory in our locality. You will note that you may select from this list plants that will do more than just one thing. I might further say that a plant, to be worthy to be put into your garden, should do two of the following six things: (1) It should have beautiful blossoms; (2) It should have lovely fall coloring; (3) It should bear colorful fruit in the fall; (4) It should have good foliage; (5) It should cast nice shadows; (6) It should hedge well. Be sure you do not lose sight of the fact that we are dealing only with deciduous materials. There will be other papers which will give conifers and broad-leaf evergreens.

* * * * *

Now for the list. Let us take the shade and ornamental trees first:

SHADE AND ORNAMENTAL TREES

Botanical Name	Common Name	Height in feet	Remarks
Acer ginnala	Amur Maple	20	12-foot spread. Good foliage and colors well in the fall.
Acer palmatum atropurpureum	Japanese Red-leaf Maple		Lovely red foliage; casts nice shadows
Acer rubrum	Red Maple	60	Good foliage. Red flowers in early spring; red foliage in fall.
Acer saccharinum	Silver Maple	75	Fast grower. Good foliage. Surface feeder.
Acer saccharum	Sugar Maple	60	Good dense foliage, colors beautifully in fall. Slow-growing; should be planted when very small

Botanical Name	Common Name	Height in feet	Remarks
Amelanchier canadensis	Shadbush	30	Native. Good bloom; good foliage; blue fruits in summer.
Betula alba	European White Birch	30	Short-lived. Casts lovely shadows. Beautiful bark.
Carpinus betulus	European Hornbeam	60	Good foliage. Hedges well.
Cercis canadensis	American Redbud	30	Casts nice shadows. Beautiful flowers in early spring.
Chionanthus virginica	White Fringe Tree	30	Beautiful flowers; good foliage.
Cornus florida	White Dogwood	30	Native. Beautiful flowers; lovely red fruit; colorful foliage.
Cornus florida f. *rubra*	Pink Dogwood	30	Not native. Pink flowers.
Crataegus phaenopyrum (cordata)	Washington Thorn	30	Perhaps the best of the Hawthorns, of which there are probably 50 varieties. White flowers; brilliant red fruit.
Crataegus oxyacantha var. *Pauli*	Paul's Scarlet Thorn	15	Red flowers. Trunk should be protected the first few years against sun scald.
Euonymus atropurpureus	Wahoo Tree	15	Dwarf. Good foliage; beautiful berries.
Fagus sylvatica Note: many of the other beeches are worth growing, but one should give them a lot of attention	European Beech	60	Good foliage; wide-spreading graceful branches.
Fraxinus pennsylvanica var. *lanceolata*	Green Ash	50	Good foliage which colors well in fall.
Ginkgo biloba	Chinese Maidenhair Tree	60	Beautiful foliage; graceful branches.
Gleditsia triacanthos var. *inermis*	Thornless Honey Locust		Good foliage; graceful branches.
Halesia carolina	Silverbell Tree	20	White flowers; good foliage; interesting bark.
Ilex decidua	Deciduous Holly or Possum Haw	30	Casts nice shadows. Good foliage; beautiful berries.
Juglans nigra	Black Walnut	75	Casts nice shadows. Long-lived.
Koelreuteria paniculata	Varnish Tree	25	Casts nice shadows. Beautiful long-panicled yellow flowers.
Liquidambar styraciflua	American Sweet Gum	50	Beautiful foliage which turns a lovely color in fall.
Liriodendron tulipifera	Tulip Poplar	70	Plant when small. Beautiful foliage; interesting bark. Plant when small.

Botanical Name	Common Name	Height in feet	Remarks
Magnolia virginiana	Sweet Bay	25	Good foliage; beautiful flowers.
Magnolia grandiflora	Southern Magnolia	30	Many doing well here. Beautiful flowers and foliage.
Magnolia soulangeana and varieties	Saucer Magnolia	20	Good foliage. Red, pink, or purple flowers.
Malus—Varieties recommended: *M. arnoldiana, atrosanguinea,* "Dolga", *floribunda,* "Hopa Crab", *ringo, scheideckeri, zumi calocarpa*	Flowering Crabapples	25	Good foliage; beautiful flowers and lovely berries. About 50 varieties.
Nyssa sylvatica	Black Gum or Tupelo	30	Beautiful tree with brilliant fall coloring. Plant when small.
Oxydendrum arboreum	Sourwood	30	Beautiful flowers and brilliant fall coloring.
Prunus americana and other American and Japanese species. The hybrids, *P. cistena* and "Newport" are probably the best purple-leaf varieties, and *P. serotina,* our wild black cherry, which grows much larger, about 60′. *Prunus subhirtella autumnalis* does well in this area.	Includes the Plum and Cherry		
Quercus alba, rubra, coccinea, palustris, and *robur* are probably the best for this area.	Oaks	30–50	Some of them should be planted when small.
Rhamnus caroliniana	Carolina Buckthorn	25	Have found one native with beautiful foliage and interesting bark.
Salix—Those that I have found best are S. *blanda* (the Wisconsin Weeping) and "Niobe" (Golden Weeping Willow)	Willows	25	Short-lived but quick-growing.
Sophora japonica	Pagoda Tree	25	Beautiful foliage and extremely graceful. Plant when young.
Sorbus aucuparia	European Mountain Ash	35	Good foliage and beautiful fruit. Plant when young.
Tilia americana	American Linden	60	Good foliage and dense shade. Plant when small.
Tilia cordata	European Linden	50	Good small foliage and dense shade.
Ulmus americana	American Elm		Probably the dean of our trees but its diseases prompt us to say, better not plant.

Botanical Name	Common Name	Height in feet	Remarks
Ulmus campestris and *Ulmus glabra*	English Elm and Scotch Elm		Most beautiful trees, but better follow advice above.

FLOWERING SHRUBS

Abelia grandiflora	Abelia	2–4	One of the best. Good foliage and blooms entire summer. May freeze back in very severe winter, but in view of the fact that it blooms on new wood, that makes no difference.
Acanthopanax sieboldianus	Five-leaf Aralia		Good foliage; interesting bark.
Amelanchier alnifolia	Service Berry	6	Good foliage; good flowers; red to purple berries in the summer.
Aronia arbutifolia	Red Chokeberry	9	Good foliage and beautiful berries through Christmas.
Berberis mentorensis	Barberry	4–6	Makes one of the best hedges; foliage almost evergreen.
Calycanthus floridus	Carolina Allspice	7	Beautiful foliage and unusual maroon flowers.
Callicarpa japonica	Lavender Pearl Bush	2–4	Flowers bluish; fruits violet or white with metallic sheen.
Caryopteris incana	Blue Mist		
Chaenomeles japonica	Dwarf Flowering Quince	3	Flowers white, pink, and many beautiful reds.
Clethra alnifolia	Summersweet	8	Beautiful fragrant white spike flowers and good foliage.
Cornus mas	Cornelian Cherry	20	Yellow flowers and beautiful red fruit.
Corylus avellana atropurpurea	Purple-leaf Filbert	15	Beautiful dense foliage.
Cotoneaster apiculata and *C. divaricata* are probably the best for our climate.	Cotoneaster	6 8	Good foliage and lovely berries.
Deutzia gracilis	Dwarf Deutzia	4	Stays dwarf. Beautiful white flowers.
Elaeagnus multiflora	Japanese Oleaster	7	Good foliage and red berries.
Elaeagnus pungens var. *simonii*	Silver-leaf Oleaster	4–6	Silvery foliage and fragrant yellow flowers blooming October-November, also February or March according to the weather.
Euonymus alatus and its var. *compacta*	Winged Euonymus	6–15 4–10	Good dense shrubs. Interesting corky bark and beautiful fall coloring.

Botanical Name	Common Name	Height in feet	Remarks
Forsythia intermedia spectabilis	Golden-Bell	8	Probably the best forsythia for this area. Good bloom and good foliage.
Ilex verticillata	Winterberry	10	Beautiful winter fruits and good foliage.
Kerria japonica	Yellow Kerria	3–5	Good foliage and beautiful flowers. Cut down each year.
Kolkwitzia amabilis	Beauty Bush	6–15	Good foliage and beautiful pink flowers.
Ligustrum Ibolium	Ibolium Privet	6–15	The best hedge privet.
Ligustrum quihoui	Summer Privet	6–10	The latest and best flowering.
Ligustrum amurense	Amur Privet	6–10	A good hedge plant.
Ligustrum vulgare	European Privet	5–8	Nearly evergreen.
Lonicera fragrantissima	Winter Honeysuckle	5–8	Makes good hedge; almost evergreen.
Lonicera maacki var. *podocarpa*	White Honeysuckle	6–10	Long racemes of berries and good foliage. Late.
Lonicera korolkowii var. *zabelii*		4–8	Red flowers and blue-green foliage.
Philadelphus coronarius	Sweet Mockorange	12	Produces the largest flowers.
Philadelphus "Minnesota Snowbank", Patented	Sweet Mockorange	9	Good dense grower and good flowers.
Philadelphus virginalis	Sweet Mockorange	8	Most beautiful of all Philadelphus flowers. Must be cut back early to make a good shrub.
Prunus glandulosa	White and Pink Flowering Almond	8	Good flowers and good foliage.
Pyracantha coccinea	Firethorn		Almost evergreen. Lovely bunches of orange fruits. Probably makes the best hedge known.
Rhus aromatica	Fragrant Sumas	3–6	Foliage good all summer; colors well in the fall.
Rhus glabra	Smooth Sumac	3–10	Fall coloring exquisite.
Ribes odoratum	Buffalo Currant	4–6	Good foliage and beautiful fragrant yellow flowers.
Spiraea bumalda "Anthony Waterer"	Anthony Waterer Spiraea	2–4	Best of the dwarf deciduous shrubs. Pink blooms; good foliage.
Spiraea prunifolia	The true Bridalwreath	8	Good foliage all summer.
Spiraea Van Houttei		10	One of the loveliest of flowers.
Syringa vulgaris in var.	French Lilacs	5–10	One should be very selective in making a list of desirable lilacs.
Syringa hyacinthiflora	Lamartine hybrids	5–10	Good early flowers.

Botanical Name	Common Name	Height in feet	Remarks
Syringa villosa and hybrids	June Lilac	4–8	Good for late flowers in June.
Tamarix pentandra	Tamarisk	5	Probably the best of the feathery foliage. Good pink bloom. Plant when small.
Viburnum burkwoodii	Burkwood's Viburnum	4–8	Good foliage, almost evergreen; light pink flowers followed by red berries.
Viburnum carlesii		6	Should be called the "Queen of all Viburnums."
Viburnum dentatum	Arrow-wood	10	Blue fruit and good foliage.
Viburnum dilatatum		10	Red fruit and good foliage.
Viburnum opulus and its var. *rosea*	European Cranberry Bush Snowball	12	Good foliage and good red clusters of berries.
Viburnum setigerum	Tea Viburnum	10	Red fruits and good foliage.
Viburnum tomentosum var. *sterile*	Japanese Snowball	10	Excellent and free-flowering.
Viburnum wrightii		9	Fruit red and outstanding; good foliage.
Vitex agnus-castus	Chaste Tree	7	Good foliage and beautiful lilac spike flowers. Blooms from early to late summer.
Weigela rosea varieties	Pink Weigelia	10	Pink bell-like flowers; good foliage.
Weigela "Eva Rathke" and "Bristol Ruby"	Red Weigelia	9	Red flowers and good foliage.

Now we have all the plants that are good in this area, what about pruning them? Prune the flowering shrubs immediately after they have bloomed, thus permitting them to make sufficient growth to bloom the next season. Then during the winter remove any dead wood, and if the plant is getting too heavy, that is with too many canes, remove no more than one-fifth of these canes during any one year. Do give each one of your shrubs a few minutes' attention each year and I am sure you will be growing much better-looking material than we now have as a whole in St. Louis.

The ever-accumulating bacon drippings, a high energy food, makes an excellent winter food for birds. A small log with holes bored to hold the bacon drippings or most any kind of receptacle hung on a tree out of the reach of dogs will soon attract chickadees, titmice, cardinals, nuthatches, woodpeckers and juncos.

THE VEGETABLE LAMB OF TARTARY

ALICE F. TRYON

In the land of Tartary toward high Inde and Bacharye in the country of the Grand Can there growethe a manner of plant that is strange and wonderful indeed. This, which they call Borametz, meaning the lamb, grows from the earth in the likeness of a real lamb having head, eyes, feet and is attached at the navel to a root or stem. Its covering is an exceedingly soft wool. In height it is half a cubit and according to those who tell of this wondrous thing its taste is agreeable and its blood is sweet. It lives as long as there is herbage within reach of the stem to which it is tethered and from which it derives its life.

The story of this curious fable reveals something of man's views toward natural phenomena and of the puzzles which arise in sorting fact from fancy as the tale is embellished. It is not possible to discover the origin but the story of the Vegetable Lamb, or Barometz, is described in one of our earliest written records, the Talmudical books. Rabbi Jochanan "in the year of salvation 436" tells of this plant-animal having the form of a lamb and attached like a gourd to the soil. It is reported as coming from the works of another personage on the authority of still another. Thus the description appears to have been told time and time again before it entered the written record. In 1235 a commentator writes that this creature is the Jedoui mentioned in the Scriptures and that witchcraft is practiced with its bones. No creature can approach within the tether for it will devour them but arrows carefully aimed will rupture the stem whereupon the animal dies. The legend was brought to England by Sir John Mandeville, something of an English Ulysses who journeys far and wide and returns after 34 years to record his adventures. In the fair country of Caldilhe there grows a melon-like fruit within which is a little beast "in Flesche, in Bon and Blode, as though it were a lytylle Lomb with outen Wolle". At this same time a similar report comes from Italy. Odoricus, a Minorite friar, traveled out of Padua among the Tartars of the East and tells of gourds in which are found little lamb-like beasts growing in the mountains of Capsius, in the province of Kalor. One of the early accounts of plant curiosities, *Histoire Admirable des Plantes* by Claude Duret has a chapter on these zoophytes which live as plants but are sensitive like animals, existing in Tartary—a place filled with heavy and dense air.

By the 16th and 17th centuries the story reached the academic circles and the doctors and professors began their speculations, arguments and investigations. Kircher, a mathematics professor at Avignon argued that it was a plant in spite of its quadruped form. Girolamo Cardana of Pavia dis-

Agnus Scythicus vegetabilis.
Barometz dictus.
ex
Musco Breyniano.

Illustration from a Latin treatise titled "Dissertiuncula de Agno Vegetabili Scythico, Barometz vulgo dicto" written in 1725 by Dr. Breyn of Danzig. Independent of the English botanists he arrived at the conclusion that the Barometz was made from the stem of a fern. Dr. Breyn with the characteristic precision and serious point of view of the Prussian scientist lamented the influence of the quaint and human influences in the realm of Natural History. He advised all those who search for the hidden treasures of Nature to bear in mind the axiom that the works and productions of Nature should be discovered, not invented.

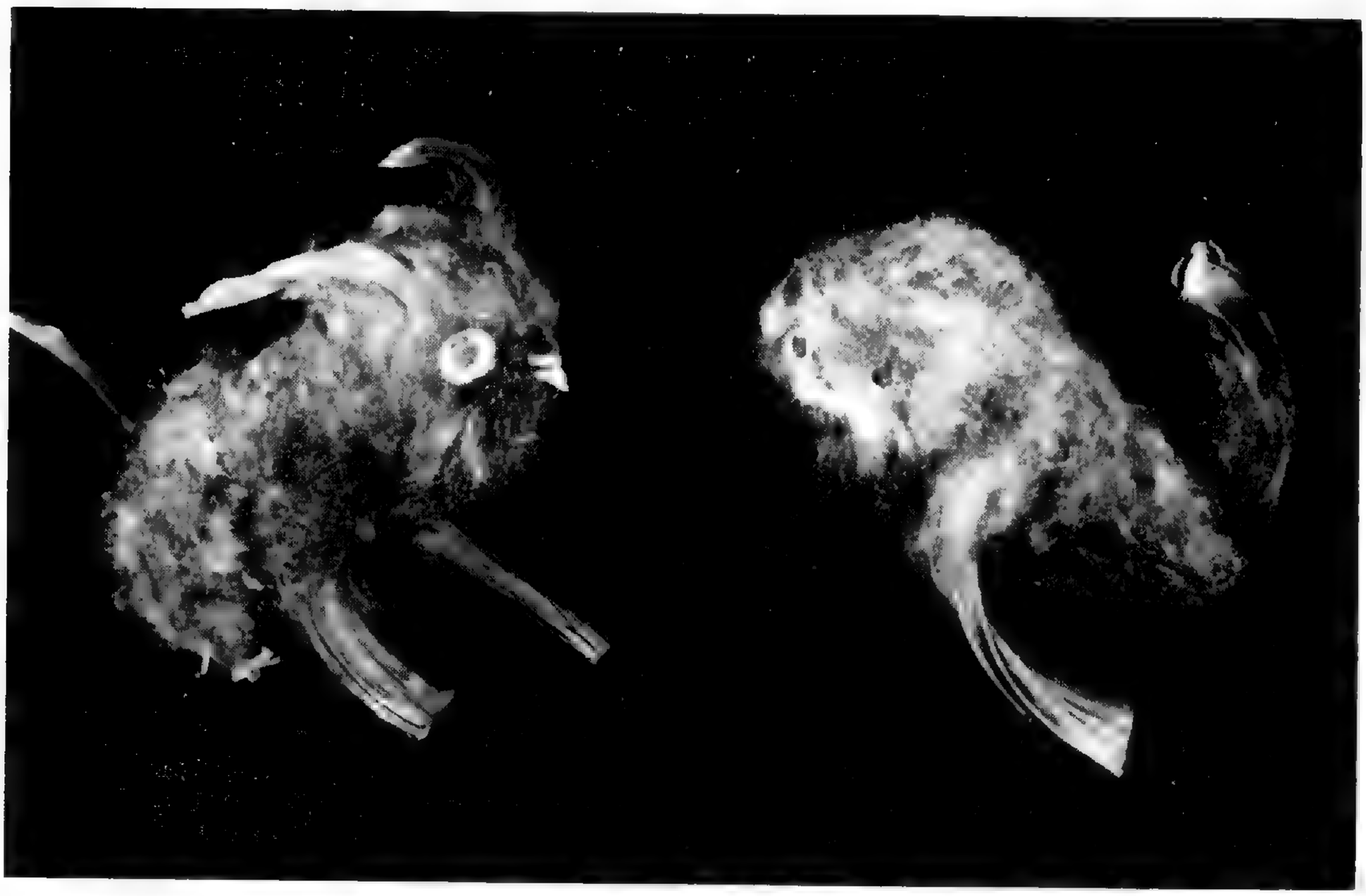
cussed the impossibility of the phenomenon contending that if it had blood it must have a heart and the soil could not supply the heart with the proper movement or warmth. Dr. Kaempfer, a surgeon to the Dutch East India Company, journeyed to Persia in search of the creature. Although he found nothing but ordinary sheep, he observed the custom of taking unborn lambs for their softer fur and he considered that these might be the source of the legend.

At last a specimen was found. In the pomp and splendor of the Royal Society of London the celebrated physician and botanist, Sir Hans Sloane, laid the object before the scientific world. It was about a foot long, covered with dark, yellowish hair having a body much as a lamb. The Vegetable Lamb of Tartary, the Barometz, was identified as a portion of a fern plant which grows in southern China. The fern specimen exhibited by Sir Hans Sloane was much like the one in the accompanying photograph recently sent to the Garden from Formosa.

These are extraordinary ferns, not small woods or rock plants but trees reaching the height of 15 feet, belonging to the genus, *Cibotium*. The species of the lamb is appropriately named, *C. Barometz*, and although it does not develop a trunk it bears a cluster of handsomely cut fronds growing to a height of 14 feet and the large stem is covered with long, tawny hairs. In Europe and China these silken hairs are placed on wounds to stop the flow of blood. The floss of other Pacific species is called *Pulu* and has been used to stuff cushions and mattresses. *Cibotium Barometz* is native to southeast Asia and in southern China and Formosa the lambs are prepared. A portion of the stem with several fronds is removed and the latter are cut leaving only the stubs to serve as appendages. The eyes, made of seeds of *Duranta repens*, a plant of the Vervain family, are affixed and the mouth is embroidered.

The appeal of the legend was not lost after the scientific explanation was presented for it was enshrined in the verse of Erasmus Darwin. This Darwin was a physician and keen student of nature who believed that changes in evolution were due to internal desire—a theory quite unlike that proposed by his famous grandson, Charles. He was a philosopher and poet as well and in his fanciful verse titled *The Botanic Garden* he perpetuates the legend of the lamb:

> Cradled in snow, and fanned by Arctic air,
> Shines, gentle Barometz, thy golden hair;
> Rooted in earth, each cloven hoof descends,
> And round and round her flexile neck she bends,
> Crops the gray coral moss and hoary thyme,
> Or laps with rosy tongue the melting rime;
> Eyes with mute tenderness her distant dam,
> And seems to bleat—a 'vegetable lamb'.



Vegetable Lambs made in Formosa from fern stems

Ding Hou, our Chinese student studying at the Garden Herbarium, relates that the fern, *Cibotium Barometz*, is common in north and central Formosa. There the country folk gather the stems, add the essential parts and fix the face preparing the lambs for the city market. They are usually sold near the temples, and he has seen some twenty vendors each having a dozen or more of the animals along a roadside near the Buddhist temple on a mountain south of Formosa's capital city, Taipei. The locality is selected not for any religious implications but rather because this is a likely place to sell the lambs to tourists who have come from the China mainland to visit the temples.

By the end of the 19th century the influence of Sir Hans Sloane's explanation had lessened and the legend was re-examined by another Englishman, Henry Lee. With the object of reporting the history of cotton he reviews the story of the vegetable lamb in a delightful little book titled, *The Vegetable Lamb of Tartary, a Curious Fable of the Cotton Plant*. He claims the legend for cotton with arguments based on philologic, geographic and botanical evidence. The prepared fern rhizomes are relegated to toys made in the image of a small rufous dog. His arguments seem sound but perhaps it was too late to dispel the confusion between the two and the fern long having the name Barometz can to this day be called the Vegetable Lamb.

HORTICULTURAL CONSULTANTS

In the last ten years a considerable portion of the country's population has moved out from closely built cities into new suburban communities. Whole villages of new houses have sprung up, sometimes literally over night; thousands of people who used to live in city apartments have found themselves with a lawn and garden to take care of for the first time in their lives. St. Louis has been no exception to this general trend, and the city is now ringed by a series of ranch-house communities populated by amateur gardeners. As never before, the Garden, the public libraries, and similar institutions are flooded with requests for advice.

To meet this need the Garden's Horticultural Council has gone into the problem extensively with the Nurserymen's Association of Greater St. Louis. In January somewhat over a dozen volunteers began a training program at the Garden as horticultural consultants. They will be ready to start operations early in the spring, and full details of the plan will be announced in a later BULLETIN. In so far as possible they will work with community groups, particularly in newly built-up areas. Their main function will be to serve as centers of information, directing these new home-owners to the firms, institutions, and societies in the St. Louis area which can help them make better gardeners of themselves.

If the plan works out effectively it is hoped that a much larger number of consultants can be trained a year from this winter. It is estimated that at least forty or fifty such people would be needed in the St. Louis area but it has seemed best to start in a small way and gradually feel out the various problems involved.—E.A.

THE HENRY SHAW PAPERS

Henry Shaw not only kept a meticulous account of his business and civic and personal enterprises; he wrote these records in ink in a fine clear hand and filed them away in an orderly fashion with other pertinent papers. So detailed an account do they give of nineteenth-century business expansion in the United States that in 1939 they were sent to the library of the Harvard Business School on an extended loan. In the ensuing fifteen years they have been studied, catalogued, and photographed.

In mid-January they started back home to the Missouri Botanical Garden, three crates and one large carton. It is planned to display them briefly in Mr. Shaw's old Museum Building and to publish portions of the records which are of general interest in St. Louis. Eventually it is hoped to use them in producing a scholarly history of Mr. Shaw and his garden.—E.A.

CATTLEYA AURANTIACA, THE ORANGE CATTLEYA

(Photographed at the Garden by Clifford Paulsen)

Never was a plant more appropriately named than this tiny-flowered Cattleya from Central America. The flowers are of an orange so vivid that though the individual blooms are not bigger than the end of your finger, the whole bunch makes a bright splash in the greenhouse or at a flower show and always interests visitors. The texture is as outstanding as the color; the petals are so waxy that the flower appears to have been carved out of orange-colored paraffin. This waxy texture gives it unusual lasting qualities.

CROSSBILLS AT THE ARBORETUM

Crossbills are strange little sparrow-like birds of the northern hemisphere which migrate erratically in flocks, so that they may be common in one area for some weeks and then not be seen again for a good many years. Their favorite food is the seeds of conifers; their curious bills are adapted for ripping apart the cones of evergreen trees and getting out the seeds. The ordinary seed-eating beak of such a bird as the sparrow is prolonged to make a pair of powerful forceps which can pull out the seeds from under the cone scales. At other times when the tips are not in use as forceps they may actually cross past each other giving an unusual snaggle-toothed appearance which is responsible for the common name.

A local naturalist, Mr. David Jones, was the first to report the presence of a flock of crossbills at the Arboretum this winter. He found them there at New Year's and since then they have repeatedly been observed by Earl Hath, J. Earl Comfort, and other St. Louis ornithologists. As is often the case, the flock is made up of two different species, Red Crossbills and Whitewing Crossbills. During the day they feed on spruce cones in the Pinetum, flying in every morning from the South, apparently from roosts in the Garden's Red Cedar glades along the Meramec River.

FLORENCE FENNEL AS A HOUSE PLANT

Last year, early in the season, Mrs. George Becker sent us a nice packet of seeds of the bronze variety of Florence Fennel, a feathery-leaved herb with succulent leaf bases and an anise-like taste. Through oversight they were not planted until late in the summer and are being carried through the winter in five-inch pots. They have proved to be extraordinarily effective as house plants; so far as we know the first time they have ever been tried for this purpose. They do well on a window-sill and will even grow for several weeks on a table away from the window. The feathery leaves are even more attractive indoors than outdoors and may be used as a garnish if one can bear to cut them. The bronze color of this variety does not develop as strongly as under the outdoor sun but it gives an interesting metallic cast to the developing young leaves at the top of the plant.

The Red Cedar in Missouri is not only more variable than it is throughout the East; on the average it is much more fruitful here. Fruiting trees have such masses of gray-blue berries as to be most attractive in the landscape and of real importance as a bird food.

BOOK REVIEW:—

The Ferns and Fern Allies of Minnesota. By Rolla M. Tryon, Jr. 186 pp. 207 figs. 85 maps. University of Minnesota Press, Minneapolis. 1954. Cloth-bound, $4.00; paper-bound, $2.75.

This attractive book on ferns concerns those which occur in Minnesota and adjacent states but over half of them you might happen upon in the fields and woods of Missouri. The Maidenhair and Rattlesnake fern, like most of these plants, have delicate, lacy-cut fronds which add much beauty to rich, shaded woods. A few, as the Cliff-brakes and the Lip ferns, grow in drier situations in crevices and on ledges of limestone cliffs. The rush-like Quillworts are aquatic growing in shallow pools and streams—their beauty unnoticed until the spores are seen. These tiny structures, about the size of a pin-head, are exquisitely sculptured in ridge and spine patterns and a likely source of inspiration for fabric design. The fantastic-formed Horse-tails and Club-mosses are fern allies, really not ferns at all, but remnants of a great group of ancient plants which flourished during the Coal Age. These are among the nearly one hundred kinds of ferns which can be identified with this book. The method of identification using keys is presented in a simple manner with the botanical lingo brought to the point in a pictured glossary. The technical aspects, however, can be easily by-passed and identifications made by matching specimens with the many photographic silhouettes. Some information is supplied on native species which can be transplanted and are suitable for the garden.

First attracted by ferns in the Dune area of Lake Michigan, the author has continued his interest on the kinds of ferns and how and why they grow where they do. He is Assistant Curator of the Herbarium at the Garden and currently studying the ferns of Peru. The exquisite drawings and prints done by Wilma Monserud were largely prepared by a special photographic process from the actual plants.—A.F.T.

During most of January the Garden has been host to two Argentinian botanists, Dr. and Mrs. Antonio Krapovickas. He is of Lithuanian ancestry, she of Austrian, but both of them received their training in Argentina. They are working, among other things, on the history and classification of the cultivated peanut and have found the old books in our library of tremendous help in their work.

THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden carries on the garden established by Henry Shaw over a century ago at "Tower Grove," his country home. It is a private institution with no public support from city or state. The old stone walls and cast-iron fences, the Linnean House, the Museum, the Mausoleum and the "Old Residence" all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's Day and Christmas) from 9:00 a. m. until 7:00 p. m., April to November, and until 6:00 p. m., November to April, though the greenhouses close at 5:00 p. m. Tower Grove, itself, Mr. Shaw's old residence, is open from 1 until 4. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., opposite the junction of routes 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

MISSOURI BOTANICAL GARDEN BULLETIN

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COVER: In the Pinetum at the Arboretum—Deer range in any language! Photo by Missouri Division of Resources and Development.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri

Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.

Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

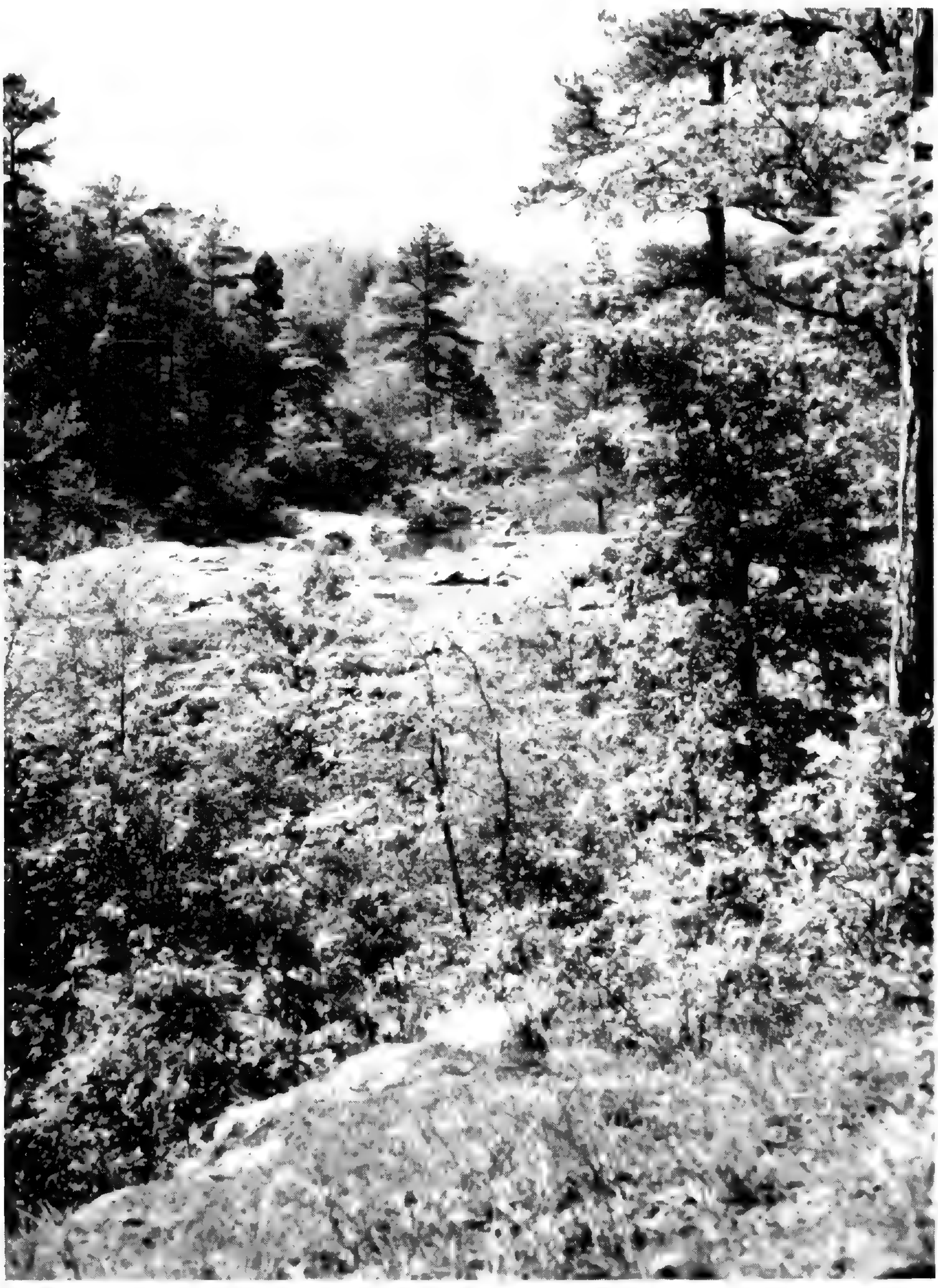
Vol. XLIII MARCH, 1955 No. 3

MISSOURI'S OZARKS

AUGUST P. BEILMANN

The Ozark region of Missouri has become very well known far beyond its boundaries. Many sons and daughters have gone to other parts of the world—some to achieve fame and others notoriety. Many who stayed have become equally famous and have contributed greatly to the affairs of the state and the nation. The region has also attracted outlanders who have stayed long enough to add to that which, when summed up, is Missouri's Ozarks. The area houses a resident population that long has furnished material for jokesmiths and cartoonists. In this respect it shares honors with several sister states. But it is significant that the very same jokesters, when threatened with a new outbreak of ulcers, return, to recover health while float-fishing a clear Ozark stream! Vance Randolph in his earthy writings has intimately described the people. Harold Bell Wright has immortalized the White River Country. Dr. Carl Sauer has written learnedly about the geography of the region. The area has been a challenge to every articulate visitor for nearly four centuries. Len Hall and other contemporary writers find it just as fascinating.

To understand the Ozarks we must lean heavily upon Carl Sauer's "The Geography of the Ozark Highland of Missouri". The area comprises about one-third of the state, all of it south of the Missouri River. The eastern portion is the most heavily timbered. The million-acre Mark Twain and Clark National Forests, as well as the largest private forest holdings, are located there. Here also is Taum Sauk Mountain, about 800 feet higher than the average for the state, and here too are steep valleys. A few are almost 700 feet lower than the average of the nearby hilltops. Springs are abundant, many of which are large enough to give rise to full-fledged rivers. Nearly every valley has a clear running stream fed by numerous springs. The smaller valleys are often broad enough to furnish some plowland for cultivated crops. The soils generally are quite shallow, rather rocky, and somewhat infertile. In favored places orchards, vineyards, and small-fruit farms



Joachim Creek near Farmington

have been established with marked success. The very diversity of the Ozarks is the basis of its homogeneity, and it has supported a population for almost as long as Europeans have known the Mississippi Valley. This, then, is the Ozark region, at once diverse and homogeneous, and of surpassing interest to many who might agree to its development but would strenuously object to its exploitation or plundering.

There have been proposals to lift the population by its boot-straps; to industrialize the region; to dam its clear streams; to grow forests and to burn them; to do this and to do that. Fortunately, no one has found a panacea, and this ancient mountain range and its people view these proposals with little alarm. However, there have been changes, and they have closely followed the advancing automobile roads. Often the latest gadgets of the Advertising Age can be found in remarkably inaccessible places. Now determined people are attempting to preserve the folkways and the ballads by reducing them to tape recordings.

Any proposal for the Ozarks, any plan for the future, must not fail to recognize the problem in terms of the people who are scattered on small farms and little villages. There are no great cities and even very few large towns. The surplus population has always migrated to the outside. Those that remained have either lived well or have lived poorly, depending upon a personal point of view. All are acquainted with hard times. Close contact with the region generally leaves one with the feeling that the problem is largely economic. What is needed is a dependable supplementary income for those who live in the region. The topography imposes certain limitations. This might be expressed as the "carrying capacity". In turn, this can be translated into acreage of plowland, extent of the forests, the human population, amount of livestock and even game and wildlife. Farming can be expanded somewhat, and modern know-how and methods will increase production and improve the diet. But the area can never compete with farming regions more favorably located on better soils.

It is unsafe to generalize, even about farming, in this region. One might point out that hogs and cattle running wild have done irreparable damage—then discover an operation that is without serious fault and is economically sound. Because of the high-grade feed required, one might dismiss dairying as a farming operation only to encounter several dairy herds being very properly managed. Even the spring branches are "farmed". Here grow the aquatic plants seen in fish bowls, and tons of the prepared plants are shipped annually. Beef cattle have great possibilities. Southwestern cattlemen who have been "burned out" year after year have assembled large acreages and shipped in foundation herds. The long grazing season and the unlimited clear water in most of the valleys have proven most attractive to cattlemen.

Cattle from this region have quality and finish. An Ozark bull raised at Edge Cliff Farm by Andy Knapp was judged Champion of the Show at the American Royal. Edge Cliff Farm is reclaimed brushland in an area that has supported an immigrant population since lead mining began in the late 1700's.

Forestry, which furnished much of the livelihood at one time, is again furnishing employment and it can be expanded much farther. The annual growth per acre is small, and this places a limit upon the capital that might be invested in that activity. However, the T. J. Moss Tie Company owns and operates immense holdings along the Current River and Leo Drey has recently acquired the forest lands of the National Distilleries, Inc., which are on the upper Current River. Together totalling more than a million and a half acres, these forests are being managed with great care in the expectation that growth and cut can be balanced for many years.

Practical forestry, fire control, and the reforestation of areas not now growing trees is an incomplete answer to the problems in Missouri's Ozarks. Extensive forests are relatively new. Within historic times the region has been described by travellers as covered with grass (Beilmann & Brenner, The Recent Intrusion of Forests in the Ozarks. Ann. Mo. Bot. Gard. Vol. 38. 1951) and the trees were confined to the water-courses and areas where the rough topography afforded protection from the prairie fires. It requires no vivid imagination to visualize the destruction that fire might have caused in either 1953 or 1954 if there had been no fire-protection system in the forested land. Had successive dry years and unchecked fires followed each other a century earlier—and this must have happened many times—the grass and not the forests would have dominated the scene. It may be an ecological blunder to plant more trees without regard for the species, the site, and the soil. It may also be a mistake to furnish fire protection to every bit of brushland. Perhaps much of the area should remain in grass. The forester usually falls heir to those lands which are so poor that no one has found them useful or valuable. Such land will not grow good trees but it might grow good grass.

Of all the uses to which the Ozarks might be put it would seem that recreation offers the greatest opportunity and the greatest chance for expansion without a concomitant loss of natural resources or a loss of the unique background that is the Ozarks. There is a market for recreation and there is no shortage of customers, so an economic problem is perhops soluble in this one facet. Recreation has many meanings. We shall confine ourselves to two activities which are less garish than most. The Ozarks have been used more extensively, and for a longer time, by fishermen and hunters than by any other visitor. Float-fishing is a long established activity and competent outfitters are readily located. Such fishing trips can continue

Mr. Beilmann demonstrates distillation of Mountain Mint at the Eastern Missouri Beekeepers' Field Day at the Arboretum.

Under the leadership of Mr. Beilmann and his staff, the Arboretum has developed into an outdoor laboratory and demonstration plot for dealing with the various problems of landscape in the broadest sense of the word. This program has attracted so much attention that the Arboretum is now increasingly the center for a field day or a series of field days. These go all the way from a visiting garden club which spends the day studying the collection of naturalized daffodils and other Narcissi to the enormous affair staged two years ago by the Friends of the Land. It combined a demonstration of landscape management with a three-day pageant "The Saga of the Meramec" which brought more than 30,000 visitors to the Arboretum grounds. In the illustration Mr. Beilmann is demonstrating the amount of volatile oil in one of our native bee-plants for a group of visiting beekeepers.

only so long as the clear streams remain free of "multi-purpose dams". The dams which have been constructed have fallen short of the claims made for them, and they have destroyed the game fishing which is part and parcel of Ozark fishing. The streams can remain clear and the springs running full only if the headwater areas are properly utilized. If farming is expanded to include more and more of the steeper land the streams will not remain clear. If pastures are grazed too closely each rain will bring down a flood of muddy water. If the axe and fire and goats are used in the forests then destruction will follow. We cannot control the activities of each landowner, so let's assume that through example and education the land-use pattern will improve. Land-use practices will improve if it can be shown that the proposals are economically sound and within reach of the farmer.

We might also remember that the construction of the highway we demand to-day may very well cause more erosion, and in a shorter time, than any other single activity. The more modern the highway, the more certain we may be that the drainage pattern of an extensive area has been disrupted. Low places are filled, hills cut through, and the roadside ditches are engineered to discharge water into the nearest drainage-way just as quickly as possible. Can you think of a faster way to drain the Ozarks than a cross-state ditch as much as several hundred feet wide? How much terracing would be required on the little farms to save as much water as such a road is designed to carry away? Often the older and less important roads are equally destructive; it is not difficult to find an outwash of rock and debris hundreds of feet from the lower end of a county road ditch. Can any plan, no matter how bad, be more destructive to the Ozarks than the one to throw a dam across each stream? Dams forever submerge the meagre plowland in the valleys; there is no hope of ever correcting a gross blunder. They have intensified flooding downstream—the very areas they were designed to protect. State agencies have made two studies of Ozark streams that have been dammed. One deals with the decline of sport fishing behind the dams; the other with the policies of land acquisition that make displaced persons of the former residents of the area. Both studies have been widely quoted in other states faced with similar pork-barrel projects, and both studies should be required reading for any one interested in the future of the Ozarks. It would seem, then, that every one of us, either directly or indirectly, has contributed in some measure to whatever problems confront the Ozarks to-day.

The forests are the most conspicuous part of the Ozark landscape. They will remain so unless continued drought does irreparable damage. At the moment we cannot tell how much harm has been done; nor can we compare the effects of the dry 1930's with this cycle. In the 1930's the forests con-

The beginning of Juniper invasion in an old field at the Arboretum. Bird-planted seedlings competing with an old Slippery Elm which will shortly die because of the competition.

tained fewer trees per acre and all of them were smaller; there has been a significant improvement in the forests during the past two decades. They furnish employment and recreation and they are a protection to the watersheds. We must learn to live with and within them. But not every acre should be given over to trees. Grassland may furnish just as much protection to a stream unless it is grazed to the ground. It also supports other kinds of plants and wild life. During a dry cycle it may allow more water to reach the soil and percolate downward than does the forest. This was the experience in Oklahoma where the removal of the cedars (*Juniperus*) and the re-establishment of grass restored springs that had dried. In wet seasons there is a surplus of rain, and enough reaches the ground even though as much as half may be lost through evaporation from the surfaces of the trees. During a dry period, a good grass cover will allow far more water to reach the soil and percolate downward to keep the springs at peak flow.

We hear much about a "natural balance", a kind of beautifully poised community in which every member lives his life to the fullest! There has never been a "balance" which was maintained long enough to measure. All landscapes are artificial. The first footprints across a prairie can never be erased. They destroyed a momentary interdependence of plants and animals, and it doesn't matter if that footprint was made by an Indian moccasin, a Spanish military boot, or the heavy footgear of the first farmer. Man can, and does, bend a landscape to suit his needs. We need only watch the burrow

of a single ground-hog on an Ozark hillside to see that animals do the same. A dramatic change of flora follows such selective feeding as ground-hogs do, and a herd of deer or even a flock of robins may completely revise the flora of an area in a very short time. By searching out and feeding upon favored plants a herd of deer can remove those species from their range. As often happens during the winter, thousands of robins visit the Ozark cedar glades in search of berries. In their flight from the feeding grounds they scatter seeds far and wide. At the moment, Franklin County, as well as other areas, is in danger of being over-run by seedlings of this tree. The species has crossed the Missouri River and begun a march northward across the prairies.

The Indian set the grassland ablaze to discomfort his enemies. He thus provided a barrier, devoid of game and forage, through which an enemy raiding party travelled only with great difficulty. Since his bow and arrow were less than adequate as hunting weapons he used fire to drive the game within reach, into traps and over a precipice where they might be gathered in the quantities the village needed. A fire begun by a hunting party, or started by lightning, might very well rage unchecked for hundreds of miles. In the absence of fire-fighting equipment and adequate manpower (recent innovations) such repeated burnings would definitely limit the forest distribution. In time there would emerge a landscape dominated by grassland, with some forests where the topography afforded protection from the annual fires.

It would seem, then, that we are concerned with the creation of an artificial landscape, one that will serve all our needs without sacrificing any resources and planned so that is can be readily and rapidly amended as our needs change. At the moment there can be no better plan than to use each acre as best we can within the limitations imposed by our imperfect knowledge and understanding. This would also be the key to the preservation, as well as the utilization, of the Ozarks by the two groups who use them the most—the hunter and the fisherman. Both these groups pay their way in a fashion not commonly understood. Under the Dingell-Johnson Act of 1950, an excise tax is levied on all fishing equipment, and under the Pittman-Robertson Act of 1937, a similar tax is levied on all sporting arms and ammunition. The funds derived from these sources are returned to the states for investigation, land purchase, development, coordination and maintenance as an aid in fish and wildlife restoration. In addition, every hunter and every fisherman pays a direct tax in the form of a license—and there are special fees for trout fishermen and deer hunters. Beyond this every taxpayer has contributed to the establishment and the maintenance of the National Forests.

Here then are acreages ready at hand for experimental purposes, and here is the financial assistance needed to learn more about the problems and to demonstrate what is known. It is not suggested that the Ozarks be manipulated solely for the fisherman and the hunter; many visitors do neither. But it has been our experience at the Arboretum that the visitor who has a glimpse of a fleeing deer, has seen a fox cross a trail, or even come across a lowly ground-hog for the first time is very likely to forget all the flowers he saw. But if both the wild things and the floral displays are seen in one afternoon, then it has been a day to remember! Visitors often tell us of the things they have seen, and in the telling, ground-hogs approach black bear in size and ferocity.

The forest is a several-storied habitat, capable of supporting animals that live above and below ground and birds that use the forest floor as well as those which fly at will through and above the trees. The capacity of a forest to accommodate all these creatures depends upon the age and height of the trees, the plants that form the understory, and the cover between the trees on the soil surface. The mature forest, with widely spaced trees, many bearing fruit, and with shrubs, herbs and grass on the forest floor, probably supported the greatest and most diverse bird and animal life. The recently cut-over area, now slowly coming back through a succession of sprouts and with a new flora on the soil surface, may temporarily have even a greater carrying capacity for some species. But the closely packed forest of "pole-timber" (6- to 8-inch trees) has the least capacity. Since the trees are too young and crowded to bear fruit and since the forest floor is almost free of plants, few birds or animals can find suitable food or shelter. Unfortunately, too many of the forests in the Ozarks are in this intermediate stage. They do not produce game and they are equally unattractive to the visitor who does not hunt. They would be quite valuable as protection to the watersheds in wet decades but they are quite wasteful of rainfall during the drier years.

Since we are dealing with an artificial landscape and since man has always manipulated them to suit his convenience, it is suggested that the Ozarks be deliberately developed for maximum recreational usage. As a first step in this direction it is further suggested that the area be managed for the maximum production of game of all sorts. Here is a usage that will furnish additional employment and will increase the use of local farm products. It will pay its way through a greater year-round use by visitors. We cannot be equally sure that expanded farming will be profitable, and industrialization must wait upon a proper economic climate.

To accomplish this recreational project it will be necessary to move into the forests, and onto the land, to do what is necessary to produce the habitats required. Often it will be necessary to thin trees, or even remove them, to create the openings. Some sites should be returned to grass. In other places

the invasion of cleared areas by trees should be checked. The techniques are known. The literature reports scattered instances of successful efforts to grow both game and trees. On a small scale, at the Arboretum, we have attempted to have both plants and animals. We have found that we can grow a richer flora if we manage the forests properly. And we have learned that the game moves into such areas. Such a program will require a co-operative attack by both game manager and forester. At the moment, the problems in each field are being solved independently. The U. S. Forest Service, dedicated to growing trees, has no provision for deliberately removing trees that might improve a habitat for game—unless an improvement automatically follows a timber sale. In fairness, it must be said that it has attempted such work as a demonstration on several small tracts—and it has worked! The Conservation Commission, operating under a mandate to grow and allocate game, furnishes fire protection. Fire protection alone, especially during certain stages in the growth of a forest, may actually close such a forest to both the game and the visitors who pay the bill to maintain the forests. A forest will be of more interest to the casual visitor if it has a rich and varied flora. And the birds and animals will quickly find these improved habitats.

Turner's Mill, one of the largest "overshot" wheels in the Ozarks. View through the wheel from the old factory.

WATER POWER IN THE OZARKS

AUGUST P. BEILMANN

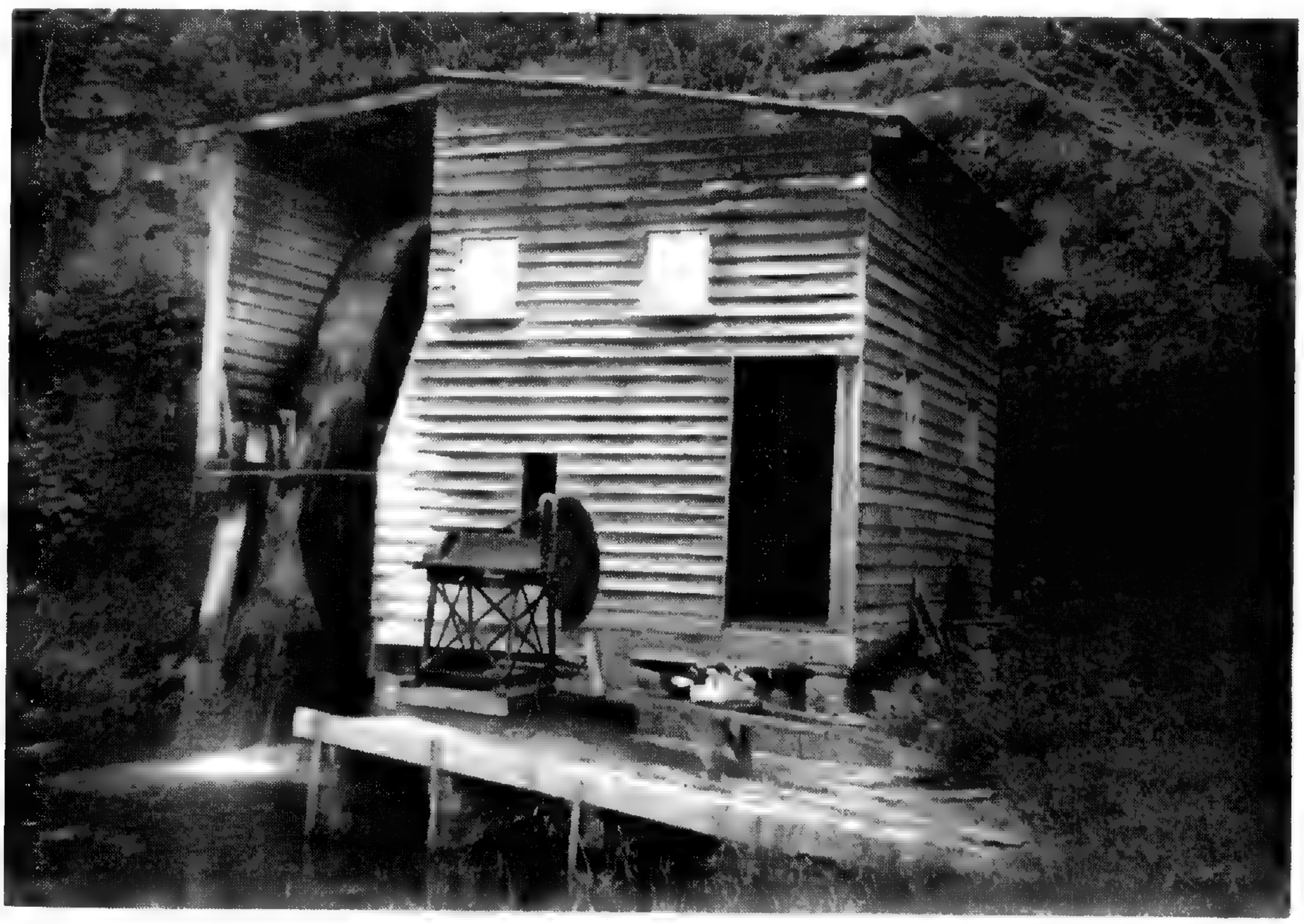
There are innumerable springs in the Ozarks and all of them contribute to the flow of clear streams. The larger streams virtually become rivers as they emerge from the underground passageways. Big Spring, near Van Buren, is the largest single spring in the United States, flowing as much as 640,000,000 gallons a day. The springs are every bit as interesting to the visitor today as they were to the first explorers. Many of the larger will be lost forever if the heedless proposals to dam all Missouri's streams are put into effect. In spite of the gigantic springs, none of the Ozark streams are a dependable source of hydro-electricity. They can be used to produce a little "dump" power to firm up a distribution system during short peak loads, but they are not a source of firm power. During 1954, some of the most modern installations produced no power for weeks at a time. And the Atomic Age is just around the corner!

Earlier generations were intrigued by the rushing springs and the swift spring branches and they harnessed many in ingenious ways. The mechanical power they produced was used to grind grain and operate machinery. Some few installations were large enough to operate saw-mills. In general, one of two kinds of equipment was used to harness water power—either the "overshot" wheel or the turbine. The method chosen depended upon the topography and the uniformity of water flow, and quite possibly the roads to be travelled and the weight of the dismantled machinery also dictated a choice.

The simplest and most picturesque equipment was the "overshot" wheel. Here a spring was tapped at a higher elevation, and the water was carried overhead in a wooden flume, to the top of the wheel. When discharged into broad cups, or buckets, the weight added to one-half the wheel caused it to revolve. Once started, it continued to turn until a gate in the flume shut off the water supply. Falling Mill Spring, in Oregon County, is an excellent example of the utilization of a small spring issuing from the face of a steep bluff. The water is carried only a short distance through a flume to the top of the wheel. This mill is still being used to grind feed and saw firewood. Turner's Mill, also in Oregon County, with a wheel over 30 feet in diameter, is one of the largest of this kind and could generate about 100 horsepower. This is a rating of usable power and not the kind of "developed" horsepower we encounter in automobile advertising! Once the site of an extensive woodworking factory, Turner's Mill has fallen into disrepair. Most of the machinery has been removed but the wheel remains intact and in good condition.

The difficulty of constructing a suitable dam across a rushing spring branch, where a greater volume of water was available, led to the use of the turbine. The old mills at both Alley Springs and at Montauk were powered in this manner. In such installations, the spring branch was tapped behind a small dam at a higher elevation. The water conducted through masonry ditches to a lower point was discharged through the turbine. The relatively small rotor, equipped with fins and energized by the falling water, operated at higher speed. While rather complicated gates and sluiceways were needed the turbine was quite compact and totally submerged. It also required less shafting and belting to operate machinery. This application of water power to the everyday business of living was much less spectacular than the "overshot" wheel. However, it was more efficient and worked especially well in the vicinity of the larger springs or where a small stream could be dammed. The old mill at Cedar Hill is of this type, which often operated, with a minimum of maintenance, for half a century.

At one time many hundreds of these mills were in operation and nearly every community was served by a miller, who often was a combination of all other frontier crafts The power of rushing water was thus used to move all sorts of machinery and to lighten the tedious drudgery of such simple tasks as converting grain into bread. Unfortunately, few of Missouri's early water-power installations are being either maintained or restored. And even



Falling Spring Mill—a little-known and seldom-visited spot in Oregon Co. The spring gushes from the bluff just slightly above the top of the wheel.

fewer are being operated. Power lines follow every road and search out every potential user. Then, too, we get all our food in boxes! We haven't time to watch the rushing water while the miller grinds our grain. Unless, of course, we are on vacation—then we rush to photograph these relics of a calmer day!

THE GARDEN AND THE ARBORETUM DURING THE EARLY SPRING

The main spring displays at the Garden are already well under way. In the Floral Display House orchids, which began in late January, will gradually give way to spring flowers leading up to a special display beginning just before Easter. At almost the same time the very earliest of the snowdrops came into flower in the mausoleum grounds and continued to bloom in between record-breaking cold waves. By the last days of February they were providing really charming displays during spells of sunny weather. They will continue into March, being followed by scillas, daffodils, and then by sheets of white and pink and blue wood-hyacinths which come hurrying up from under the ivy leaves as if by magic, in late April and early May. Now that the "Weeders and Seeders" garden club is putting the walks and plantings in the Mausoleum grounds into first-rate condition, this is one of the nicest places in metropolitan St. Louis to visit on a pleasant spring day. The dignified grounds, with their ivy mantle and their background of cast-iron fencing and limestone pillars, look like a little piece out of an Englishman's estate. Mr. Shaw's country home TOWER GROVE is adjacent to these grounds and is open every afternoon from one until four o'clock.

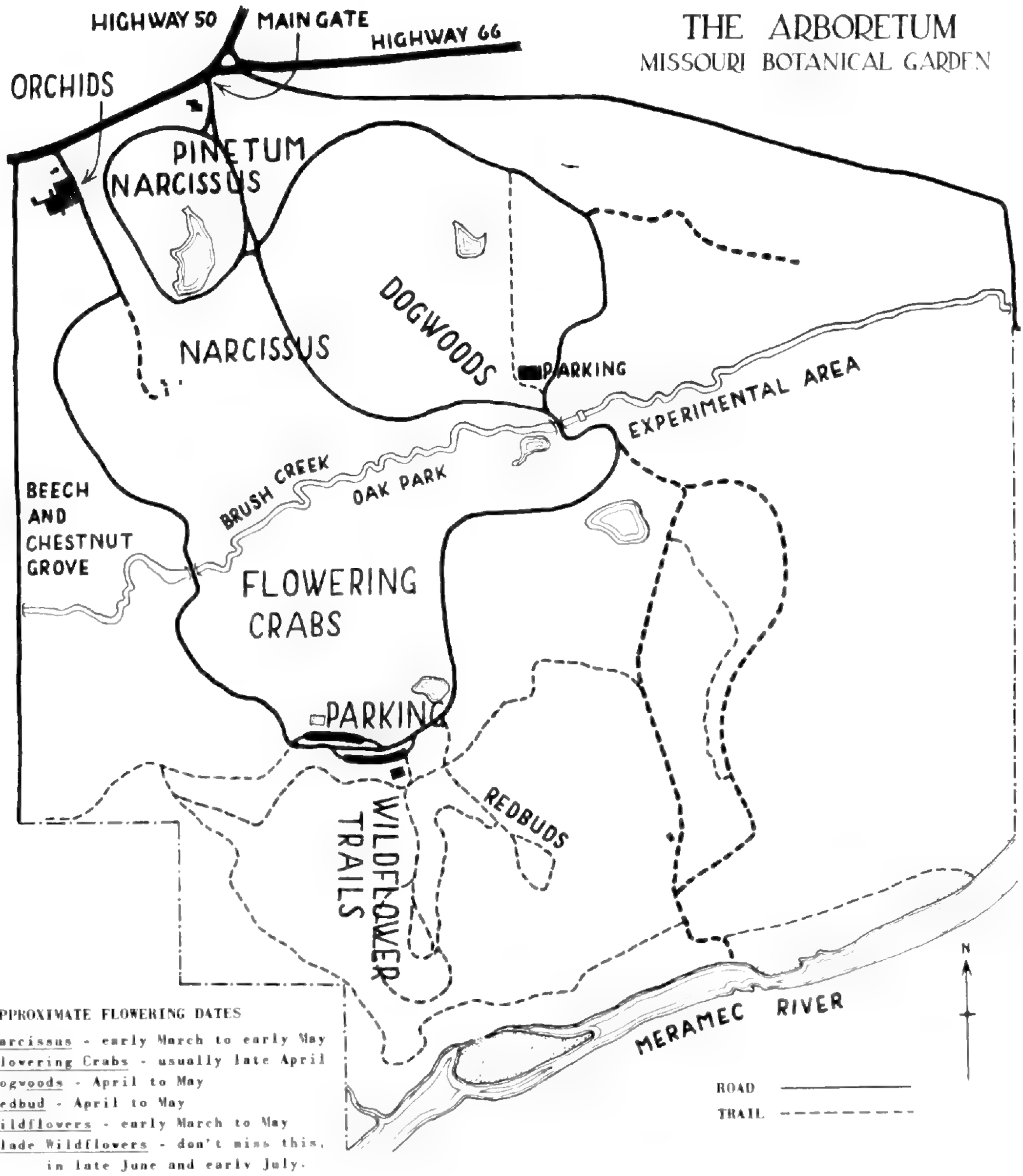
At the Arboretum the early daffodils become conspicuous by the end of March, and they and the crabapples provide a series of mass displays during April. The open meadows in which the daffodils are growing tend to be swept by chilly winds, so bring a heavy coat if you expect to get out of the car.

From the Trail House, where there is abundant parking space, the series of wildflower trails, provided by a special gift from the Garden Club of St. Louis, lead off into the woods and in among the cedars. The usual early spring flowers begin the first part of March and reach a climax by the end of April. It is then that the special beauties of the Arboretum's display begin to take the stage. In the lowland woods there are sheets of gray-blue Miami Mist *(Phacelia Purshii)* in May. By late May the open limestone glades begin their dazzling show of glade and prairie wild flowers which

continue all through June and into early July, long after most wild flowers have gone to seed. There are purple cone-flowers in varying shades of pinkish-lavender, golden coreopsis, and Missouri Evening Primrose, set close to the rocky ground with pale sulphur-yellow flowers as large as salad plates.

The design of the Arboretum is not as complicated as it might seem when one glances at the map on the opposite page. The grounds are roughly a mile wide and extend for something over a mile between Highway 66 and the Meramec River. The land on the south side of the river is operated as a farm, having been purchased to conserve the natural character of the river front. In the portion open to the public a winding road two miles long starts from the Main Gate and comes back to the same point. It has been designed for a modern arboretum to which nearly all the visitors come by automobile and a considerable fraction never get out of their cars. The road enters through the Pinetum with its pleasant little lake which serves as an emergency reservoir for the orchid greenhouses. It then winds through meadows and woodlands to the Field House which is near the summit of the highest hill. Broad parking areas help to conserve the hill top for its all-embracing views and a series of wildflower trails; some short and almost on the level, others much longer and with a good deal of climbing, take visitors through the most interesting portions of the wild-flower reservation. There are rustic tables at which visitors may eat their picnic lunch (though no fires are permitted). The roadway then continues through meadows and back across Brush Creek to the highway. The wooded valleys and the wide stretches of blue-grass meadow have proved most attractive to deer, and there are usually more than a score about at any one time. One cannot count on seeing deer during any one visit, yet he is most certain to do so several times during each half-dozen visits. In mid-summer there is always the hope that one may see one or more white-spotted fawns feeding in the meadows or along the roadway, or in early autumn that one will glimpse the stags with their magnificent branched antlers.

The major lumber companies in the Northwest have long recognized the recreational potential of their forests. For some time they have been providing unusual assistance to hunters who use these forests during the open season, and the game is concentrated in those areas where some cutting has been done.


THE ARBORETUM
MISSOURI BOTANICAL GARDEN
HIGHWAY 50
MAIN GATE
HIGHWAY 66
ORCHIDS
PINETUM
NARCISSUS
NARCISSUS
DOGWOODS
PARKING
EXPERIMENTAL AREA
BRUSH CREEK
OAK PARK
BEECH AND CHESTNUT GROVE
FLOWERING CRABS
PARKING
WILDFLOWER TRAILS
REDBUDS
MERAMEC RIVER
N
ROAD
TRAIL
APPROXIMATE FLOWERING DATES
Narcissus - early March to early May
Flowering Crabs - usually late April
Dogwoods - April to May
Redbud - April to May
Wildflowers - early March to May
Glade Wildflowers - don't miss this, in late June and early July.

NOTES

February saw the beginning of a project to make the Garden more useful to science teachers and to school-children in the city of St. Louis. Plans were worked out to have Mr. Nathaniel Watlington of Harris Teachers' College work at the Garden under the direction of Dr. Dwyer of St. Louis University, a member of the Garden's staff. Mr. Watlington will work out a handbook for the use of teachers and classes which visit the Garden so that they may get the maximum benefit out of their trips through the greenhouses and the grounds.

For two weeks in mid-February, Dr. H. S. Gentry, plant explorer of the United States Department of Agriculture, has been working in the library and herbarium studying several kinds of plants which are of increasing importance to modern medicine. Chief among these are the Agaves, the pioneer work on which was done by Henry Shaw's close friend and adviser, Dr. George Engelmann, and by the Garden's first director, Dr. William Trelease. These plants have been found to be of promise in the commercial production of cortisone drugs. There are so many species and the species differ so widely in their commercial value that the problem is an intricate one. One of the interesting facts about the kind of scientific work carried on in such large herbaria as that at the Garden is that its importance frequently increases with age. When Dr. Engelmann and Dr. Trelease undertook their studies these curious semi-desert plants were of interest only to a few collectors of succulents and to students of desert vegetation. Now, over half a century later, these studies are found to be of value to modern medicine and to the United States drug industry.

In March, the first number of the forty-second volume of the ANNALS OF THE MISSOURI BOTANICAL GARDEN made its appearance and started off in the mails to scientific laboratories and scientific libraries all over the world. This particular number is devoted to studies by two members of the Garden's staff, Dr. Rolla M. Tryon and his wife Dr. Alice F. Tryon. Her contribution is the description of a new species of fern from South Africa. His is a technical monograph of around 100 pages. It deals with a group of plants (*Selaginella rupestris* and its allies) fairly closely related to the ground pines which are so conspicuous underfoot in northern woodlands. The 43 species dealt with by Dr. Tryon are grayish-green little plants especially adapted to life in dry places, rocky or sandy, most of them hugging the soil so closely as to seem almost a part of it. They are inconspicuous, and their study has been neglected partly because of this fact and partly because botanists have had a difficult time figuring out just where one kind ended and another began. However, for this very fact they are of interest to students of evolution and also because they are the one group of desert-loving species in a whole assemblage of plants adapted to cool and damp situations.

THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (April to November) and until six (November to April) though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., opposite the junction of routes 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

MISSOURI BOTANICAL GARDEN BULLETIN

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COVER: View in the Dendrobium House.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

Vol. XLIII APRIL, 1955 No. 4

DENDROBIUMS, GOOD ORCHIDS FOR ST. LOUIS

The cover picture shows the *Dendrobium nobile* house at Gray Summit as it appears every year from February to April. Of all the orchids raised by the Garden none seems to revel more in our difficult climate than *Dendrobium nobile* and its varieties and hybrids.

By and large, these Dendrobiums give somewhat the same effect as sweet peas. The colors are similar. The commonest is a bright pink deepening towards the tips of the petals and with a black-purple eye in the center of the flower. There are pure white varieties, deep pinks, and hybrids in soft shades of yellow. The flowers are smallish as compared to the common Cattleya but are borne in great profusion, and the petals are so beautifully waved and lightly poised that, like sweet peas, they have a butterfly aspect.

When one learns how to use the blooms they are excellent for flower arrangements. They are short-stemmed, about like a pansy, and, like pansies, they are remarkably easy to condition. The flowers are cut, thrown into cold water, and pushed down under the water with the hands until completely submerged. It seems strange to treat such delicate-looking blossoms like so much parsley, but they have the constitution to take it.

Small potted plants of Dendrobiums in full bloom make attractive house plants. They only need to be watered two or three times a week and will stay in blossom for several weeks, giving a bright spot of color and a fairy-like atmosphere to a flower window or plant porch.

A NICE QUIET EVENING WITH A POTATO

EDGAR ANDERSON

People connected with our great universities tell me that old-fashioned botany is not a popular subject these days. It may be that these academic experts do indeed know what they are talking about but to one who sits in the Director's office of a big botanical garden the problem is not the lack of such an interest but rather how to find time to answer all the letters and the telephone calls of people who want to know more about plants. Inquiries pour in; publishers want books written; men's garden clubs, women's garden clubs want lectures or even whole courses in botany; plain John Doe and Jennie Doe want to know this, that, and the other thing.

Nearly all these people are adults. It may be that the average college or university student is adult enough for English Literature or Sociology, perhaps even adult enough for Mathematics but is not yet mature enough to study Botany! Whatever the reason, those of us at botanical gardens have this ever-increasing thirst to slake. "Why didn't I study Botany in college when I had the chance?" This is the chorus of lost souls which one in my position hears day and night—and when I say night it is not just a figure of speech; the telephone still bears this plaint to my ears (often with apologies for calling at such a time) up into the late hours of the evening.

Nor is the phenomenon merely a local one. During the current month I am giving three consecutive lectures on elementary old-fashioned botany to a group of women in New York City; the mail which comes to my desk is country-wide. There is certainly in these days a growing curiosity about plants. It is connected, but only indirectly, with the present-day increase in garden-club membership and with the tremendous development of amateur interest in gardens and wild flowers and plant breeding. The number of active, specialized plant societies increases each year. The old established ones such as the Rose Society and the Orchid Society have been joined by many others in the last two decades. There are now Pentstemon and Primrose societies on a national scale. There is even an active, intelligent, well-directed group whose very name "Gesneriad" demonstrates the degree of specialization which is now being reached. The man in the street may not have heard of Gesneriads, for they have no common name. A Gloxinia (if you happen to know it) is our commonest Gesneriad, but there is now a group of highly talented amateurs—chemists, printers, real-estate salesmen and the like—who gather nationally once a year and discuss Gesneriad matters so technical that they are beyond the ordinary knowledge of ordinary botanists. This interest in plants and in botany, and most particularly in old-fashioned kinds of botany, seems to be growing rapidly. I imagine that

if it keeps up for another decade or so the universities will at length be affected and an appropriate kind of botany may get taught in colleges.

In the meantime what does a botanical garden do about this flood of requests? Well, everything it can. We answer telephone calls and letters, we give lectures, we organize courses, we write books if we can find the time, but most persistently of all we persuade the intelligent public that if they love plants they need few books; all they need is enough enthusiasm to study the plants themselves. These people who come to us in such numbers are adults. If one is dealing with adults the best thing to do is to show them how to help themselves.

All of which brings us back to our title, "A nice quiet evening with a potato." If you're an adult and you want to teach yourself how to find out about plants there is no more convenient way to start. Get a potato, a nice big one, out of the bin, wash it off carefully, and sit down in a comfortable chair with a good light coming over your shoulder. Turn the potato over in your hands. Don't be too tense and earnest. If you can get a friend with kindred interests to join you, so much the better, and if you talk about other things now and then it's all to the good. Just try to build up a little intelligent enthusiasm for this starchy sphere which previously you have taken so for granted.

Well, let's look at the potato. Most obviously it has eyes. Nearly everybody knows this much, yet have you really ever looked a potato in the eye? There is something more or less like an arching eyebrow with an eye-hollow within the arch and coming up out of this hollow are little dark buds. Now notice the arching eyebrows. They don't arch any old which way; they are all focused in the same direction. To our surprise we will learn that each potato has a well-defined front end and an equally well-defined rear end and that these are very different in appearance. At the front end the eyes are clustered closely together, the buds always frontwards from the arching brow. This brow is really a kind of leaf, or the mark where such a scale leaf was borne and then fell off. Sometimes new potatoes will show delicate little membrane-like scales rising up off the tuber's surface in these arching lines; in the ordinary grocery-store spud the membranaceous scale has usually gone by and only a faintly curving scar is left. Now turn the potato about and look at the other end, then examine the whole region in between. At the other extreme from the active apex with its closely clustered buds you will find either a piece of the little round underground stem on which the potato was formed or the neat little circular scar where this stem was broken off.

A potato, you see, is what botanists call a tuber. It is just the swollen coalesced buds at the end of an underground stem. It is not a root; it is

part of a true stem though borne underground. Like all stems, it has joints (the technical word is nodes) at which leaves (or leaf-like scales) are borne and it is in the axils of these scales that all the new branch stems arise when the potato is sprouted. This is how one tells stems from roots in those plants with both underground stems and true roots. Stems have nodes (joints); roots don't. Stems have leaves or scales at the nodes; roots have neither. If you find a root with some little scales on it at fairly regular intervals, it isn't a root. It's an underground stem of some sort. Finally, stems are precise in their pattern of growing; they branch only in the axils of the leaves or scales; roots branch very irregularly.

Our humble potato is therefore a much more precisely organized bit of life than one would have imagined. Like virtually all life it is highly polarized. It has a head end, an apex, at which growth is most active. It has an innate orientation to up and down, to frontwards and backwards. Plant your potato in a bowl of sand or sawdust or vermiculite, keep it well watered and watch its development for a few weeks. See the way the new stems sprout out from the buds near the apex. Plant another potato in the garden and dig it up and wash off the roots after the plant is well developed. You will be able to see for yourself the difference between the true roots and the jointed underground stem on which the potatoes are borne.

So what? Well, you'll have made a beginning at understanding for yourself the world around you. The world looks chaotic; deeper study shows us the order in it; with still deeper and more intensive study we are able to understand enough of the order underneath the apparent chaos so as to work with it rather than against it.

If the potato interests you after you have learned something of how it is put together, go on from there. Look at some of the other brown things we dig up out of the earth and figure out for yourself just how much of each one is stem, what is root, and what is leaf. A gladiolus bulb, for instance, is little leaves on top of a thickened stem; an onion is overlapping juicy leaves attached to a small central stem; an iris plant is mostly a jointed horizontal stem with leaves and roots coming off at the nodes and with occasional upright flowering branches rising from the axils of the leaves. After a few such attempts you'll begin to understand about roots and stems and leaves. The problem of whether a stem is a stem and a root a root turns out to be more complicated than you used to think. A stem is a very definite kind of thing; even though it grows underground and looks like a root it is still a stem. It has nodes and it branches only at the nodes. It can't develop any old way, like a root, but follows a definite pattern. Having set up this stem complexity, nature has been astute in using it in various ways. Each kind of plant has its own distinctive set of internode and stem-branching patterns.

They make that kind of plant what it fundamentally is; if you are going to manage the plant efficiently you need first of all to comprehend these underlying patterns.

So if plants are beginning to interest you and you wish you knew more about them, no need to sigh for lost opportunities, no need for that magic book which will tell you painlessly the very things you wish you knew. Sit down quietly with a potato, a nice large, clean potato. Relax in your chair. Take a friendly interest in this succulent brown blob which you have previously ignored. Let it become a simple introduction to learning about plants from plants themselves. Take your first step towards botanical insight by spending a nice quiet evening with a potato.

SOME FINE NEW FORSYTHIAS FOR ST. LOUIS GARDENS

Gradually the Garden is getting together a demonstration collection of shrubs which are particularly to be recommended for St. Louis. Of these, the Forsythias are now the farthest along, and several of the bushes were large enough this spring to indicate their probable usefulness in St. Louis gardens. Three varieties were outstanding. SPRING GLORY is a charming light yellow, much less buttery-yellow than the average Forsythia. It is graceful, informal, and early-flowering. LYNWOOD GOLD is later, and a deeper yellow, a much stiffer and more upright plant. It ought to make a good informal screen planting or might be used as a high untrimmed hedge. The most unusual variety in the collection was produced at the Arnold Arboretum by Dr. Karl Sax. It is named BEATRIX FARRAND after the well-known landscape architect. The flowers are larger than any other variety in the collection; they are deep yellow, and the bush has an attractive fountain-like shape which bids fair to be spectacular when thoroughly established.—E. A.

THE EFFECTS OF THE THREE-YEAR DROUTH ON MISSOURI PLANT LIFE

An Appraisal

JULIAN A. STEYERMARK

During the past three years we in Missouri have been hearing as never before of record-breaking heat spells, record drouths, and lowest water levels, drying-up of springs and streams which had never been known to go dry, and other similar distressing statements. Just what has been the impact of all this dry hot weather on the native vegetation? How well have the forests fared during this record-breaking siege? Have rare and beautiful wild flowers and ferns died out because of the scorching winds?

Taking trips into the various counties of Missouri to obtain herbarium specimens to record the exact geographical range of each native species necessitates my traveling all kinds of roads, tramping up and down hills, over prairie, swamp, pasture, fallow fields, along bluffs, streams, and every other conceivable type of habitat. It meant sweltering during the past July in extremes of 117° in the shade while I trudged over seared Missouri hillsides. It meant gazing on dried lake bottoms and lowered streams. During 1954 it meant traveling nearly 15,000 miles in Missouri working over 35 counties in detail. From such an intimate contact with the Missouri countryside, my conclusions concerning the effects of the past three-years' drouth are based on first-hand observations.

At first thought one might believe that the past three-years' drought has exacted a heavy toll on native plant life and I was prepared to face the worst possible picture. Let us see what actually happened to Missouri vegetation, then, over the three-year period. We can best discuss the effects of the drouth from the standpoint of (1) effects upon the forests themselves, (2) effects upon the herbs and tender plants of the land, (3) effects upon plants growing in moist habitats.

I. EFFECTS UPON THE FORESTS THEMSELVES

The general conclusion I have drawn after direct observation of the forests is that they have received only a negligible amount of permanent damage. Over broad stretches of land, the forest canopy has maintained a solid green front. Here and there, conspicuous because of its exception, stands a brown seared dead oak. It was observed that on some slopes, less than $\frac{1}{100}$ of one percent of the forest was damaged, whereas on other slopes, especially where there was overgrazing or on a west- or south-facing bluff or glade, damage was greater and a larger (although never excessive) proportion of trees suffered. The occurrence of dead trees was very spotty; in some sec-

tions of a county there were greater numbers than in other sections. Previous fires and excessive overgrazing in the forests had weakened trees in a number of areas, and an inspection of such trees revealed that the drouth finished off what was originally started by fires or over-grazing or both. In some areas it was necessary to differentiate clearly between trees that had been killed by natural causes, such as the drouth, and others that turned brown and were killed by various types of brush-killers. Particularly on more shaded north- and east-facing slopes, or in areas where the natural undergrowth and leaf mulch were undisturbed, or where grazing and fires had been kept out, few or no dead trees were observed.

It was especially interesting to see how well most of the forest trees withstood the effects of great heat and lack of rainfall over a long period. Hanging on to craggy limestone bluffs or exposed limestone glades were Southern Buckthorn or Chittim-wood *(Bumelia)*, Indian Cherry *(Rhamnus caroliniana)*, and Dwarf Hackberry *(Celtis tenuifolia* and *C. laevigata* var. *texana)*. In some cases they were living under the adverse conditions of pronounced exposure to sun and wind; in other cases, but in not as many as might be expected, they had succumbed. In general, Sugar Maples withstood the effects of the drouth remarkably well on dry limestone slopes. In protected ravines and in narrow draws Red Maple and Sour Gum thrived. The tough Buckley's Hickory *(Carya texana)* and other species of hickory showed little damage from the adverse conditions created by the prolonged drouth.

With its vivid rose-red autumn color, Flowering Dogwood appeared everywhere abundant and healthy as part of the understory. Sumacs, Sassafras, and Ozark Witch-Hazel had not dropped their leaves prematurely and were everywhere in evidence with their usual healthy fall coloring. Likewise, Pawpaw and Spice-Bush on shaded slopes appeared normal.

The trees which were dead or exhibited signs of dying were mostly the ones found standing by themselves in open fields or pastures, or near houses and clearings. In such places, deprived of the normal protection of forest cover or exposed more to the sun and drying winds and with the water table farther removed from the reaches of their roots, these isolated trees had in a number of instances finally succumbed. American Elms and various oaks seemed to be the ones most easily affected.

Despite the drouth, it was amazing to observe the tenacity of the trees in general. While some trees in various parts of the state shed their leaves because of excess dryness, the great majority held on to them, creating a superb autumn coloring effect.

II. EFFECTS UPON THE HERBACEOUS PLANTS

If any of the native vegetation were to be adversely affected by the pro-

longed drouth, it would be expected that the tender herbaceous vegetation would be the first to show the ill effects of record heat and dry spells. Yet, strange as it may at first seem, these natural conditions during the past three-year drouth have not killed the herbaceous plants. The many rare species, scattered throughout the state, are still surviving peacefully in their favorite haunts, according to their nature, in crevices of bluffs, on wooded slopes, glades, hot prairies, wet meadows, and other types of habitats favored by particular species. It is true, of course, that the plants frequently showed the effects of the hot dry weather by wilting, inrolling or loss of leaves, or abortion of flower buds or no flowers at all, but they did not die. On one dry slope a species of waterleaf *(Hydrophyllum appendiculatum)* occurred; normally the basal rosettes of maple-like leaves would have persisted all summer, but during the summer of 1954 the plants dropped the leaves only to grow out new ones in October after freshening rains. The sun-baked rocky glades (limestone, sandstone, chert, and granite), with all the characteristics of a desert environment, nevertheless harbored their usual flora. The little annuals, such as heliotrope *(Heliotropium tenellum)* and the crotons *(Croton monanthogynus* and *C. capitatus)*, bloomed merrily on throughout the heat of July until October, sharing the hot limestone glades with such perennials as Missouri Black-eyed Susan *(Rudbeckia missouriensis)*, Missouri Primrose *(Oenothera missouriensis)*, and Side-oats Grama Grass *(Bouteloua curtipendula)*. Similarly, on the dry sandstone glades, the Triple-awned grasses *(Aristida dichotoma, A. longespica,* and *A. purpurascens,* among others), Bluecurls *(Trichostema dichotomum)*, and *Crotonopsis elliptica* of the Spurge Family, flowered and prospered as usual.

During the prolonged record heat of July, it was sad to walk over seared woodland slopes noting drooping wilted leaves of Wild Ginger, but after October rains the same leaves had become firm and fully expanded. Likewise, on parched woodland slopes, rosettes of asters and goldenrods, among them *Aster anomalus, Solidago arguta* and S. *flexicaulis,* were dull green and looked lifeless during the height of the dry spell of the summer, but in October they had given rise to beautiful flowering stalks of purple or yellow.

Rosettes of numerous herbaceous plants in late summer and autumn gave promise to carry on, despite the drouth, into 1955. There were the maple-like rosette leaves of Bishop's Cap *(Mitella diphylla)*, which appreciates moisture when it can get it, the leathery three-lobed leaves of liverwort or hepatica, the dissected leaf-rosettes of Bird's-foot Violet *(Viola pedata)*, and the circular frilled collar-like rosette leaves of Early Saxifrage *(Saxifraga virginiensis)*. These and numerous other species of herbs testified by their very renewal or persistence of rosette leaves that they were impatient to get started for spring of 1955. Such little bits of green, standing out in the

forest or in the prairies or glades, were in themselves messages of an optimistic note for 1955. Perhaps, more than anything else, they do more to encourage us to believe that the plant life in Missouri is far better able to adapt itself to dry adverse conditions than most of us realize.

In only one instance, namely with respect to the American Columbo *(Swertia caroliniensis)* did the drouth apparently destroy the basal rosettes. In several instances during the summer, colonies of this species were observed in which the leaves were dead on rosettes as well as on flowering stems. Some of these plants may have died, but it will not be possible until next year to determine the extent of the death toll of this species.

III. EFFECTS UPON PLANTS GROWING IN MOIST HABITATS

Under this heading, we would include those plants growing naturally in such moist habitats as swampy meadows (fed by springs), sink-hole ponds, and stream margins. Ordinarily, such habitats when left undisturbed (not cultivated nor grazed over) account for a luxuriance of interesting and rare plant life, mostly of the herbaceous type. During the past year some of these unusual habitats have been, for the first time in their history, dried out by having cattle come in and stomp over the soil, and ruthlessly graze the tops of plants or root them out of the soil, destroying them completely. This has happened in a number of the unique sink-hole ponds of the Ozarks, where a flora exists dating back to an ancient day millions of years ago when the vegetation now characteristic of the Atlantic and Gulf Coastal Plain prevailed over most of the Ozark area. The herbaceous oddities which grow in these ponds, counting among their number such unusual species as Lance-leaved Violet *(Viola lanceolata)*, Water-millet *(Zizaniopsis miliacea)*, Water-violet *(Hottonia inflata)*, remarkable species of Spike-rush *(Eleocharis equisetoides)* and Bulrush *(Scirpus etuberculatus)*, are the relics of bygone days and must be preserved for posterity. All of them had a rough year in Missouri during 1954 and in some cases have become nearly exterminated, because the owner of the pond, not realizing their value, has either bulldozed the pond to deepen it, or has allowed cattle to come in and dry it up with constant trampling and stomping of the soil. Consequently, the rare vegetation of these ponds, for the first time since occupying the ponds, is being threatened during the drouth years by man or his domestic animals.

The story is the same in other ordinarily wet habitats. Swampy meadows, normally filled with Indian Paint Brush *(Castilleja coccinea)*, Grass-of-Parnassus *(Parnassia grandifolia)*, Grass-pink *(Calopogon pulchellus)*, Spotted Sweet William *(Phlox maculata)*, and some species not found elsewhere in the state, are being heavily overgrazed and dried out by cattle trampling

over the soil. In many instances they are being plowed under and turned into seeded pastures, sealing their fate and dooming them to extinction. The dry 1954 season has, as in the case of the sink-hole ponds, accentuated the tendency to bring in cattle or alter the original habitat.

Along stream courses, the vegetation, where not grazed, has fared much better. Here, the lowering water level has not killed any of the herbaceous plants. Instead, they have followed the water-level line and adapted themselves accordingly. Cardinal Flower, Blue Lobelia, Monkey Flower, Water Loosestrife, Water-willow, Fog Fruit, and other wet-shore dwellers have either moved lower down nearer the water level or else adapted themselvés to a somewhat drier soil.

On the other hand, in natural ox-bow lakes in river valleys or natural upland ponds, in many cases completely dried up, the plants continue to survive in an altered environment of wet instead of inundated mud. Such has been the plight of Water Primrose *(Jussiaea repens* var. *glabrescens)*, False Loosestrife *(Ludwigia polycarpa)*, Water Purslane *(Ludwigia palustris* var. *americana)*, Arrowhead *(Sagittaria brevirostra*, S. *latifolia*, and S. *rigida)*, Water-plantain *(Alisma subcordatum)*, among other species. But such a change does not lead to the plants' death. Even some species of Pondweed *(Potamogeton americanus*, *P. diversifolius*, *P. pulcher)* survive in lake bottoms, which, in the cases I observed, were not completely dry, but were somewhat moist underneath. Fortunately, rains do re-occur, and even though they may not be sufficient to raise the water in the pond to its normal level, they prevent the plant from drying out entirely.

CONCLUSIONS

From what has been written above, it is apparent that the direct effects of the past three-years' drouth on Missouri vegetation have been negligible. While admittedly some areas have suffered worse than others and show a greater number of dead trees, the over-all picture of the forests and natural undergrowth is good. In general, within a given forest a relatively small number of trees have died. The dying-out has been more pronounced on rocky bluffs, on glades, and on slopes facing south or west, exposed to more pronounced sunlight and intense heat, but this has varied from one locality to another. Where areas have been severely overgrazed, cut over, or burnt, the plant life has reacted unfavorably and such conditions have weakened the chances for survival of particular trees and shrubs. Where the soil cover has been left in place protected by a heavy leaf mulch, where the undergrowth has been undisturbed, or where a slope faces north or east, dying-out of a tree is conspicuous by its absence.

The herbaceous vegetation has suffered only where it has been disturbed

by overgrazing or cultivation. It has shown remarkable powers of adaptation to drouth conditions, successfully overcoming extremes of heat and dryness by shedding leaves, failing to flower, remaining dormant until the next rainfall as desert plants are accustomed to do, or reducing the leaf surface by inrolling of the blade. Leaf-rosette formations appearing in summer and fall testify to the forthcoming 1955 season and to the remarkable adaptability of such species. The herbaceous plants of the glades and woodland came through the 1954 and previous drouth mostly in good condition. Rare and endemic species continue to survive such adverse years of drouth, indicating, in the case of those used to a cooler moister climate, that it will require a much more severe heat and drier spell to exterminate them. The herbaceous plants which have suffered most during the drouth have been those inhabiting the ancient sink-hole ponds and the swampy meadows. Where these habitats have been disturbed by man's cultivation or bulldozing activities or by the trampling and stomping of the soil by his domestic cattle, the rare and unique species inhabiting these moist places are threatened with extinction. The last three years of drouth have produced some changes, but they are very negligible in the main and have not affected the mass of the vegetation. The dominant green canopy of forest continues to prevail over the Ozarks and the rest of Missouri, and, in general, the natural vegetation of the state remains intact.

Dr. Julian Steyermark whose interesting article on drouth damage to native plants is printed elsewhere in this issue is now in South America on an expedition from the Chicago Museum of Natural History. Though his professional hours are largely taken up with technical studies of the vegetation of South America, he has never forgotten his first love, the flora of the Ozarks. The Garden helps sponsor this part of his activities and defrays part of the cost of his collecting trips in Missouri. In 1954, indefatigable as ever, on top of his various other commitments, he visited and studied the local flora of 35 different Missouri counties:

Adair	Cooper	Howard	Reynolds
Andrew	Crawford	Laclede	Ste. Genevieve
Audrain	Dallas	Macon	Scotland
Bollinger	Daviess	Madison	Scott
Callaway	Dent	Moniteau	Shannon
Camden	Gasconade	Montgomery	Stoddard
Carter	Gentry	Platte	Washington
Cape Girardeau	Harrison	Polk	Wright
Clark	Hickory	Putnam	

Few Missourians who live the year round in Missouri could equal this record. Certainly no one else on the staff of the Missouri Botanical Garden has seen so much of the state in the last year.

IS THE TOMATO A FRUIT OR A VEGETABLE?

EDGAR ANDERSON

Once a year or so some one in St. Louis calls up the Botanical Garden and wants to know: Is a tomato a fruit or a vegetable? They never like the answer that it can be either and are even irritated that this answer can be reached by two quite different routes. It is usually evident that the call has been made to settle an argument; human beings apparently would rather lose an argument than to have the point at issue left permanently up in the air, forever unsettled. The answer, however, is of more general importance than the question itself since it is a neat illustration of the difference between scientific terminology and common speech. It points up the differences in the ways of thought and the uses of language in scientific discussion and in everyday conversation.

This particular example is illuminating because we can answer the question on either the botanical or the everyday level. The botanical answer is the simplest, though the man in the street usually feels let down when he finally gets it in his head. Botany is a science, and terms used scientifically are made as precise as possible. Both "fruit" and "vegetable" are words which, used in a scientific discussion, have very precise meanings, meanings moreover which are somewhat at variance with their everyday sense. Botanically, fruit is a ripened seed or seed-head with all the accompanying tissues. The seed-pod on a radish plant is, botanically speaking, a fruit, so is a pumpkin, so are sticktights, so is an apple or a pear, and quite as equally a ripe bean pod or the seed-head of a poppy. Botanically therefore, the answer is clear. A tomato consists of the seeds of the tomato plant and the tissues immediately around them. Scientifically considered, a ripe tomato is most certainly a fruit in the purely botanical sense of the word. As for the word "vegetable" it has the same meaning in botany as in the old guessing game of "Animal-vegetable-mineral." It means anything to do with a plant, rather than with an animal or with inorganic materials. We speak scientifically of the Vegetable Kingdom, meaning all plant life. In a purely botanical sense all weeds, all flowers, all trees are vegetable in nature. In the precise vocabulary of botany, therefore, the answer is clear. A tomato is vegetable; it is also a fruit.

But both "vegetable" and "fruit" are also words in common speech and there they have somewhat different meanings. Such talk, moreover, is not precise. It varies from time to time and from place to place; the greatest dictionary-makers define words not so much in precise terms as by giving copious illustrations of the various ways each word has been used by various writers. In this argument a botanist loses his professional standing. He is no more the expert than any other person who has taken a little interest in

his native tongue. Just as an amateur, however, a botanist may attempt to answer the question.

Just what is a fruit in everyday talk? What is it that grapes, apples, figs, raspberries and plums have in common? Well, they are plant parts associated with the ripening seed which are attractive in taste and frequently in appearance as well. They are eaten usually before or after a meal, only very rarely with the meat course and are often indulged in between meals. Frequently, the juice is extracted, sweetened, and used as a drink. A vegetable may be any part of the plant (including, however, those which are going, or have gone, to seed). It is eaten with the meat course, frequently in combination with other vegetables or with meat or cheese or eggs.

Well, by these tokens is a tomato a fruit or a vegetable? Obviously, when tomatoes are being used with a meat stew they are being used like a vegetable. Almost as obviously when they are eaten fresh out of hand, between meals, they are being used like a fruit and this kind of use is on the increase. When tomato juice, with a little lemon juice and sugar added to it, replaces orange juice as a breakfast drink, tomatoes are being used like a fruit. When, as in upstate New York, sliced tomatoes are eaten at supper time with sugar and thick cream they are being used in the same way as sliced peaches. The role of tomatoes in salads is not so clear except that one notes cottage cheese and tomatoes in exactly the same dishes at the same type of meal by the same family as cottage cheese and pears. My answer therefore (and remember that in this sense it is an amateur's answer) would be that tomatoes are ordinarily used as a vegetable in the United States but that occasionally (and increasingly) they are being used as a fruit. Clearly at meal times a tomato can be either a fruit or a vegetable—but these are not botanical terms used in this way and there is nothing wrong about using them in a loose fashion.

The most recent request for a decision on this question came to the Garden from a St. Louis saloon where a considerable sum of money had been wagered and the pay-off depended on our answer. You may not like our reply any better than did the men in the saloon but it is an honest one.

BOOK REVIEWS:—

Winter-hardy Azaleas and Rhododendrons. A brief account of these plants and their culture in zero climates of the American East. By Clement Gray Bower. 112 pp. Massachusetts Horticultural Society, Boston, Mass. 1954. $3.00.

This little book is attractively printed on good paper and has 17 full-page illustrations in black and white, all of them excellent and several of them breath-takingly beautiful. Dr. Bowers speaks out of his experience in growing, and trying to grow, many kinds of Rhododendrons and Azaleas in upstate New York, not the easiest place in the world to make such an attempt, though by no means as difficult as Missouri in soil and climate. The book is tersely and honestly written in good plain English prose. Recommended to all those who have been growing Rhododendrons and Azaleas in the St. Louis area.—E. A.

Wild Flowers of Missouri. By Theresa C. Rickett. Second edition, revised and edited by E. M. Palmquist and C. L. Kucera. 148 pp. Missouri Handbook Number 3, University of Missouri, Columbia. 1954. Paper-bound, $.75.

This unpretentious but informative and familiar guide to the more common wildflowers of Missouri is again in print. Published in 1937 by the Agricultural Extension Service and long out of print, it is republished by the state university as its Missouri Handbook Number 3. Although it is not strictly a reprint the only changes in wording seem to be those of Latin names made in conformity with the last edition of Gray's Manual. The photographs have been made uniform in size and include some not appearing in the first edition.

The main body of the text is divided into four parts devoted respectively to early spring, late spring, summer, late summer and autumn. Each part is a running commentary on the flowers to be found in the period treated. Most of the plants get an informal description, together with some bit of plant lore; on a near-by page there is often a good photograph of the plant in flower. There is a twelve-page key employing multiple choice at each division, rather than simple dichotomy. The main divisions of the key are based upon such characters as woody or herbaceous growth, parallel-veined or netted-veined leaves, flowers of various colors, etc.; the characters used to separate genera and species are shape of leaf, number of petals, and the like. The key worked well in the cases tried and is simple enough for any one who is willing to attempt its use. There is a short introduction briefly explaining the ideas of family, genus and species, and the notions behind the precise

naming of plants in Latin; the introduction concludes with a simply-worded appeal for wildflower preservation.

Frankly a book for beginners it covers only a small part of Missouri's rich flora, but even the more advanced student would find such a simple guide useful among plants new to him. Many a scholarly taxonomist, otherwise lost among synonomy and exsiccatae, would do himself proud to produce such a work.—G. B. Van Schaack.

The Secret of the Green Thumb. By Henry T. Northen and Rebecca Northen. 431 pp. 221 figs. The Ronald Press Company, New York. 1954. $5.00.

If you have rooted African Violets but have not tried to air layer a Fiddle-leaf Fig, have Chrysanthemums blooming in September but not in July, use nicotine sulphate for aphids but not Lindane or have the urge to develop a new plant variety, you will want to have this book in your gardening library. It is a volume for the serious gardener who wants to know more about plants and the way they grow. The main attraction—the flower—is the first subject. Its form and function and subsequent products, the seeds and fruit, are explained in relatively simple terms. Following an acquaintance with these, the chapters on plant breeding and heredity will prepare you for creating new varieties. The portions on the centers of operation—the leaves and the roots, their structure, modifications and relationships to water, oxygen, temperature and light—contain all the fundamentals of a botany textbook but these technicalities are discussed in connection with their practical applications in your garden. Most of the information you can use directly but chapters on plant communities, survey of the lower plants and evolution will bring gardeners an appreciation of our great natural gardens and how they originated. The profuse photographs effectively illustrate the text although a few are not first rate. The book brings together in a single volume pertinent information on plants and modern developments which will make any gardener a wiser and happier one.—Alice F. Tryon.

The Library of the Missouri Botanical Garden has been built up largely with the needs in mind of those of us who live and work here—the staff and the students. However, it serves a far larger public, not only in St. Louis but in other parts of the country, as is demonstrated by some of the requests which came in recently. In one week there were three long-distance calls: (1) A gentleman from Detroit phoned to say that he had visited our library and had got much help from a book on evergreens. All that he could remember was that it was "about 1½ inches thick and about evergreens" but he

had found it so helpful he wanted to know the name. Miss Kohl, who had helped him, remembered the name and the complete reference was sent off airmail; (2) The Director of the Natural History Museum of Houston, Texas, called with a list of 26 references which he needed to see in preparing an inclusive guide to the trees and shrubs of the Southwest. Some of the books were sent off to him by express, and the rest, being either too valuable to be sent out of the library or in too constant demand by the staff and students, are being photostated here in St. Louis; (3) A call from DeSoto, Missouri, concerned a diseased holly and what to do about it. The librarians immediately got in touch with Dr. Meyer, of the Garden staff, and he forwarded the necessary information.

The Big Freeze.—The blizzard and freeze of March 24 to 26 broke all records in the history of gardening in the Middle West. Those of us who live and garden in St. Louis, in spite of long experience with the violent changes of temperature so characteristic of the flat central plains and prairies of a big continent, had never seen anything like it. We hope we never do again, though such information as can be pried out of the experts on long-time shifts in weather pattern is not reassuring. On Thursday morning, March 24, the Garden was just recovering from a freezing cold wave earlier in the week. Daffodils were in bloom; the earliest of the flowering cherries were just opening their buds; the LAMARTINE lilacs were beginning to show a little color; much of the shrubbery was bright with new green leaves. Twenty-four hours later it was snowing fiercely, with a piercing wind, the temperature was way below freezing, and eventually reached 7° above zero. By Tuesday it was again nice spring weather. Gardens were a shambles. Plants looked as if they had been gone over with a blow-torch or dipped in boiling hot water. The shrubbery which had been so attractive with bright new leaves was singed and scorched. Roses were frozen back, sometimes to the ground, bluegrass and Italian rye grass were scorched at the tips of the leaves. Some iris varieties were killed almost to the ground. Not even the native vegetation escaped. Wild plum leaves and flowers were partially injured; most of the redbud bloom was totally killed, and there will be little display on our hillsides this year. A very few things rode out the snow and cold. The early yellow daffodil, FEBRUARY GOLD, had an amazing record. In some places around town where it had been held back and was in full growth it was injured by the cold but generally it came through both the blizzard and the freeze and was attractive during the next week. Leaves on some ivy vines were badly scorched, but the Garden's own introduction, MBG BULGARIA, came through the storm unharmed.

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (April to November) and until six (November to April) though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., opposite the junction of routes 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

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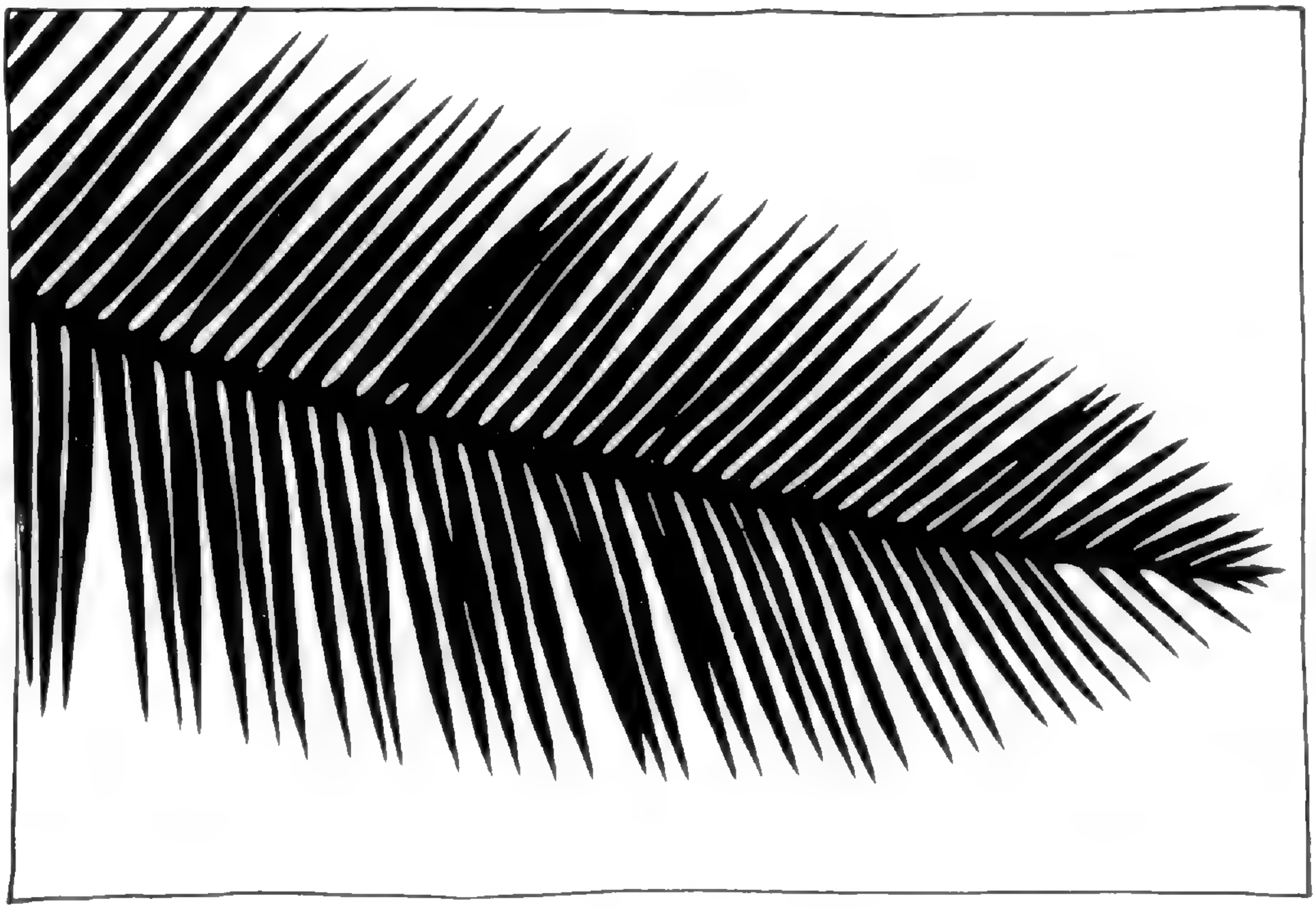

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COVER: Sporophylls and seeds of *Cycas revoluta*. Photograph by C. J. Chamberlain in 1905, × ¾.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Missouri Botanical Garden Bulletin

Vol. XLIII MAY, 1955 No. 5

ANCIENT SEED PLANTS: THE CYCADS

The Missouri Botanical Garden has one of the most representative living collections of Cycads in the country. It is housed in the north portion of the Main Conservatories since none of the species are hardy in the St. Louis climate. The collection has been extensively used by my classes in Ferns and Gymnosperms at Washington University, and this year, in addition to studying the collection, the students have prepared a series of papers on various aspects of the Cycads with a map of the greenhouse and a numbered guide to some of the more important specimens. It is hoped that this material will serve to introduce others to our fine collection of this unique group of plants. Evelyn Barbour, Edward Davis, Harold Kidd, Robert Long, Chester Marvin, Bernard Mikula, and Robert Mohlenbrock have contributed to this BULLETIN.—Rolla Tryon.

NATURAL HISTORY OF CYCADS

Cycads are woody plants, usually trees, which upon casual observation resemble palms. They are true Gymnosperms and, like the more familiar pines, spruces, and firs, bear their seeds unenclosed on modified leaves called sporophylls. Cycads are not closely related to any other group of living plants but are thought to represent a transitional stage between the rest of the Gymnosperms and the ferns.

THE CONES

The sporophylls may be arranged at the top of the stems in loose whorls or they may be much modified and aggregated into compact cones. Male and female cones are borne on separate plants. The female cones are borne at the apex of the stem and vary in length from about 2 cm. in *Zamia pygmaea* to as much as 70 cm. in *Macrozamia Denisonii*, the cones of the latter being the largest which have been known to exist. Some specimens have weighed as much as 85 pounds! The sporophylls are arranged spirally on the axis of the cone, each sporophyll bearing two or more seeds on its margin, two being the most common. The seeds are usually large, the average

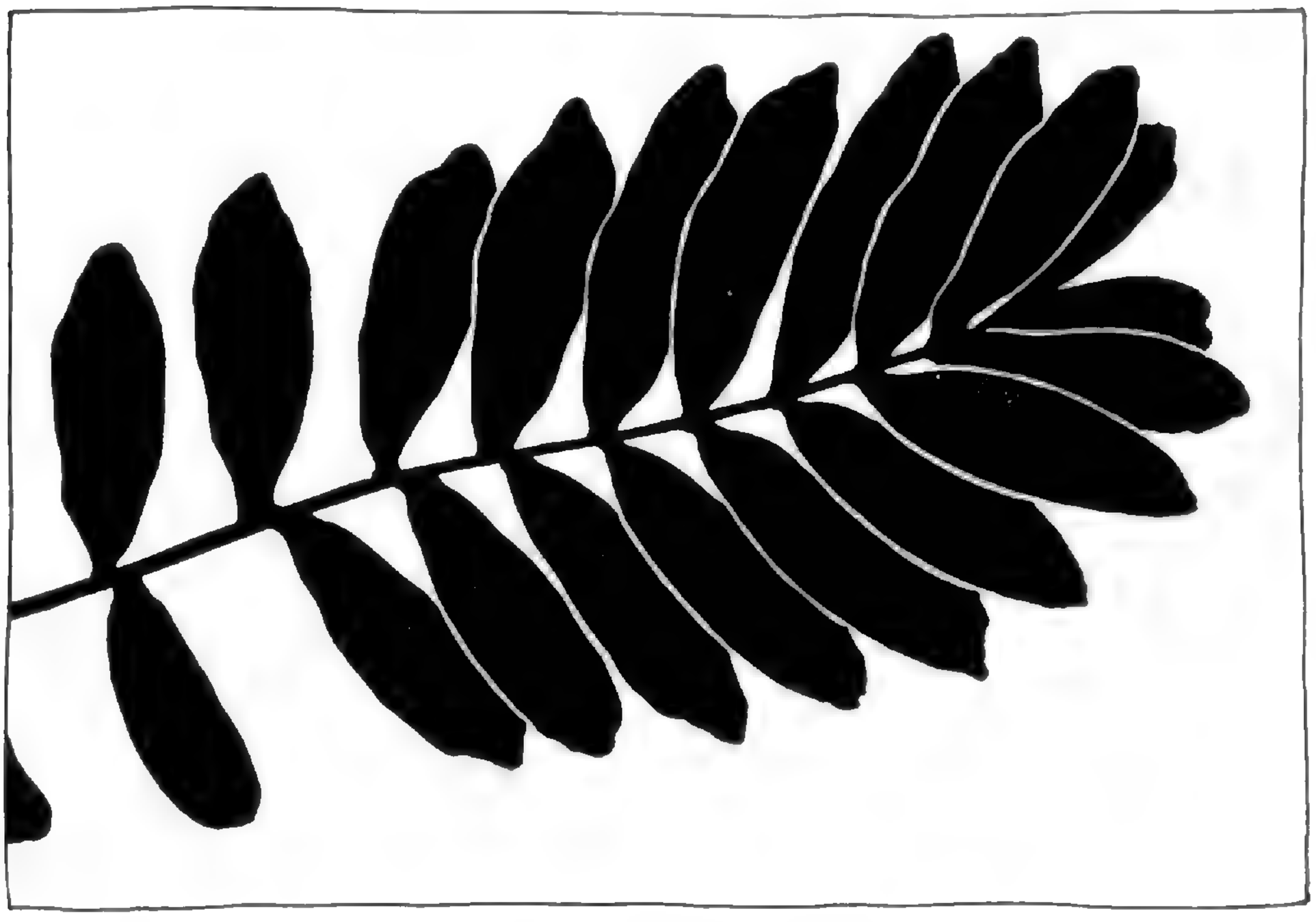


Fig. 1. *Zamia furfuracea*, × 1/4.

length being about 4 cm. The range in size is from about 6 mm. in *Zamia pygmaea* to 6 cm. in *Macrozamia Denisonii* and *Cycas circinalis*. The seeds have an integument or covering which consists of three layers, an inner papery layer and an outer fleshy layer, with a stony layer between them. The outer layer is variously colored, being red, yellow, pink, or white. The color seems to be constant for a given species.

The male cones (fig. 3) are found at the apex of the stem or rarely in the axil of a leaf. The sporophylls are arranged spirally as in the female cone, but the cone is so compact and the arrangement is so regular that they appear to be in vertical rows, like the grains in an ear of corn. Each sporophyll bears numerous sporangia on its lower surface. These are arranged in sori, or small groups, of 2 to 5 sporangia. This is similar to the arrangement in the ferns where the sporangia are also borne in groups on the lower surface of the leaves. These sporangia contain the spores (pollen grains), each male cone containing up to 3,000,000 pollen grains. In Gymnosperms the pollen is carried from the male cones to the female cones exclusively by the wind. This contrasts with the flowering plants where in the greater number of species it is transferred from flower to flower by insects.

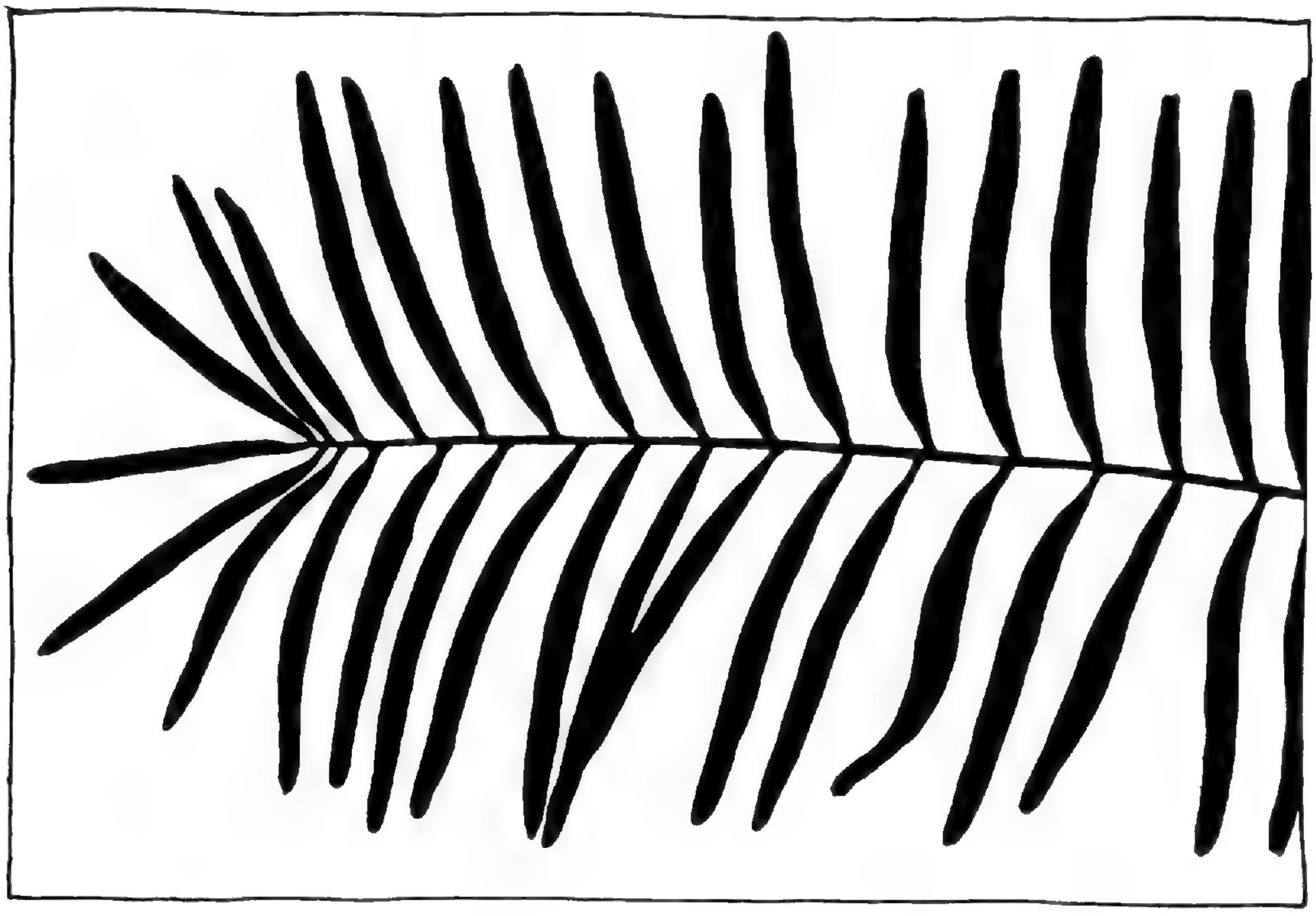


Fig. 2. *Zamia integrifolia*, × 1/4.

THE LEAVES

The leaves, seen from a distance, have a feather-like appearance, being described as pinnately compound. The variety of leaf forms has been illustrated by a series of silhouettes. Also, in common with the ferns, Cycad leaves have an open-type venation and circinate vernation, a type of development in which the leaves, being coiled rather than folded in the bud as they are in higher plants, unroll in the manner of the "fiddle heads" of the ferns. The leaves vary in length from 5 or 6 cm. in *Zamia pygmaea* to about 3 meters in *Cycas circinalis*. The leaflets may be entire or deeply incised and usually vary greatly with the age of the plant in number, size, and shape. The leaves are developed in a spiral succession from the base of the stem to the summit, a new crown being formed every two years. They do not fall off as do the leaves of most trees, but lose their leaflets, bend down and decay at a point a few inches from the cortex. An abscission layer then develops which cuts the petiole of the leaf (leaf stalk) off cleanly. Successive abscission layers occur beneath the original one, each cutting off a thin layer of the petiole so that the diameter of the trunk may be smaller at the base than it is at the summit.

THE STEMS

The stems of Cycads may be either tuberous and subterranean or arborescent. They are usually unbranched although branching does occasionally occur. Cutting off these side branches and planting them will result in the

Fig. 3. *Encephalartos caffer*, male cones, × 1/5.

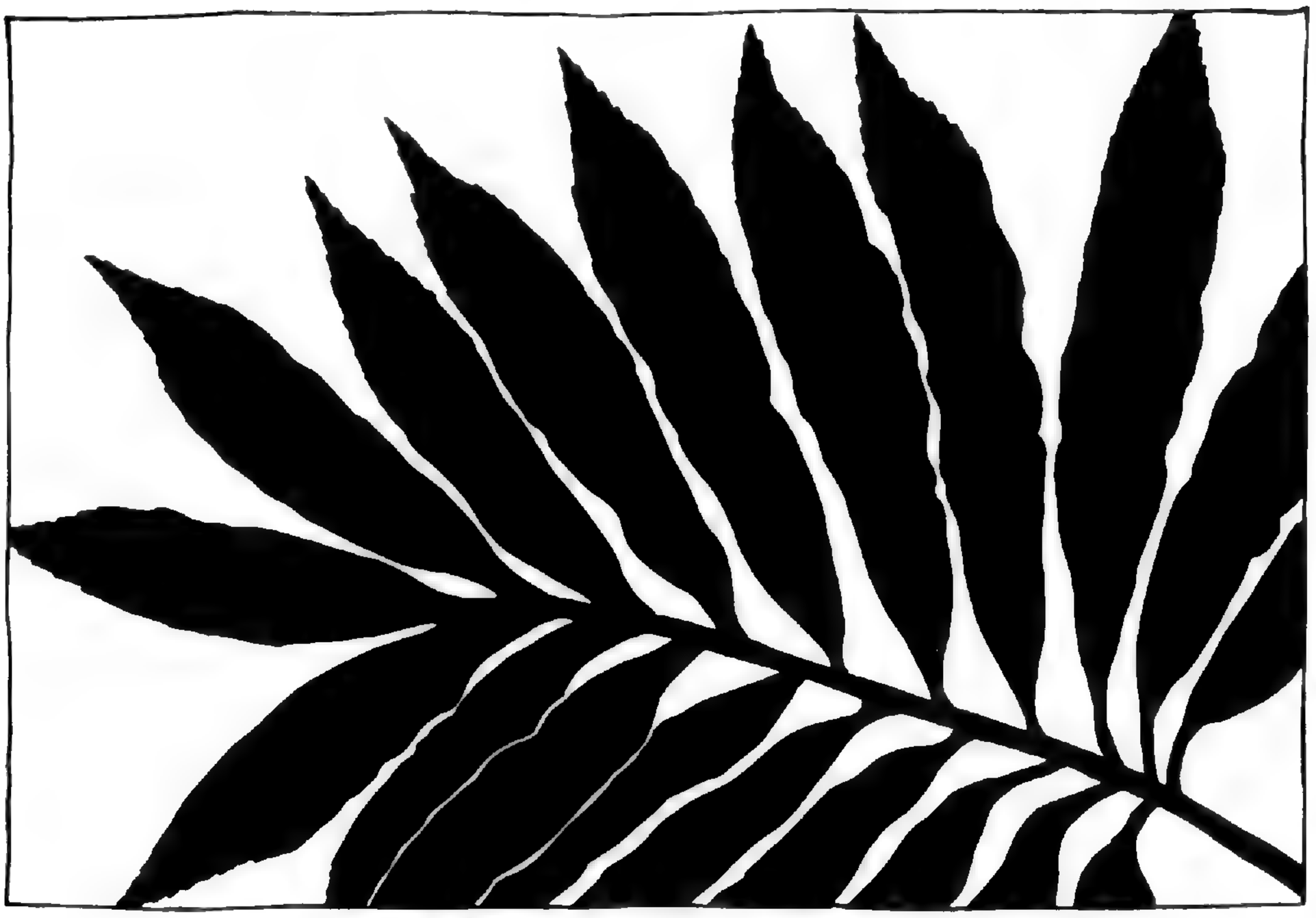


Fig. 4. *Stangeria paradoxa*, × 1/4.

growth of a new plant and is the chief means of vegetative propagation. Some of the tuberous forms branch below the surface of the ground. The typical habit of the arborescent species is an unbranched stem with a crown of leaves at the top. The tallest of these is *Macrozamia Hopei* which reaches a height of about 60 feet. *Dioon spinulosum* occasionally grows to a height of fifty feet. The other genera are not so tall, and the average height of the arborescent species is probably about 6 feet. The smallest known Cycad is *Zamia pygmaea* with a tuberous stem 1 or 2 cm. in diameter and about 3 cm. long.

The stems are unusual in several ways. They contain a surprisingly small amount of wood. Stems 15 cm. in diameter may contain a ring of wood only 5 cm. in width enclosing a large pith and surrounded by a still larger cortex. Compared to most woody plants, stem growth in Cycads is exceedingly slow. Over a ten-year period, a Cycad tree will produce about ½ inch of wood compared to nearly 8 inches produced by an elm tree during the same length of time. Another unusual feature is the absence of growth rings in the stems of most species. Even in those species in which rings do occur, they are never annual or seasonal as in most other trees. In *Dioon spinulosum*, they occur each time a new crown of leaves is formed, and in *Dioon edule*, rings are formed only at the resumption of growth after a prolonged resting period.

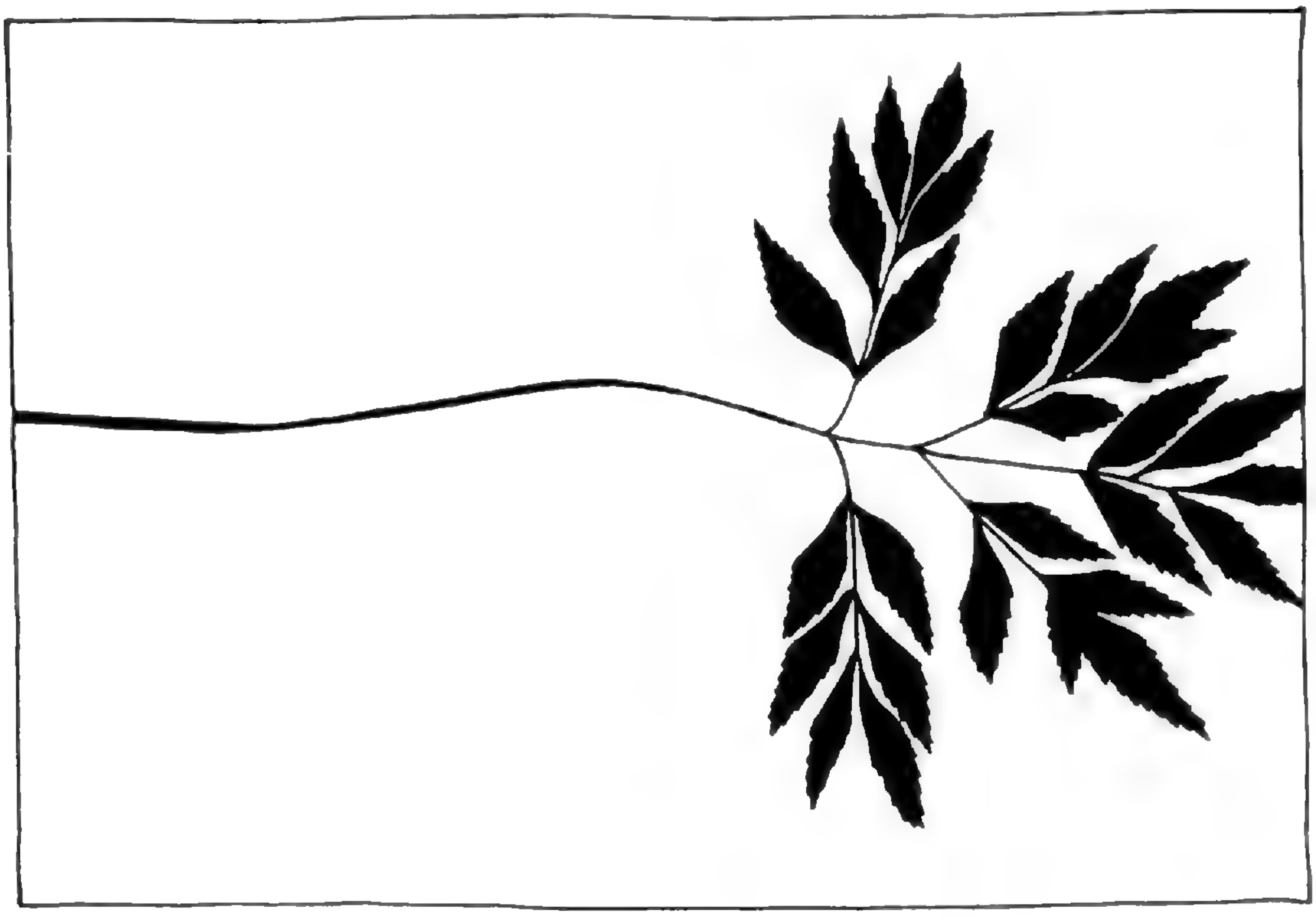


Fig. 5. *Bowenia serrulata*, × 1/4.

CYCAD LONGEVITY

Since there are no reliable annual rings to determine age in Cycads, other methods must be resorted to. By counting the number of leaf bases on a trunk and dividing their number by half the number of leaves in the crown (two seasons' growth being present at any time) the age of a plant can be estimated. Some plants of Dioon have been found by this method to be as much as 1000 years old.

HABITATS

Cycad habitats are usually open woodlands or the drier mountain slopes in tropical and subtropical regions. Adaptive features which suggest their xerophytic nature are their thick, tuberous underground stems or usually short and unbranched aerial stems and the old persistent leaf bases which, combined with the thick cortex of the stem, give the trunk its excellent insulating qualities.

LEAF MORPHOLOGY

Less obvious features of Cycads suggesting their dry habitat may be found by examining cross-sections of the leaf microscopically. To illustrate special modifications we have compared the Cycad leaf with a typical deciduous leaf. As the chief photosynthetic organ of the plant the leaf may be expected to be composed of cells containing chlorophyll bounded by some protecting layer or layers. In the deciduous leaf of lilac the chlorophyll-containing cells are of two types, the closely packed palisade cells and the

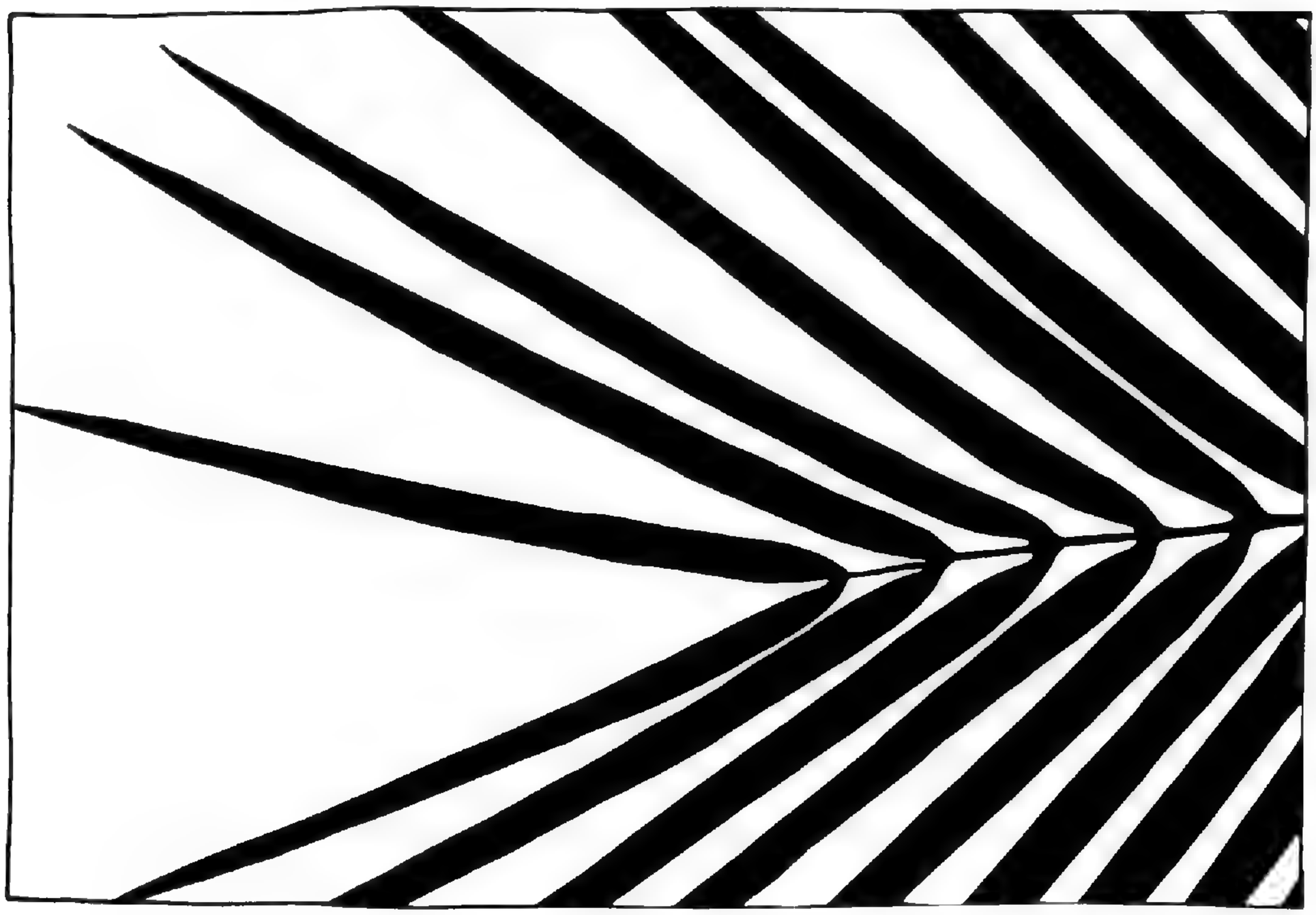


Fig. 6. *Ceratozamia mexicana*, × 1/4.

spongy parenchyma (so called because of the numerous air spaces). These chlorophyll cells are sandwiched between two layers of protective epidermis. The Cycad, on the other hand, has a single palisade layer below which is a horizontally oriented compact parenchyma noticeably lacking inter-cellular spaces. These tissues receive a three-fold protection with the hypodermis, the epidermis, and the waxy cuticle surrounding them on all sides. Besides cutting down water loss, which is the chief function of these layers, the thick-walled upper hypodermis adds rigidity to the leaf. As with all foliage leaves, the protecting layers are pierced by numerous openings called stomates which permit the inward diffusion of carbon dioxide necessary for photosynthesis as well as the outward diffusion of water vapor. The stomates of Cycads are sunken, thus protecting the leaf from the deleterious effects of the drying air currents. The lilac does not show this adaptation.

GEOGRAPHICAL DISTRIBUTION

This group of plants is divided into nine genera with between seventy and one hundred species. These are restricted to the tropical and subtropical regions of the world. The Western Hemisphere harbors four genera: Ceratozamia and Dioon in Mexico, Microcycas in the mountains of western Cuba, and Zamia in Mexico, the West Indies, northwestern South America, and Florida. Five genera are confined to the Eastern Hemisphere: Encephalartos and Stangeria in South Africa, Macrozamia and Bowenia in Australia, and the wide-ranging Cycas from Madagascar and Australia north to India, China, and southern Japan. (See maps 1 and 2.)

Maps 1 and 2. Distribution of living genera of Cycads and localities where fossil Cycads have been found.

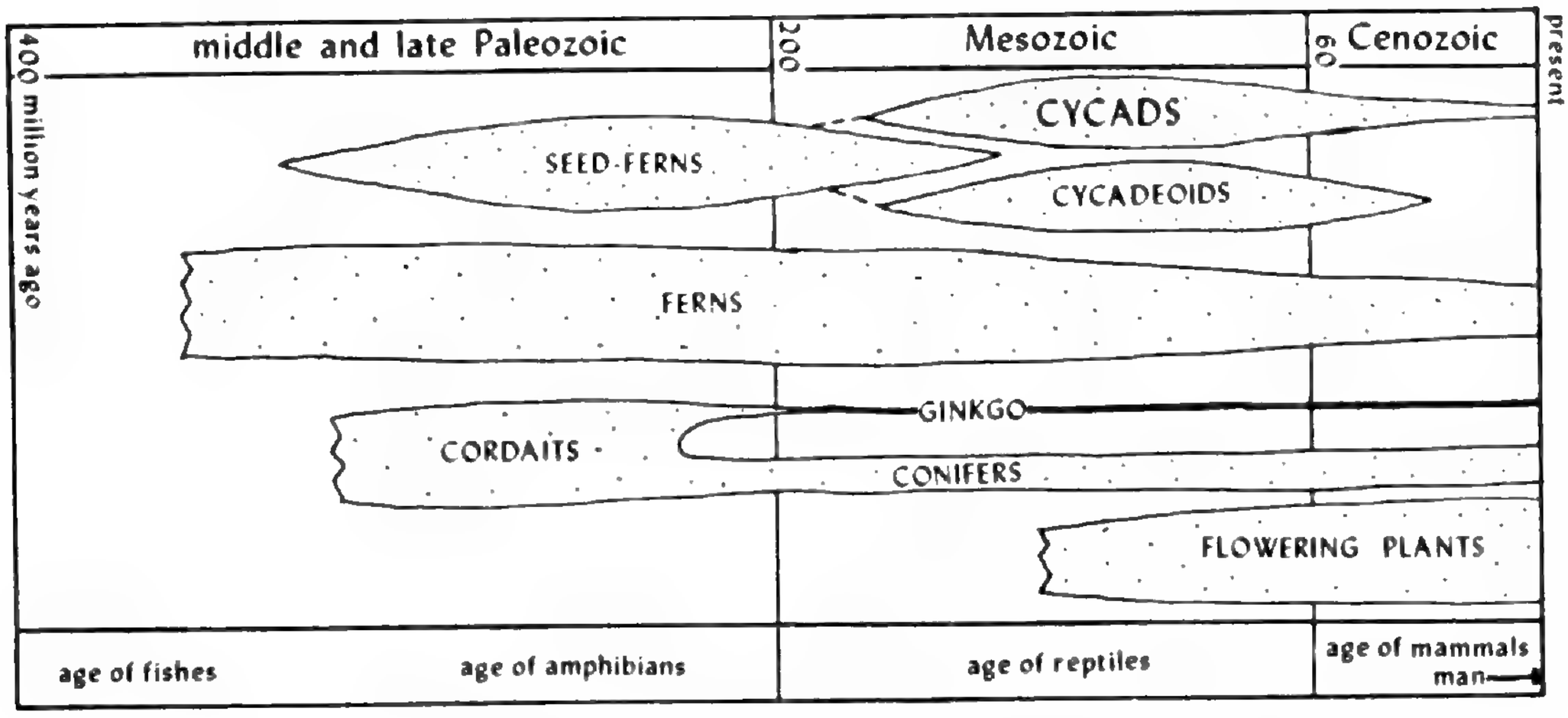


Fig. 7. The geological history and the relationships of Cycads.

FOSSIL CYCADS

The Cycads of today have been called "living fossils," perhaps not unduly since they are the remaining representatives of an ancient group that, with other fern-like plants, dominated the flora during the time of the giant reptiles. Indeed, they show very little change from some of the fossil forms that are millions of years old. Fossils of fruiting structures, or cones, and of epidermal fragments are found in the early land formations in both the Old and the New Worlds and from the arctic to the antarctic. In successively more recent formations Cycads diminished and finally disappeared entirely from the northern and southern zones until now they are restricted to the tropical and subtropical zones. Among the fossils formed during the so-called age of Cycads, 150 million years or more ago, are found many leaves and stems which, though Cycad-like, on the basis of their fruiting structures are sufficiently different to indicate an early divergence of an ancestral form into two types—the Cycads and Cycadeoids. In the Cycads the seeds are produced in sporophylls or in simple cones borne on separate plants from those producing pollen, while in the Cycadeoids the seed-bearing cone is surrounded by a whorl of pollen-bearing sporophylls giving it a flower-like appearance. The two groups have many similarities; most characteristically they all produce naked seeds and have pinnate leaves. Of the two, only the Cycads have living members; the Cycadeoids are believed to have become extinct about 60 million years ago.

ECONOMIC USES OF THE CYCADS

The Cycads have been used as a source of food in times of scarcity by many primitive peoples. Such usage is greatly restricted today, although it may continue to a limited extent in remote areas, particularly in the Malay Peninsula and some of the Asiatic islands. Both the stem, which is made up

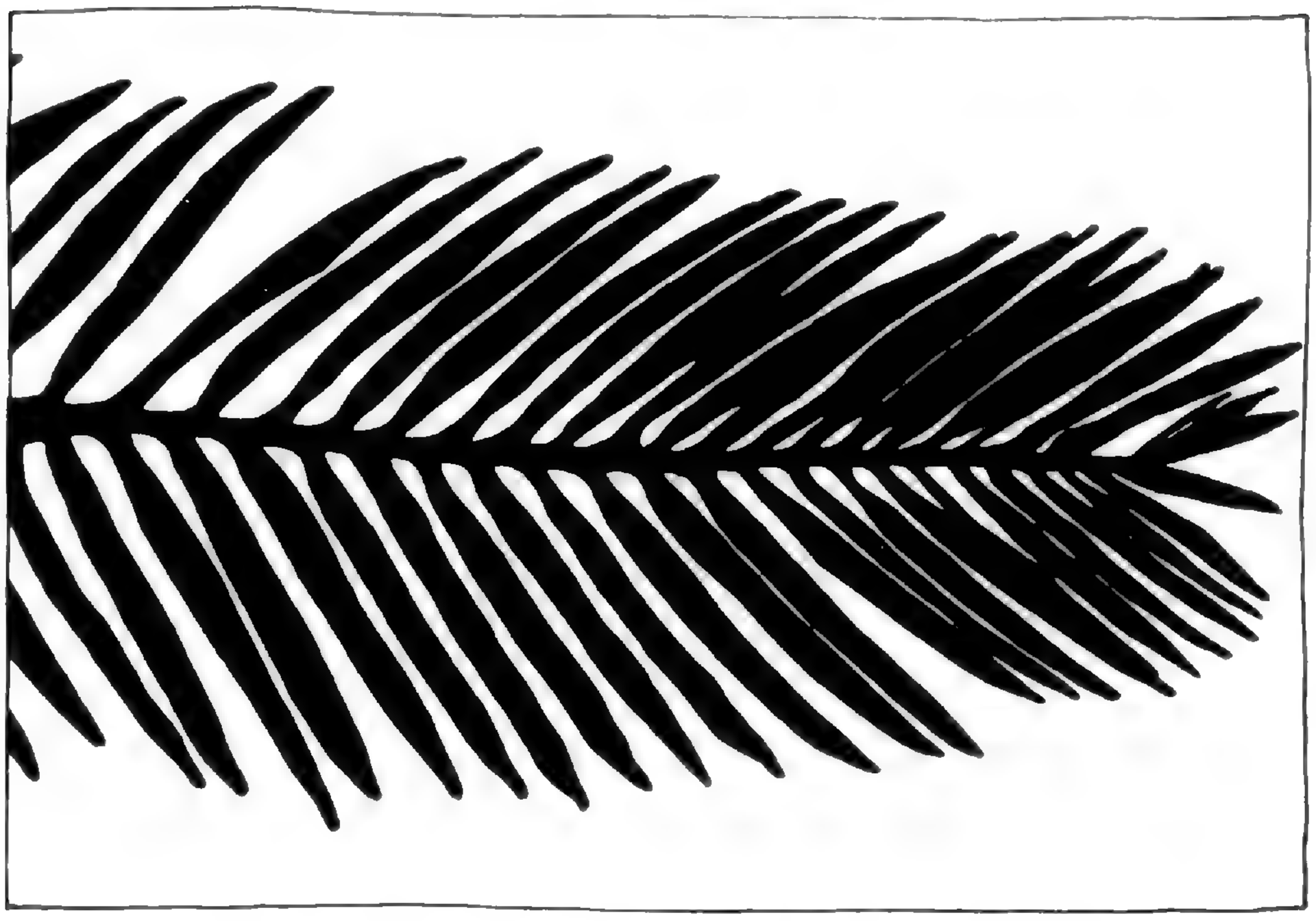


Fig. 8. *Encephalartos Lehmannii*. × 1/4.

largely of thin-walled cells, and the seeds are very rich in starch, and a kind of sago can be made from them. Sometimes the seeds, which are usually large, are roasted. The Cycads used for food appear to belong chiefly to the genera Cycas, Macrozamia, and Zamia with occasional mention being made of Dioon and Encephalartos. The tuberous stem of Bowenia is said to resemble a yam and is used by the natives of Australia. Cycas and Zamia are also the most widely distributed genera of the group, which probably accounts for their use, while Macrozamia is common in certain parts of Australia. The popular names of many species attest to their usefulness as food plants. The South African *Encephalartos caffer* is called "Kaffir Bread," or "Hottentot Bread Fruit." *Cycas media* is called the "Nut Palm" in Australia, and many species of Zamia are called "Sago Palms."

The use of Cycad plants as food is attended with danger, as they are poisonous in the fresh state, with the possible exception of Zamia, and they must be carefully prepared. In the Malay Peninsula, where a sago is made from *Cycas circinalis*, the poison is removed by pounding and soaking the plants in water, the water being changed constantly. To prepare the food, a tree is felled, the outer layer of the trunk is peeled off, and the inner part is sliced up and dried in the sun. When it is crisp, it is pounded into a flour. This is then soaked repeatedly, changing the water after each soaking. After the last soaking the starch is allowed to settle out, forming a cake which is

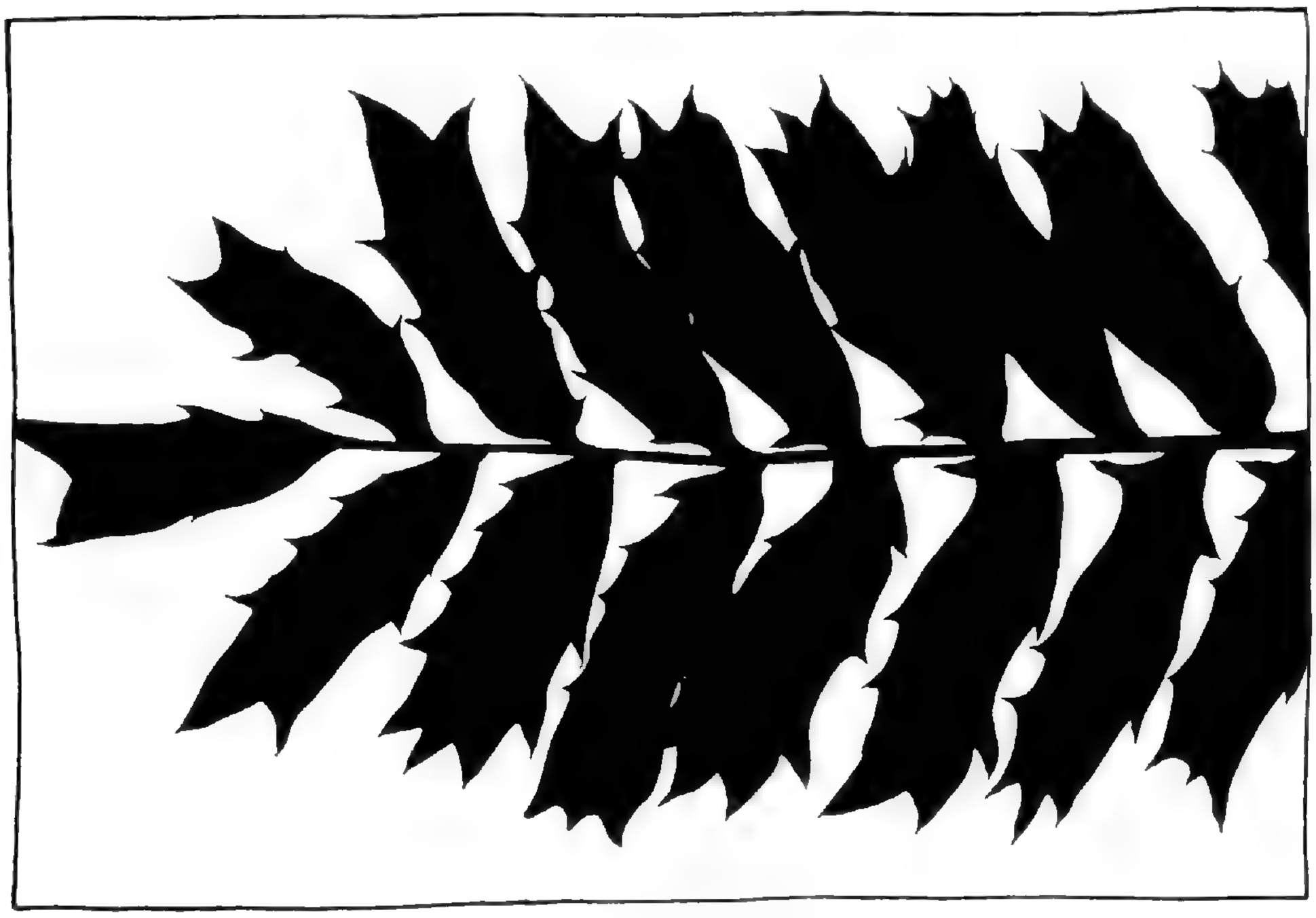


Fig. 9. *Encephalartos kosiensis*, × 1/4.

ground and baked. Even after having been treated in this way, prolonged use is said to cause intestinal disorders.

The Kaffirs are said to bury the stem of the Kaffir Bread for some months, after which they extract the starch in a way similar to that used by the Malays. The natives of Australia prepare a sago from the seeds of the Nut Palm. The seeds are broken open, the fleshy part is removed, pounded, and dried in the sun for three or four hours. The resulting flour is then placed in running water for three or four days and then in stagnant water for a similar period of time. The latter part of this treatment seems hardly likely to reduce the toxic properties, however.

The poison seems to permeate the whole plant. In Australia, cattle are paralyzed by eating the leaves of Macrozamia; and attempts have been made, therefore, to destroy the trees. Girdling, the usual method of killing trees, is of no effect on Cycads since the phloem (the tissue which conducts food from the leaves to the roots) is covered by a broad band of cortex, which in turn is surrounded by the hard, persistent leaf bases. Consequently, another method had to be found. A gash is cut in the trunk, and arsenic is poured into it. The effect on the tree seems to be immediate. The leaves droop, the trunk becomes brittle, and the first strong wind destroys it.

The Malays are said to use the tender, uncurled leaves of *Cycas circinalis* as a vegetable, a fact which seems puzzling in view of the known toxicity of

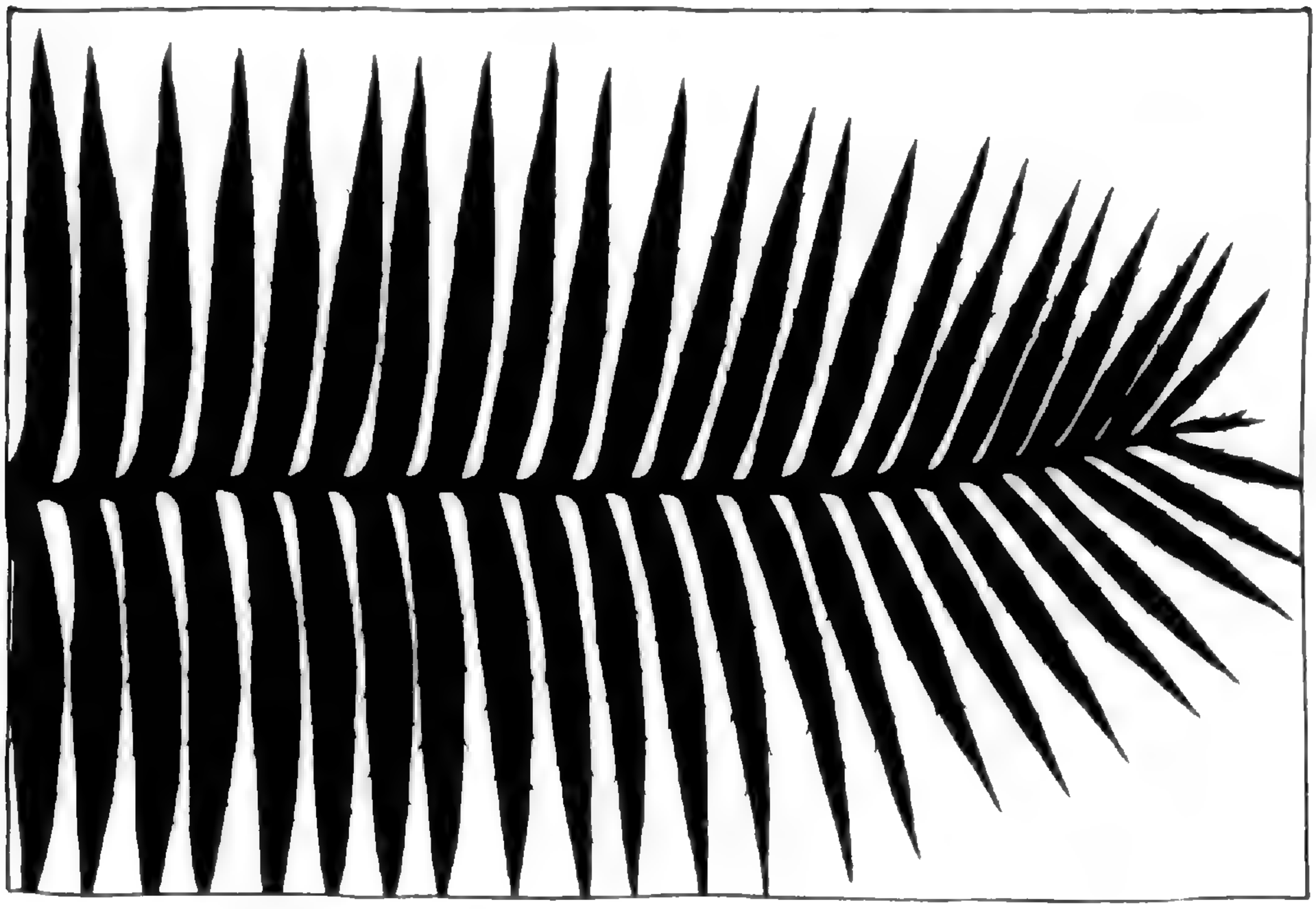


Fig. 10. *Dioon spinulosum*, × 1/4.

the leaves of Macrozamia. Perhaps when quite young they have not developed the poison. Thunberg relates that, in the latter part of the eighteenth century, *Cycas revoluta* was reserved for the use of the army in Japan as a small morsel of the pith could sustain life for a long time. This seems hardly credible, however.

Zamia is the only genus of which no mention of toxicity is made, and it is the only one which has any commercial importance. A commercial arrowroot is made from the tuberous stems of *Zamia floridana* by a process similar to those described, though considerably more refined. It is said that in Colombia, the seeds of *Zamia chiqua* have been used to make bread and a kind of mash which is eaten with milk and sugar.

In Malaya and some of the Asiatic islands, poultices are made from the seeds of *Cycas circinalis* which have been pounded in olive oil.

In Australia, a fiber obtained from the leaves of *Macrozamia spiralis* is sometimes used as a stuffing for couches and mattresses.

The Missouri Botanical Garden Collection

The date on which our first Cycads were received must remain unknown, as well as their source, since our records are complete only since 1898. Several Cycads were grown previous to that date, and those plants formed the nucleus of the present collection. The most notable additions were received in 1904 from the St. Louis World's Fair, and in 1918 from Mr. D. S. Brown

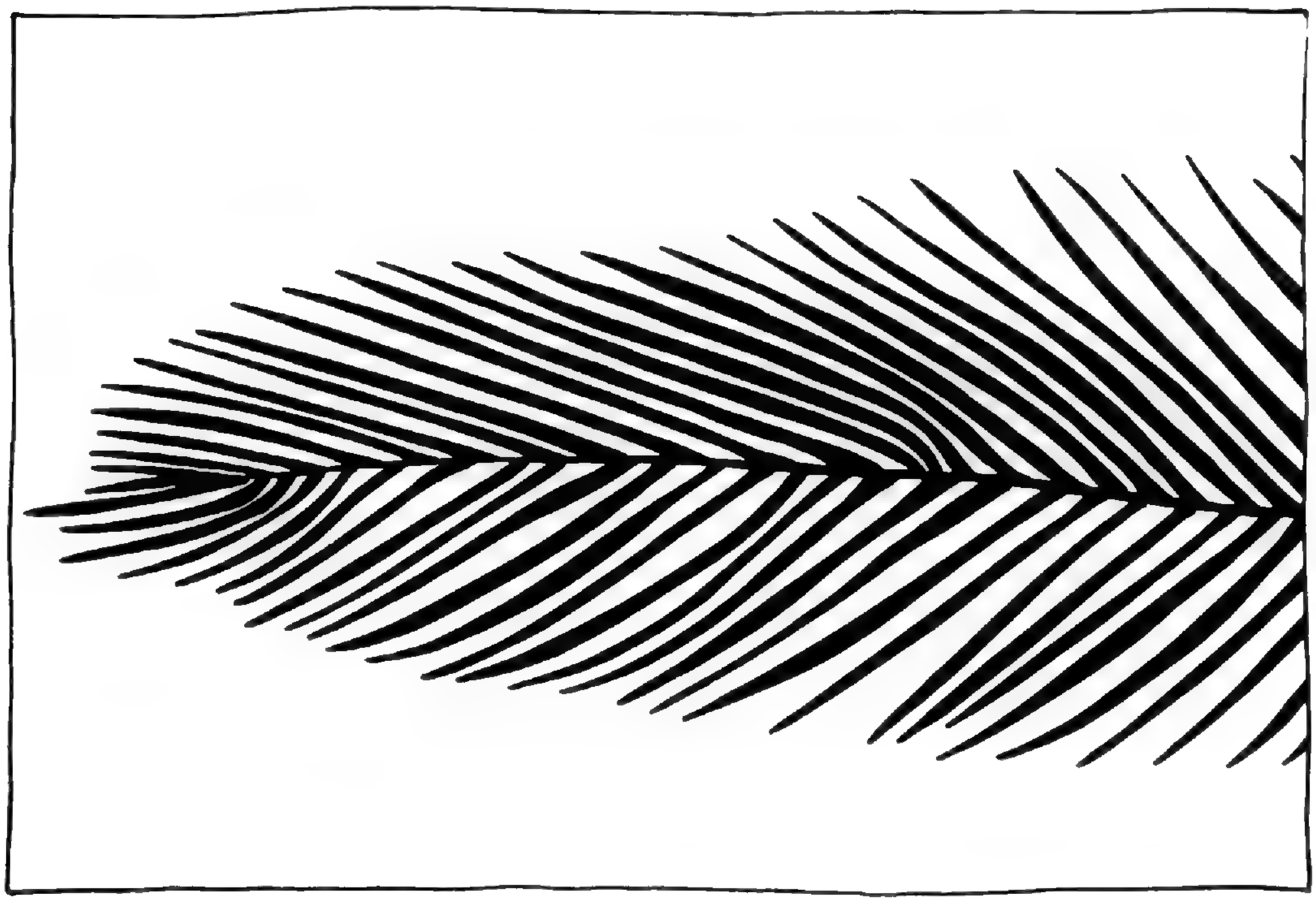


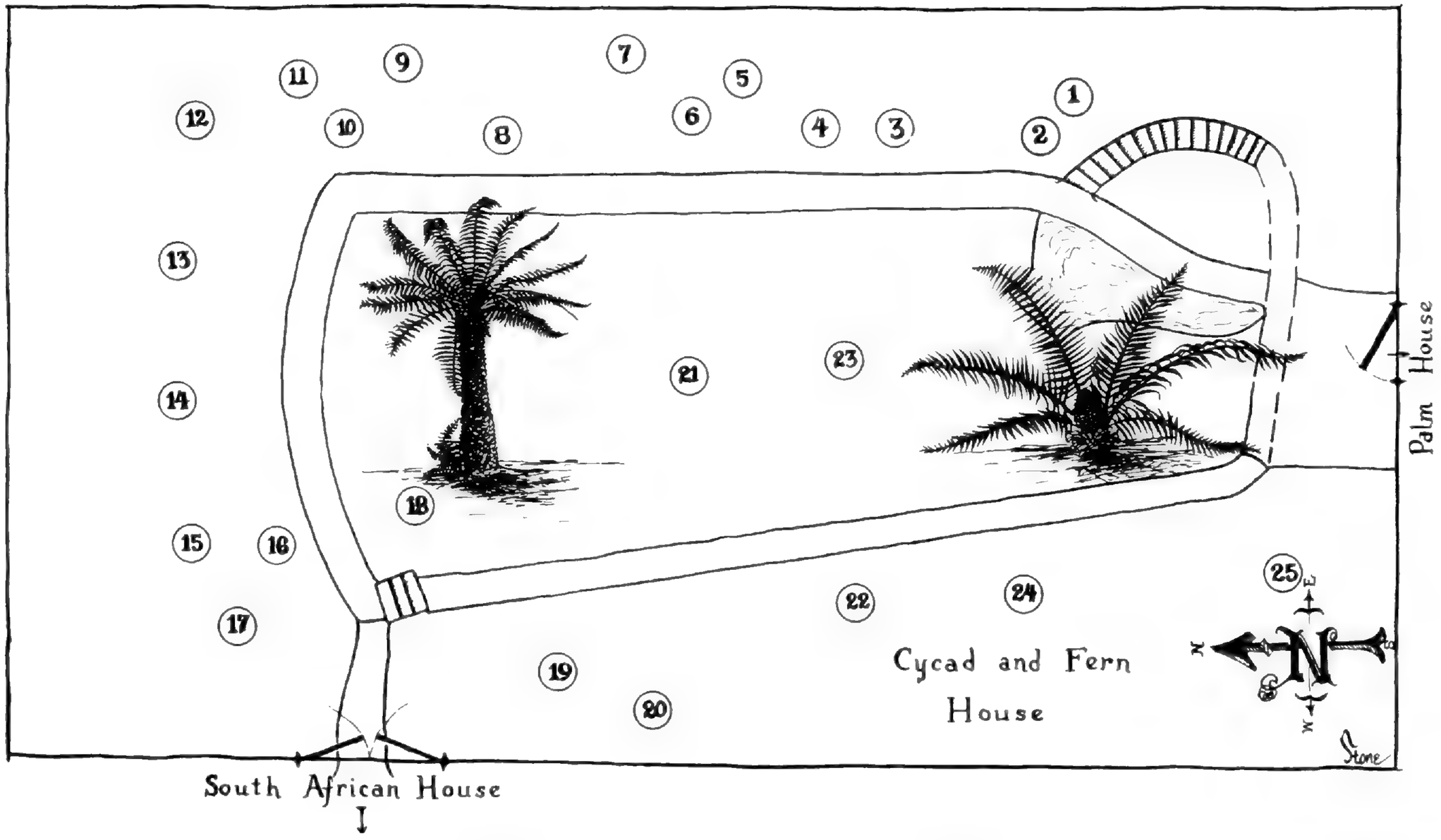
Fig. 11. *Macrozamia spiralis*, × 1/4.

of Kirkwood, who maintained a notable collection of plants. Both of these acquisitions increased the number of species and plants considerably. In addition to these, occasional plants have been continually added from various sources.

One may gain some estimate of the relative rate of growth of these plants from the accession numbers which appear on the labels in the Cycad House. Thus in the number 52-19-63, the second number indicates the year in which the plant was received, 1919, and at the present time the plant would be more than 37 years old. Since we do not have records of the age of the specimens when received, their exact age can not be known.

A GUIDE TO THE CYCAD COLLECTION

On the next page is a map of the Cycad House. The numbers indicate the locality of noteworthy specimens and correspond to those of the plants on the following list. The plants are not numbered in the greenhouse but by comparing the name on the label with that in the list the specimen under discussion may be determined. It is suggested that by starting with No. 1 at the southeast corner of the house, a brief survey of the Cycads may be obtained. With more time, the various characters of leaves, stems, and cones of individual species may be studied. Cones are produced at rather irregular intervals and sometimes there may be few plants bearing them. There are a good many other kinds of plants in the Cycad House; the



Map 3. The Cycad House, showing the location o f noteworthy specimens. The numbers correspond to those in the list on the opposite page.

ferns especially may at first appear to be similar to the Cycads. This list is followed by a key for the identification of the genera on the basis of leaf characters. Key the plant out; one person can conceal the label while the other uses the key.

PLANTS IN THE CYCAD HOUSE

1. *Cycas circinalis* L. This plant is used for food by several native peoples. Starch (sago) is extracted from the stem; the nuts are sometimes roasted whole; often the tender, uncurled leaves are used as a vegetable. Also, a poultice made from the seeds pounded in coconut oil is applied to various kinds of sores.
2. *Zamia floridana* A. DC. The stem of this species likewise produces a sago. Some of the cities in the southern United States have this tree planted as an ornamental.
3. *Encephalartos Lehmannii* Ecklon. This species is easily recognized by its whitish waxy covering of the leaves and stems.
4. *Encephalartos elongatus* Miq.
5. *Encephalartos lanuginosus* Lehm. This specimen was received by the Garden before 1898.
6. *Macrozamia spiralis* (Salisb.) Miq. The common name for this species is "Pineapple". Economically, food is obtained from the stem and fibers are removed from the leaves and used as mattress and pillow stuffings.
7. *Zamia portoricensis* Urban. Our specimen was received as a young plant in 1947. It is producing male cones during the present year.
8. *Stangeria paradoxa* Th. Moore. This plant is known b the natives of its area as "Juma." For many years, it was thought to be a fern. It was only after fruiting specimens were found that the true identity became known; hence the Latin name *paradoxa*.
9. *Ceratozamia mexicana* Brongn. This specimen is producing male cones during the present year.
10. *Encephalartos gratus* Prantl. Our plant was received in 1944.
11. *Cycas Micholitzii* Dyer.
12. *Encephalartos Altensteinii* Lehmann. This is another one of the plants in the Garden's collection which was received prior to 1898.
13. *Dioon spinulosum* Dyer. The native name for this species is "Chicalitos." It is one of the tallest Cycads, sometimes reaching a height of fifty feet.
14. *Dioon spinulosum* Dyer. See 13.
15. *Cycas tonkinensis* (Linden et Rod.) Hort. This plant sometimes goes by the name of "Federico-Palme."
16. *Zamia furfuracea* L. f. A sago is made from the stem of this species.
17. *Macrozamia Moorei* F. Müll. This species is poisonous to cattle in its native land, Australia. Our specimen was received as a seedling in 1953.
18. *Dioon edule* Lindl. In Mexico, this species is known as "Palma de la virgen."
19. *Cycas revoluta* Thunb. This is a common ornamental in Florida and neighboring areas.
20. *Ceratozamia mexicana* Brongn. This specimen was received at the Garden before 1898.
21. *Encephalartos caffer* (Thunb.) Miq. The common name for this is "Kaffir Bread" or "Hottentot Bread." It is used for food by South Africans.
22. *Cycas Beddomei* Dyer.
23. *Cycas siamensis* Miq. In its native land, this species is called "Prong."
24. *Ceratozamia terrestris* Hort.
25. *Dioon spinulosum* Dyer. See 13.

OTHER SPECIES IN THE CYCAD HOUSE:

Cycas Rumphii Miq. The Curly Pine Palm.
Encephalartos ferox Bertoloni f.
Encephalartos Hildebrandtii A. Braun et Bouché.
Encephalartos kosiensis Hutchinson.
Microcycas calocoma (Miq.) A. DC.
Zamia angustissima Miq.
Zamia integrifolia Rich.
Zamia Loddigesii Miq.
Zamia Ottonis Miq.
Zamia pumila L.

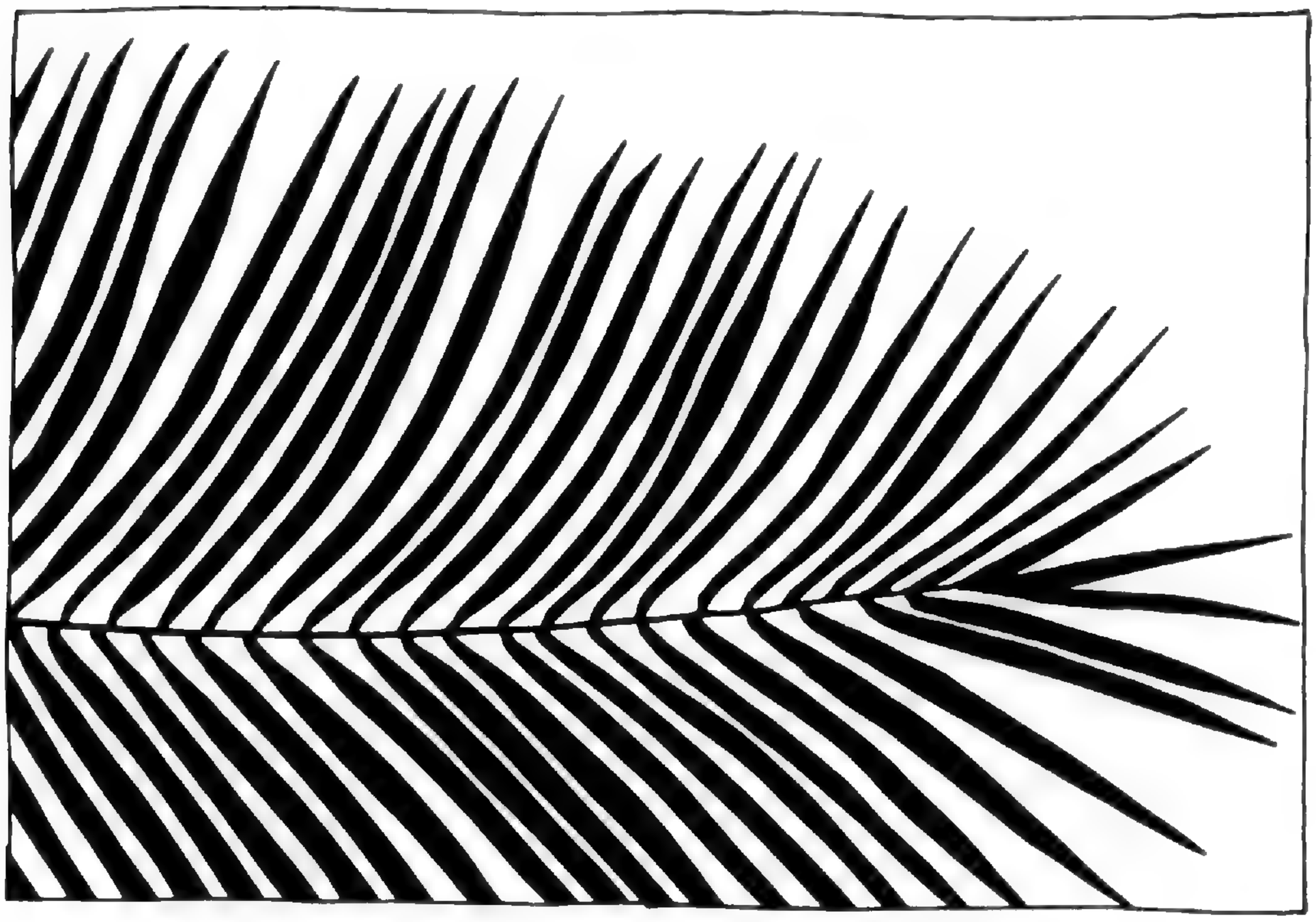


Fig. 12. *Cycas circinalis*, × 1/4.

SPECIMENS LABELED AS HYBRIDS:

Zamia latifoliolata Pren. × *Zamia floridana* A. DC.
Zamia latifoliolata × *Zamia monticola* Chamb.
Zamia latifoliolata × *Zamia portoricensis*.
Zamia pumila L. × (*Zamia latifoliolata* × *Zamia pumila*).

KEY TO THE GENERA OF CYCADS

A. Leaves twice-divided ..... BOWENIA
A. Leaves once-divided ..... B
  B. Leaflets with distinct mid-vein C
    C. Leaflets with distinct side veins projecting from mid-vein ..... STANGERIA
    C. Leaflets with only the mid-vein evident ..... CYCAS
  B. Leaflets without distinct mid-vein ..... D
    D. Leaflets widened at point of attachment to rachis ..... E
      E. Leaflets broadest at point of attachment ..... DIOON
      E. Leaflets broadest above point of attachment ..... ENCEPHALARTOS
    D. Leaflets narrowed at point of attachment ..... F
      F. Leaflets with light-colored swollen area at base ..... MACROZAMIA
      F. Leaflets without obvious swollen area at base ..... G
        G. Leaflets gradually reduced to two rows of spines near base of leaf ..... ENCEPHALARTOS
        G. Leaflets not gradually reduced to two rows of spines at base of leaf, but leaf stalks sometimes bearing small scattered spines ..... H
          H. Petiole with scattered spines near base I
            I. Spines 1/4–1/2 inch long ..... CERATOZAMIA
            I. Spines about 1/12 inch long ..... ZAMIA LODDIGESII
          H. Petiole without spines ..... J
            J. Stem almost completely underground; leaflets blunt at tip ..... ZAMIA
            J. Stem aerial with a single trunk; leaflets pointed at tip ..... MICROCYCAS

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SOME FACTS ABOUT SHAW'S GARDEN

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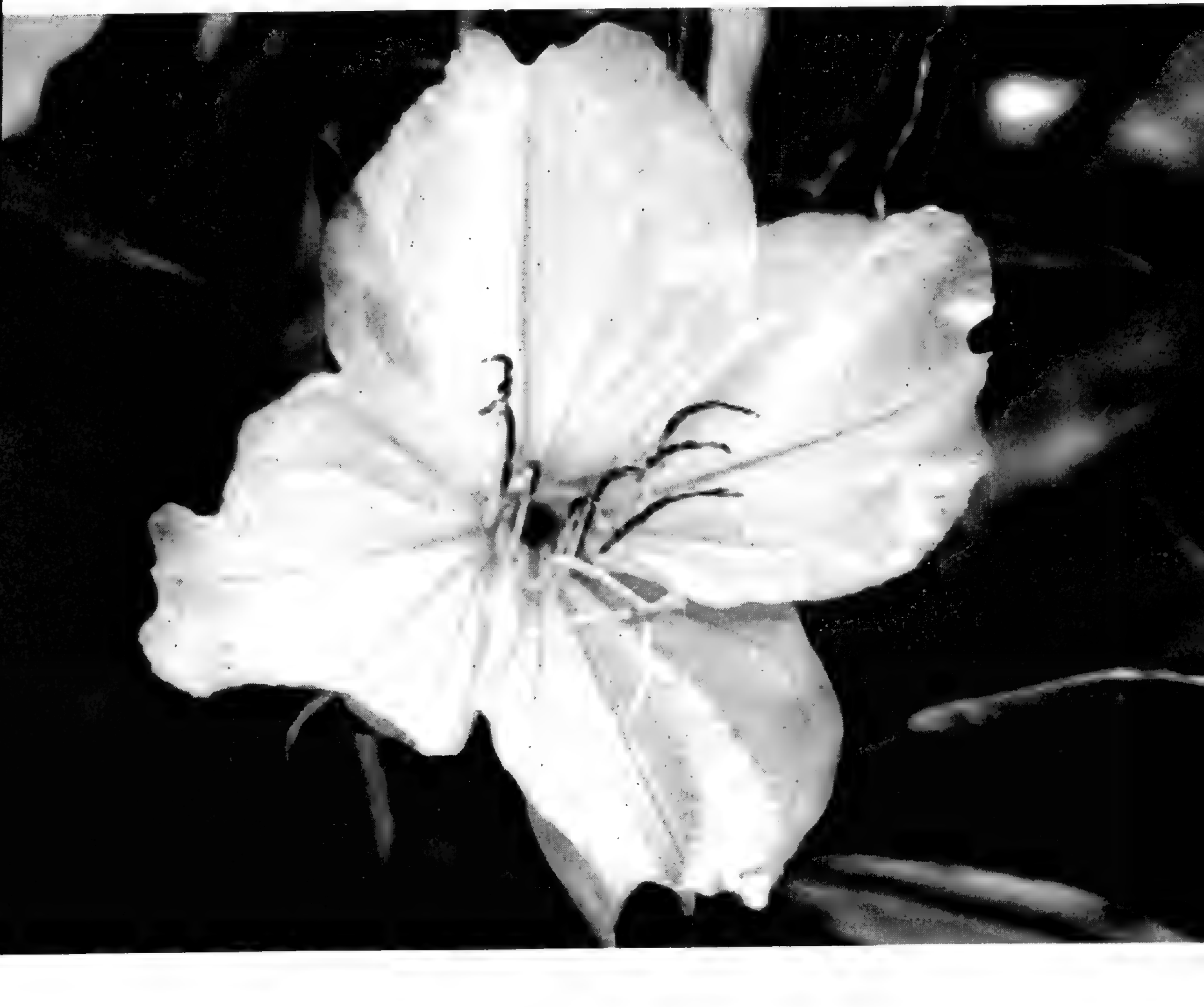
MISSOURI BOTANICAL GARDEN BULLETIN



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COVER: Glade Lily or Missouri Primrose *(Oenothera missouriensis)*.

(This photogsraph, as well as several others in this issue, courtesy of Dr. Julian Steyermark)

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.

Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.

Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.

Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

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Missouri Botanical Garden Bulletin

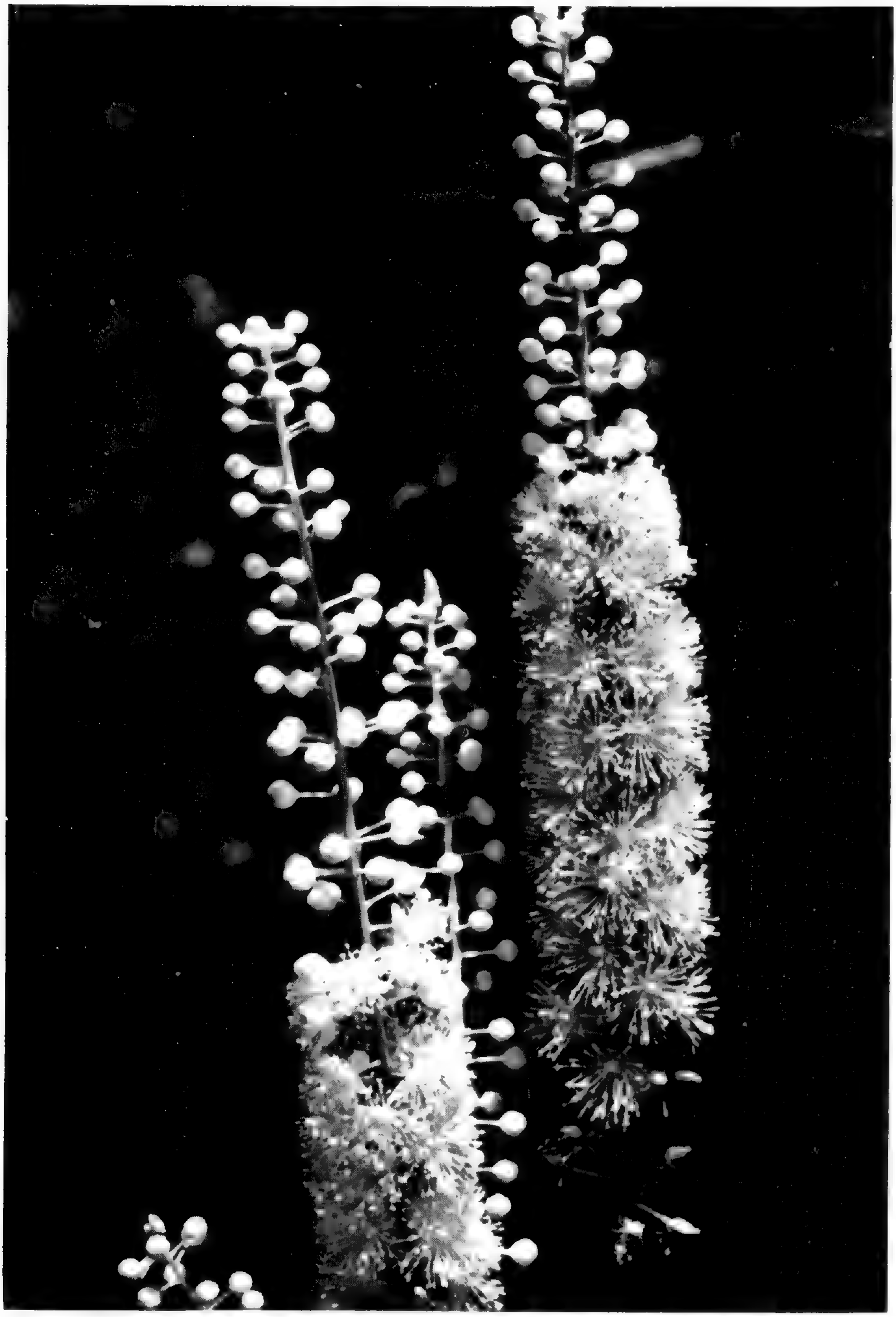
Vol. XLIII JUNE, 1955 No. 6

WILDFLOWER CONTRASTS BETWEEN NORTHERN AND SOUTHERN MISSOURI

JULIAN A. STEYERMARK

People who travel through northern Missouri are often surprised and disappointed when they do not see favorite wildflowers they have seen in the Ozarks. The purple-flowered dwarf Spiderwort, often called "Wild Crocus" *(Tradescantia longipes)*, the Rosy Azalea *(Rhododendron roseum)*, locally known to Ozarkers as "Honeysuckle", Black Cohosh *(Cimicifuga racemosa)* with tall white columns of flowers, the Glade Lily or Missouri Primrose *(Oenothera missouriensis)*, with gorgeous large yellow blossoms, are among the numerous wildings encountered in the Ozarks but absent from northern Missouri.

To an Ozarker the charm of spring is enhanced by the little Bluets, Early Saxifrage, Vernal Witch-hazel, and Flowering Dogwood, yet each of these is scarce or entirely absent in Missouri north of the Ozarks. The common Bluet *(Houstonia minima)* is found as far north as Linn, Livingston, and Lincoln counties, but north of these counties is absent in the state. The Vernal Witch-hazel *(Hamamelis vernalis)* reaches Franklin County, Early Saxifrage comes up as far as St. Louis County, and Flowering Dogwood is found in a wild state as far north as the region of Hannibal in Marion County on the east and Saline County on the west. Such familiar Ozark forest-dwellers as Southern Yellow Pine *(Pinus echinata)*, Lowbush Blueberry *(Vaccinium vacillans)*, Farkleberry *(Vaccinium arboreum)*, Yellow Honeysuckle *(Lonicera flava)*, and Round-lobed Hepatica *(Hepatica americana)*, all are absent from Missouri north of the Ozark area. That tiny woodland March wildflower, the Harbinger-of-Spring or Pepper-and-Salt *(Erigenia bulbosa)*, with its contrasting white and purplish-black small flower clusters, taken for granted by those tramping through Ozark woodlands in search for signs of spring, reaches its northern limits in Missouri in Macon, Shelby, and Ralls counties on the east, and Cooper, Johnson, and Clay counties on the west.



BLACK COHOSH *(Cimicifuga racemosa)*

A woodland plant not found in Missouri outside of the Ozark region.

Numerous other instances could be given of Ozark plants absent from most of northern Missouri. At this point the lover of wildflowers might well conclude that northern Missouri is not a happy hunting-ground for plants. This is not true, however. Although lacking the great variety of wildflowers that exist in the Ozarks, northern Missouri stands out in other respects. First, to its credit must be acknowledged that what northern Missouri woodlands often lack in *numbers of species* is made up in *numbers of individuals* of a species. Deep-wooded ravines of glacial soils are frequently sprinkled with hundreds of yellow Lady-slipper Orchids and lavender-and-white Showy Orchis *(Orchis spectabilis)*. In contrast, when these same species are encountered in the Ozarks, they are represented usually by only a small number of individual plants. I can recall the great pleasure I had on one excursion on a northwest Missouri hillside to count no less than 125 yellow Lady-slippers in bloom. Some of the largest and most luxuriant stands of Columbine, Interrupted Fern, and Maidenhair Fern, where the plants covered whole stretches of wooded slopes, I have seen in the northern Missouri counties. One of the noblest and tallest of ferns, the Ostrich Fern, actually is found only in the northernmost counties of the state. The beautiful and outstanding Blue-eyed Mary is frequent in dense colonies in rich woods of central Missouri north to Macon County, but is rare or absent from most of the Ozark counties.

Similarly, our prairie flora forms outstanding displays in much of northern Missouri, either on natural prairies or on remnants of them preserved along railroads. Thousands of the deep blue-purple Downy Gentian *(Gentiana puberula)* may be seen in October flourishing along the railroad right-of-way in northern Missouri, where earlier had bloomed hundreds of Prairie Violet *(Viola pedatifida)*, Shooting Star *(Dodecatheon Meadia)*, and two species of Blazing Star or Gay Feather *(Liatris)*.

Lest we forget, the flora of the loess mounds of northwestern Missouri is unique and harbors a number of wildflowers not found in any other part of the state. Among these may be mentioned a species of Thimbleweed *(Anemone cylindrica)*, the striking Soapweed *(Yucca glauca)*, a handsome blue-lavender Penstemon *(Penstemon grandiflorus)*, and the cream-yellow Downy Painted Cup *(Castilleja sessiliflora)*.

In addition to the peculiar plants of the loess mounds, in northern Missouri are wild trees, shrubs, and herbaceous plants which are either not found in the Missouri Ozarks or else very rare. The attractive Grove Sandwort *(Arenaria lateriflora)* is confined to a few northeastern Missouri counties. Except for one station in Shannon County, Starry Solomon's Seal *(Smilacina stellata)* is a denizen of the rich alluvial woodlands of northern Missouri; so is Snowy Campion *(Silene nivea)*, except for a southern station in Franklin

PURPLE BEARD-TONGUE (*Penstemon Cobaea* var. *purpureus*)

A purple-flowered Penstemon inhabiting the limestone glades and "bald knobs" of the White River region of southwest Missouri and northwestern Arkansas but not found elsewhere.

ROSE PINK *(Sabatia angularis)*

These beautiful flowers are annuals. Their prevalence varies widely from year to year; some years there are none, while in other years they are common, both in pink and white.

County. Among the shrubs, the Red-berried Elder *(Sambucus pubens)*, Nannyberry *(Viburnum Lentago)*, and Southern Arrow Wood *(Viburnum dentatum* var. *Deamii)* are known in Missouri from only one or two northern counties. Among the trees, the Hill's or Jack Oak *(Quercus ellipsoidalis)* has been found only in extreme northern Missouri near the Iowa line, and both the Large- and Small-toothed Trembling Aspen are very scarce trees and found only in northern Missouri. The Choke Cherry *(Prunus virginiana)* is mostly found in northern Missouri, being discovered only occasionally in a few Ozark counties. The beautiful white-flowered Meadow-sweet *(Spiraea alba)*, a rare shrub in Missouri, is known mostly from a few counties in northern Missouri, and from only one south of the Missouri River.

It must be admitted, then, that northern Missouri has much of interest for the lover of wildflowers. At this point it might be asked why so many Ozark wildflowers are missing from most of northern Missouri. The answer lies in geological history, for during the Ice Age (Pleistocene period) which prevailed in the United States thousands of years ago, certain advances of the ice sheet destroyed the Ozark plants which were growing in the northern Missouri counties. The glacial soils and transported boulders attest to this. The ice sheets in Missouri came down in some places to or nearly to the Missouri River, but did not reach the region south of the Missouri River. Judging by the flora, topography, and geology, it also missed (1) the counties bordering the Missouri River east of Howard County, and (2) most of the territory from the region of Hannibal in Marion County southward (including Ralls, Pike, Lincoln, St. Charles, and parts of Audrain and Monroe counties).

The effect of this glacial period was to leave a flora in the Ozarks undamaged and far richer in variety of species, because of those that survived the glaciation, than the flora found in the glaciated northern portion of the state. Then, too, the Ozarks had never been flooded by continental seas or marine invasions of the Gulf Sea, nor had been glaciated since the end of the Paleozoic era (millions of years ago), and so during all this long period of time has had an opportunity to evolve separate species which became isolated and different from those from which they had originated. A number of these Ozark plants have been found by botanists to be distinct from other species. Attention was called to these endemic species, as they are known, found only in the Ozarks, in the January, 1955, number of the Garden BULLETIN (page 4), where another reason was given why the Ozark flora contains a greater number of wildflowers than northern Missouri.

Because of the contrasts between the plant life of the Ozarks and of northern Missouri, it is necessary to know the exact boundaries for each native plant found in the state. This is one reason that it is so important to

Flowering Dogwood in the Missouri Ozarks during the spring of 1955 was not damaged by the early freeze. Hillsides throughout the southern and central part of the state were whitened by the blossoms this spring.

carry on detailed exploration of the flora throughout the state. The specimens collected are deposited eventually in the large collection in the herbarium of the Missouri Botanical Garden. In this way the plants of a particular part of Missouri are preserved and serve as a definite record for all time. By means of time-consuming botanical exploration in each county of the state, necessitating constant field work over a period of hundreds of years, we are enabled gradually to find what the natural geographical distribution and boundaries (north, south, east, and west) are for each plant that exists in a wild state in Missouri.

SOME SHADE-TREE PROBLEMS

AUGUST P. BEILMANN

Not in two decades has the tree-owner been confronted with so many problems. And seemingly some of the troubles occur in the developmental stage, a factor that further complicates the problems of growing a shade tree. Unlike the forester, who expects some tree mortality from various causes and is not concerned over the loss of a few specimens, the home-owner finds it hard to understand why the tree he planted should show distress and perhaps die. It is not always possible to pin-point the underlying cause. Often a good many factors help create a complex problem of maintenance or contribute to the death of a tree.

In addition to the extreme heat and lack of rain last year, the sudden drop to zero on March 26 this spring caused considerable damage. But even this injury follows no clear-cut pattern, and it becomes unsafe to generalize about the harm that has been done. The flowers of most oaks were killed, yet there are areas locally where acorns will be abundant. At the Arboretum the hickories fared better, and there will be some hickory nuts. Many of the southern plants, notably the magnolias and the rhododendrons, were completely dormant on March 26 and thus escaped injury. On the other hand, the Star Magnolia from China was, in some places, killed to the ground. The flowers of the much tougher and supposedly better-adapted soft maples, elms and cottonwoods were nearly all frozen, and few seeds have been produced. Apparently few of the woody plants which flower before mid-May escaped heavy injury to flower-buds. However, the dogwoods were quite good, although the redbuds lost all flowers. The flowers of Sugar Maple, Spice Bush (Benzoin), Pawpaw, and Service Berry were all frozen, while the Wild Plum made an excellent showing. The damage was not restricted to flower buds alone. Few trees opened leaf-buds in a normal manner, and many were not only erratic but very much delayed.

Fortunately the rains of early April, and again about thirty days later, did much to repair the damage caused by both the sudden zero weather and the preceding dry year. Both rainy spells came at a most opportune time. Woody plants had hesitatingly begun to open leaf-buds and those rainy periods did much toward the development of normal leaves. Had either rainy spell been delayed another week the damage would have been severe and quite extensive. Even now we can observe how erratic was the growth of early spring. Large trees have a normal branch here and another there, but few show a completely normal development unless they were irrigated.

Since so many of our shade trees are being grown about homes where heavy grading has been done, we might expect that drought damage would

be severe. Grading usually removes all top-soil, or dumps it into a low spot and leaves a raw soil that has never supported any sort of plant life—much less a tree. Established surface drainage patterns are upset; houses, streets, and driveways form a roof over much of the soil, and there is little chance for rain to percolate to a depth necessary for trees. Once dry, such a soil, or what is left for soil, absorbs water very slowly. Only irrigation, mulching, and fertilizing will allow the establishment of trees or permit their continued growth.

Superimposed on these difficulties is the very real possibility of an insect outbreak. For the past two years the population of bark beetles has been rising. They prefer to feed upon weakened trees, and the drought has furnished them with whole hillsides of such trees. The woodpeckers have moved into those areas to feed upon the beetle larvae, and they, along with the many predatory wasps, may put a halt to bark-borer depredations. However, the various leaf-chewing insects seem on the increase. During the dry 1930's there was a serious outbreak of tent caterpillars and tussock moths (there were others as well) and a complete and thorough program of arsenical spraying was necessary for some years. So far this year we have seen the June-bug and the striped oak-worm in great numbers. In fact, some oak trees at this moment are without a single fully intact leaf. Where the June-bug damage was most severe many trees are almost without leaves.

Insects generally have rather complicated life-histories. For a species to reach epidemic proportions it must have adequate food and temporarily it must be without enemies. Perhaps the hard dry soil of last summer favored the June-bug larvae; at least it restricted the movement of moles who prey on such grubs. Fortunately for the tree-owner, there is equipment available which can reach the tallest trees and there are insecticides on the market which can furnish protection.

THE MISSOURI PRIMROSE

EDGAR ANDERSON

The Missouri Primrose or Glade Lily *(Oenothera missouriensis)* is one of the most spectacular wildflowers in the United States and might well have been chosen as the state flower of Missouri. Its details are well illustrated on the front cover though there is nothing in the picture to suggest the enormous size of the blossoms. They are always as large as saucers, while well-developed specimens may be even wider than a salad plate. Their predominant color is a pale golden-yellow. Like all Evening Primroses, individual flowers do not stay in bloom very long, opening in the late afternoon and closing about noon the next day. They are borne on inconspicuous little branching plants usually only a few inches high, so that the enormous flowers seem to spring directly out of the ground.

The seed-pods of the Missouri primrose are as interesting as the flower and are almost as beautiful, in an odd sort of way. The structure is about two or three inches long and is made up of a central cylinder no larger than a lead pencil from which there fan out four thin, membranaceous wings, making the whole pod nearly as wide as it is long. At first these strange-looking pods are light yellow-green sometimes flecked with deep red but as the pod matures they weather to a silvery gray. They open at the far end, splitting down each wing, the four segments bending gracefully back so as to resemble a silvery gray lily with four petals.

Spectacular though they may be, the Missouri Primroses are little known to the average St. Louisian, because in Missouri they are pretty much limited to cedar glades, rocky open spaces usually sloping to the south or west and surrounded by red cedar trees. One of the outstanding features of the Garden's Arboretum at Gray Summit, Missouri, is a series of these cedar glades. Missouri Primroses are to be seen there in quantity from some time in May until about the middle of June. They usually come into bloom just before the Purple Cone-flowers which grow in quantity on the same glades. During the week or ten days when both species are in bloom side by side the landscape is truly spectacular.

Unfortunately, the Missouri Primrose is not readily cultivated in an ordinary garden, though expert rock gardeners have little difficulty in flowering them. The species is more variable towards the western limits of its range; seeds from Oklahoma or Kansas localities are apparently more desirable than those from eastern Missouri if one is attempting to establish the Missouri Primrose in his rock garden.

THE PERUVIAN DAFFODIL

EDGAR ANDERSON

Having frequently admired the Peruvian Daffodil in many old St. Louis gardens, I acquired a few bulbs from friends of mine who were growing them. It is one of the most fascinating plants to have in one's own garden. If the bulbs are set out after the weather is warm they come up with the most amazing speed, and a good strong bulb may be in full flower in less than two weeks after it was planted. The flower, furthermore, is no trifling thing. It is really a good-sized, trumpet-like lily, handsome in form and delightfully fragrant. It interested me so much that I started looking around the library to learn a little something of its history. There are several species, but the one commonly grown in St. Louis is *Ismeme calathina* (= *Hymenocallis narcissiflora*). It has all the earmarks of a plant which has been selected for doing well under cultivation and is probably not the exact equivalent of a wildflower anywhere.

There are several species of these beautiful flowers in Peru where they grow wild in great abundance and where our cultivated one apparently came from. Since very early times they have been the occasion for religious ceremonies and in "Stewart's Visit to the South Seas," there is a fascinating account of the way in which their blooming was celebrated early in the 19th century. Since the plant itself is probably well known to a good many readers of the BULLETIN, I have thought that this story might be of interest. The plant grows in great quantities at the foot of the mountains near Lima, Peru, where it is the subject of the "Festival of the Amancaise" (or Amancaes as it is more frequently spelled).

"The *Amancaise* is an annual festival celebrated at Lima on the 24th of June; it is something similar to our 'May-Day'; the occasion of it being the height of bloom at that time of a flower peculiar to Peru, called the 'Amancaise,' to gather which, the citizens of every class, in the afternoon of the day, hasten, as to a gala, to a spot in the vicinity of the city, deriving its name, as well as the festival itself, from the flower which grows in greater abundance there than in any other place.

"After an early dinner, our party, principally on horseback, set off. It was with difficulty that a sufficient number of steeds could be secured, as every animal of the name and similitude, in the city, is put in requisition at this time, if at no other during the year.

"We left the city by a new and handsome gate on the north, and crossed the bridge over the Rimac river . . . . . beyond it lies a large suburb, after passing which we entered a regularly-planted and beautiful *almeda,* or avenue, a favourite promenade of the Limanians.

"After passing the almeda, we entered a narrow, winding, and sandy road, enclosed on either side by high mud-walls and completely filled by parties in carriages, on horseback, and on foot, gazing at each other, and interchanging looks and bows of cheerful hilarity. Here were persons of every class of society, from the highest to the lowest, and of every shade and colour, from the fairest Briton to the deepest ebony of the African Tribes.

"At the end of two miles we found ourselves close to the wild and naked hills, encircling Lima on the north and east, and immediately in front of a gorge between two of these, terminating at the distance of half a mile against the steep acclivity of a third. The whole were bare as volcanic ashes and sand can make them, except where the bloom of the flower, which had called the crowds together, exhibited here and there a tinge of yellow, (for this was the 'Amancaise,' the spot of our visit,) and over the precipitous sides of which, small parties were already scattered, and even horsemen, at the seeming hazard of their necks, clambering to points fitted apparently only for the footing of the goat or the chamois.

"The general appearance of the multitude, at the distance first seen, was that of a field in America at a general militia-muster, or of a race course; and a nearer view, save in the variety of colour and novelty of custume, did not lessen the resemblance. There was the same bustle and hum of laugh and talk, the same pressing and hurrying from one place to another, the confused sound of musical instruments in different directions, and the loud and coarse mirth of the booth and the stall.

"On either side of the way were carriages drawn by mules, with a postilion and footman, and filled with ladies and children in rich evening dress; around these, groups of genteel-looking horsemen were gathered in gay conversation and laughter; while within a few rods on every side, might be seen thronged circles, in the midst of which, negroes and negresses, in as full dress as their masters and mistresses, were dancing to music scarce less heathenish, vulgar, and rude, than that heard within the kraals of their aboriginal country.

"Every person was decorated with the *Amancaise*, and clusters of the flowers were placed in the bridles and harness of the horses, as well as on the hats and head-dresses of the riders. . . . . .

"We rode to a rancho, or booth, for the purpose of tasting a common drink of the country, called *chichi*. It is made from new corn ground, and tastes much like the beer at a distillery of whiskey, after fermentation, and before distillation has taken place. The primitive and favourite preparation of it among the Indians was by chewing, in the manner of the *Ava* at the Sandwich Islands; a fact which I was satisfied not to have learned till after my curiosity in tasting it had been indulged. . . . . .

"By this time, the scene around had reached the height of interest in its novel and varied exhibitions. In addition to hundreds of *Calesas*, the clumsy and antique carriage in general use, there were two English chariots, two barouches, two gigs, and a few other foreign vehicles, on the ground. One or two Scotch and English ladies, on horseback, were also distinguished in the throng, and a few Spanish ladies, mounted, in similar dresses and attitude; while other natives, male and female, Peruvians, both Spaniards and Indians, negroes and negresses of every shade, and in an endless variety of costume, some on foot, and others on every kind of animal, from the noblest of horses to the sorriest jackass, were scattered in thousands around.

"It was not long before the fashionables began to move on a return, and the mob slowly to follow; many of those on foot dancing as they went, to the rude tunes of the negroes, still heard at a distance. I observed one Peruvian female advance in this manner at least a quarter of a mile, turning as in a waltz the whole time, in the midst of carriages and gay horsemen, apparently in danger every moment of being run over.

"In coming from the city, I had noticed at the termination of the road where we entered the Amancaise, a kind of tent in crimson hangings, at which there was dancing and music, with a crowd around. The throng pressing forward, however, was so great, that I merely observed a man and woman, running to the carriages and horsemen passing, with plates extended, for money. On our way back, we stopped here for a moment; the musicians were still playing; the instruments, a violin, flute, and rude harp; the air, a monotonous repetition of a few wild notes. But what most astonished and affected me, and what is perfectly characteristic of the religious views and state of the people, was to behold a table, in front of which the dancers were, spread with the flowers of the Amancaise, at which was seated a full-length waxen figure of the Saviour of men, crowned with thorns, and streaming with blood! representing Him who was emphatically 'a man of sorrows and acquainted with grief,' thus presiding over a scene of mirth and folly.

"The sight induced a sadness, which all the gaiety of the thousands we met and passed on our way to the city could not dissipate. And it was only with the deep tones of the vesper bell, falling upon us from the towers of the cathedral as we entered the royal square—invoking from all, a moment, at least, for solemnity and prayer—that a change of thought and feeling came over me." (From Stewart, C. S. A visit to the South Seas, in the U. S. Ship Vincennes during the years 1829 and 1830. London, 1832.)

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ADVANCE OF SPRING IN MISSOURI, 1955

JULIAN A. STEYERMARK

During the last week of March, when I returned to the United States from a botanical expedition in South America, I was jolted by reports and pictures of damage to vegetable and flower gardens, orchards, and nursery stock resulting from a severe freeze over the southern United States. St. Louis papers and radio announcements gave accounts of vegetation injured or killed by the freeze. Azaleas were reported to be frozen in the deep South, the peach crop was destroyed in southern Illinois and other peach-producing areas, and lilacs and many other flowering shrubs were set back. With such catastrophic news, I was prepared for the worst as I started on a spring collecting trip in Missouri between April 22 and May 1. My traveling led me from the lowlands of southeastern Missouri, west across southern Missouri to Webster County, then north beyond the Missouri River to the northwestern part of the state near the Iowa line, and finally east to the northeastern corner—in all a distance of 1,500 miles covered.

Throughout the southern counties of the state it was plain to see the setback given the vegetable and flower gardens in general. Tips of Narcissi foliage showed discoloration. Vegetable gardens were just beginning to get a fresh start, the first crop having been ruined by the freeze. Flower borders lacked their usual colorful display of this time of year. The commonly planted ornamental conifer, Oriental Arbor-vitae *(Thuja orientalis)*, usually of a lively green color, was badly browned and often killed in many areas. Lilacs and other flowering shrubs were producing new crops of leaves, but revealed patches of dead wood. Normally, the oaks in the forests would have been nearly leafed out, but now they were producing a second crop of leaves. This new growth gave an over-all effect on the ridge tops and hillsides of pastel tones of gray, pale rose, yellow, pale green, chartreuse, and buff, reminiscent of early instead of late April in the Ozarks.

No damage to the native herbaceous wildflowers was observed. Appearing on the wooded hills were scarlet masses of Fire-pink *(Silene virginica)*, lilac and purple patches of Birds-foot Violet *(Viola pedata)*, the pale blue-flowered species of Bluets or Quaker Ladies *(Houstonia caerulea)*, Early Saxifrage *(Saxifraga virginiensis)*, and colorful purple and rose clumps of Spiderwort *(Tradescantia virginiana, T. longipes,* and *T. Ernestiana)*. Wildflowers were prolific at every turn. Some hillsides were aglow with the brilliant orange clusters of Honeysuckle *(Lonicera flava)*, and Flowering Dogwood *(Cornus florida)* was everywhere conspicuous, "polka-dotting" thousands of hillsides and ravines with white, cream-colored, or sometimes pink-tinted blossoms.

Travelling "North with the Spring" from southwestern and southern Missouri towards the Missouri River, we had expected to see the vegetation less developed than in the southern portion of the state. Imagine our surprise, then, upon entering Lafayette County, on the south side of the Missouri River in the neighborhood of Lexington, to see the foliage of trees and shrubs more fully developed than farther south. When we crossed the Missouri River and approached Richmond, Ray County, the foliage was seen to be far in advance of what we had seen anywhere to the south. Upon inquiry we learned that in the country adjacent to the Missouri River and northward from there, vegetation had not advanced sufficiently during late March to have been affected by the freezing weather that killed the more advanced Ozark vegetation. Here in Ray County the lilacs, crabapples, iris, and Oriental Poppies were in full bloom. The leaf tips of Narcissi, burnt farther south, were here in good condition. The foliage of the Oriental Arborvitae, so severely killed everywhere in the southern part of the state, had a healthy green appearance in the area bordering the Missouri River and northward.

Throughout northern Missouri, the story was the same. At Cameron, Maysville, and McFall (located respectively in Clinton, DeKalb, and Gentry counties), tulips, lilacs, and bridlewreath were in good bloom, and forest trees, including oaks, had leafed out ahead of the same species to the south in the Ozarks.

So it was a striking thing we encountered during this late April, 1955, in Missouri, this reversal of the advance of spring—one of those surprise freaks of spring weather which must be expected to occur now and then in this part of the world.

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(Photograph by Clifford Paulsen)

THE MONKEY-FACE LADY-SLIPPER

One of the most oddly beautiful plants in the Garden's orchid collection is the Monkey-face Lady-slipper, *Paphiopedilum hirsutissimum* (or *Cypripedium hirsutissimum*, the name by which it is most widely known in the trade). The face-like markings from which it gets its common name are not at all conspicuous. They consist of whitish little eyes and stippled spots at the very center of the flower which do indeed resemble the face of a tiny animal. Much odder is the color scheme of the flower. Predominately it is dark with blackish-greens and amber-greens shading into one another, but the two petals, which spread way out sidewards, shade from purple into a purple-blue as bright in tone and texture as a piece of enamel. There are touches of blue-purple elsewhere in the flower, though not so clear and brilliant, so that these two bright blue wings tone in beautifully with the whole blossom. The back of the flower and the stem are so heavily and softly hairy that they add to the general effect. It really looks like an unusual artificial blossom made by a milliner and backed up with very dark green plush, a flower out of "Never-Never Land."—G.H.P. and E.A.

PHILODENDRONS

Missouri Botanical Garden Bulletin

olume XLIII September, 1955 Number 7

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

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PHILODENDRON

The Versatile And Most Decorative House Plant

LADISLAUS CUTAK

Probably no other group of so-called exotic foliage plants has been taken to our bosom as completely as the ornamental Aroids. It is true that a few of its members, like Dieffenbachia and Aglaonema (the common Dumb-canes), have long been established as house plants but it is only in recent years that an unprecedented interest has been created in them. First, let me explain what these plants are before getting down to their descriptions.

"Aroids" is a collective name given to all those plants belonging to the fascinating Jack-in-the-pulpit family, the Araceae. This family is represented in almost all the warmer regions of the world, and even a few are native to temperate zones where winter cold sends the plants into a state of dormancy. Almost everyone, I'm sure, is acquainted with or at least has heard of the Jack-in-the-pulpit and the Skunk Cabbage, both of which are found in our northern woods. The first, known botanically as *Arisaema triphyllum*, possesses a wrinkled turnip-shaped corm and leaves divided into three-pointed leaflets. The second, *Symplocarpus foetidus*, is an herb with a very thick rootstock and a cluster of very large and broad veiny leaves, preceded in spring by the nearly sessile spathes which barely rise out of the ground. All the Aroids have an acrid or pungent juice, and the Skunk Cabbage in addition emits a strong odor like that of the skunk. Another hardy aroid is *Peltandra virginica*, a rather striking low arrowleaf herb which grows in marshlands and makes an attractive border plant around lakes, ponds and pools. At the Garden this American aroid grows luxuriantly beside the pools located back of the ranges of greenhouses.

All the Aroids present tiny flowers upon a spadix (a spike with a fleshy axis) which is usually surrounded by a spathe (a large bract—highly colorful in some species). If one doesn't still recognize this family, then perhaps another example, the Calla Lily, will help in identifying the group. The Calla Lily should be well known to everyone but I must caution you that, despite its popular name, it is not a true lily.

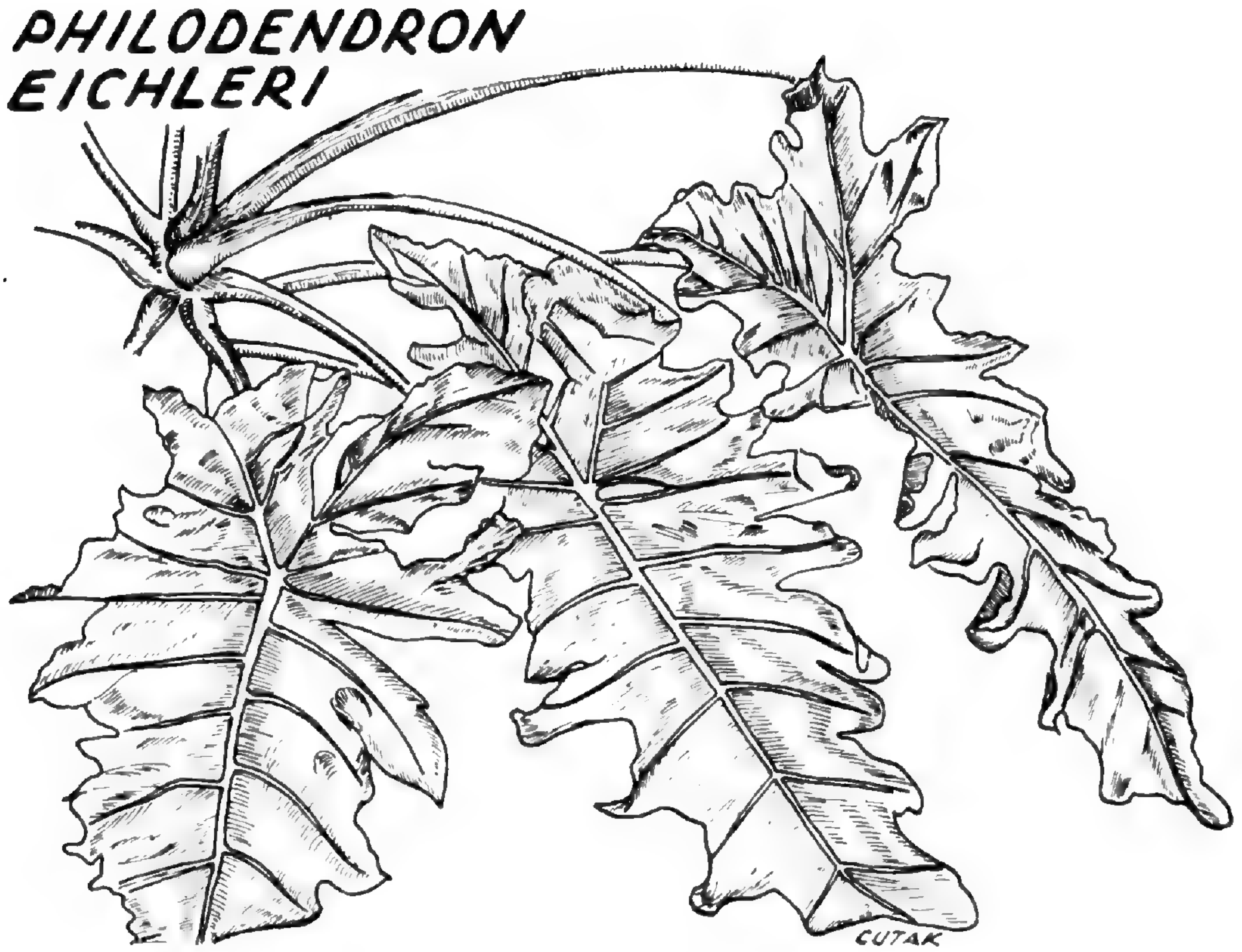
My discussion of Aroids will overlook the hardy kinds and treat only the tropical forms which make such suitable house plants. The common Heartleaf Philodendron *(Philodendron cordatum)* which can be bought at any dime or department store or the florist shop, has been grown by the millions and graces wall brackets in thousands of homes. Most of the Aroids are fairly easy to grow, and that is one reason why they have become such great favorites. Another reason is that all of them present a bold pattern which is highly appropriate for modern homes and furniture. The interior decorator has leaned heavily upon their rugged grace. The plant explorer has combed the jungle forests for new introductions and the nurseryman has used many of these in hybridizing to produce excellent crosses with keeping qualities. Many of these can be seen growing in permanent beds in the Palm House and also as pot specimens in the Aroid Pit-House. In this new home the visitor will be able to acquaint himself with specimens suitable for the home as necessity requires potted material in such quarters.

To be successful with these choice exotic plants a few requirements must be met. Some conditions can be easily attained, while others need some planning. Hardly any Aroid can withstand strong sunlight, therefore diffused light is very essential to its well-being. Since most Aroids live on the jungle floor or even perch as epiphytes on trees they will need a well-drained soil, loose in texture and high in humus. I prefer a potting soil consisting of loam, leafmold, and well-decomposed manure in equal parts to which sand and spent osmundine is added. Fairly high temperatures are also required but most homes are usually kept quite warm so this condition will pose no problem. Probably the greatest need is for humidity which ought to be fairly high, especially for the more delicate species such as *Philodendron verrucosum* and *P. Andreanum*. Doctors tell us that most of our homes are entirely too dry for our health's sake. The humidity range that is most satisfactory for your health is fine for plants. In non-airconditioned homes greater humidity can be supplied through the use of humidifiers on the radiators or over the warm air ducts. Any open container filled with water will serve the practical purpose. Frequent syringing is beneficial and foliar feeding highly desirable. Plants can be syringed easily in the bathtub or placed outdoors during a warm shower. Water copiously, especially in the summer season, and see to it that the mossed sticks used for support are kept moist at all times. Mulching with peat or sphagnum moss will prevent excessive surface drying where humidity is low, and frequently the florist who sells you a plant will have already provided for this.

There are a number of insects that may attack Aroids but vigilant attention will prevent heavy infestations. As a matter of fact, insects have never given our Aroids too much trouble, even though other plants around them were sometimes "lousy" with them. If, however, insects do appear they can be controlled with ready-to-use

Philodendron erubescens in flower

Though most of those who grow Philodendrons in their living-rooms have never seen them in bloom, they are true flowering plants and blossom freely in their native habitats. Most of the flowers look pretty much like this drawing of *Philodendron erubescens.* Some of them are white, some yellow, and some green. Frequently there is a bright flush of pink or red on the inside of the spathe.

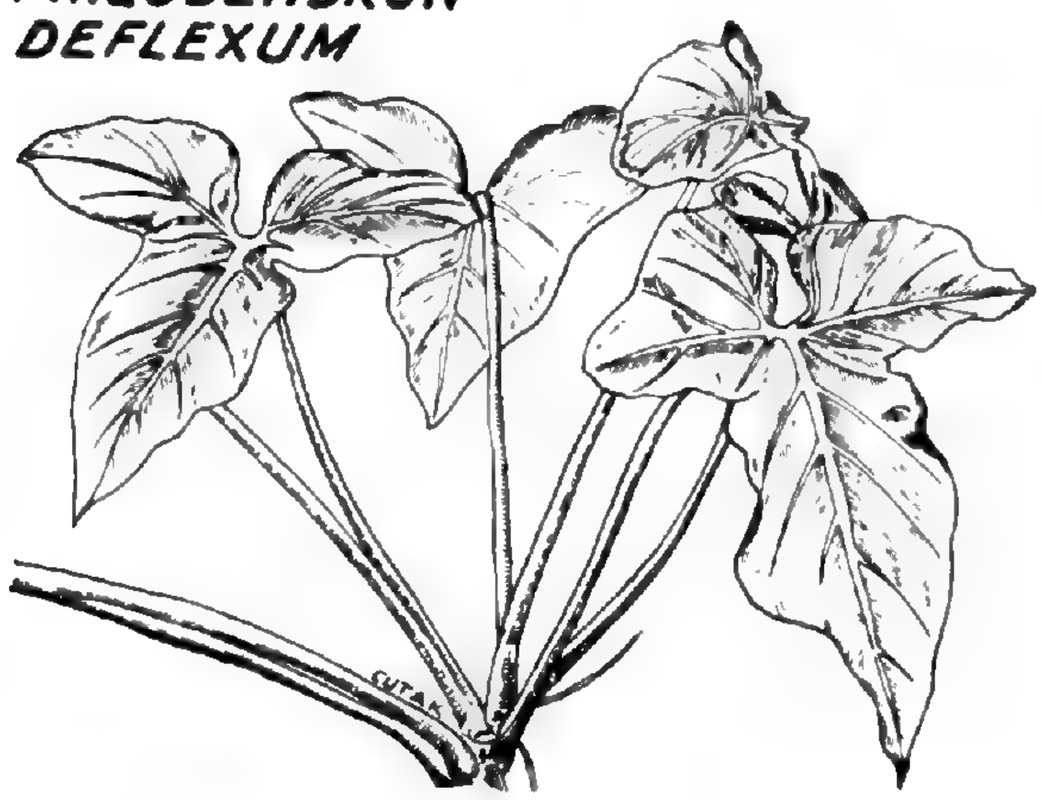


Philodendron Eichleri, "The King of the Philodendrons"

This species has magnificent leaves. In well-grown specimens they can be up to seven feet long and three feet wide. There is a distinctly metallic cast to the foliage which gives them an extra air of permanence.

sprays manufactured for the particular culprit. Mealybugs prefer to hide in the crowns or around the axils of leaves and branches; scales establish themselves usually along the stems or leaf veins; while red spider is prevalent on the undersides of the leaves. Mealybugs may often be washed off with water under slight pressure. Scale insects may be more persistent but usually can be removed with Volck or other oil sprays.

PHILODENDRON DEFLEXUM



In regards to feeding your own Philodendron, use a good balanced liquid fertilizer once every four weeks or so. Repot it when necessary. I have been using liquid manure whenever possible and in addition have applied Rapid-Gro on the foliage. If too much fertilizer is applied leaves will burn and become discolored. Should this happen stop the application, and to be on the safer side flush the pot with running water to leach out the excess food stored in the soil.

Although the Heartleaf Philodendron *(Philodendron cordatum)* is undoubtedly the most common Aroid grown in our homes, the Swiss Cheese Plant or Fruit Salad Vine *(Monstera deliciosa)* is even more attractive. It is more robust with heavier and larger leaves, excellent as a pot plant for almost any location. If given room it assumes a scrambling mode of growth and is then especially adapted for creeping up a brick or concrete wall or the trunk of a tree. For this reason young plants are trained to climb a moss-covered pole. The leaves of *Monstera deliciosa* are very outstanding for their bold effect. At first they are bright green and tightly rolled up but soon unroll into very broad heartshaped blades deeply slashed from the margin halfway to the broad midvein and punctuated by oblong perforations. Well-developed mature leaves attain a size of 3 feet long by 2½ feet broad. This is the plant frequently seen in hotel lobbies, restaurants, big department stores, modern office buildings and in spacious living rooms. In its juvenile stage, with solid or partially indented leaves, it is often sold under the erroneous name of *Philodendron pertusum*. It is to be remembered that young plants of both Monstera and Philodendron have quite different characteristics from mature ones, and anyone not acquainted with both forms will swear two species are involved. That is the reason why so much confusion exists in the Philodendron nomenclature. The *Philodendron pertusum* of the trade is then nothing but one of the horticultural selections of *Monstera deliciosa*, now proposed to be called cultigen "Dwarf Ceriman" by Birdsey[1] who published a

[1]Birdsey, M. R. The Cultivated Aroids. 140 pp. 1951.

Philodendron squamiferum is a handsome species, hardy and easy to grow, which is steadily gaining in popularity. It can be trained to a "totem pole" of moss, or the stem can be made to grow horizontally and twined around a large container, making a sort of hanging-basket effect. The striking dagger-shape of the leaves is effective seen against the background of a modern living-room.

well illustrated and instructive book on Aroids. This book is not a complete and definitive work but rather an attempt to review the present status of the cultivated Aroids and to indicate the gaps that exist in this available information. There is supposed to be a true *Monstera pertusa* with smaller, narrower, more oblique and less-perforated leaves but as far as I know it is not in cultivation anywhere. All the *Philodendron pertusum* sold on the market today are rightfully *Monstera deliciosa*.

Since it is not my intention to deal extensively with all the exotic Aroids but rather only with the Philodendrons, I will confine my remarks chiefly to this group which, in my estimation, contains the most versatile and decorative house plants today. Philodendron has taken the world by storm and I venture to say that virtually every home has a specimen of one kind or another, either in the window garden or book nook.

The genus Philodendron, as we know it today, contains over 200 species with new ones being discovered right along in the forests of tropical America and its islands. Also many hybrids have been produced since the intricacies of hybridizing the Aroids have been successfully solved. Prior to 1945 or thereabouts only one Philodendron hybrid was known to exist, *Philodendron corsinianum*, which was raised by the flrm of Messrs. Makoy of Liege, Belgium, in 1887.

Most of the early species of Philodendron were described by the late Dr. Schott of the Imperial Gardens of Schoenbrunn, in Vienna, who had imported many himself from the forests of Brazil. These were a favorite study of his. In this famous garden of the

Austrian emperor were long ranges of high houses which were festooned from end to end with magnificent specimens climbing on poles, trellises, and rafters. The Aroid collection at Schoenbrunn was one of the most outstanding horticultural exhibitions in the world. Other famous collections were housed in the botanical gardens of Berlin, Germany, St. Petersburg, Russia, and Kew Gardens, in England, but from all reports none of them could compare with the Schoenbrunn collection.

The word Philodendron is Greek, and, literally translated, means "tree loving", from the fact that most of

the species attach themselves to trees in the tropical forests either by climbing up the trunk or nestling in the crotches of branches and in rough bark. They are all remarkably sturdy plants which can adapt themselves very readily in any home. To be sure, some species are delicate and will test the grower's skill but most are easy to manage, requiring only a minimum of care and attention. The plants are as much at home in a small apartment as

PHILODENDRON CORDATUM

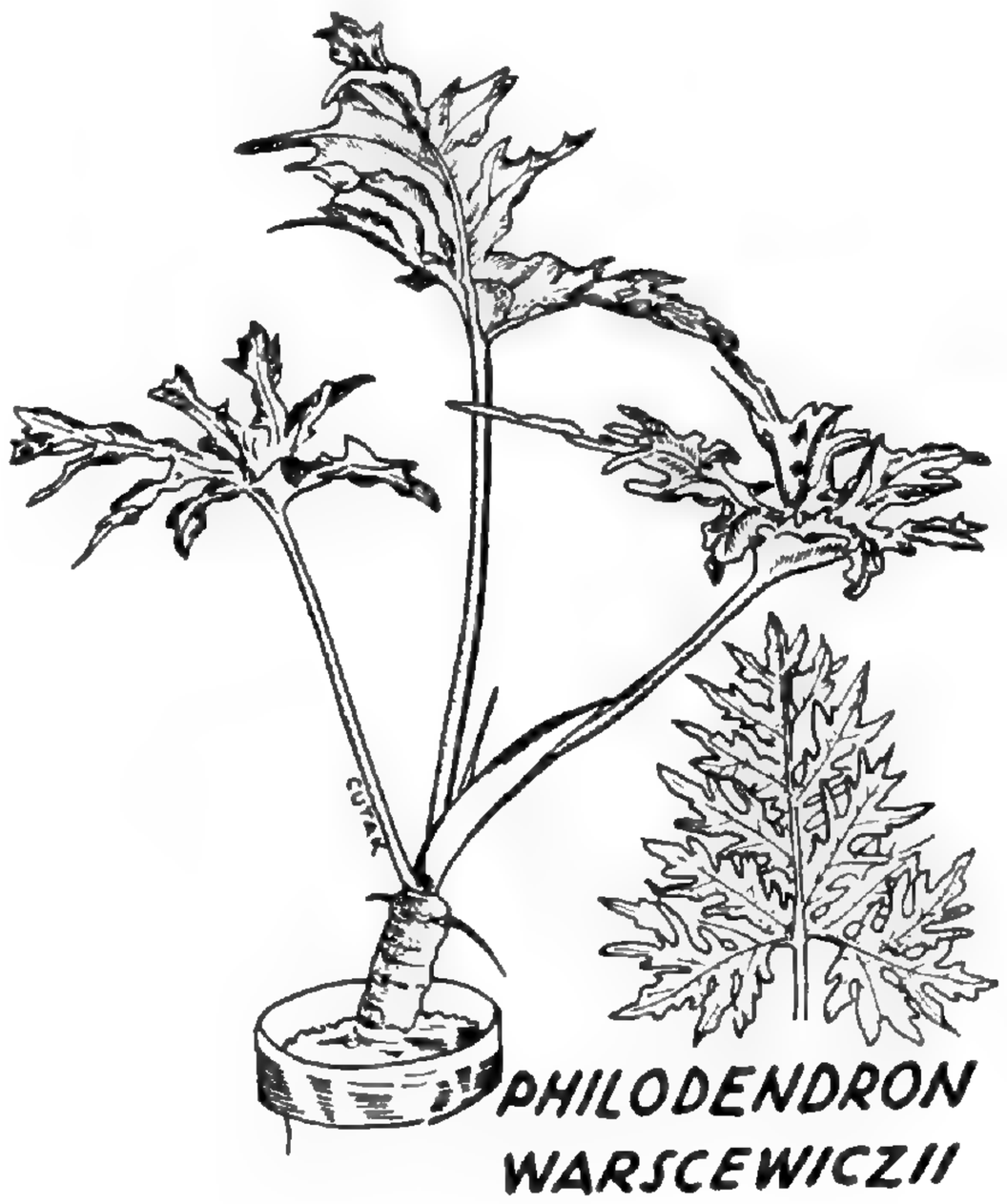
in a spacious home. The commonest species, *Philodendron cordatum*, often is seen vining from windows and shelves or racing up a totem pole. A bachelor friend of mine has the Heartleaf twining over wires the length of two of his rooms. This variety persists under the most adverse growing conditions and will bring living green to many dark nooks. I know of no other plant that is as foolhardy as it.

Of the more than 200 species of Philodendron that inhabit tropical and subtropical America, only about 75 varieties can be found represented in the best-known collections, and perhaps of these a mere 50 can be obtained through commercial channels. The Missouri Botanical Garden is proud to announce that through recent acquisitions it has increased its Philodendron collection to the point where it is probably the largest in America. Last winter the writer went to Florida for the express purpose of ferreting out species and hybrids not yet represented in our collection. Well-known nurseries specializing in Aroids were visited, including Foster's Tropical Arts and McColley's Bamboo Gardens in Orlando, Blaser's in Bradenton, Wedding's in St. Petersburg, and Wilson's Fantastic Gardens in Miami. Right now the Garden has about 65 kinds of Philodendron which are being grown naturalistically in both the Palm and Economic Houses where the plants are set out in beds at the bases of palms and trees to clamber up the trunks, and also in pots in the new Aroid Pithouse where rainforest conditions are being attempted.

Philodendrons, for convenience, can be divided into the climbing and self-heading types and these again divided into entire and cutleaf groups. Of the climbing species, *Philodendron cordatum* is believed to be the most foolhardy vine in existence. Sprigs of it are often used in dish gardens, terrariums, and novelty containers, where they either hang gracefully, trail along the soil, or climb upon trellises. When this vine is allowed to grow

freely as in conservatories, it will produce very large leaves and look unlike the small plants seen in the home. There seems to be considerable doubt as to *cordatum* being its correct specific name. It is believed that all the plants offered in the trade as *P. cordatum* are really *P. oxycardium* which originates from Puerto Rico. The true *P. cordatum* is native to Brazil, according to Birdsey, and he describes the spathe as being purple. The *Philodendron cordatum* growing so luxuriantly on the concrete wall of the northwest wing of the Floral Display House, according to our plant records, is from five plants collected in Brazil by Mr. Fendler about 1869 and appears to be one of the few greenhouse plants still remaining from Henry Shaw's time. It flowers practically each year (unless the vine is pruned heavily) and the spathes are always of a creamish-white color on the outside with splotches of green showing on the lower half. Cut open, the spathe is creamish yellow for two-thirds of the way down and brilliant red in the lower third. Mr. George H. Pring, Superintendent of the Garden, states that cuttings from this vine were given to Bourdet Floral Company for trial as a possible commercial plant some 43 years ago. Thus the Garden has furnished the stock which made the Heartleaf Philodendron the universal house plant that it is today.

Another slender trailing vine with perhaps smaller leaves is *Philodendron micans*, sometimes listed under the name *P. scandens*. It has the same general habit as *P. cordatum*, except that the upper side of the leaf is velvety green and iridescent while the underside is reddish. One of the most beautiful trailers is *P. verrucosum*, with delicate satiny green leaves that are a combination of salmon and violet underneath. The petioles are conspicuously covered with bright red bristles and green hairs. Its only drawback is its habit of losing the lower leaves, maintaining only a few at the upper end. This one likes an extremely hot and humid atmosphere



in order to keep its leaves. Another spectacular climber is *P. squamiferum* which has leaves shaped like a Malayan *kris*, a peculiar dagger with a serpentine blade. It is good for a hanging basket, as is also the spreading *P. laciniatum*. The leaves are of a dark dull green color, notched several times nearly to the midrib. *P. Sodiroi* is a neat vining type of slow-growing habit. The leaves are broadly heart-shaped with large irregular mottling pattern giving a silvery appearance.

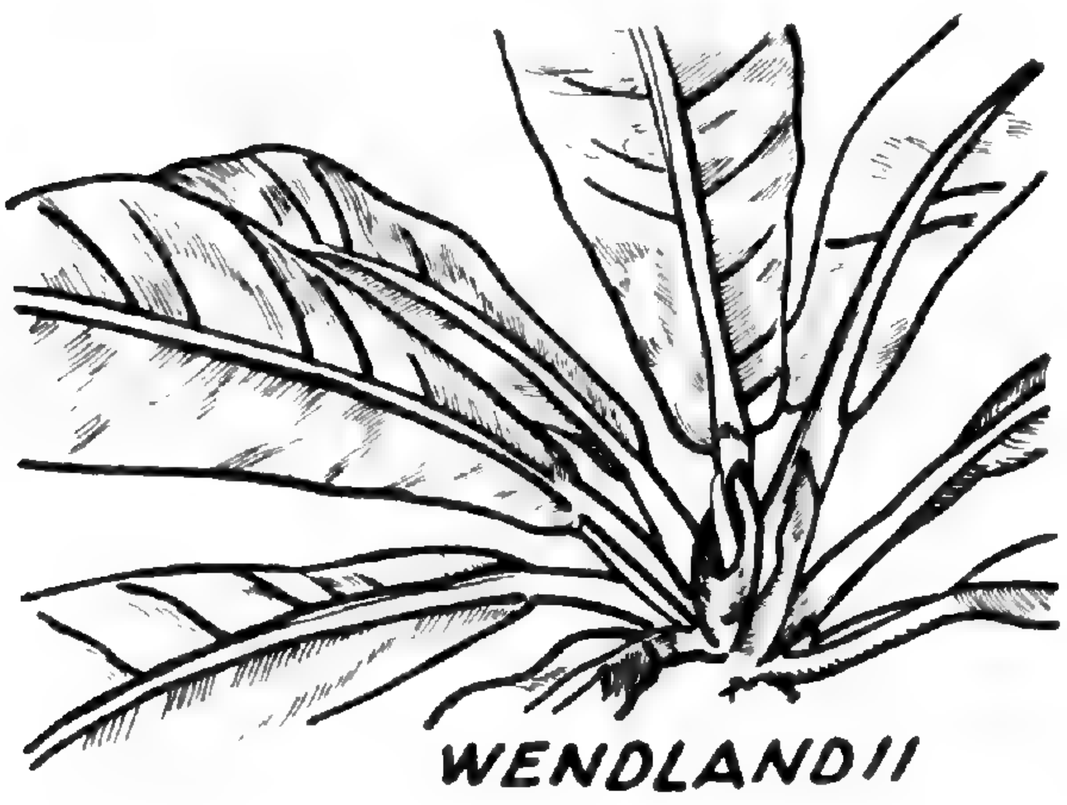
A Philodendron fast becoming popular with house-plant enthusiasts is the oddly lobed *P. panduraeforme* which has excellent keeping qualities. It is best grown on a moss stick but will do equally as well in a basket. Of similar nature is the Peruvian *P. alatum*. A slow-growing but exciting exotic foliage plant is *P. Mamei* from Ecuador. The large, silver spotted, corrugated, heartshaped leaves are borne on long petioles, and because the plant seldom branches it forms a compact subject for a pot. Another large heartleaf Philodendron on the order of the preceding is *P. gloriosum*. It is likewise a slow grower but makes up for this condition by producing attractive velvety foliage that will please everyone. The dark green velvety leaves are distinctly marked with heavy ivy-colored veins. What might be recognized as the queen of all Philodendrons is the stately *P. Andreanum* from Colombia. The climbing stems support velvety iridescent leaves of a nearly black green which are a striking contrast to the whitish midveins and lateral veins. It grows nicely on a moss stick but will not thrive in locations kept dry and cool.

Philodendron Pittieri, a recent introduction from Costa Rica, is already a favorite with house-plant growers. Its heartshaped leaves are thickish, smooth and shiny, gracefully carried on slender petioles. It does well on a moss stick but also can be grown as a pot plant without any support. For best performance see to it that shade and humidity are given similar to that required by the majority of foliage plants. A temperature of about 70 degrees F. ought to be maintained.

Philodendrons such as *Pittieri*, *micans*, and *cordatum*, with a trailing or climbing habit, should be planted in threes in a single pot in order to produce the fullest specimens. This pertains to cuttings or small plants. The growing tips should be fastened to moss sticks by a hair pin or string so that the roots will become attached as soon as possible. Moss sticks, or totem poles as they are called in the trade, can be made of Hawaii treefern, cork bark, or cedar posts covered with osmundine or even sphagnum moss. The purpose of a moss stick is support for the plant as well as a medium for aerial roots. Keep the sticks moist.

Among the very sturdy Philodendron climbers are *elegans*, *erubescens*, *hastatum*, *lacerum*, *radiatum*, *sagitti-*

folium and *sanguineum*. One which has been a great favorite for many years is *P. radiatum*, usually sold under the name of *P. dubium*. In the very young plants leaves are nearly entire but as the plant grows they become incised and in maturity are deeply cut almost to the middle. A plant that looks quite similar to *P. radiatum* is *P. elegans* but is daintier and its segments are much narrower and perhaps more numerous. If you desire a specimen with really good-looking leaves insist on securing *P. lacerum*.



The leaf blades are quite large, heart-shaped and deeply incised, with the midrib and main lateral veins a lighter shade of green. The leaves of *P. Selloum* are very attractive, being quite incised. This plant is also known for its hardiness as it will stand a great deal of cold. I have been informed that in California *P. Selloum* has come through nicely even in freezing weather. It has been used as one of the parents in hybridizing work.

Even though the cutleaf Philodendrons may have greater appeal because of their more intricate patterns we should not overlook the entire-leaved species such as *hastatum*, *sagittifolium*, *sanguineum* and *erubescens*. The first produces elongated arrow-shaped leaves of leatherlike texture and it is probably the most popular of the group because of its sturdy habit. The same goes for *P. sanguineum*, which has a dark green sagittate leaf with a prominent light midrib. The underside of the leaf is tinged with a purplish-red whereas *P. hastatum* is green. Although *P. erubescens* has a tendency to grow rank it has found favor with many house-plant owners. The medium-sized leaves are of a dark shiny green above and dark reddish-purple or coppery underneath. It is excellent for totem poles. If allowed to develop into a large climber it will produce beautiful dark red inflorescences.

Permit me to mention a few self-heading Philodendrons because these are even more desirable than the climbing kinds, although not yet as available in quantity and variety. It is only in the last five years that a method was devised to propagate them from seed on a grand scale. In the dense jungles of tropical America some of these self-heading Philodendrons grow into immense specimens but under cultivation they are slow-growing and spreading which makes them even more desirable in our homes. Unlike the climbing types, these cannot be increased by cuttings. Probably the most ideal self-heading Philodendron for the average home is *P. Wendlandii*, which produces oblong leaves in a birdnest fashion. Its thick, spongy, semi-terete petioles are characteristic of this type of Philodendron. Similar to it is *P. cannifolium*, a

species with short and stout petioles that resemble the pseudobulbs of certain orchids. A much heavier plant is *P. Melinoni* which bears large, long-stalked leaves spreading out from a short thick shaggy stem. Several hybrids of self-heading kinds may now be obtained from nurserymen including *P. Evansi* with large divided leaves; *P. Orlando* a compact plant with elongate heartshaped leaves; and *P. Fosterianum* having the appearance of *P. bipinnatifidum*, one of its parents.

In order to understand the Philodendrons now being cultivated at the Garden some remarks about each variety should be helpful to a student of these remarkable plants.

PHILODENDRONS GROWN AT THE GARDEN

ANDREANUM: Ultra-tropical climber requiring high humidity and warmth; excellent for totem poles. Possesses elongate, cordate to arrowshaped leaves up to 3 feet long and a foot broad. Leaf blades on extended petioles hang parallel to the support. They are brownish-green to dark green, velvety and iridescent on the upper surface, dull on the underside, with the midrib and 10 to 20 lateral veins prominently cream-colored. Advertised as the queen of the climbing Philodendrons.

AURICULATUM: A new compact grower noted for its foot-long mottled petioles which are flattened on the upper side. Leaf blades oblong to elliptic, dark green with broad midrib. Blades measure 12 inches long by 6 inches wide in our specimen.

BARRYI: Ours is a juvenile plant and a recent acquisition, and therefore it is too early to describe or make any comments about it. Not in the trade.

BIPINNATIFIDUM: Plant quite similar to *P. Selloum* but seems to have longer, more slender petioles, a more upward airy growth, and possibly more foliage. Leaf blades appear smaller and narrower, with the pinnae extending almost to the midrib and with greater space between them. A beautiful specimen can be seen in the southeast bed in the Palm House. Brazil.

BRENESII: A nice climber with large shiny green leaves oblong-cordate in shape. The blade with a pale green midrib and 6 to 8 less prominent lateral veins is borne on a winged petiole. Costa Rica.

CANNIFOLIUM: A very striking plant which has been in our collection for many years. It is still rare and a slow grower. The broadly lanceolate pale green leaves are borne on flask-shaped petioles that remind you of pseudobulbs of certain orchids. Grows as an epiphyte on large trees in French and Dutch Guiana.

COLOMBIANA: A climber with heavy, waxy, deep green leaves. Suitable for totem poles. Native of Colombia.

CRASSINERVIUM: A singular climbing plant with long narrow, strap-shaped leaves up to 2 feet long, coriaceous. Grows in Brazil.

CRESTIFOLIUM: A vining Aroid with large solid crenated leaves of a pleasing green similar to *P. lacerum*. Identity doubtful but it was received under this name from Alberts & Merkel Bros.

CRUENTUM: A decorative upright-growing Philodendron from Peru with the back of the leaf a clear mahogany-red. Our plant, however, is not displaying such rich color at this time.

DEFLEXUM: A robust plant from Peru which is not commercially available as yet. The long, more or less erect petioles support tri-lobed blades of leathery texture. A good specimen can be seen in the west bed in the Economic House.

EICHLERI: A very magnificent species from Brazil, regarded as the king of the self-heading Philodendrons. Bears extremely large (up to 7 feet long) elephant-ear leaves with scalloped edges. The blades are quite flattened even in young leaves and are dark olive-green with a narrow horny margin. Our plants are still small; one is planted out in the Palm House and the others in pots.

EICHLERI × SELLOUM: Our plant is too small to rave about at present but when the excellent qualities of both parents manifest themselves in this cross, the appearance should be fantastic.

ELEGANS: A South American climber with fern-like leaves up to 20 inches long by 16 inches wide. This Philodendron, with its long narrow finger-like segments, is probably the most graceful of all the climbers. The good specimen in the south-center bed in the Palm House attests to this fact.

ERUBESCENS: A free-growing climber with leaves a foot or more long. The glossy, dark green, heart-shaped leaves have a slight reddish cast on the upper surface and coppery beneath. Several specimens clamber up the trunks of palms in the Palm House and produce rich red inflorescences.

EVANSII: This is a choice cross between *P. speciosum* and *P. Selloum* and belongs in the semi-selfheading class. It produces large divided leaves with wavy margins and is said to be tolerant to some cold.

FENZLII: This is a climbing Philodendron with tri-lobed weak leaves. Only a small cane is in our possession, so comments are reserved for a later date. It hails from Mexico.

FOSTERIANUM: A very rugged selfheading plant, combining the best characteristics of *P. bipinnatifidum* and "P. species #1." The latter is a robust grower with a heavy trunk producing about fifty leaves at the head. The hybrid produces as many as 25 leaves per plant.

GIGANTEUM: A spectacular West Indian species with many large broad, cordate-ovate leaves. A beautiful specimen is thriving in the north-center bed in the Palm House.

GIGANTEUM × WENDLANDII: Knowing that both of the parents have excellent keeping qualities, this cross is a welcome addition to the growing list of hybrids created in the last few years. Promises to be an excellent pot plant.

GLORIOSUM: This is one of the difficult Philodendrons but very striking when grown successfully. The stem creeps on the surface of the soil and puts out long, thick petioles with large heartshaped leaf blades of a deep velvety green enhanced by the pinkish to white midrib and main lateral veins. Native to Colombia.

GUTTIFERUM: A rather striking plant that makes an excellent subject for the totem pole. The foliage is narrow and somewhat corrugated, fleshy, and of olive-green color. Native to Costa Rica.

HASTATUM: A long-established favorite because it can stand quite a bit of abuse. It is a climber with arrowhead leaves of glossy light green. Good specimens may be seen on trunks of some of the palms in the Palm House. Birdsey states that the plants sold under this name are not "*hastatum*", but it is best to use this name until more accurate information can be dug up.

HASTATUM VARIEGATUM: A rather spectacular mutant of the above is proving to be a sensation in gardening circles. The sagittate leaves are beautifully streaked and splotched with yellow, green and white variegations. Often one side of a leaf will be pure ivory or yellow.

ILSEMANNI: Another highly colorful Philodendron with sagittate leaves on long petioles issuing from a slender stem. Large patches of white intermingled with green are its outstanding characteristic.

LACINIATUM: A vining type with odd-shaped leaves that looks well in a hanging basket. The stem remains horizontal until the weight of the leaves pulls it down. You'll love this species which grows wild in Brazil and the Guianas.

LACINIATUM × SQUAMIFERUM: Promises to be more robust than either of its parents. This is a new cross recently put on the market.

LIGULATUM: A slender unidentified vine found in a local nursery. It is now growing nicely in the Palm House and seems to match the plant sold under this name by the Julius Roehrs Co. It has oblong-obovate leaves broadening toward the tip. Said to come from Costa Rica.

LUNDII: A Brazilian plant very closely allied to *P. bipinnatifidum* and sometimes considered a variety of it. Our plant is still in the juvenile stage.

LYNETTE: A selfheading Philodendron that looks like the well-known *P. Wendlandii* but with a crinkled appearance. Origin unknown.

MACNEILIANUM: Advertised as an attractive cold-resistant hybrid. It is a cross between "P. species #1" and *P. Selloum*. Juvenile leaves are slightly incised. Appears to be a good pot plant.

MANDAIANUM: The reddish hue which this hybrid climber inherited from *P. erubescens* made this plant an outstanding favorite. The arrowshaped leaves come from its other parent, *P. hastatum*. Petioles have a red tinge and are winged.

MAXIMUM: A plant of doubtful identity received under this name is being grown in the Palm House.

MELINONI: This is a truly handsome self-heading Philodendron which has been in our collection for many years. It is a compact plant with a wide-spreading habit. Several specimens on view in the Palm House have been greatly admired. The leaves are leathery and quite large. Comes from French Guiana.

MELLO-BARRETOANUM: Seedlings are being grown.

MICANS: This is a small-leaved twiner looking like the common *P. cordatum* except for its velvety bronze leaves. It is a leggy climber from Central America.

NOBILE: Ours is a very small plant which is doing nicely. It was collected by Dr. Julian Steyermark on one of his recent expeditions to Venezuela. Very rare.

ORLANDO: This is a hybrid between *P. Wendlandii* and an unidentified "P. species # 2", developed by Mulford Foster and named for his city. It has longer and heavier stems than *P. Wendlandii* but the leaves are similar.

PANDURAEFORME: A climber that can be beautifully grown on a totem pole and is proving to be one of the best of house plants. The oddly lobed leaves attain 20 inches in length and 8 inches in width. The irregular-shaped olive-green leaves are unsurpassed for interior decoration. Native to Venezuela.

PINNATIFIDUM: A deeply notched Philodendron received under this name is being grown in the Palm House in order to reach maturity sooner. It is a climber native to Venezuela.

PITTIERI: A Costa Rican climber with small, heartshaped, glossy green leaves on the order of *P. cordatum* but more succulent. It will tolerate dry conditions.

QUERCIFOLIUM: This Brazilian species has olive-green leaves which are among the most interestingly cut of all the Philodendrons, effecting a lacy pattern. A highly desirable pot plant.

RADIATUM: A climbing species with deeply segmented glossy dark-green leaves of a heavy, leathery texture. A rather common Philodendron which in the trade is often sold under the name *Philodendron dubium*. A good specimen can be seen upon entering the Palm House where it grows up the trunk of the tallest date palm. In the wild state it grows in Mexico and Guatemala.

RUBENS: Plant similar to *P. erubescens* but with larger and wider leaves. Leaves are ovate heartshaped, dark green on upper surface and copper-green underneath. Stipular sheaths are pinkish and membranous. It grows in Venezuela.

SAGITTIFOLIUM: An arrow-leaf climbing Philodendron of robust habit of growth, which flowers regularly in the Fern House where it has been established for the past 25 years. Native to Mexico.

SCHOTTIANUM: A climbing Aroid of noble character, the upper stem clothed with shredded remains of leaf sheaths. The somewhat terete petioles are flattened just below the insertion of the leaf blade and are about 28 inches long. Leaf blades are heartshaped, slightly more than 2 feet long and 15 inches wide, with the midrib depressed and main lateral veins sunken. A beautiful specimen is found in the south-center bed in the Palm House.

SELLOUM: A selfheading, large pinnatifid-leaved plant native to the humid forests in various parts of Brazil and Paraguay. It is noted for its lush, rich green foliage and rapid growth, and for this reason has been used as a parent in many recent crosses.

SELLOUM × BIPINNATIFIDUM: Two tall subarborescent species were used to make this cross and the result should net a very fine plant. The parents are closely related and similar in habit, with large notched leaves, and *Selloum* is cold-resistant.

SIMSII: Quite an interesting introduction from British Guiana. It is a climber with oblong, cordate, leathery leaves. Excellent for poles and bark.

SODIROI: Here is a beautiful climbing species with large heartshaped leaves which eventually reach up to 16 inches long by 12 inches wide. Our specimen is still small but very attractive, as the dark olive green leaves show profuse irregular mottling of light gray, giving a silvery sheen to the plant. Said to be native to Colombia, home of many fine Aroids.

SPECIOSUM: Another excellent Brazilian Aroid with entire leaves like a giant elephant ear on long petioles. Has been used in crosses. A small plant is growing in the Palm House.

SQUAMIFERUM: A vining type with a very twisted habit of growth. The strong, 5-lobed, rich green leaves have been likened in shape to the Malayan *kris*. The petioles are covered with a red pubescence. It is an excellent subject for the hanging basket and will flower readily under humid conditions. Comes from French Guiana.

TALAMANCAE: One of our recent acquisitions, still in the juvenile stage. Bob Wilson of Fantastic Gardens has it for sale, although it is still a rare item. It has many long-pointed leathery leaves and is said to climb very slowly. Native of Costa Rica.

TRIPARTITUM: A scandent species with thrice-divided leaves growing in the east bed of the Economic House. At most a scraggly plant because the distance between the leaves is too great for beauty.

UNDULATUM: A selfheading deep green, leather-leaved plant from Paraguay, noted for its large, wavy, heartshaped leaves on long stems. Ours is still small.

URBANIANUM: A climber from Cuba with dark green ovate lanceolate leaves. Good for totem poles.

VARIIFOLIUM: A graceful climber with heartshaped leaves resembling *P. Sodiroi*. It possesses similar silver mottling which makes it an attraction. Peru.

VERRUCOSUM: Long vining type with undulate leaves up to 18 inches long by 10 inches wide. The leaves are dark velvety-green highlighted underneath with red splotches. Petioles are covered with soft succulent bristles and hairs. This is one of the most beautiful species but requires high humidity and warmth to keep it healthy. Comes from Ecuador.

WARSCEWICZII: A rather interesting Guatemalan and Mexican climbing Philodendron having spectacular bipinnate wavy leaves with pointed segments. I saw it growing in the wild at the base of a cliff in Chiapas and brought stems home for trial in the greenhouse. Leaves are deciduous with us.

WEND-IMBE: A semi-selfheading type combining the virtues of *P. Wendlandii* and *P. Imbe*, its two parents. It will need support when it gets large.

WENDLANDII: A selfheading Aroid with broad spatula-shaped leaves arranged in bird-nest fashion. It is a durable and most ideal house plant introduced from Costa Rica.

WENDLANDII × HASTATUM: Another hybrid of semi-selfheading character, ideal as a house plant. Quite similar in habit and form to *P. Orlando*.

WENDLANDII × LACINIATUM: Still another hybrid—this one with swirly heavy-textured leaves acquired from *laciniatum*.

WILSONI: Our plant is small but when mature it will have large sagittate green leaves with wavy edges. It is apparently a hybrid although the parentage is unknown to me at present.

YOUNGII: A plant received from Switzerland about five years ago. I cannot trace the name anywhere in literature. It is a climber with heartshaped leaves on long slender horizontal petioles which are sprinkled with small reddish humps.

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (April to November) and until six (November to April) though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

THE MISSOURI BOTANICAL GARDEN

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HASTATUM

GLORIOSUM

WENDLANDII

GUTTIFERUM

SODIROI

VERRUCOSUM

MISSOURI BOTANICAL GARDEN BULLETIN

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COVER:—Dr. Louis O. Williams beside a vine of *Philodendron Warscewiczii* along the Río Yeguare in central Honduras. During the wet season this is at times a roaring torrent; during the dry season, little more than an occasional pool of water here and there among the boulders. So common are Aroids in the tropics that at least two other kinds are growing on the further side of this same rock.—Photo courtesy of L. O. Williams.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

Vol. XLIII OCTOBER, 1955 No. 8

LEARNING A LITTLE SOMETHING ABOUT AROIDS

EDGAR ANDERSON

THE average American spends more hours per year in the company of Aroids than any other kind of plant. Few indeed are the American homes which do not have at least one Philodendron vine. When Mamie Eisenhower spoke to the army brides a year or so ago she told them to make a home out of any more-or-less temporary lodgings by setting out a few family knick-knacks, sprouting a sweet-potato vine, and installing a Philodendron on the table or the window ledge. These little vines with the heart-shaped leaves, these house plants that root and grow in a glass of water, that will still be alive when you come back after a ten-day vacation, that grace millions of living-rooms, are Aroids, A-r-o-i-d-s, "ay", "arr", "oh", "eye", "dee", "ess". It strikes me as strange that "Aroid" remains such an uncommon word in common speech, that almost no American should know the name of the kind of plants Americans are now living with.

Aroids, to be precise, are any of that family of plants such as the Calla Lily or the Jack-in-the-Pulpit, with true flowers set so tightly together in a little central finger that you hardly ever notice the separate parts or think of them as flowers. Just below this little wand is a very special leaf, often brightly colored, which calls attention to the blossom. This "spathe" forms the elegant white cup of the Calla Lily, the bright red flaring base of the Anthurium blossom, the mottled green "pulpit" of Jack-in-the-Pulpit. Though aroids are mostly native to the tropics, a good many are amazingly adaptable and are very much at home in apartment living-rooms. Philodendrons are only one of several kinds of Aroids which are seen with increasing frequency in American homes. The Swiss-Cheese plant with the big holes in its leaves, the Chinese Evergreen which thrives even in dark hallways, and the dainty little arrow-leaved Nephthytis, sold by the millions in five-and-ten-cent stores all over the country, are Aroids. So too are Skunk Cabbage, Elephant's Ear, fancy-leaved Caladiums, and many lesser-known plants.

It seemed to me that if Americans were living with Philodendrons and other tropical Aroids the director of a big botanical garden ought to know something about them, so the last time I went to the tropics I kept my eye out for them and found them fascinating plants to study. There was a big native Philodendron growing right

along the path a mile or so from the Escuela Agricola Panamericana, where I was staying in central Honduras, and I spent a couple of days studying it and making herbarium specimens to bring back with me.

This particular Philodendron vine was growing up over a big boulder along a little stream and climbing on up into the trees higher on the bank. The snaky green trunk of the vines, nearly as large as your wrist, clambered up the face of the rock. From some of the joints on the stem, long, thin, wiry roots dropped straight down to the soil of the stream bank. The leaves, artistically cut and waved, some of them over a yard long, arched gracefully away from the twisting, hawser-like trunk. It is these leaves which give the vine its common name of "*tras tras*" ("get along, get along") in Central Honduras. Parents cut one and use it as a not-too-painful switch to hurry young folks ahead of them down the long, narrow footpaths.

The first thing to catch my professional attention was the variation in the shape of the leaves. Most of them were deeply cut. The fundamentally arrow-shaped leaf was so deeply lobed, and these divisions themselves so lobed again, that the whole appearance was feathery, something like an enormous stalk of celery. All the more conspicuous, therefore, were the new leaves which sprouted out at places where the stem had branched. Ordinarily, the stem does not branch, but this big vine was directly on the route of boys who pass by armed with long *machetes* which they swing back and forth at everything along the path. Where the vine had been lopped off, it had sent out branches. The first leaves on these new shoots were so different that it was hard to believe that they came from the same vine. The first to appear was small and broadly arrow-shaped without a notch anywhere in the margin. The next was larger and had a few small, hooked projections, resembling very closely the so-called *Philodendron dubium*, common in many plant porches and sun-rooms in St. Louis. The next was a little more lobed and cut and even larger, and so on up the stem until finally the leaves were as plumy as elsewhere on the plant. These are the so-called juvenile leaves, since they resemble very closely the first few leaves which come out when a vine is grown from seed.

When I studied the vine carefully I noticed that its growth was never even but that it had come in a series of quick flushes. The joints on the stem would be close together in those places where it had grown slowly and far apart where growth had been rapid. Furthermore, these zones of rapid and of slow growth alternated regularly all the way up and down the stem.

Scars on the stem showed where the vine had flowered. These flower scars, significantly, were all where the vine had been growing slowly and the leaves were close together. I then picked a set of leaves from a whole vine and discovered that they too varied with the flowering. The leaves from the quick-growing, non-flowering parts of the vine, though very much lobed, had broad flanges of leafy tissue coming out away from the veins; the leaves from the flowering zones had their leafy portions cut back almost to the veins. With a little study it was easy

to learn how to know these two extreme types of adult leaves. One could look at the whole feathery thatch of vine and say, "Now, this will have a flower scar at the base" or choose one of the opposite extreme and say, "Now, this one will be in the middle of the quick-growing zone," and be right every time.

No wonder the scientific classification of these vines has been somewhat mixed up! They have leaves not of two sorts merely, but of three. There are: (1) the unlobed juvenile leaves of seedlings and young branches; there are the adult leaves of both extreme sorts; (2) the skeletonized ones of the sexual phase; (3) the leafier ones from the vegetative phase. Stray specimens brought back from the tropics and studied by European botanists, vines grown from cuttings and introduced into the trade, not yet mature enough to have adult leaves, have been difficult to understand. Few of those who attempted to classify them had had the chance to study a big vine as it climbed up over the rocks and on up into the trees.

The juvenile leaves of this particular vine were, as I have said, very similar to the cultivated Philodendron usually called *P. dubium*. This is now known to be the juvenile form of a big cut-leaved species called *Philodendron radiatum*. The vine I was studying proved to be a closely related species, *P. Warscewiczii*. Its adult leaves are even more feathery than those of *radiatum*, and its fruits and cataphylls (nurse leaves) are green rather than red.

This big vine of *P. Warscewiczii* gave me an answer to another question that for several years had been lying around unanswered in the back of my mind. Why should these tropical Philodendrons be so much at home in American apartment houses? The question is easily answered. This part of the tropics is alternately hot-and-dry, warm-and-rainy. There may be no rain for several months and then a sudden downpour of five to ten inches. Life in such an environment prepares one for an apartment house window-box, no water at all for a week and then a whole pitcher full of cold water all at once. Nature has bred these vines to withstand the alternate parching and drenching which they are given when we grow them in our dry, furnace-heated homes. The closely related *Philodendron radiatum*, whose juvenile form *dubium* is almost the toughest of all these accommodating Philodendrons, has had a long association with man. It is found in Yucatan, where, since Mayan times, water has been obtained by digging big wells or cisterns down into the rock. In these rock-lined wells *Philodendron radiatum* grows today. Its snaky trunks wind over the rocks. No wonder these plants do well in apartment houses. Much of the day the light is diffuse and the air is cool. Then the burning sun shines directly down the well for a few midday moments. Much of the year the rocky lining is parched and dry; then tropical rain falls in torrents. Burning sun, dim light, weeks of drought, torrents of cold water. The plant had had a long experience with these terrors before we brought it into our homes.

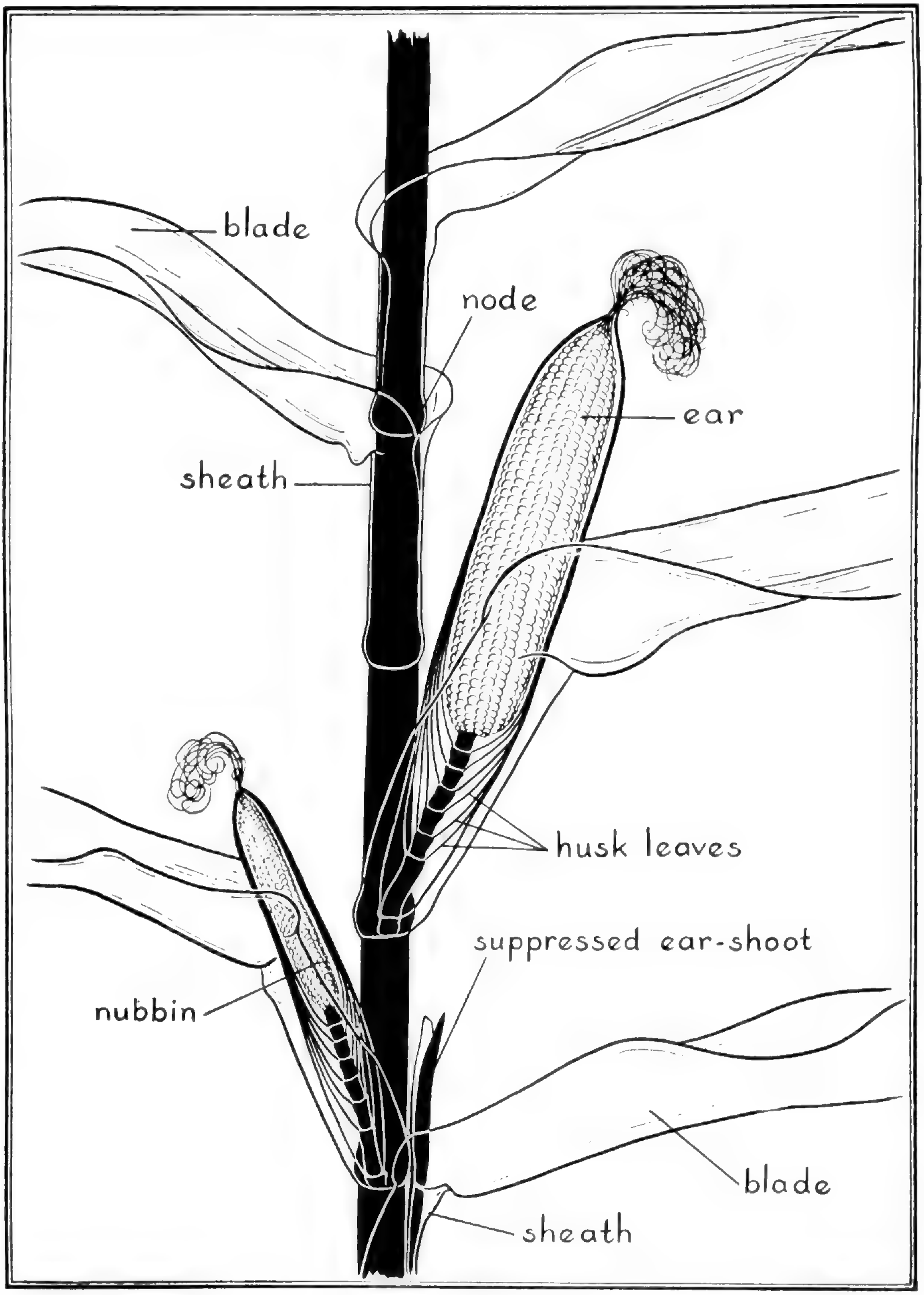
blade
node
ear
sheath
husk leaves
suppressed ear-shoot
nubbin
blade
sheath

Figure 1

A SECOND HARVEST

EDGAR ANDERSON

AFTER the sweet corn has been brought in from the garden and the empty, yellowing plants still stand up stiffly in the row, what better way to spend the end of a summer afternoon than to pull up a couple of them and carry them off for study to the porch or the garden terrace? Corn plants were, to the peoples who preceded us in this New World, not only the staff of life; they were the center of many native religions and were objects of devout veneration. Indian Corn is, by any standards, an astounding plant. It is the center of our national economy, the most important of all our crops, a strange giant evolved by man from rank tropical grasses, its history just now being pieced together, laboriously bit by bit, from different kinds of evidence.

But corn is really a grass, and just because it is a grass it is especially worth studying. By grasses we live, particularly those of us in the temperate zone. They are our cereals—corn, wheat, rice, rye, barley, they form the bulk of the food for our pasture animals; they cover the ranges where our herds are fed; they mantle vast portions of our plains and prairies. Grasses are not really complicated as plants go, but they are different from other plants. They have a strangeness about them, even to most botanists. Not until one has sat down deliberately and tried to understand what it is like to be a grass, will he begin to comprehend their forms and patterns and ways.

For learning something about the grass world a corn plant is superb. It is big and not too complicated. It is so large that the technical details which in most grasses would need a hand-lens or a reading-glass, properly to be understood, are here paraded out on a bold scale.

So pull up two or three plants and bring them to the terrace. Get a comfortable chair or bench or stool and a good sharp knife; a pocket knife or a paring knife from the kitchen will do very nicely. Most important of all, see if you can't achieve an air of adventure. You really are setting out for a world you've never been into before, the world of grasses. Be expectant and

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Fig. 1. A more or less "X-ray" view of the developing ears on a corn plant. Note that the top ear, and the "nubbin" below it are borne at the summit of very short branches. It is the leaves borne at each joint of these little branches which form the familiar protective husks of the corn plant. Each kernel of corn as it develops is largely made up of a single female flower from the tip of which a single long silk extends to the summit of the ear. Eventually it pushes out into the open, catching on its long receptive surface the pollen grains released by the tassel of the same or other corn plants, which are blown about in the air. In the fields where hybrid corn is produced to be sold as seed corn, the plant's own tassels are pulled out while they are immature and only pollen from another strain of corn (planted in the next row) will be flying about in the air. On the detasseled rows all the seeds will be crosses between the two strains. On the alternate pollinating rows all the seeds will be pure for the pollinating strain.

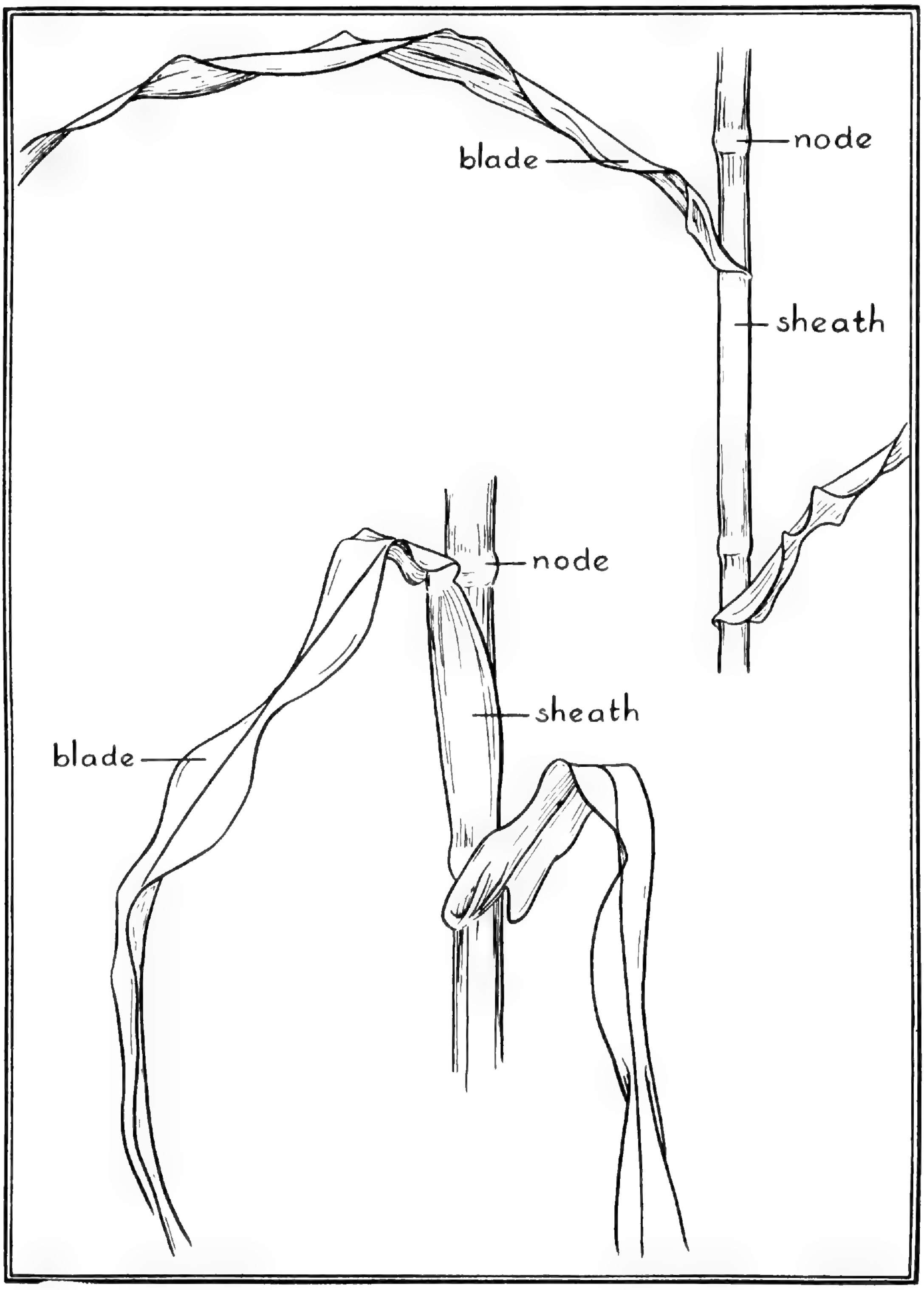


Fig. 2. Leaves from two different varieties of corn. Notice that the lower part of each leaf (as in grasses generally) is a tube-like structure, the sheath, which wraps tightly around the stem.

alive and interested, but not too awfully earnest; something, shall we say, like the way you might be when first visiting a dude ranch.

When we take our withering corn plant in hand it has, compared to a rose or a lily, or even a squash vine, a very work-a-day look. It is stiff and a little harsh. The surface of the leaves feels durable, but not particularly attractive. Nowhere on the plant (unless possibly in the drying husks) is there anything to rival the clean, clear yellow of a daffodil, the silky sheen of a rose petal, the almost metallic elegance of a chrysanthemum in full bloom. Grasses are like that. Some of them, the rice plant or various bamboos, may have a certain delicacy of form, a kind of austere beauty of outline, but their textures are prevailingly practical, their colors never very brilliant. If we pass on to consider the parts of the corn plant and the way they develop, we may catch some glimmering of why this should be so.

The plants lie before us on the terrace; a rather unattractive mess of drying leaves. Take one in hand, examine the surprising regularity with which it is put together, and you will begin to see some of the inherent beauty of its design. The leaves are not scattered any old which-way; they are set regularly on just two sides of the main stalk. First there is one to the left, then one to the right. They are more or less telescoped into each other and they veil the stalk. Let us cut each one off carefully at its base, revealing the underlying pattern. All the leaves on the main stem have the shape of grass leaves generally. The bottom part is a cylinder which clasps tightly around the stem. It is known as the sheath, and from its summit the leafy portion of the leaf stretches out at right angles off into the air and light. It is this curious leaf design, common to all grasses, rare in other plants, which is ultimately responsible for many of the other peculiarities of grass. First, however, we shall have to get the architecture of this particular grass plant thoroughly in mind.

As we take off the leaves, one after the other, each with its clasping cylindrical sheath, the underlying skeleton of the stalk is clearly shown. It is a single stem, jointed where the leaves are attached, the successive sections becoming more and more slender as we pass up the stalk.

At the apex of the stem is the tassel, a much-branched panicle of grass-flowers. There is no nonsense about them. Chaffy little flower parts enclose stamens packed with pollen; these are carried atop the plant where winds can bear the pollen away to other plants. The whole structure is a tough, efficient device for producing lots of pollen and launching it into the air. Female flowers are lacking in a normal tassel. They are all down in the ear, set tightly together in mathematical regularity over the cylindrical cob. Each of these flowers, early in the season, had its own strand of receptive silk which hung down from the tip of the young ear and caught the air-blown pollen. Once lodged on the silk, the pollen grain sprouted and, growing back down inside the silk to the young kernel, carried the sex cells which fertilized it and set it off on its suc-

culent path of development.

These are odd kinds of flowers compared to a rose or a water-lily, these strawy pollen factories of the tassel, these gelatinous blobs of tissue on the cob, with their long silky receptive organs. The flowers of the young ear of corn, these kernels-to-be, are strange, even among grasses, but the florets of the tassel are typical of grass flowers generally. The flowers of most grasses have strawy parts, and their stamens are the only feature easily recognizable as similar to the flower parts of other plants. Why should the world's grasses have gone off at such

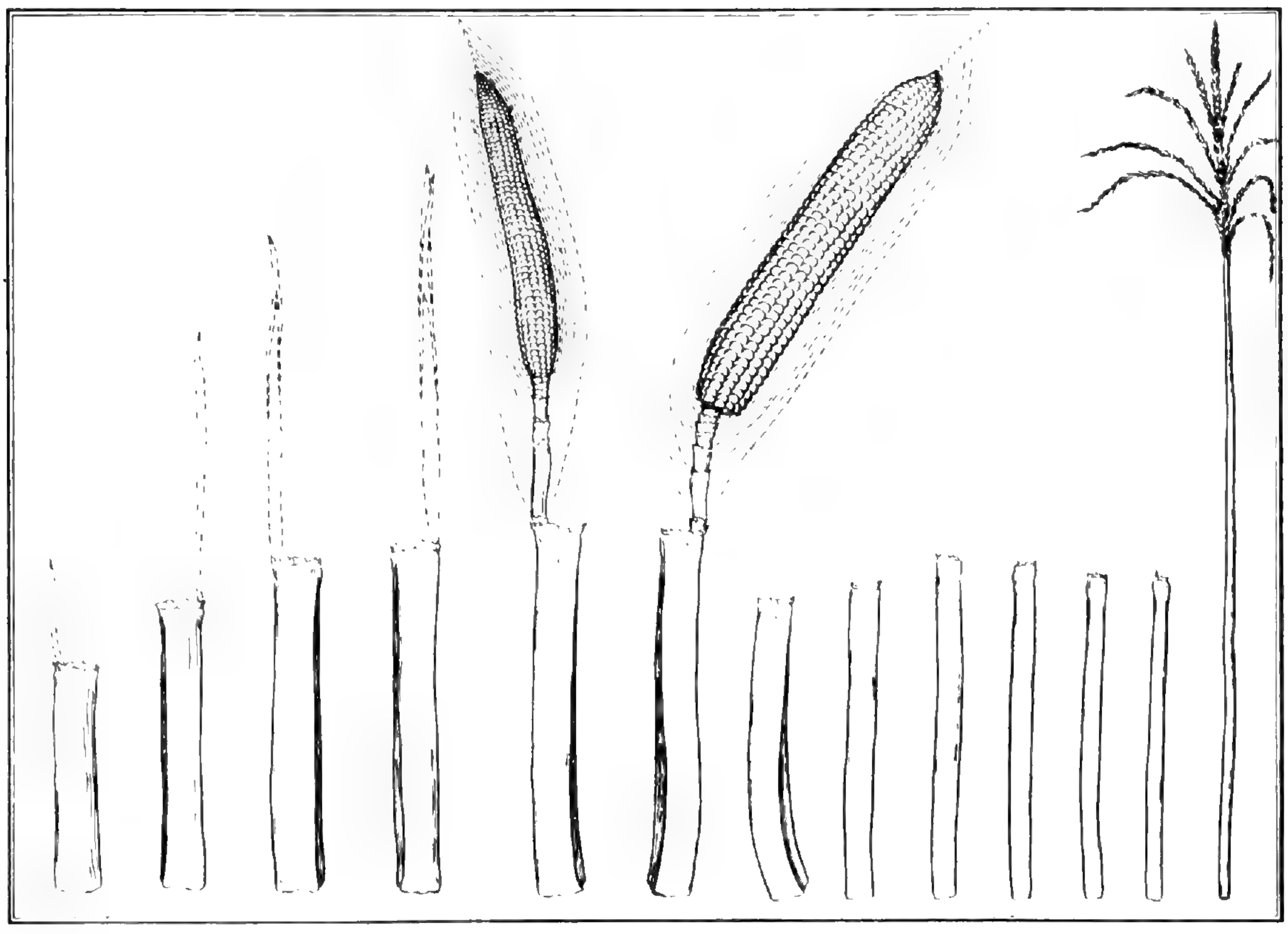


Fig. 3. The successive joints (internodes) of a corn plant cut across at each node and placed side by side for comparison. At the right is the tassel with the long topmost internode below it. Then seven nodes beyond it comes the ear shoot, its husk leaves shown diagrammatically with dotted lines. Note that the internode which developed along side the ear (now set over just to the right of it) has a deep groove where it was pressed against the young ear. In successive positions to the left are the lower internodes of the stem. First, there is the second small ear or "nubbin", then a succession of smaller and smaller ears which did not develop completely. Note that as these ears get smaller the creases or grooves which they made in the stems developing along side of them get smaller and smaller too.

Corn is a very special kind of a grass but these jointed stems, some of them with grooves and creases where other parts pushed against them (as they developed under pressure down inside the infolding leaves) are typical of all kinds of grasses, all over the world.

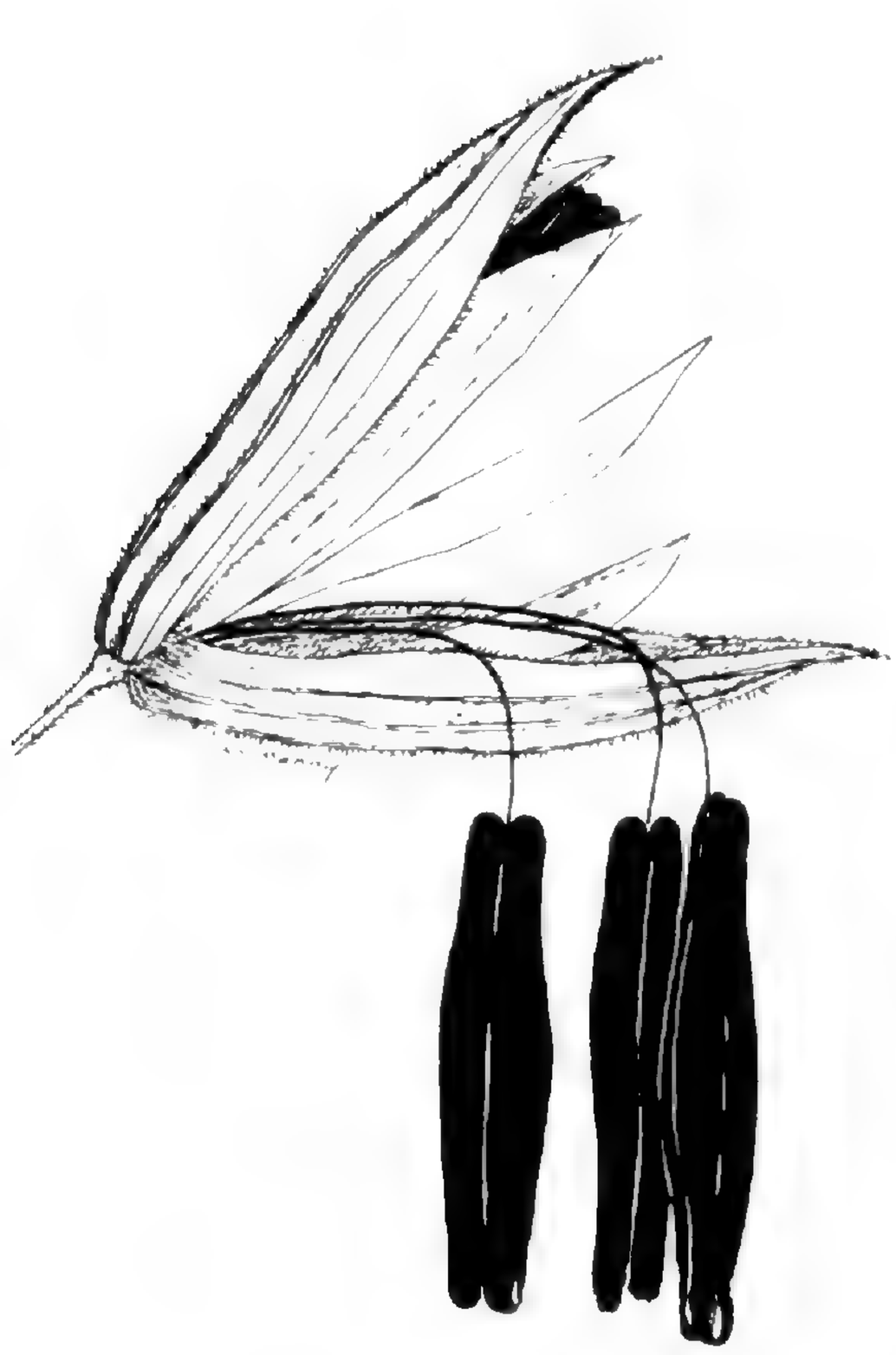
an evolutionary tangent? Why, wherever we find them throughout the world, should grasses present us with stream-lined flower parts and chaffy flowers? Before we answer that question let us pass on to a more careful examination of how the ear is set on to the main stalk.

If we remove the whole ear from the plant and cut off each husk where it is attached, we find that the ear was really at the end of a little branch. This branch, like the main stem, was jointed and had leaves set first to the left and then to the right. On the ear branch, however, these leaves or husks are not clearly differentiated into a sheath and a blade. Each husk is a wide, enveloping wrapper, sometimes with a tiny blade coming off slantwise from its apex.

Here now is the slender skeleton of the corn plant before us, a single-jointed stalk bearing two bunches of flowers. One bunch, the tassel, is made of loosely dispersed male flowers, and it is borne at the apex of the main stalk. The other bunch, what we call the ear, is made up of female flowers set closely together at the apex of a little branch which is hitched to one of the joints of the main stem. At the joint below this, there is a poorly formed ear or nubbin; at the joint below that a still less developed ear shoot; and so down the stalk, till at the base of the stalk only tiny vestiges of shoots can be found hidden down under the leaf sheaths.

A glance at some younger corn plants will show us how this whole shoot develops. The upper leaves all come up from inside the leaves below them. The sections of the stalk are very short when originally formed. As they elongate, from below upwards, the young plant pushes itself apart. As the corn grows it is as if some force laid hold of the young tassel and just pulled it gradually out from within its enveloping sheaths. If you've got a young corn plant to waste, now is a good time to waste it. Take one in which the tassel is just barely showing and pull it to pieces, leaf by leaf. The lowest leaf on the stalk is on the outside, the next one is just within it, and then the next and the next. The sheaths are set a full 180 degrees from each other and are wrapped so tightly that, even with a sharp knife, it is not easy to peel them off. Deep within the heart of the plant is the young tassel, all yellow and pink at the base, green and dry at its emerging tip. Still farther down inside is the young ear shoot, flattened within its enveloping leaf sheath, an almost microscopic plume of rapidly developing tissue.

Now you have before you the secret of the distinctive ways of all grasses. This is their kind of development pattern. The delicate, rapidly growing tissue is always buried, tightly held by successive wrappings of tough sheaths, the lower, already-formed tissues of the lower leaves. Imagine what it is like as a tender developing baby leaf to grow your way up into that all-enveloping strait-jacket! There is plenty of pressure there. Take your knife and slice open a developing corn shoot. Whether you make your cut cross-wise or merely make a slit deep into the side of the young plant, the release of pressure is instant and sur-



Two flowers from the tassel of a corn plant, very much magnified. The lowermost flower is open and the three stamens are hanging down from it so that pollen escapes from the little pores, one of which shows plainly in the lower right-hand corner of the picture. The uppermost flower also has three stamens which are just beginning to push out into view. The two flowers and the chaffy glumes above and below them make up what is known as a spikelet, the basic unit in all grass inflorescences. Nearly all grass flowers are straw little things, more or less on this pattern.

prising. It seems incredible that development could go on in the face of such pressures, but it does, not only in this corn plant but in all grass plants everywhere. The rapidly growing parts of grass plants—leaves, stems, flowers—all come into being and finish their earliest formative stages tightly bound by successive overlapping sheaths.

Turn back now to the jointed main stalk with which we started. Above the ear each section of the stalk (internode is the technical term) is an almost perfect cylinder, circular in cross-section. However, the internode beside the ear shoot has a deep groove, the section below it a lesser one, the one below a still smaller groove, and so on down the stalk almost to the base of the plant. These are mute evidence of the tremendous pressures under which the stalk developed within its encompassing leaf sheaths. Look at the internode beside the ear. When the young ear was developing down inside the sheaths, the internode next to it was still soft and buttery and accommodated itself in this manner to pressure from the young ear growing up along side. By constant and increasing pressure the young ear made the growing stem into a kind of little cradle. At the next internode below there was only a nubbin, so the cradle was not as deep, and at successive internodes down the stalk it gets smaller and shallower. The lowermost nodes had only one or two little leaves on a tiny branch, but they too had to grow at the same time as their accompanying internode, and even these tiny leaves which never grew into an ear pressed a little trough into the internode growing along side them.

For further evidence of how all the parts of a grass plant are controlled by the pressures under which they develop, pull out a young tassel from a sweet corn plant when the top of it first begins to show among the bouquet of leaves. If you pull slowly and firmly it will break off down at its

base where the young stem is still soft. You will have the whole tassel in your hand fully developed, stiff and gray-green at the top, more or less embryonic, limp and yellow at the base. Examine the lower half which was still under pressure from the leaves about it. See how all the little chaffy flowers are packed together; and remember, this is the way in which all grass plants develop. This is the pattern which the grasses of the world have been using since they first evolved into grasses millions of years ago. Not only this corn plant, but all its ancestors back to the first true grasses of remote geological times have grown up under this urgency of pressure.

Once given this pattern, nature has accommodated herself to it. Variations which would ease life in a crowded tube, once they arose, tended to be retained by Natural Selection. As the grass family evolved under this strict necessity, its flowers have shed encumbering ornamentations, its leaves have developed a tough protective epidermis, the whole pattern of the plant has gradually become stream-lined in response to evolution-under-pressure. For millions of years, ever since grasses first took on this distinctive way of life, their evolution was ruled by these needs. Hence the small, strawy flowers, the simple panicles, the tough epidermis, the curving surfaces adapted to development in a crowded tube. It is an efficient way of life; the rapidly developing parts which need food and water the most are close to the supply systems; the delicate young tissues just forming are amply protected from the outside world. To achieve this protection and efficiency, however, they all have to put up with more overcrowding than in other kinds of plants. Evolution has of necessity brought to them the capacity to fold themselves up efficiently in these tight quarters, has caused them to develop the kinds of tough surfaces which will be successful in resisting mutual pressure when the growing tip thrusts itself forward into the concentric wrappings of already overcrowded sheaths.

Such are the facts which account for the over-all utilitarian air of the world of grasses. The withering sweet corn plants lying around us on the terrace have given us a notable second harvest, an insight into the kinds of consequences-upon-consequences which govern the world of grasses and our own world too.

Autumn Flower Shows.—

On three successive week-ends the Garden played the host for a series of flower shows produced by various St. Louis organizations. The Cactus and Succulent Show and the Dahlia Show were preceded by the third annual Harvest Show staged by the St. Louis Horticultural Society and a number of cooperating organizations. Virtually every horticultural organization in the area cooperated in one way or another in putting on this show, making it a fitting climax to the gardening year. The exhibits filled the Floral Display house as well as a large area to the north and east of it. The show was kept open until ten o'clock in the evening on both Saturday and Sunday and was very well attended.

RESUPINATION IN ORCHIDS

ROBERT J. GILLESPIE

SOME members of the orchid family exhibit many oddities or quirks not generally found in other plant families, which have fascinated and confused botanists and horticulturists for over a century. Far too often the modern orchid enthusiast fails to observe many of these oddities, being completely occupied by the desire to grow and produce healthy, vigorous plants and flowers.

The phenomenon of resupination is one of the orchid family's most interesting quirks. It can be defined briefly as a process by which the flower, during anthesis, revolves through an arc of from 90 to 180 degrees. If you ever have the opportunity to watch an orchid flower open you will see that it actually does revolve through an arc, and that the labellum or lip is really the uppermost floral part before resupination and that it becomes the lowest part after resupination. This process leaves its tell-tale mark on the flower through the twisting of the horizontal lines of dehiscence on the pedicellate ovary. These lines remain in a torque, much like the stripes on a peppermint stick, even after the flower has reached maturity.

Botanists, being scientists, have never been satisfied merely to observe this phenomenon, but have continually occupied themselves with delving into its whys and wherefores. To date little progress has been made on "resupination investigation" and many questions about it remain unanswered. For example: What is the "*raison d'etre*" behind resupination? Why is it an almost completely universal trait in the Orchidaceae? Did it originate early, while the genera were still rather indistinct, or could it have developed independently after speciation had occurred? What are the forces causing this twisting? Early investigators assumed resupination to be a relatively simple thing, and would have an elementary physical explanation. Consequently, their experimental efforts followed these lines. It was theorized, for instance, that the force of gravity moved the heavier lip structure to its final position. Orchid plants were turned upside down; flowers were weighted and lips were removed—all to no avail. Eventually botanists concluded that this phenomenon is more complex than a casual examination would seem to indicate. As yet the reason for and the forces behind resupination remain unknown.

Another interesting academic question which this trait raises is that of floral parts. Is the flower in its "natural" state before or after resupination? Is the lip the uppermost floral organ or does the "dorsal" sepal fit into this category? Certainly these questions need not bother the average orchidist. They should, however, increase his insight and appreciation of the orchids he is growing, as he realizes that every orchid plant has this innate habit, forcing the flowers to turn as they open, which has been carried down through countless generations.

MEMORIES OF ALICE EASTWOOD

EDGAR ANDERSON

SINCE the days of Henry Shaw and Dr. George Engelmann the Garden has maintained close contacts with those botanists who discovered and described the flora of our western states. Miss Alice Eastwood, who died on October 30, 1953, at the age of ninety-four was one of the last of these, and one of the greatest. She was a person of such zest for living, of such force of character that her little casual every-day actions were significant. It somehow seems peculiarly important that she should be remembered for all that she was, that even those of us who knew her slightly are in duty bound to write down what we can.

I heard of her first when I was a graduate student at Harvard taking part of my work at the Arnold Arboretum. There were things in the living collections which she wanted pressed for the California Academy Herbarium and getting a few of them together was one of my chores. It was then I first heard of her Christmas greeting to Professor Sargent, the Arboretum's first director. Among other things he had been honored by having a west-coast cypress named after him. Characteristically, Miss Eastwood thought he deserved fresh branches of his own cypress at Christmas time, and year after year she sent him a holiday package. It was not until twenty years later when I first got to California that I learned she gathered the branches herself from trees on Mt. Tamalpais.

I first saw her in England in 1930 when she came over to the International Botanical Congress and visited the laboratories where I was working. She was then beginning to look like an old lady, but what an old lady!—large of frame, ample of figure, charged with vitality. Her honest, intelligent face shone with kindliness. She treated me at once as if I were a favorite nephew and roped me into helping her a bit with Fuchsias. She had promised the Fuchsia Society back in California to do what she could for them in putting into some kind of order the classification and history of the cultivated sorts. Characteristically, on top of everything else (official visiting, sightseeing, conferences, herbarium work) she was enthusiastically looking up Fuchsia collections, visiting nurseries, talking to collectors, helping to lay the groundwork for the monograph which has since appeared. It is characteristic too that when I next met her in California, over a decade later, she remembered all I had told her about one or two English collections which had interested me, though in the meantime I had myself completely forgotten all these details and remembered only that we had talked about Fuchsias.

She was over seventy when I took her through the collections of the John Inness Horticultural Institution. When I met her again in California she was well past eighty but busy at work in the Academy Herbarium and still producing in her spare moments little knitted gifts for all the babies of the young married botanists she knew, a very considerable flock. It was on this trip that I turned to her for help. I

was then interested in making a detailed history of maize in the United States and one of the chapters in this story was the "maís del país" of the early Spanish settlers in California. A century before it had been a flourishing crop all along the coast from San Diego to San Francisco. It had quickly been displaced over most of this area, first by barley and then by beans. I had for some months written all the experts that any one could suggest in a vain attempt to find some conservative family which might still be growing it. Finally I went over to the Academy to see if Miss Eastwood might just possibly have a specimen of this old colonial variety in her herbarium. It was not there but she was immediately interested, and within a fortnight she had succeeded where all the agronomists and historians and antiquarians had failed. In the first place, she used her knowledge and common sense. If "maís del país" was still being grown anywhere, it would most probably be around San Luis Obispo. No sense in looking elsewhere until that area had been thoroughly combed. If it was being grown there, one would need to contact some one who had dealings with the old Spanish families around about. In the second place, she had all her friends to draw on, and no one I have ever known had as many close personal friends as Miss Eastwood. To know her was to love her and to want to help with anything she might be taking an interest in. She immediately thought of a dear friend of many years whose brother ran a big store much patronized by the Spanish-American ranchers. She wrote them at once, and though neither of them had ever heard of "maís del país" they made inquiries of some of the store's old customers. Miss Eastwood was soon triumphantly writing me that she had located the old variety still being grown in considerable quantity within a few miles of several of the agricultural and historical experts I had already consulted!

Mr. Shaw's beautiful old country home, "Tower Grove," has been open every afternon from one until four o'clock, with guides furnished by the Federated Women's Clubs. Occasional vandalism on the part of sightseers has made it necessary to charge an admission fee of twenty-five cents. Since this went into effect there has been no further damage, and it is possible to keep the building clean and attractive. It is gradually being equipped for official entertaining on the part of the Garden and its friends. The Federated Women's Clubs used the home for their historic pageant portraying the life of Henry Shaw. The Horticultural Council was entertained there, and distinguished scientists have stayed over night in the same bedroom where Henry Shaw entertained visiting scholars. Mr. Shaw, in his will, made arrangements for the Garden to carry on official entertaining after his death. It is therefore particularly appropriate that the restoration of his old country home makes it possible to carry on this friendly tradition.

GO TO THE INDEX FIRST; DON'T USE THE KEY UNLESS YOU HAVE TO

EDGAR ANDERSON

FLORAS and manuals (whether popular or technical) are apt to have keys in them. Towards the front of Steyermark's useful *Spring Flora of Missouri* there is a long one, illustrated with little sketches, supposedly a guide to every plant in the book. In such monuments to botanical scholarship as Rehder's *Manual of Trees and Shrubs* you will find technical keys sprinkled with a lavish hand. These are all right in their way, especially when they help you distinguish between closely related and easily confused species, but by and large you would do well to use them only as a last resort. Most professional botanists do not use the keys, particularly the long ones, unless they absolutely have to, and there is no reason the amateur should struggle with them any more than is necessary.

There are other ways of getting the information you want out of such books; they usually have an index and frequently they have pictures or diagrams. With these two crutches and a little ingenuity you have a good chance of getting what you are after. Let us suppose you found a beautiful little flower blossoming in an Ozark woods in the early spring. To you it looks more or less like a buttercup, though rather different from any buttercup you ever saw. Well, just look up in the index under "buttercup" and turn to the pages where these plants are illustrated and discussed. It turns out that there are a good many species of Ranunculus (buttercups) in Missouri, more than you suspected, but if you'll ruffle through the pictures there are only one or two which could possibly fit your little plant. Read the descriptions which go with the pictures and you find that one of those you suspected might really be it; something indicated as *Ranunculus fascicularis* is described as blooming in very early spring on wooded hillsides. None of the others which you thought might possibly be your flower fit the description half so convincingly. You've identified your plant in just a few minutes and feel reasonably certain that your diagnosis is correct.

An even better use of the index is in finding out more about the plants you already know, finding out enough more, so that this understanding will be useful to you in the future. For instance, let's suppose that you start out for a country week-end in very early summer with a copy of Dr. Steyermark's useful little *Spring Flora.* You probably thought when you bought it, "Now this will tell me the names of the plants on our country place that I don't know." Well, you'd be much wiser to begin with the ones you are already fairly certain of. The Black-eyed Susans are in flower and you've known them since you were a child. They are one of the best routes to the understanding you crave. Look them up in the index and find out where they come in the book and what comes near them. Compare them carefully with their descriptions and their pictures. Now you know more than just their name; you are really begin-

ning to understand something about them. Late in the summer when you encounter their close relatives, the summer-blooming Rudbeckias, even though you don't have Steyermark to help you, since he only treats of the spring flora, you'll probably recognize these summer flowers as either Rudbeckias or something very similar, and you'll be on your way to an ever wider understanding of the native flora.

Sooner or later, of course, you'll have to face the key, though let us hope not the long one at the beginning of the book. If this is really inevitable, then face up to the chore and do a good job of it. You'll save time to find out everything you can ahead of time, so that you don't get lost half way through. First, study your plant exhaustively. How are the leaves arranged? How does the stem branch? Where are the flowers and how are they disposed in the inflorescence? How many petals are there and how many stamens? Is the plant hairy on the leaves and the stem? Spend a long time getting the construction of your little unknown as firmly in your mind as you can, then you'll have at least a sporting chance of finding your way through the intricacies of the key.

BOOK REVIEWS:—

Garden Spice and Wild Pot Herbs. By Walter C. Muenscher and Myron A. Rice. With illustrations cut on wood by Elfriede Abbe. 220 pp. 1 pl. Comstock Publishing Associates (division of Cornell Univ. Press). Ithaca, N. Y., 1955. $16.50.

This is the popular-priced edition of the most beautiful herbal of modern times. One of our ablest botanists, a man who knows plants in his garden and along the roadsides as well as he knows them in the herbarium, has collaborated closely with an outstanding botanical illustrator and with a horticultural expert. The artist and senior author have been closely associated in their professional work at Cornell University. As a result, we have not only a beautiful and most useful volume, but a thoroughly integrated one. There are 56 full-page plates in addition to some smaller illustrations, all but two or three of them made from woodcuts.

At last we have a modern book to rival the great herbals of the fifteenth and sixteenth centuries. Here are pictures which are a delight to the eye, yet so distinctive of the plants they portray that the better one knows these herbs the more he will treasure the pictures as portraits of old friends. The botanical descriptions, the notes about the uses of the herbs, and suggestions about growing them in the garden are all pithy and accurate. The high-priced limited edition which appeared last spring was snapped up by libraries and collectors almost as soon as it appeared. Let us hope that this popular-priced edition will go through reprinting after reprinting. There has been no better nor more beautiful book on herbs in modern times and it is to be doubted if a serious competitor will appear for many years.

—EDGAR ANDERSON

THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden carries on the garden established by Henry Shaw over a century ago at "Tower Grove," his country home. It is a private institution with no public support from city or state. The old stone walls and cast-iron fences, the Linnean House, the Museum, the Mausoleum and the "Old Residence" all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's Day and Christmas) from 9:00 a. m. until 7:00 p. m., April to November, and until 6:00 p. m., November to April, though the greenhouses close at 5:00 p. m. TOWER GROVE, itself, Mr. Shaw's old residence, is open from 1 until 4. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students and visiting scientists. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., opposite the junction of routes 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

MISSOURI BOTANICAL GARDEN BULLETIN

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COVER:—*Laelio-Cattleya* "Ellen A. Ricker," a new orchid created and grown at the Garden, hybrid between *LC.* "Geraldine S. Thompson" and *Cattleya* "Fabia '.

Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

Vol. XLIII NOVEMBER, 1955 No. 9

GARDENING IN THE CITY

NELL C. HORNER

ONE of the often-quoted remarks of the great Dr. Johnson is that a preaching woman and a walking dog are alike in that neither do the job very well but the surprising thing is that they do it at all. Now Dr. Johnson's remark applies to my garden. It is certainly not remarkable, and the wonder is that I, or people like me, have a garden at all The people like me are those who work away from home about eight hours a day and have to spend another one and a half or two hours getting to and from their places of business. When they reach home there isn't much daylight left, and no matter how soon they get up in the morning they barely have time to water a small garden patch. And as for the week-ends, they are so full of a number of things that we are lucky to get in even a few hours of digging.

Obviously, the solution is to plant the hardiest, the most reliable, and the best adapted things there are. Delicate and exotic things can be tried, of course, but after a few failures you decide to stick to the old reliables. What are they? Well, most of them are very common and some of them are what people call "weeds". They can be compared to the ordinary cats (and they compared very well) which I saw mixed in with the Siamese, the Persians, and the Angoras at a cat show. When one of the visitors exclaimed, "Oh look at the alley-cats," a judge remarked, "Those, my dear, are domestic short-haired cats." And my plants aren't weeds—they are domestic or adapted plants that have been given a comfortable home and they have responded gratefully. Sometimes they present a riot of color, and always during the spring and summer there is something in bloom, at least enough to make one of those hit-or-miss Victorian flower arrangements.

In addition to having no time and no money, I have other difficulties connected with gardening. For instance, there is a big elm tree at the back and only shade-tolerant plants can be grown under its spread and its spread is considerable. Then there is a granitoid walk down the center of the back yard ("garden" through courtesy) from the kitchen porch to the alley. However, there is a sturdy perennial border on each side of the walk—iris, bachelor's-buttons, larkspurs, pinks, phlox, red balm, sedum, etc.—which I hope distracts attention from the straight and narrow path.

Of course we inherited bad soil. It seems to be the custom for builders to level off the high places and to fill in the low places with old dump material, for I have found broken china, rocks, bricks, slate, etc., just by digging down less than a foot. For years I have been working on that soil. I made a compost heap, not a very scientifically made one, but my home-made product has certainly helped; I have bought topsoil as I was able to afford it and could find time to apply it; I have appropriated bushels and bushels of sand from the area back of us which was once a street-car track; I have used commercial fertilizers and manure, and nearly all the mulches recommended except pecan shells, and those are coming next.

When we moved to our house, we had no lawn—just chickweed and shallow ponds in the spring (we had rains in those days) which were followed by plantain and many other weeds, including crabgrass. Making a lawn has taken *work*, but by following directions in the Garden BULLETINS our lawn now looks quite respectable. The only thing that I do that the Garden apparently didn't think about recommending is to sprinkle lawn grass seed over the sparsely settled places on top of a late snow, usually in March. The blue-grass from this early sowing is nearly as well established by May as that sown at the proper time (in the early fall). I have very little chickweed or crabgrass now. I have used the weed-killers at various times, but weed killers kill clover, and I like clover. Now I dig the weeds by hand, a score or two at a time, and *before* they go to seed, making use of the trowel kept on the back porch, when I come in or go out of the house. Fortunately, the two lawns are not very big. The front is about 40 × 20 feet including the terrace, the back about 25 × 60 feet, excluding the walks and flower beds. As for mowing, our next-door neighbor has a power-mower, also a teen-age son who is allowed to use it to make extra money. Before he and his father's mower made their appearance my sister usually cut the grass.

Now having built up the soil and made the lawn according to directions I will give a list of the plants in my garden. The May 1947 BULLETIN (reprinted in January 1954) gives a list of twenty-five plants recommended for city gardens. I have most of these plants, and the worst thing that I can say about them is that some of them grow too well. Some one said that my garden had a "blowsy charm", and it does look unrestrained. Some day it will get a great digging out, giving the restrained ones breathing space and a chance to assert themselves. The plants are here taken up in the order of blooming, although no plant starts or stops blooming on either the first or the last day of a season.

MARCH–APRIL–MAY

Flowering Shrubs.—The small white flowers of the Fragrant Honeysuckle *(Lonicera fragrantissima)* sometimes come out as early as February. This shrub will bear neglect but of course looks better if pruned after blooming. Cornelian Cherry *(Cornus mas)* is usually in bloom by early March. Its small yellow-green flowers might pass unnoticed if one weren't on the lookout for signs of spring, but it has beautiful foliage and red fruit, and it

may be planted in semi-shade. Golden-bell (Forsythia), which follows it, is much more striking. The Garden is trying out some of the newer varieties of this old shrub, but at present *Forsythia intermedia spectabilis* is the one most commonly seen. Its bright yellow flowers come out before the leaves, making a blaze of gold in early March. Bridal-wreath *(Spiraea prunifolia plena)* usually blooms in mid-April, a "hackneyed" shrub, some people call it, but its long hanging branches of white flowers are very graceful and make a beautiful background for the narcissus and tulips which bloom about the same time. My favorite of the spring-blooming shrubs is *Kerria japonica* (I don't believe that it has a common name). It will grow in the shade, but if planted in the sun it has a better form. Its flowers, about the size and shape of an apple-blossom, literally cover the plant and are an almost dazzlingly bright yellow. The double variety (var. *pleniflora*) is even better, for it has a longer blooming period and flowers shaped like a button chrysanthemum. The Jetbead (Rhodotypos) is very much like it except that it bears white flowers and is more tolerant of shade. The Mock-orange (Philadelphus), *Deutzia gracilis* and *D. Lemonei*, Highbush Cranberry *(Viburnum Opulus)*, Snowball *(Viburnum Opulus sterilis)* and Weigelia *(Weigelia florida)* are all early or mid-May bloomers, which is the high tide for gardens in St. Louis.

I have about four lilac bushes, but they have bloomed scarcely at all. They will probably be dug up next year along with the Beautybushes (Kolkwitzia). After seeing a Beautybush in all its glory on a garden tour one spring, I immediately bought two. It may have been because of too much shade or improper care but mine have never been covered with flowers as were the specimens I saw on the garden tour, and the branches of mine come out at the most peculiar angles. I will stick to the old-time favorite, Weigelia, which is something like it.

Flowering Trees.—Several times I have tried to get beautiful flowering trees established but the conditions are not right for them; too much shade may be part of the trouble. However, a plum tree came with the house. It is old and going fast, but before it goes it will have left many descendants here and there—too many for me to keep dug out of the flower beds. A plum tree in flower (generally the last of March or the first of April) is a beautiful thing, and the tree doesn't have to be pampered. Furthermore, a bowlful of plum blossoms mixed with narcissus blends the little garden with the country side. There is also an apple tree belonging to my neighbor, about half of which hangs over in our garden.

I do not have a Redbud tree *(Cercis canadensis)*, but it should do well in my garden for it is a native plant and it can stand some shade. Also it is very effective for its form and its pinkish-lavender blossoms which stud the tree (see May 1951 BULLETIN).

Two of the Magnolias, the Star *(Magnolia stellata)* and the Saucer *(Magnolia Soulangeana)*, are the next things to be tried in my garden. Both are thriving in my neighbors' gardens, so they ought to do all right in mine. However, I'm told that they are diffi-

Hall's Honeysuckle

cult to transplant and that they are more successfully handled before growth commences, so I'll have to wait until early spring to plant them. The Star Magnolia, which usually blooms the last of March, has white flowers, and the Saucer Magnolia follows about a week later with flowers of rosy-pink. Both species are so full of bloom that from a distance you can't see the trees for the flowers. Their greatest drawback is that their blooming period is too short, or seems to be.

Bulbs.—Early spring is the time for bulbs, and the first to appear in my garden are *Narcissus* "February Gold", one of the twenty-five "reliables" described in the BULLETIN. It is a small deep yellow trumpet daffodil and so hardy that it withstood the freeze of the 1955 spring without a tremor. It is a good propagator but unless the bulbs are divided every three or four years they will stop blooming. In late March or the first of April come the larger-flowered Narcissus such as KING ALFRED and SIR WATKIN and the white daffodils (which of course are Narcissus too), then the tulips. I usually buy about 24 tulip bulbs—reds, pink, and yellows—and plant them in front of the flowering shrubs (Kerria, Spiraea, Philadelphus) beneath the living-room window. Even my family approve of this riot of color, and I have heard passers-by comment too.

Perennials.—With the shrubs as a background and the bulbs shooting up all over the garden, one would think that I would be surfeited with color. However, there are lots of low perennials that bloom at about the same time or later. Whether you like it or not, if you have shade you will probably have violets and Sweet-William. The violets would take over if I didn't root them out, but Sweet-William is more satisfactory. Each March you have more and larger patches of this

purple-flowered Wild Phlox, but it does not seem to crowd out anything important. Another plant that can stand shade is the pansy. I plant dozens of the young plants in March which bloom until hot weather if they are cut constantly. Most of the perennials seem to bloom in April and May—Virginia bluebells, false indigo (Baptisia), bleeding-heart, Shasta daisy, columbine, verbena, pinks, iris, Anchusa, and many others which I do not have. I started with about four columbines but through division and reseeding I now have at least a dozen large clumps in several colors—red-and-yellow, yellow, blue, blue-and-yellow, lavender, which look like butterflies in flight. They have a longer blooming period than some other things that are not nearly so attractive, and furthermore they grow in semi-shade. The creeping buttercup *(Ranunculus repens)* around the bird bath has done too well, and is trying to crowd out the Creeping Speedwell *(Veronica repens)* which blooms a little later. When the buttercups were given to me by a friend she remarked, "I wouldn't give this to my worst enemy, so I give it to you." I feel the same way about it, but I can certainly recommend it to any gardener who wants something tough. Recently I dug up dozens of the little plants that had crept into the lawns and other places where they shouldn't be and planted them beneath a window in hard soil that the hose is dragged over, and they are not only alive but increasing. What's more, with its shiny scalloped evergreen leaf and golden-yellow flower, it is quite attractive. Another friend presented me with a few Forget-me-not Anchusas *(Anchusa myosotidiflora)* which I planted near the bird-bath. Whether it is the moist location that did it, I do not know, but they have increased and increased. And they are so much easier to grow than the real forget-me-not (Myosotis) and much more effective. If you have miniature bouquets as a hobby, this little blue flower fits in very well.

May seems to be a blue month, with a preponderance of blue columbine, bluebells, Anchusa, false indigo. Even most of the iris bordering the central walk are a light lavender-blue, *Iris pallida,* another one of the twenty-five plants specially recommended for St. Louis. It is not so effective as some other iris, but its flowers are borne on tall erect stems and give the effect of a company of soldiers in formation, if you can imagine soldiers dressed in pale blue. Like all iris, they have to be divided every few years or else the roots become matted and rot. I do have a few of the better iris planted in the perennial beds bordering the fence, but they can't take it as the *Iris pallida* can.

Vines and Ground Covers.—When I first became garden-conscious I took every plant anybody gave me, and some one gave me Hall's Honeysuckle *(Lonicera japonica* var. *Halliana)* Now I have honeysuckle as a ground cover, as a fence cover, as a trellis cover, and always there is some in the trash heap. It is just too enthusiastic. But it does smell sweet, and if you have a place where "simply nothing grows" try honeysuckle. If it gets a head start, just be ruthless. Use your spading fork to get at *all* its roots then burn it. The same can be said of Gill-over-

the-Ground *(Nepeta hederacea)*. It likes shade, but it takes over. Bulgarian Ivy is much more attractive, and twice I have dug up all the Nepeta plants and tried to get ivy established in their place. In just two places have I been successful, the little strip between our house and our neighbor's and the foundation planting in front.

Roses.—June may be the month of roses in most places, but in St. Louis they seem to be at their best from the last of May to the middle of June. I have not many varieties and those must take an acid test to grow in my garden, for the rose bed is underlain with elm tree roots and shaded by a next-door apple tree. Mr. Nies, of the St. Louis Rose Society, advised me to spade down a foot or two around the rose bed and cut the tree roots leading to the bed. That has helped, as has mulching. Much to my surprise, I've been able to grow PEACE—perfect blooms and rather large ones too. The January 1954 BULLETIN gives a list of varieties for St. Louis; of those recommended I happen to have RED RADIANCE, PINK RADIANCE, CHARLOTTE ARMSTRONG, EDITOR MC FARLAND, CHRISTOPHER STONE, and MC GREDY'S YELLOW, all of which grow with the minimum of attention. I have only two Floribundas which are planted in the perennial beds—GRUSS-AN-AACHEN and CAMEO. I think that GRUSS-AN-AACHEN is worthy of being planted more often for it has a lovely tight apricot-colored flower and it blooms profusely. Over the fence the former owner had planted TAUSENDSCHOEN and CRIMSON RAMBLER but they aren't doing very well—too much shade and competition with honeysuckle. I have very little black spot ordinarily. Every few days I pick off a few affected leaves and burn them, to keep the disease from getting a head start on me.

JUNE–JULY–AUGUST

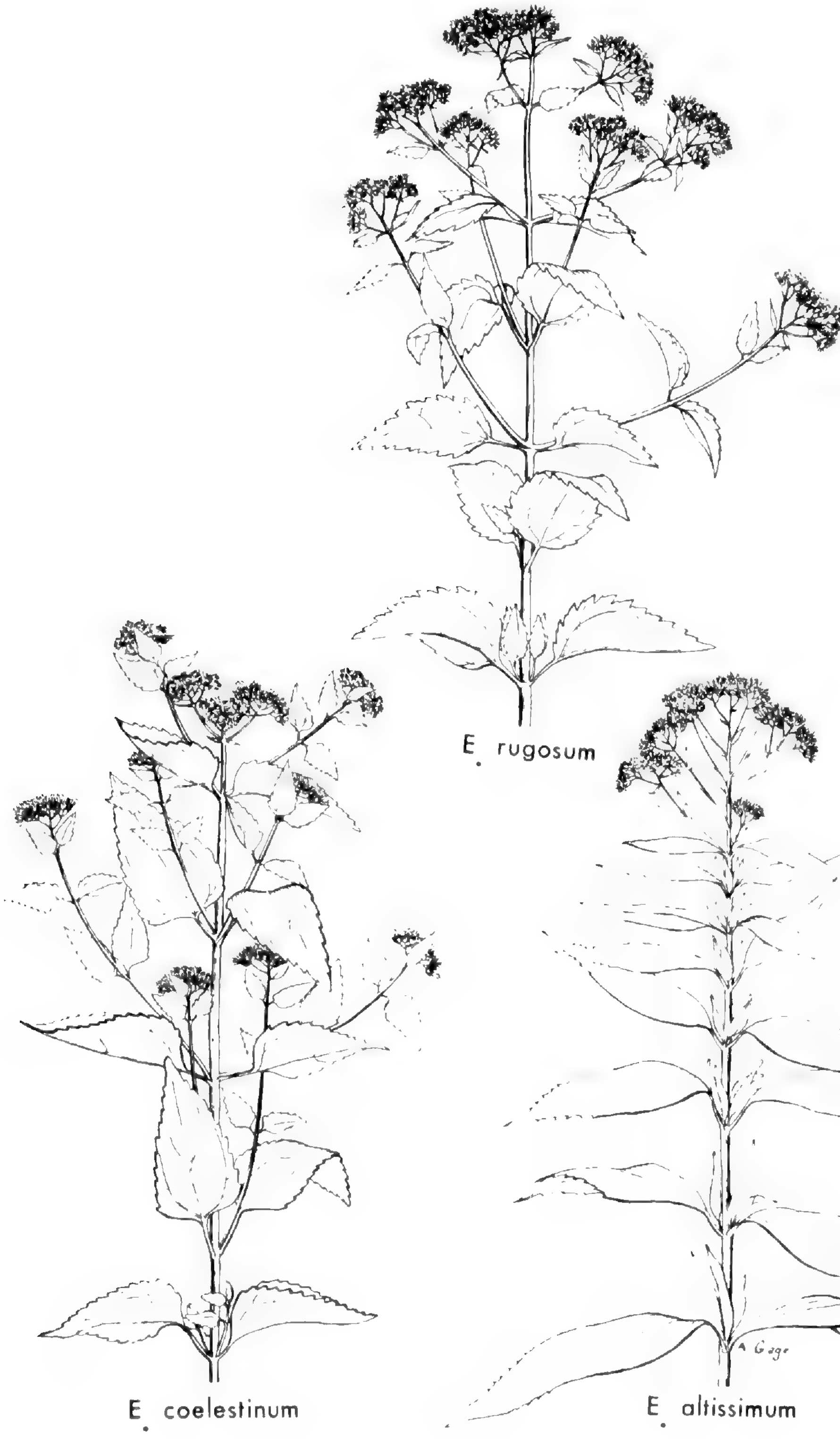
Most gardens in St. Louis gradually peter out during the summer months, and mine is no exception. Roses are still blooming in June, but they become scarce in July. There are a few columbines in June, a few daisies, Stokes' Aster, Canterbury-bells and the like. According to my family, all that I have in the summer are clumps of two kinds of plantain-lily *(Hosta caerulea* and *H. japonica)* which they think are colorless; but there are so few things that will tolerate the dense shade that Hosta does. The flowers are a light lavender-blue borne on spikes about 8–10 inches long, and the leaves look like overgrown glossy plantain leaves. Transplanting them is quite a job, for the roots are all interwoven. However, if you have any strength left after getting the clumps out of the ground, place them in a bucket of water. After the soil oozes out they can be separated readily and planted. The same method is good for lily-of-the-valley.

Of the trees and shrubs that bloom during the summer I have only *Spiraea Bumalda* var. "Anthony Waterer," Rose of Sharon (Althaea) in several shades, and the Chaste Tree *(Vitex Agnus-castus)*. If the Chaste Tree is planted in full sun, which mine isn't, the spikes of flowers form a solid mass of lavender over the tree from mid-July to the last of August. The Althaea can take most anything — drought,

Day-lilies

burning sun, even poor soil. My favorite is a double rose-pink. If the shrub is cut back about one-third in early spring, the flowers are larger and bloom more profusely.

For color during the summer I rely mostly on a group of weeds. First, the day-lily, or *Hemerocallis fulva* (there are beautiful hybrids but I do not happen to have them), which is so well adapted that it has to be literally kicked out of the perennial bed once in a while. Then the cone-flowers (Brauneria) which are planted along the back fence, for they are just a little too coarse for a close-up. However, the same cannot be said of bachelor's-buttons and the annual larkspur which are dainty plants and among the twenty-five recommended in the BULLETIN. Since they reseed themselves, they are likely to come up in the lawn or in other beds where you don't want them. The flowers of both bachelor's-buttons and annual larkspur come in white and several shades of blue, pink, and lavender. Bachelor's-buttons have flowers that look like small carnations, and those of the larkspur are borne on spikes. Their blooming periods overlap and they look well in Victorian bouquets. Bouncing Bet *(Saponaria officinalis)* makes its appearance in July whether it is invited or not. I try to keep it on the alley ridge, but it pays no attention, just sneaks in when my back is turned; fortunately it settles in the shade. Much less responsive is Queen Anne's Lace which I've invited in but it seems to prefer a place in the sun, even though it is on the alley terrace. Hollyhocks are at their best in July, and they literally walk down the terrace back of our house into the alley. That is one plant that seems to prefer being kicked around. I have fixed a good bed for it inside the garden, but it would rather live surrounded by cinders and rubbish. A honeysuckle-covered arch over the picket gate which terminates the garden walk makes an effective frame for



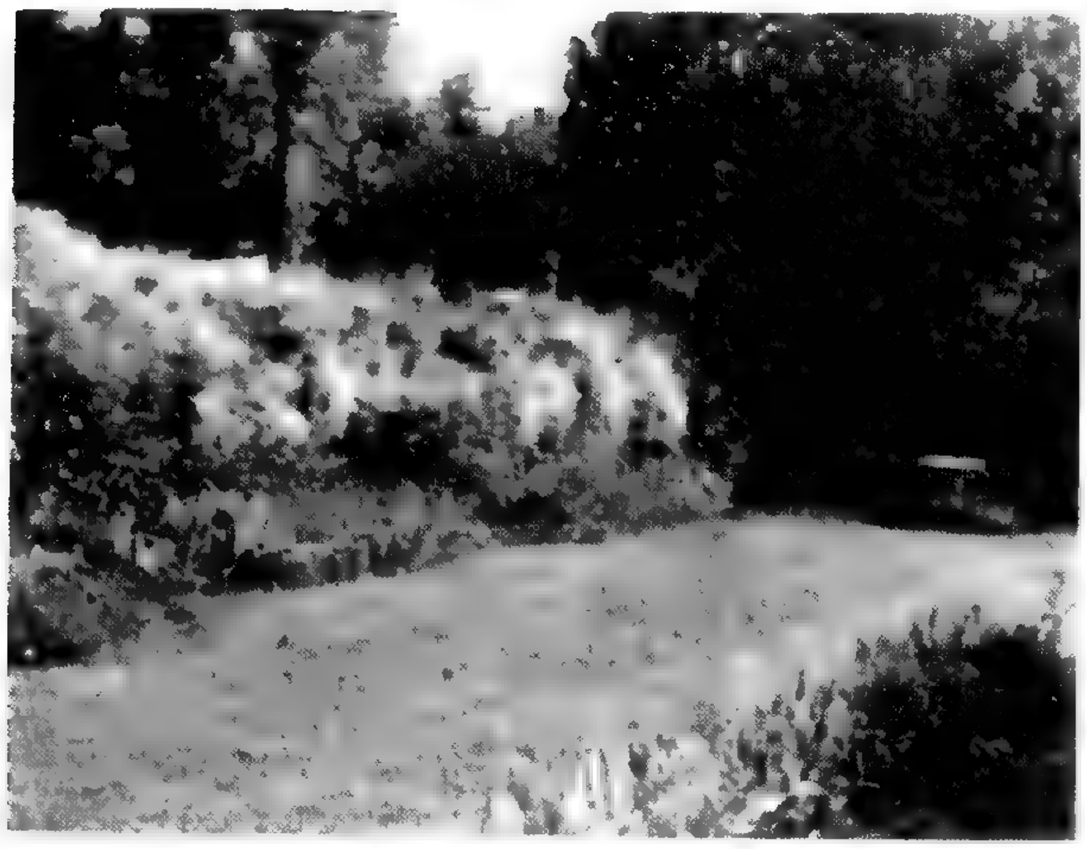
Eupatorium species

Hosta caerulea

the spires of pink, white and red hollyhocks.

As the spring plants finish blooming I plant annuals—zinnias, petunias, marigolds, cosmos. Until this year I had masses of watermelon-pink phlox in July but they seem to have become infected. Next year I'll either have to buy some new plants or make up my mind that Red Balm *(Monarda didyma)* is just as effective from a window as phlox and so much easier to grow. The only trouble with this red-flowered plant is that it spreads and spreads. My two-door-up neighbor has promised to trade petunias for it, those being as rampant in her garden as Monarda is in mine.

In August comes the Blue Mist Flower *(Eupatorium coelestinum)* which most people call Ageratum. This is another plant that is a little too enthusiastic but you can always dig it up and give it to a neighbor. What's more, it stands shade and it makes a bit of lavender-blue in the perennial border when most blue things are gone. The New England Aster *(Aster novae-angliae)* starts to bloom in late August. The flowers are small and a nice shade of blue-lavender, but the plant won't stand up straight in my garden and is inclined to get "fungusey." Golden Glow *(Rudbeckia laciniata* var. *hortensis)* gives a nice touch of color; and there are yellow "weeds" worth harboring — sunflowers (Helianthus), Heliopsis, and Black-eyed Susans *(Rudbeckia hirta)*, for instance. One of the most satisfactory plants for August is the Silver-lace Vine *(Polygonum Auberti)*. It blooms for a long



Silver-lace Vine covers garden fence in late August.

period in August and September and covers the trellis over the fence with small white flowers. According to Paul Kohl (December 1939 BULLETIN), this vine is free from all troubles, and the tired gardener "may gaze through the leafy branches with the assurance that it will thrive without the mighty ministrations [of spraying]."

SEPTEMBER–OCTOBER

If I had some chrysanthemums I might have something to write about for fall but I can't find any hardy enough to take the beating that my plants have to take. The live-forevers *(Sedum spectabile)* and the asters are still blooming in September, and they make splotches of pink and lavender here and there; and if you haven't had an August vacation or there hasn't been a drought your zinnias, marigolds, petunias and cosmos are still in bloom. Some of the wild plants have come in too, such as golden-rod *(Solidago altissimum)*, the White Snakeroot *(Eupatorium urticaefolium)*, a white-flowered form of the blue "Ageratum", and Rosy Allium *(Allium stellatum)*. Roses have a second blooming beginning the last of September. As a rule, though, I can't be bothered with fall-blooming things. The lawn must be fertilized in September in preparation for seeding, which means a final weeding out of plantain, dandelion, chickweed, and that takes all the spare time available. After September I just admire other people's gardens and look forward to the following spring—that is after I've pruned and weeded and transplanted and mulched.

LAELIO-CATTLEYA "ELLEN A. RICKER"

EDGAR ANDERSON

A HANDSOME orchid, created and grown at the Garden, has been named after the late Miss Ellen Ricker of St. Louis. Nearly a decade ago a bequest to the Garden of around a quarter of a million dollars was announced after Miss Ricker's death. The will was contested by some of her relatives, and as a result the Garden never received any of the money directly. Not all the heirs, however, believed that justice had been done. As a result, a series of generous checks have turned over to the Garden some of the funds awarded to her heirs.

A fine specimen plant of the new variety is illustrated on the cover of this issue of the BULLETIN. The flowers are a misty light mauve with an intense spot of winey crimson on the lip. They were raised from a plant of *LC.* "Geraldine S. Thompson" pollinated with *Cattleya* "Fabia" on January, 1938. The seeds were ready to sow in September of that same year and, like all the other orchid hybrids produced by the Garden, were raised artificially on prepared media as "bottle babies".

Visiting Experts.—

During the summer the Garden had a succession of interesting visitors. Mrs. Ida Langman, of the staff of the Academy of Natural Sciences of Philadelphia, who has been working for some years on a bibliography of Mexican botany, came back again to use our library because it has so many things difficult to obtain in other botanical libraries in this country. Mrs. Sherman Adams, of Wellesley, Massachusetts, a prominent member of the American Orchid Society, has begun a scientific survey of the results of hybridization in these remarkable plants. She conferred with Dr. Anderson, and they laid plans for a joint scientific paper. Hybridization, both in nature and as carried on by orchid raisers, plays an amazing role in the orchid family, and though the facts are occasionally referred to in the scientific literature it is many years since any attempt has been made to bring the over-all picture up to date. Dr. Russell Seibert, a former graduate of the Henry Shaw School of Botany (as well as the son-in-law of our Superintendent, Mr. Pring), stopped in St. Louis for several days on his way East. He has just taken on the directorship of the beautiful DuPont garden at Longwood, near Philadelphia, now the most richly endowed botanical garden in the world. Dr. Thomas Whitaker, who is in charge of the government's canteloupe- and lettuce-breeding station at La Jolla, California, paid us a return visit after an absence of a decade. Dr. Whitaker is not only one of the country's most successful plant breeders; he is also a distinguished scholar. For some years he and Dr. Cutler have been cooperating in an investigation of the pumpkins and squashes of the New World.

HORTICULTURAL COURSES IN 1955 AND 1956

FOUR COURSES in horticulture will be given by the Garden during 1955 and 1956. Except for the Orchid course, which will be conducted at the Garden Arboretum, Gray Summit, the courses will be given in the Experimental Greenhouse at the Garden, with Dr. F. G. Meyer as instructor.

As materials for each course are purchased immediately after the closing registration date, no registration fees can be refunded after the last day of registration for any particular course. Please send registration fees to:

Horticultural Courses,
Missouri Botanical Garden,
2315 Tower Grove Ave.,
St. Louis 10, Mo.

COURSE I—BULB FORCING

Six sections (each a 2½-hour period). Indicate your choice of section. Registration limited to 180.

Place: Experimental Greenhouse at the Garden. Enter Cleveland Avenue gate.

Time:

Day sections, 1:30–4:00 P. M.—
Monday, November 7.
Tuesday, November 8.
Thursday, November 10.
Monday, November 14.

Night sections, 7:30–10:00 P. M.—
Wednesday, November 9.
Friday, November 11.

Registration: Until November 1. Fee $5.00.

Scope of Course: Lecture on technique of bulb forcing. Hints on outdoor bulb culture.

Each student will receive at least 24 top-quality bulbs of tulips, narcissus, paper-whites, hyacinths, to be planted in five 7-inch bulb pans. Planted bulbs will be given cold treatment in cold-frames at the Garden until ready to flower (about 60 days). Postcards will be sent to each student telling them when to pick up the bulbs.

Course II—Plant Propagation (Lippagator Course)

Four sections, two 2½-hour periods each. Indicate your choice of section. Registration limited to 60, minimum of 10 per section.

Place: Experimental Greenhouse at the Garden. Enter Cleveland Avenue gate.

Time:

Section I, 7:30–10:00 P. M.—
Friday, January 20, and Friday, January 27.

Section II, 1:00–3:30 P. M.—
Monday, January 23, and Monday, January 30.

Section III, 1:00–3:30 P. M.—
Wednesday, February 1, and Wednesday, February 8.

Section IV, 7:30–10:00 P. M.—
Friday, February 3, and Friday, February 10.

Registration: For Friends of the Garden, December 15 to January 13; for others, January 2 to January 13. Fee $10.00.

Scope of Course:

1. Two lectures devoted to methods of propagating plants by vegetative means (root cuttings, suckers, division, crowns, hard- and soft-wood stem cuttings, summer-wood cuttings, offsets, layering, scales, tubers, leaf and bud propagation).
2. Various new propagating methods will be displayed, such as rooting plants under mist and under plastic; air layering.
3. Two practice sessions in making cuttings.

Each student will be given one Lippagator (plastic-covered propagating box) and at least 50 kinds of plants to propagate.

Course III—Growing Orchids in the Home

(Instructor, Robert J. Gillespie)

One all-day period.

Place: Orchid Range, Missouri Botanical Garden Arboretum, Gray Summit, Missouri.

Time: April 21, 1956, from 10:00 A. M. to 3:00 P. M.

Registration: For Friends of the Garden, March 15 to April 15; for others, April 1 to April 15. Fee $10.00.

Scope of Course:

10:00 A. M.—Lecture and Demonstration.

1. Discussion of "genera" and "hybrids" suitable for home culture (orchids that like St. Louis).
2. Discussion of factors influencing orchid growth and development (for home-adapted genera only)—light, temperature, etc. How to meet these conditions in the average home, by the use of Wardian case, evaporating dish, artificial light, etc.
3. Potting demonstration.
4. Question and answer period if time permits.

12:00 M.—Lunch. Garden will supply coffee and soda.

1:00 P. M.—Growing orchids in unusual conditions in the home, in baskets, on slabs, poles, etc., with examples and demonstration of potting and care.

2:00 P. M.—Inspection of greenhouses.

3:00 P. M.—Individual potting instruction by members of orchid department staff. Students may take potted plant home.

Course IV—Spring Horticulture

Four sections, each meeting five times for a 3-hour period. Indicate your choice of section. Course limited to 85 students.

Place: Experimental Greenhouse at the Garden. Enter Cleveland Avenue gate.

Time:

Section I, 1:00–4.00 P. M.—

Friday afternoons, March 30, April 6, 13, 20, and 27.

Section II, 1:00–4:00 P. M.—

Monday afternoons, April 2, 9, 16, 23, and 30.

Section III, 9:00–12:00 A. M.—

Wednesday mornings, April 4, 11, 18, 25, and May 2.

Section IV, 9:00–12:00 A. M.—

Friday mornings, April 6, 13, 20, 27, and May 4.

Registration: For Friends of the Garden, February 27 to March 26; for others, March 17 to March 26. Fee $15.00 (covers all materials, including flats).

Scope of Course:

1. Five lectures, including practical discussions on soils, seed sowing, fertilizers, liming, mulching; kinds of broad-leaf evergreens for St. Louis; pests and diseases.
2. Demonstration of pruning trees and shrubs.
3. Tour of the Garden's world-famous herbarium and library.
4. Five sessions of practical work in the greenhouse in which student will be instructed in seed sowing and transplanting of summer annuals and perennials.

Each student will receive four metal flats for growing plants which may be taken home at end of course. They will contain enough space to plant 16 kinds of seeds. Seeds avalable at the greenhouse or bring your own if you wish.

NOTES

The September number of the Garden's scientific publication (ANNALS OF THE MISSOURI BOTANICAL GARDEN) has recently appeared. It reports basic research work connected with the Garden and the Henry Shaw School of Botany. This issue contains the following papers: Tassel Modifications in *Zea Mays*, by Norton H. Nickerson and Ernest E. Dale; A New Species of *Doryopteris* from Surinam, by Rolla M. Tryon, Jr. and Karl U. Kramer; Revision of the Genus *Celastrus*, by Ding Hou.

Among some of the important new acquisitions by the Garden library are the following: Histoire des Roses, by Charles Wald, containing 12 plates in color by R. Bessa (Paris 1818), a rare and exquisite little book presented by Mr. John S. Lehmann; Old Garden Roses, by Sitwell and Russell, Part I (1955); Icones Plantarum (1791) and Sertum Austro-Caledonicum (1824-25), by La Billardière; Todaro's Hortus Botanicus Panormitanus (1876-1892); Grandidier's Histoire Naturelle des Plantes de Madagascar (1886-1903); Allonius' Auctarium ad Flora Pedemontanum (1789).

Two of the graduates of the Henry Shaw School of Botany who have done most of their work at the Garden received degrees from Washington University in June and have departed for jobs in New England. Dr. Emanuel D. Rudolph has been appointed to the botany department at Wellesley College; Dr. Ding Hou, to the staff of the Arnold Arboretum of Harvard University. Two other young scientists have left for positions elsewhere. Miss Evelyn Barbour, who was a scientific assistant on a project supported by the National Science Foundation, has gone to a similar position at Yale University. Mr. Karl U. Kramer, who assisted in the curatorial work of the Herbarium, has returned to Holland where he will shortly be a candidate for the doctorate. Mr. and Mrs. Lawrence Kaplan, who have been associated for some years with Dr. Cutler's studies of economic plants, have returned to Mexico to make further collections.

Second Symposium on Systematics. —Since the days when Mr. Shaw followed Sir Joseph Hooker's advice and started off his Botanical Garden with a Library and Herbarium the Garden has been an outstanding center for the naming and classifying of plants—a study technically known as Systematics or Taxonomy. A year ago an informal week-end symposium on taxonomic problems was organized here. This year, with a grant from the National Science Foundation, a slightly more ambitious affair was staged on November 4 and 5. Over 120 botanists and zoologists registered for the symposium, representing 31 institutions scattered through 14 states chiefly in the Middle West. Michigan led out-of-state visitors with ten staff members and graduate students from the University of Michigan, Michigan State College, and the Cranbrook Institute of Science. The theme of this year's symposium was "Contributions of Systematics to Evolutionary Studies." A few key papers were thoroughly discussed under the guidance of Dr. Karl P. Schmidt of the Chicago Natural History Museum and Dr. Reed Rollins of Harvard.

SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (April to November) and until six (November to April) though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.

THE MISSOURI BOTANICAL GARDEN

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MISSOURI BOTANICAL GARDEN BULLETIN

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Office of publication: 306 E. Simmons Street, Galesburg, Illinois.
Editorial Office: Missouri Botanical Garden, 2315 Tower Grove Avenue, St. Louis, 10, Missouri.
Published monthly except July and August by the Board of Trustees of the Missouri Botanical Garden. Subscription price: $2.50 a year.
Entered as second-class matter January 26, 1942, at the post-office at Galesburg, Illinois, under the Act of March 3, 1879.

Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage guaranteed.

Missouri Botanical Garden Bulletin

Vol. XLIII DECEMBER, 1955 No. 10

THE STAR OF BETHLEHEM ORCHID AND ITS STORY

EDGAR ANDERSON

THE Star of Bethlehem Orchid is a Christmas flower. This year, as every year, its waxy buds were swelling rapidly in our greenhouses in early December. By the middle of the month the first of them had opened and expanded into strange six-pointed stars as large as your hand, smooth ivory flowers which will persist into the holiday season. It is indeed a Christmas flower both in feeling and in the time of year it blooms, but its story is not at all a Christmas story, though an interesting one in its own way and quite worth the telling. It is a story about Charles Darwin and how far ahead he was of many of the scientists of his own time.

Half of the story can be read in one of Darwin's masterpieces, a 300-page volume on orchids, a book with a long Victorian title that rolls off the tongue like an old-fashioned oration, "The Various Contrivances by which Orchids are Fertilized by Insects". During his long career Darwin carried on several series of investigations which in one way or another grew out of his interest in Evolution. One of these was a survey of the varied and complex devices by which cross-pollination is achieved in different kinds of orchids. This was the interest which led him to *Angraecum sesquipedale*, the big, starry-flowered orchid from the jungles of Madagascar which was introduced into European greenhouses more than a century ago.

The flower of this Star of Bethlehem orchid is strange, even for an orchid flower. It is larger than many of them, with a wide expanse of pure ivory. There are none of the spottings or bizarre shapings which are so nearly universal in this family of floral prima donnas. As one can see from the illustration, the big blossom is chaste in outline and uniform in texture. It has one astonishing feature which gave rise to the mouth-filling scientific name "sesquipedale", this being merely a technical way of indicating a length of one foot and a half. The long, whip-like nectary which opens in the center of the blossom and hangs down far below it is a narrow, greenish-

white tube 12 to 18 inches long with a honey-like nectar in its terminal inch or so.

This was the feature which first puzzled Darwin. Why should there be such a long tube, and then only a little nectar in the very end of it? Big, white flowers with long honey tubes are usually pollinated by night-flying moths. The flower shines in the moonlight, the giant moths are nectar feeders and have tongues so long they are neatly rolled up below their mouth parts when the moths are not feeding. Perhaps, thought Darwin, the long tube with nectar in only the very tip would cause such a moth to push its head way into the center of the bloom to reach far enough down to get these few precious drops. He took a slender rod of about the diameter of a moth's head and forced it into the position the insect would have to take on such a theory, then withdrew it gently. The sticky masses of pollen were automatically transferred to the rod! Darwin explains all this in technical detail in his monograph:

". . . . I, therefore, took a cylindrical rod one-tenth of an inch in diameter, and pushed it down through the cleft in the rostellum. The margins readily separated and were pushed downwards together with the whole rostellum. When I slowly withdrew the cylinder the rostellum rose from its elasticity and the margins of the cleft were upturned so as to clasp the cylinder. Thus the viscid strips of membrane on each underside of the cleft rostellum came into contact with the cylinder, and firmly adhered to it; and the pollen-masses were withdrawn. By this means I succeeded every time in withdrawing the pollinia; and it cannot, I think, be doubted that a large moth would thus act; that is, it would drive its proboscis up to the very base through the cleft of the rostellum, so as to reach the extremity of the nectary; and then the pollinia attached to the base of its proboscis would be safely withdrawn."

No such moth was known from Madagascar in Darwin's time but to him the case was clear. The data and the theory all fitted together nicely and agreed with his vast understanding of cross-pollination in orchids and other kinds of plants. However, he was immediately ridiculed by several entomologists but bore their scorn with Olympian calm, merely pointing out in his book that a tropical sphinx moth nearly as large had already been found in Brazil.

So the matter rested until well after Darwin's death. A French scientific expedition to Madagascar eventually collected the moth. It was a giant, night-flying sphinx moth as Darwin had predicted. The little specialists, who ridiculed the theory worked out by a first-class mind that viewed the problem as a whole, were wrong and Darwin was right. The proboscis of the giant sphinx of Madagascar was fully as long as he had predicted it would have to be.

Darwin, you see, had the whole problem in mind, not just part of it. His discussion of the relation between the course of evolution in the moths and in the orchids is still timely for students of evolution. It is a fundamental piece of scientific reasoning quite worth the extra trouble of following with extra-close attention. Listen then to Darwin as he discusses the evolutionary tension between the orchids and the moths:

"If the Angraecum in its native forests secretes more nectar than did the vigorous plants sent me by Mr. Bateman, so that the nectary ever becomes filled, small moths might obtain their share, but they would not benefit the plant. The pollinia would not be with-

drawn until some huge moth, with a wonderfully long proboscis, tried to drain the last drop.* If such great moths were to become extinct in Madagascar, assuredly the Angraecum would become extinct. On the other hand, as the nectar, at least in the lower part of the nectary, is stored safe from the depredation of other insects, the extinction of the Angraecum would probably be a serious loss to these moths. We can thus understand how the astonishing length of the nectary had been acquired by successive modifications. As certain moths of Madagascar became larger through natural selection in relation to their general conditions of life, either in the larval or mature state, or as the proboscis alone was lengthened to obtain honey from the Angraecum and other deep tubular flowers, those individual plants of the Angraecum which had the longest nectaries (and the nectary varies much in length in some Orchids), and which, consequently, compelled the moths to insert their proboscides up to the very base, would be best fertilised. These plants would yield most seed, and the seedlings would generally inherit long nectaries; and so it would be in successive generations of the plant and of the moth. Thus it would appear that there has been a race in gaining length between the nectary of the Angraecum and the proboscis of certain moths; but the Angraecum has triumphed, for it flourishes and abounds in the forests of Madagascar, and still troubles each moth to insert its proboscis as deeply as possible in order to drain the last drop of nectar."

* "Mr. Belt suggests ('The Naturalist in Nicaragua,' 1874, p. 133) that the great length of the nectary of this plant serves to prevent other moths which are not well-adapted for the fertilization of the flowers from sucking the nectar, and that its development can thus be accounted for. I have no doubt of the truth of this principle, but it is hardly applicable here, as the moth has to be compelled to drive its proboscis as deeply down as possible into the flower."

POPCORN AND CRANBERRIES

HUGH C. CUTLER

CHRISTMAS trees these days are trimmed with mass-production ornaments. The old-fashioned strings of popcorn and cut paper, the painted homemade decorations, are almost forgotten. Electric lights are safer than the little candles which made the Christmas season so dangerous, but there was a symbolism in the old-fashioned tree which is lacking in those of today.

Do you remember the long strings of popcorn? Many nights were spent popping the corn and staying home with the family to push the needle and thread through hundreds of kernels. Festooned from tip to top of the branches, the white ribbon suggested snow and helped to recall that corn was one of our many gifts from the Indians.

Popcorn was grown and used by the Indians long before raised bread was known in Europe. Popped kernels have been discovered in ruins of old villages from Chile to the southwestern United States, and the kinds we grow today are scarcely different from those the Indians grew more than a thousand years ago; some kinds of popcorn were probably being grown over five thousand years ago.

There are two main kinds of popcorn in the United States, the rice varieties with pointed kernels, and the pearl varieties with rounded grains. Most of the common pearl varieties are deep yellow and the popped corn is usually not a brilliant white, so the rice varieties are to be preferred for ornaments, either for stringing or for small snowball-like balls suspended by a loop of string molded in the ball.

The best popcorn will increase in volume more than thirty times when it is properly popped, but unless there is the right amount of moisture the grains may scarcely open. Keeping it in an open container in the refrigerator is a good way to insure that the moisture content is close to the optimum for the best explosion.

Popcorn strings are often varied by adding a few cranberries. Here is not only a pleasant contrast of white and red, but the meeting of a food which represents the greatest achievement of the American Indian with a food which was once gathered only from wild plants. Cranberries grow wild only in boggy and sandy places where there is just the right combination of acid soil or peat with water. Practically all cranberries are still grown in the places where the Indians gathered them from wild plants but the white man has developed a few improved varieties, and he actually plants, weeds, and cultivates cranberries, so they are really a domesticated plant. Most of the operations are done with hand tools, and the large harvest scoops, the cranberry rakes, are very like the toothed scoops the Indians used.

WINTER SWEET

LADISLAUS CUTAK

If you have visited the Economic House in the Main Conservatory at the Garden in early winter, you may have detected a very sweet odor and wondered from where the fragrance came. Right near the entrance to the Cactus House are two rather large shrubby trees with olive-green foliage and masses of white Ixora-like flowers. That's where the sweet odor comes from. Because this highly ornamental tree blooms in winter and produces such delicious fragrance it has earned the name, "Winter Sweet."

In botanical circles, Winter Sweet is known as *Acokanthera spectabilis*. It belongs to the Apocynaceae or Dogbane family, which boasts such aristocrats as the Golden Allamanda and the exotic Frangipani or Plumeria. Incidentally, both of these plants are cultivated in our greenhouses and are excellent flower producers. The fragrant flowers of the Frangipani are used by the Hawaiians in lei-making.

Winter Sweet is a South African plant, found in the coastal districts of Natal, where it is said to grow on the woody sand hills near the sea. It can be grown as a pot plant but in order to keep it shapely it must be pinched or pruned judiciously. It prefers a sunny location, plenty of water, and a rich soil mixture consisting of loam

WINTER SWEET *(Acokanthera spectabilis)*

and leafmold to which coarse sand is added.

Winter Sweet was introduced into Europe by B. S. Williams about eighty-three years ago and immediately was acclaimed as an excellent stove plant. The origin of the Garden's two specimens is obscure, but for sure we know that they date back to 1898; therefore Winter Sweet is one of the oldest of exotic plants still living at the Garden and improving with age.

For many years the vegetation in the Economic House was hiding the floral mantle which enveloped the Winter Sweet bushes, so slowly and methodically larger obstructing trees in the center bed were cut back or removed and now the floral beauty of the Winter Sweet can be fully appreciated in the early winter months. The pure white flowers in great profusion set against a rich dark green background of foliage make the Winter Sweet the flower of the month in the Economic House during December and January and sometimes the blooming period extends into February.

Our two Winter Sweets are approximately 12 to 15 feet tall, producing an umbrella-like spread overhead equal to the height. The 3-inch-thick trunk and older branches are covered with wrinkled and rough bark, dark brown in color. The bark is considered to be more or less poisonous. The twigs are dark green, obscurely-angled rather than terete and having an arching or pendent habit, exuding a milky glutinous sap when bruised. The leaves are elliptic to oblong-lanceolate in outline, 3 to 5 inches long by 1 to 2 inches broad, leathery, smooth on both surfaces, opposite in arrangement, and with a very short, thick petiole. At first they are bright green throughout but later assume darker color on the upper side. The flowers appear in dense terminal clusters of from 20 to 50 fragrant tubular pure white blossoms, which are characteristically 5-lobed.

WHAT'S GREEN?

JULIAN A. STEYERMARK

"AND THE GREEN GRASS grew all around". So often as not, a member of the Grass Family is blamed for anything green that covers the ground, especially if it is long, narrow, and "grass-like". During the winter months when green is particularly conspicuous against the bare ground or over the brown leaves, it is interesting to observe how frequently the green turns out to belong to plants that are not true grasses.

The most obvious "grass-like" plants which are not grasses are the sedges and rushes. In winter, as we climb wooded Missouri hillsides, we are often apt to encounter long, grassy leaves belonging to the genus Carex, a member of the sedge family. One of the very ornamental species of this genus with lily-like, strap-shaped evergreen leaves growing in rosettes is *Carex albursina*, while *Carex Careyana* is similar with firmer, more closely veined leaves purplish at the base. Both are denizens of rich wooded limey slopes. Many other species of Carex, likewise, have leaves which are green all winter.

Another member of the sedge family with grass-like leaves is the Needle Spike Rush *(Eleocharis acicularis)*. This has fine needle-like foliage occurring in dense mats, generally covering the outer margins of natural upland ponds. The erect, narrow, gray-green, quill-like leaves of Wild Garlic *(Allium canadense)* is conspicuous in woodlands and waste ground, and at first sight resembles some grass.

During the winter there are many kinds of plants which stay green and cover the soil or grow in the crevices of rocks: Leaf rosettes (dandelion, plantain, thistle, mullein, Yellow Rocket); evergreen ferns (Walking, Christmas, Marginal Shield, Polypody, Cliff-brake, Lip, Ebony Spleenwork, Dissected Moonwort) and fern allies (Ground Pine); water plants submerged in the cold waters of springs and spring branches (Hornwort, Coontail, Water cress, Water Starwort, Naiad, White Water Crowfoot, and pondweeds); in woodlands the dense rosette leaves of Fire-Pink *(Silene virginica)*, the three-lobed leaves of Hepatica, three-foliate strawberry-like leaves of Barren Strawberry *(Waldsteinia fragarioides)*, the plaited, solitary Aspidistra-like leaf of the Adam-and-Eve Orchid *(Aplectrum hyemale)*; in fallow fields and sandstone "glades", the fine-leaved runners of Pinweed *(Lechea tenuifolia* and *L. villosa)*, the ornamental heather-like foliage of Clubmoss *(Selaginella rupestris)*; on acid rocks, the rosettes of saxifrage *(Saxifraga pensylvanica, S. virginiensis,* and *S. texana)*.

To the above could be added numerous other examples. In fact, as we begin to look about us, we discover a multitude of greenery during the winter that has nothing to do with grass.

1955 DISCOVERIES

JULIAN A. STEYERMARK

DURING 1955 fifty counties in Missouri were botanized—twenty-one Ozark, four southeast lowland, ten central, and fifteen northern Missouri counties. New areas continue to be explored and provide valuable previously unknown records of phytogeographic significance.

Two species were added to the flora of the state this year: (1) *Trisetum pensylvanicum*, an eastern species which I found in the remarkable *Ilex opaca* locality in Stoddard County where I turned up two species last year new to Missouri; and (2) *Brachiaria erucaeformis*—a rare grass not mentioned in either Gleason's or Fernald's manuals—from Stone County. I was conducting a survey of an area to be dammed by the Table Rock Dam when I encountered the grass

The mysterious basal leaves of the Umbrella Plant. These are olive-green on the upper side and gray-white on the under side. The author had found rosettes like these in 1938 but didn't realize what he had until 1953.

A white-fruited form of a species of Rubus was collected from Texas County in an area where it was known to exist for the past twenty-five years. This form may prove to be an undescribed one after it has been studied carefully.

A visit during October to several new *Ilex opaca* localities in Stoddard County yielded the Green Wood Orchis *(Habenaria clavellata)*, *Oldenlandia uniflora*, and the Chain Fern *(Lorinseria areolata)*, the first two previously known only from Dunklin County where Bush collected them in the late 1890's, and the last previously known from two remote localities in Butler and Barton counties, and one of the rarest ferns in the state.

The southeastern lowland counties have continued to yield many new surprises and indicate that much field work remains to be done in that section of the state. The same holds true for the northern Missouri counties which again added many fine new records during 1955. A grass, *Eragrostis reptans*, previously known only from Jackson County, was discovered this year in Livingston County.

The Umbrella Plant *(Eriogonum longifolium)*, "lost" since Blankinship's original "Oregon County" discovery of it, was collected in flower this year in Ozark County.

Additional White River relicts of southeastern lowland-Mississippi Embayment distribution were found during a survey of the Table Rock Dam area in Taney, Stone, and Barry counties. They are *Diodia virginiana*, previously known only from the swamp regions of southeastern Missouri and

Close-up of a portion of the flowering branch of Umbrella Plant. Note the small flowers in bunches arising from tiny cups (involucres).

the vicinity of sinkhole ponds in Howell County, and *Jussiaea decurrens*. Other swamp-loving species, associated with southeastern Missouri, such as *Pluchea camphorata*, *Rubus trivialis*, and *Cissus arborea*, also were added to Stone and/or Barry counties as new records. Altogether, 2,500 different collections were made during the 1955 season.

Second records in the state were also obtained for two plants. A summer-flowering Larkspur *(Delphinium exaltatum)* was added a few years ago to the flora of the state by Mr. Leslie Hubricht on a field trip with Dr. Anderson into Shannon County. This summer I found it in Howell County near the Arkansas line and in another station in Shannon County. The American Frog-bit *(Limnobium Spongia)*, previously known in Missouri from a single collection made by Bush in the 1890's in Dunklin County, southeastern Missouri, was found this summer in a slough of the Mississippi River bottoms in Mississippi County.

THE 1955 MEETING OF THE INTERNATIONAL HORTICULTURAL CONGRESS, SCHEVENINGEN, THE NETHERLANDS

F. G. MEYER

FOR OVER A WEEK, from August 29 through September 6, the Netherlands was our host. Over 1500 delegates from more than 50 countries came to see, meet each other, and talk about horticulture, not to mention having a good time in such a delightful place as Holland. This was the 14th International Horticultural Congress since the 1889 Paris meeting. The next Congress is planned for the south of France or French Morocco in 1958. But in so far as this year's meeting was concerned, few countries could have offered so many fine opportunities to the visiting horticulturist as The Netherlands in so short a space of time and area. Ten and a half million Dutchmen live in and cultivate nearly three-quarters of their area, all within a space comparable to the combined areas of Massachusetts and Connecticut. Dutch horticulture epitomizes efficient land use where horticulture and land use are inseparable. So, hardly could an International Horticulture meeting in The Netherlands be anything but a success in so far as the Dutch could make it so.

We as delegates were housed in several world-renowned resort hotels at Scheveningen on the North Sea, which hails as one of Europe's oldest and most respected resorts on the outskirts of The Hague. The tourist season was very much on the wane so that conditions for the tranquility of the delegates were greatly benefited. We had the place almost all to ourselves. The meetings were held in the mid-Victorian atmosphere of the beach-side Kurhaus, a Germanic structure about one hundred years old. The meetings opened with a general plenary session at which Dr. Frank P. Cullinan, Chief, Horticultural Crops Research, United States Department of Agriculture, Washington, gave the address on "Current Trends in Horticultural Research in the United States." Talking shop and partaking of whole-hearted Dutch hospitality all the while put the finishing touches to the whole Congress atmosphere.

On the more serious side, over 150 lectures by the delegates were presented on various horticultural topics to include Vegetable and Seed Growing, Arboriculture, Tropical and Subtropical Cultures, Fruit Growing, Floriculture, and Bulb Growing. For instance, we heard about growing tomatoes in New Zealand, breeding vegetable crops in the United States, the use of the new mist method for vegetative propagation, antibiotics in the control of plant disease, origins of cultivated plants, and fruit culture in Central America. There was also a symposium on roses. The majority of the reports included topics with agricultural applications. Problems in breeding ornamentals came in for less emphasis, and it was lamentable that only about a quarter of the topics dealt with this field of horticulture.

Before and during the Congress, at least fifteen excursions were offered the delegates to such places as the bulb research station at Lisse, the experimental station for floriculture at Aalsmeer, the nursery area at Boskoop, and the center of horticultural research at Wageningen where fifty laboratories carry on research on every facet of Dutch horticulture. Possibly the most notable feature of Dutch horticulture is the ability to turn basic research into practical use. These informally conducted excursions for the Congress delegates, each for an entire day, gave opportunity to meet fellow workers from many parts of the world under ideal and relaxed conditions.

Several long-enduring functions of the Congress came in for special attention, such as the International Committee for naming cultivated plants. The job here is to try and keep confusion in plant naming under control. Such groups as the Iris, Holly, Rose, Hemerocallis, and Chrysanthemum societies, the Dutch bulb growers, the Royal Horticultural Society are recommended to act as International Registration Authorities for their respective groups. All this is directed at bringing greater stability for the professional and amateur alike who use plant names. Preparations also were made to establish an International Society for Horticultural Science with headquarters in The Netherlands. This would be a step towards easing world tensions along lines of mutual interests.

A symphony concert for the delegates in the Kurhaus, an official reception at a suburban castle, and a parting banquet at the National Bird Park called "Avifauna" were highlights on the social calendar. On one day, the town of Amsterdam provided all the facilities for an inspiring boat trip through the canals of this historic town of the Rembrandts. Before the canal trip, several sunny hours were spent as guests of the town of Amsterdam in the Olympic Stadium witnessing the annual Aalsmeer flower parade which is one of the spectacles in Europe. One goes to England to see immaculate and gay cottage gardens, but to Holland to see kaleidoscopic commercial garden estates

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A New House Plant.—When travelling in western Europe this summer we saw an unusual Rubber Plant *(Ficus elastica* var. *decora)* in store windows, flower shops, and botanical gardens. What attracted us especially about the plant was its growth habit and its permanently iridescent bronze evergreen leaves. The variety *decora* has blunt-tipped and rather closely spaced leaves and its branching usually begins low on the stem, unlike the common form which is noted for its legginess and widely spaced leaves. The Bronze-leaved Rubber Plant, although still a rarity in the United States, can be recommended as an outstanding addition to a growing list of useful and handsome house plants.—F.G.M.

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SOME FACTS ABOUT SHAW'S GARDEN

The Missouri Botanical Garden (the official name chosen by Mr. Shaw) carries on the garden established by Henry Shaw over a century ago at TOWER GROVE, his country home. It is a private institution and has no support from city or state. The old stone walls and cast-iron fences, the Linnaean House, the Museum, the Mausoleum, and the TOWER GROVE mansion all date from Mr. Shaw's time. Since his death, as directed in his will, the Garden has been in the hands of a Board of Trustees who appoint the Director.

The Garden is open every day in the year (except New Year's and Christmas) from nine A. M. until seven P. M. (April to November) and until six (November to April) though the greenhouses close at five. TOWER GROVE, itself, Mr. Shaw's old country home, is open from one until four. The Garden is nearly a mile long and has several entrances. The Main Entrance, the one used by the general public, is at Tower Grove and Flora Place on the Sarah bus line (No. 42). The Park Southampton buses (No. 80), direct from downtown, pass within three blocks of this entrance and stop directly across the street from the Administration Building at 2315 Tower Grove Avenue. The latter is the best entrance for students, visiting scientists, etc. It is open to such visitors after 8:30 a. m., but is closed on Saturdays, Sundays, and holidays. There is a service entrance on Alfred Avenue, one block south of Shaw Avenue.

Since Mr. Shaw's time an Arboretum has been developed at Gray Summit, Mo., adjacent to State Highways 50 and 66. It is open every day in the year and has two miles of auto roads as well as foot trails through the wild-flower reservation. There is a pinetum and an extensive display of daffodils and other narcissi from March to early May.