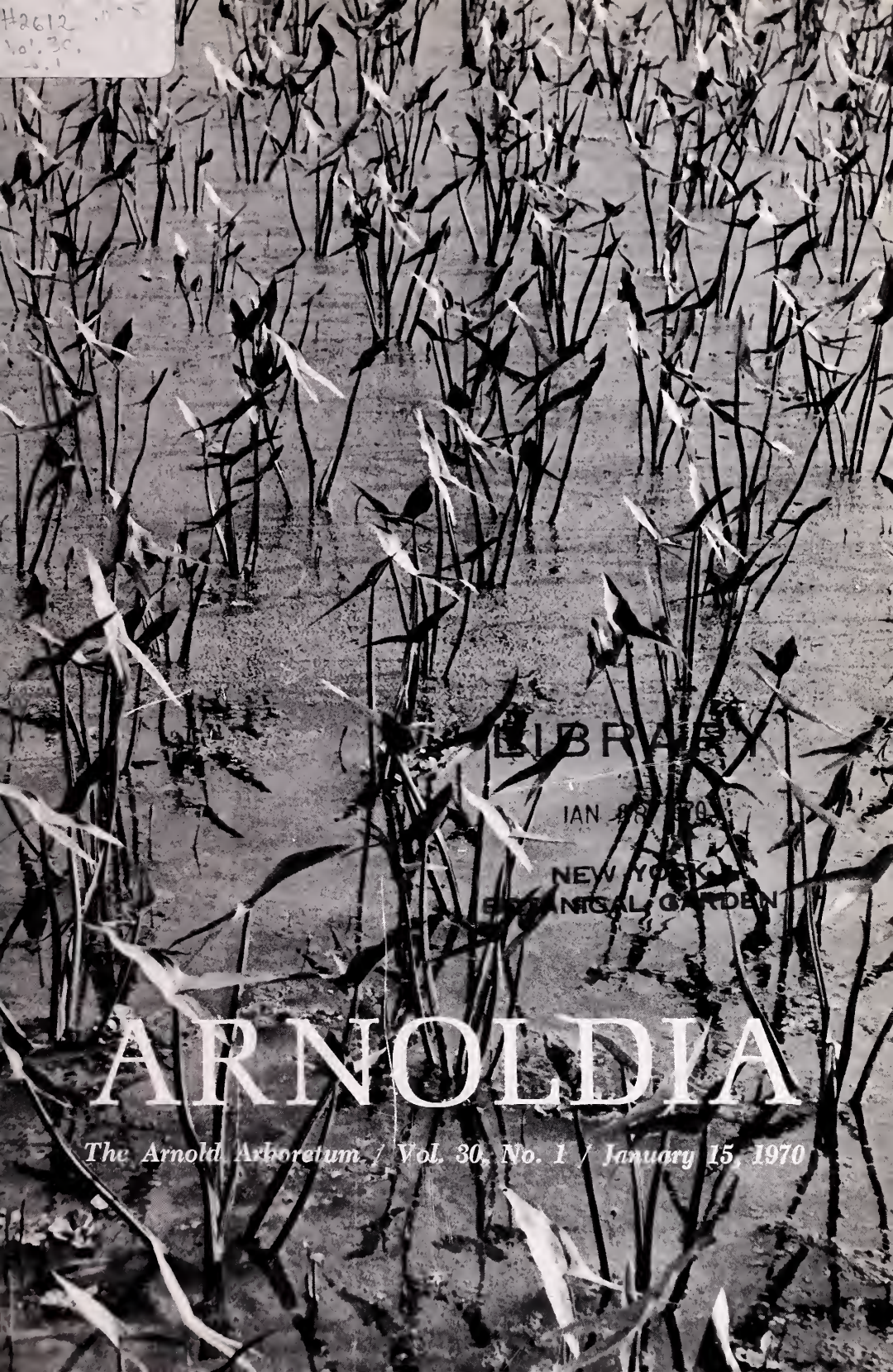

ARNOLDIA

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Contents

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On the cover: A field of Sagittaria sagittifolia, *cultivated for the edible corms. Lantau Island, Hong Kong. Photo: S. Y. Hu.*

A Change in *Arnoldia*

In 1943 the one-word title *Arnoldia* was adopted for this publication which for twenty-nine years had been called the *Bulletin of Popular Information.* This issue is the first since then with other changes.

The first *Bulletin* is now a real collector's item. It appeared on May 2, 1911, with a title that bothered librarians: "Arnold Arboretum, Harvard University, Bulletin of Popular Information — No. 1." Charles Sargent, the Director, explained his intention ". . . to issue from time to time from the Arboretum bulletins of popular information in which attention will be called to the flowering of important plants and other matters connected with them." Copies were mailed without charge to anyone who desired to receive them. The unsigned articles were written by Professor Sargent.

The New Series, with numbered volumes and an annual index, began in 1915. A note in 1916 stated: "Automobiles are not admitted to the Arboretum but visitors who desire carriages to meet them at the Forest Hills entrance can obtain them by telephoning . . ." The telephone number had but three digits.

Series Three came out a month after Sargent's death, in April 1927, on coated paper permitting the first use of photographs. The articles were signed "E.H.W." for Ernest Henry Wilson. A subscription rate was established. There is evidence of the tragedy that took the life of "Chinese" Wilson: an article dated September 15th, 1930, bears his initials for the last time.

In 1933 Series Four introduced a new format. Donald Wyman joined the staff in 1935. The first of many articles by the Horticulturist for the Arnold Arboretum was "Tree Troubles," issued in March 1936.

Inside our new 1970 cover, we plan to have contributions from several authors and a variety of articles for our readers. Notes on the plantings, notices of staff activities, and programs or classes will be listed; book reviews will be more frequent. *Arnoldia* will appear six times a year at regular intervals. To reduce the necessary subsidy we must increase the price to $3.50 to subscribers, but Friends of the Arnold Arboretum will continue to receive *Arnoldia* free of charge.

RICHARD A. HOWARD

Problems of Horticultural and Botanical Libraries

The first conference on botanical and horticultural libraries was held in Horticultural Hall, Boston, on Thursday, November 13, 1969. Sponsored by the Massachusetts Horticultural Society and organized by the Society's Library Committee, the Conference was conceived as an opportunity to discuss problems of interest to libraries in the field. Forty persons attended, representing more than twenty institutions.

The first speaker was Mr. John F. Reed, Curator of the Library of the New York Botanical Garden, who addressed himself to the "Problems of Horticultural and Botanical Libraries." Dr. George H. M. Lawrence, Director of the Hunt Botanical Library of the Carnegie-Mellon University, followed with a discussion entitled "Care and Preservation of Library Materials." The afternoon session began with an analysis of a library's "Bibliographic Responsibilities to the Plant Sciences" by Gordon P. DeWolf, Jr. In "Where Do We Go From Here?" Mr. Gordon W. Dillon, Executive Secretary of the American Orchid Society, suggested several ways to continue the discussions with a series of conferences. Following a question and answer period the group, in an informal business session, accepted the invitation of the Hunt Botanical Library to hold a second conference, in Pittsburgh, on April 24–25, 1970.

It is planned to reproduce the edited texts of the major presentations at the conference in this issue and in succeeding numbers of Arnoldia. *— Ed.*

To preface my remarks, I would like first to define my concept of the primary roles of the major botanico-horticultural libraries. To me, they represent research-resource libraries of inestimable value which are deeply involved in collecting, preserving, and providing access to the bulk of the world's literature dealing with the various aspects of plant science — pure and applied.

Specifically, their responsibilities fall into three main categories: (1) to preserve, conserve, and protect their collections; (2) to develop, complete, and expand their collections to meet the needs of both present and future users; (3) to provide service and accessibility to this literature and knowledge about this literature to their users.

The collections held in these libraries are, in truth, national resources. It is important that we who are concerned with these libraries recognize that our responsibilities exceed the bounds of our individual institutions.

In my discussion I am forced to adopt a shotgun approach that will touch briefly upon scattered problems in these areas of responsibility before going on to what I consider to be the major problems facing our libraries today. I think I should also say at this point that these problems are not unique to botanico-horticultural libraries. Although they may be more urgent for us than for libraries in other scientific disciplines, they are very similar to the problems faced by most academic research libraries.

When one speaks of a librarian's custodial duties many people immediately conjure up an image of a stuffy, intransigent guardian who jealously watches over the library stacks, suspicious of anyone who wants to read or, worse yet, borrow a book, and who is really happy only when every book is in its proper place on the library shelves. When I speak of custodial duties I am referring to the positive and constructive activities which are part of the maintenance of collections having intrinsic archival and historical value.

One of these major responsibilities is the ever-present task of physical maintenance, preservation, and conservation of the publications and other library materials in the library collection. The ravages of time — use and the chemical deterioration of paper and binding materials — are matters of constant and increasing concern, especially in libraries that attach archival importance to their collections.

A closely related problem needing much greater recognition, attention, and action in library circles today concerns the production of modern publications at high standards of quality of materials and workmanship. Failure of librarians to concern themselves with present publication practices and to put forth the problems that poor production standards create for research libraries will compound the difficulties of preservation in the future.

Technology has developed long-life — pH neutral — papers that can be manufactured and sold at costs approximating those of lesser quality, more rapidly deteriorating papers. We must urge publishers to adopt the use of these papers in their production of periodicals and monographs. It is disturbing to see how rapidly issues of some of the outstanding scientific journals published in this country, as well as abroad, begin to discolor and become brittle. It is hard to believe that those responsible for

these publications consider their work to be of such ephemeral importance.

Physical format and design of periodicals and other publications is still another area of great concern to librarians today, particularly the tendency to reduce the width of inner margins. Inner margins of one inch or 3/4 inch usually allow adequate space for libraries to bind these items either by machine oversewing or preferably, in archival collections, by smythe or bench sewing. When, usually in the name of economy, inner margins are reduced to one-half inch or less, as in the case of such substantial journals as *Planta, Excerpta Botanica* and the *Gardener's Chronicle* to name only a few, the binding of the volume by libraries becomes much more difficult. If such volumes are machine oversewn, there is often no inner margin left at all; even with smythe sewing the text often runs into the groove of the binding making the volume difficult to read or photocopy.

Librarians must be aware of the quality of both materials and workmanship that go into the publications they acquire for their libraries, for they make a great investment in purchasing and maintaining these materials. When publishing and production standards fall below those that will allow libraries to maintain usable archival collections, then those concerned with libraries must make their voices heard.

Collection development presents many challenges to practicing libraries today. Because of the increasing numbers of publications produced each year and the even more rapidly increasing costs of books and periodicals, library purchasing budgets must be substantially increased each year just to allow libraries to hold ground in their particular areas of specialization. At the same time, librarians and others involved with the selection of books, journals, and other materials for their collections, must exercise increased selectivity in allocating their available resources.

A similar problem is faced by libraries trying to fill gaps in their holdings or involved in large-scale development of collections of older literature. In these areas, increasing costs are compounded by increasing competition for this literature, especially from the developing small college and university libraries.

The most economical answer to large-scale development of collections of older literature, at least on an individual institution basis, is the purchase of this material in microforms — microfiche, microfilm or microcard. That such microforms are relatively inexpensive and require little storage space is very

attractive. Unfortunately, there is one major drawback to the use of these materials: readers confronted with the prospect of having to use microforms will go out of their way, often to considerable personal expense, to avoid their use. The development of relatively inexpensive reading-printing equipment which produces usable, inexpensive hard copy for consultation and reference should be of great assistance in helping libraries overcome much of the resistance to the use of microforms.

Aside from the archival value of microforms, the greatest value I see in them in research-resource libraries such as ours, is in the interlibrary loan and photocopying programs that we provide. By maintaining microform duplicates of rare, valuable, and fragile materials, explicitly for the production of photocopies for interlibrary loan and in-house photocopy demands, libraries can save tremendously on the wear and tear on original materials while still providing access to them.

The greatest problem facing any group of libraries today, be they related geographically or by their subject specialization, is their willingness to investigate, identify, and implement programs that lead to standardization, cooperation, and shared utilization of their resources and activities.

One of the most obvious areas for this coordination is current acquisition and collection development. I am sure that this group willingly concedes the impossibility and impracticality of any library even to attempt to collect all of the world's literature dealing with the plant sciences. Instead, individually, our approach has been, and continues to be, one of maintaining more or less comprehensive collections in our particular areas of specialization and smaller representative collections in those areas of our secondary interests. Although there must be a high degree of overlap throughout our collections, we must look beyond the bounds of our own institutions and begin to think in terms of the total information needs of the plant scientist, and we must try to assure, on a collective basis, the comprehensive collection of the plant science literature.

Coordination of general acquisition responsibilities must be accompanied by a general and freely functioning cooperation among libraries in sharing and distributing their unique holdings. Such a "network" approach to library resource development has been recognized and developed on a regional basis — particularly in state library systems. I believe a similar approach can be taken on a subject basis, although difficulties arising from lack of geographical proximity are sure to be present.

As I have already mentioned, in the libraries represented at

this meeting there is a considerable overlap in our current acquisitions programs, probably collectively greater than 50%. Among selected libraries in this group, the overlap in purchases may exceed 90%. With such a high percentage of duplication in current acquisitions, we have an ideal opportunity to share in some way the production of cataloging data and thereby to reduce our individual cataloging costs.

It has been my experience at The New York Botanical Garden that the cost of descriptive and subject cataloging to American Library Association and Library of Congress standards is often higher than the cost of acquiring the publication itself, particularly when printed Library of Congress cards are unavailable within a reasonable period of time. We have learned through experience that approximately 40% of our Library of Congress card orders for newly published monographs and serials are unfilled after six months. Most of this material consists of publications in foreign languages and analytics of serials sets, the material for which original cataloging is most costly to prepare.

Much costly duplicate original cataloging could be eliminated if we could agree to certain standards for descriptive and subject cataloging and devise a way in which to distribute cataloging copy to cooperating institutions for their individual production of catalog cards. Better yet, with further standardization of card format, we could possibly develop a centralized card reproduction center that could supply cards to our individual libraries.

Closely related to the cataloging of new published works is the production of cataloging data for our older literature collections. Several libraries are contemplating or have begun the awesome task of recataloging their collections to modern standards. The New York Botanical Garden is one of those institutions that has undertaken this massive task — one that we estimate will require 15 man-years of professional cataloging time. This indeed is a costly undertaking.

To date, our experience indicates that we can obtain LC printed cards for slightly less than one-half of the items which we must process in this project. The load of original cataloging that our recataloging staff must perform is terrific. To me it is foolish and wasteful for other institutions to duplicate this work. I would like to see some method developed to pool and share such data with other libraries embarking on similar endeavors so that needless duplication and expense could be avoided. By pooling or exchanging such information we could, at the same time, develop a very useful bibliographic tool — a union catalog of our collective holdings. This would be particularly valuable

as many of our libraries are poorly represented in The National Union Catalog.

Another area where I would like to see a coordinated approach is the preservation of archival sets of ephemeral and secondary publications. I am thinking specifically of seed catalogs and popular gardening and horticultural magazines, many of which are printed on such low grade paper that they rapidly deteriorate even with little or no use. Two good examples of such publications are the journals *Popular Gardening* and *Amateur Gardening*, issues of which less than a decade old have so deteriorated that they can no longer be bound. Assuming that archival sets of such publications should be maintained, would it not be practical for one or two institutions to assume the responsibility of conservation and preservation while the remaining libraries, interested in having ready access to these publications, could depend upon microfilm copies? If such coordination is desirable, we could pool our collective sets of such publications to make up complete sets with the best preserved copies of each issue. This sort of coordination of effort must come about if original documents are to be adequately preserved. Many publications of this nature have already reached an advanced state of decay, and their complete loss is imminent.

A valuable bibliographic tool which could be developed through botanico-horticultural library cooperation is a union list of botanico-horticultural periodicals based on the exhaustive compilation *B-P-H Botanico-Periodicum-Huntianum* prepared at the Hunt Botanical Library last year. Such a list would have two major values: the first, to provide readily accessible and up-to-date knowledge of the periodical holdings of cooperating libraries — information that is very incompletely available in the *Union List of Serials*; the second, to supply us with a knowledge of the important gaps in our collective holdings — information that would be very valuable in a coordinated collection development program.

There are two other areas of potential cooperative endeavor which I would like to mention briefly. One is the possible pooling of the various publication exchange activities presently carried out independently by a number of our libraries. At its simplest it could involve only the interchange of exchange lists and information; but at a more highly organized level it could take the form of a centralized exchange office providing service to a group of libraries — sort of a Botanico-Horticultural Farmington Plan. The other proposal for coordination involves interlibrary loan responsibilities which we all have to greater or

lesser degrees, not just among ourselves, but with the larger library community. Coordination of such activities might take the form of designating one or two of our institutions with the primary responsibility for meeting the bulk of interlibrary loan service, while the remaining institutions serve to supplement the resources of these primary lenders.

One of the first questions that arises after such a spell of idealizing is very realistic — who will pay for such cooperative programs? The answer must be correspondingly realistic — we will! Not as additional expenses over and above those we already find difficult to bear but, hopefully, from the resources saved by not having to perform each of these tasks individually. With consolidation and specialization of effort in such functions as collection development, cataloging, and interlibrary loan, there should be corresponding economies.

A less definite, but posssible, outcome of activities of coordination and cooperation is that by working together we might better qualify for the grant dollar. A recent issue of *College and Research Libraries News* (no. 9, Oct. 1969) reported that the National Science Foundation's Office of Science Information Service has stated that its resources are "being concentrated on developing information systems in basic disciplines which take advantage of the available technology."

Coordinated and cooperative endeavors such as those I have outlined today are certainly a humble beginning, but they could eventually develop into much more sophisticated programs.

John F. Reed
Curator of the Library,
New York Botanical Garden

Report from Hong Kong

Dr. Shiu-Ying Hu, Botanist at the Arnold Arboretum, has made three trips to Hong Kong since January 1968. Her first stay was from March through June 1968; after a summer in the United States, she returned there for the academic year 1968–69; she left Boston again this past September for her third visit. In return for financial support for her living expenses and field work, Dr. Hu has taught a class in Taxonomy of Angiosperms at Chung Chi College, a part of the Chinese University of Hong Kong. The Chinese University is a federation of three colleges in which the principal language of instruction is Chinese. The Chung Chi campus is located near Sha Tin in the New Territories. Dr. Hu has also made extensive herbarium collections of native plants. This report summarizes her activities during her second trip, including her short stops in Korea and Japan where she investigated species of daylilies under the sponsorship of the American Hemerocallis Society — Ed.

Field work and botanical collections. People who have read or heard about Hong Kong from reports of tourists who visited the congested shopping areas, or from missionaries who discussed the conditions of refugee life, have the impression that Hong Kong is a small piece of land overcrowded with buildings and people. This is an untrue picture. Actually, 95% of the land area controlled by the Hong Kong government is wilderness. It is true that certain historical collecting sites, such as Captain Champion's Happy Valley, are crowded with apartment buildings, but the vast area is still botanically unexplored. A map issued in 1968 by the Crown Lands & Survey Office of Hong Kong indicates that the built-up areas are limited to the north side of Hong Kong proper (Victoria Island), Kowloon Peninsula, and very small areas in the New Territories. The primary reason for the lack of development in Hong Kong is water supply. Now the Jubilee Reservoir, the Tai Lam Chung Reservoir, and the Kowloon Reservoir have been built in the New Territories, and Plover Cove has been converted into a fresh water lake. These will provide water for a population shift to the New Territories. The huge Shek Pik Reservoir is on Lantau Island, the largest island in the Hong Kong area. (See map, p. 16–17.)

When I left Hong Kong in June 1968, my collecting record ended with number 5551. During the summer T. K. Woo col-

lected twenty sets of specimens. On my return to Chung Chi College in September, I began my collections with number 5572; when I left this June (1969), the last number was 7791. During this period I collected approximately 2250 sets of specimens.

Field work in the tropics is strenuous but always exiciting. The combination of available water and good roads makes Hong Kong a plant collector's paradise in southeast Asia. The most memorable of my trips were (1) the visit to the type tree of *Camellia granthamiana* Sealy behind the Jubilee Reservoir, on Tai Mo Shan, and (2) the rediscovery of *Manglietia fordiana* Oliver on Ma On Shan.

When Sealy described *Camellia granthamiana*, he remarked, "It was . . . a shock to find that a specimen collected in the New Territory . . . in October 1955 . . . represented a new and very distinct species of *Camellia* — especially as it is a striking plant with white flowers 5½ inches across and handsome, shining bullate leaves. How such a plant can have remained undiscovered until now is a mystery, . . ."[1] To find the cause of the mystery, to see the plant, and to collect some specimens for our herbaria, I participated in a field trip with the Hong Kong Natural History Society on November 4th, 1968. The area is remote from any path. There was only one man in the group who knew the exact locality of the tree. It is no mystery that the species remained hidden so long in this wilderness! The interesting thing about the occurrence of the species is that, after extensive field work and a thorough survey of the adjoining area, no other *C. granthamiana* was found. So, up

[1] Sealy quoted from a letter from R. E. Dean, Superintendent of the Gardens Division, Hong Kong, as follows:

"You will be interested to know that only one plant, a small tree about 10 ft. high, has so far been found. It is growing in partial shade, on the edge of a wooded ravine, in company with *Ilex rotunda* (20 feet tall), *Caesalpinia* spp. (climbing), *Adina* spp. (5–6 feet tall), and grass about 5 feet tall. It is a multibranched tree, with a base diameter of a little over 12 inches. There is strong reason to believe that it was cut to within a foot or so of the ground a long time ago.

"Its age is difficult to determine, but it is probably between fifty and seventy years. No other similar plants have been found growing within a radius of a hundred yards of this particular specimen . . .

"The area concerned is very remote, and is served only by a narrow track; it is a good one and a half hours' hike from the road. In the ordinary course of events it is certain that the spot is hardly ever visited, except by an occasional forester or villager; the forester who told us about it had no particular business in the area and came upon it quite by chance. It is quite likely that it has hitherto been passed off as a *Gordonia*." (*Journal of the Royal Horticultural Society*, LXXXI: 181–182, April 1956.)

Fig. 1
Camellia granthamiana *Sealy*

to the present, the species is known only from the type plant. The species was described on the basis of two herbarium specimens; they are both in the herbarium of the Royal Botanic Gardens at Kew. The specimens which I collected are from the type plant and have both flowers and fruit. (Fig. 1, p. 11)

Manglietia fordiana Oliver was described from a specimen collected on Victoria Island and it was known from the type tree only. Our herbarium has no specimen of this species. Oliver remarked that *M. fordiana* was the first record of the genus from China. In the 1930's Dandy described over a dozen species of the genus from China, Thailand, and Indochina. Later H. H. Hu and his associates described another half dozen species from the Chinese provinces of Yunnan and Szechuan. However, *M. fordiana* has only been recorded from Hong Kong. During the Japanese occupation of Hong Kong the area was very short of fuel, and *M. fordiana*, together with other plants, was cut for firewood. On the afternoon of May 11, 1969, when my assistant T. K. Woo and I were looking for a shortcut to return to Chung Chi College from the top of Ma On Shan, I suddenly spotted a tree with deep green leaves and large white flowers on the other side of a deep gorge. Ting Kwok suggested that we wait until another trip to collect it, but I insisted on seeing if I had found another tree of *Camellia granthamiana*. When we saw the tree up close, I thought it was a *Magnolia* because the luster of its leaves and the size of the flowers remind one of *Magnolia grandiflora*; but it is more beautiful because the anthers are a brilliant red. Returning to the laboratory, I keyed the specimen out to be *Manglietia fordiana*. Mr. H. C. Tang told me that *M. fordiana* had not been found anywhere except at Victoria Peak, and that the tree was lost in the war. Consequently, I convinced the horticulturist and landscape designer of the Chinese University of the importance and beauty of this species, and he sent three of his men to air-layer thirty plants for planting in the new University campus and for distribution.

In November 1968 and February 1969 I made two collecting trips to Lantau, the largest island in the area; it is about one and two-thirds larger than Victoria Island. It has a very complicated geological formation, with granite, porphyry, marine silt, syenite, alluvial deposits, and sandstone all occurring in an area of less than fifty square miles. Until recently, the people of the island lived only on small alluvial plains where agriculture was possible. Not long ago, however, roads were built, and a very large reservoir was constructed at Shek Pik. Comfortable modern buildings with very reasonable rates have been built by the Methodist Mission and the YMCA. Buses and vans transport

people across the island. These facilities help a botanist reach areas that have never been botanized.

All the students in my class in the Taxonomy of Angiosperms went along on the February trip. We worked for three solid days in various localities on Lantau Island. Before we went, two student volunteers did research on the geographical conditions of the island, including the population, towns, roads, transportation facilities, and vegetation. Their reports were mimeographed and distributed to their fellow students. The seventeen students were divided into four field groups: (1) covering the cultivated areas and the market place, emphasizing the economic plants; (2) covering the mid-high altitudes; (3) speed climbers who collected high altitude specimens; and (4) covering the seashore and cliff plants. We chose three centers: at the eastern end of the island for the first day, at the southwestern end for the second day, and the peak on the northern side for the third day. The students were very enthusiastic about the work. They began the day with the whistle at 6:00 a.m. and ended it when they finished writing their field notes and pressing their material.

My collection ran up to 170 numbers. The high altitude group collected much more than I did because there were three students in addition to T. K. Woo. The other groups collected fewer specimens. Some of the material collected by the high altitude group was indeed interesting. T. K. Woo built a charcoal heater, but that was insufficient for drying our specimens. The Biology Department at Chung Chi College built a very good drying case which is normally adequate for quick drying. This time, however, there were too many specimens, and not all of them were properly dried. Chung Chi College keeps one specimen of each collection; the rest are for the Arnold Arboretum.

It should be noted here that Ting Kwok Woo is the gardener of the Biology Department. He is one of the victims of the political upheaval in China. When he was twelve he was told, "You are the son of a landlord. You have no right to an education." He was sent to work on a farm where he nearly starved. He told me that he was so hungry that he ate the thick rhizome of *Cibotium barometz*. When he became older, he escaped by crossing the barbed wire fence. He is now twenty-one and works during the day while attending night school for a middle school diploma; at present, he is in the second form of junior high school. He is very good at climbing and collecting. He can climb a tree like a monkey. I was indeed fortunate to have him as an assistant on some of my field trips.

The biology students at Chung Chi College carry very heavy loads. They have five or six laboratories every week. Many of

Fig. 2: Chung Chi campus, looking towards Ma On Shan. Building on left is servants' quarters. Photo: S. Y. Hu.

them have to tutor special high school pupils to earn some spending money. For these reasons, the biology majors have not organized as many field trips as the geography majors. I made some of my best collecting trips with geography majors or with the staff of the Geography Department. The outstanding ones were (1) the trip to Ping Chau, (2) the Castle Peak hike, (3) the Pak Sin Ling climb, and (4) the Dragon Pool, Plover Cove collection.

Ping Chau is outside Mirs Bay and about one and a half miles from mainland China. It can be reached only by a large fishing boat. Normally, the coast and the possible danger prevent students from going there to study the special geological formations and vegetation of the island. In order to lower the cost for the students, the organizer gathered sixty-four people for the trip, and one of them weighed 300 pounds! On our return we were stopped by a police boat, and the owner of the boat was arrested because his boat was licensed for only thirty-five people. I had a very good collection from that island, which had never been botanized before.

The Castle Peak hike introduced me to a completely different vegetation. On this trip I made my only collections of *Nepenthes*

and *Platycodon*. It was a long day, and we did not return to the college until midnight.

Pak Sin Ling is a mountain chain with eight peaks. Two of the five students on this trip were track stars. The group planned to cover all eight peaks. They ate and drank very little. The climbing was rather strenuous for me, and my collecting must have delayed the students. They did not climb all the peaks because, by three o'clock, we saw eight fires starting from various directions. We were afraid of being trapped by the fire, so we decided to change our direction and turned south.

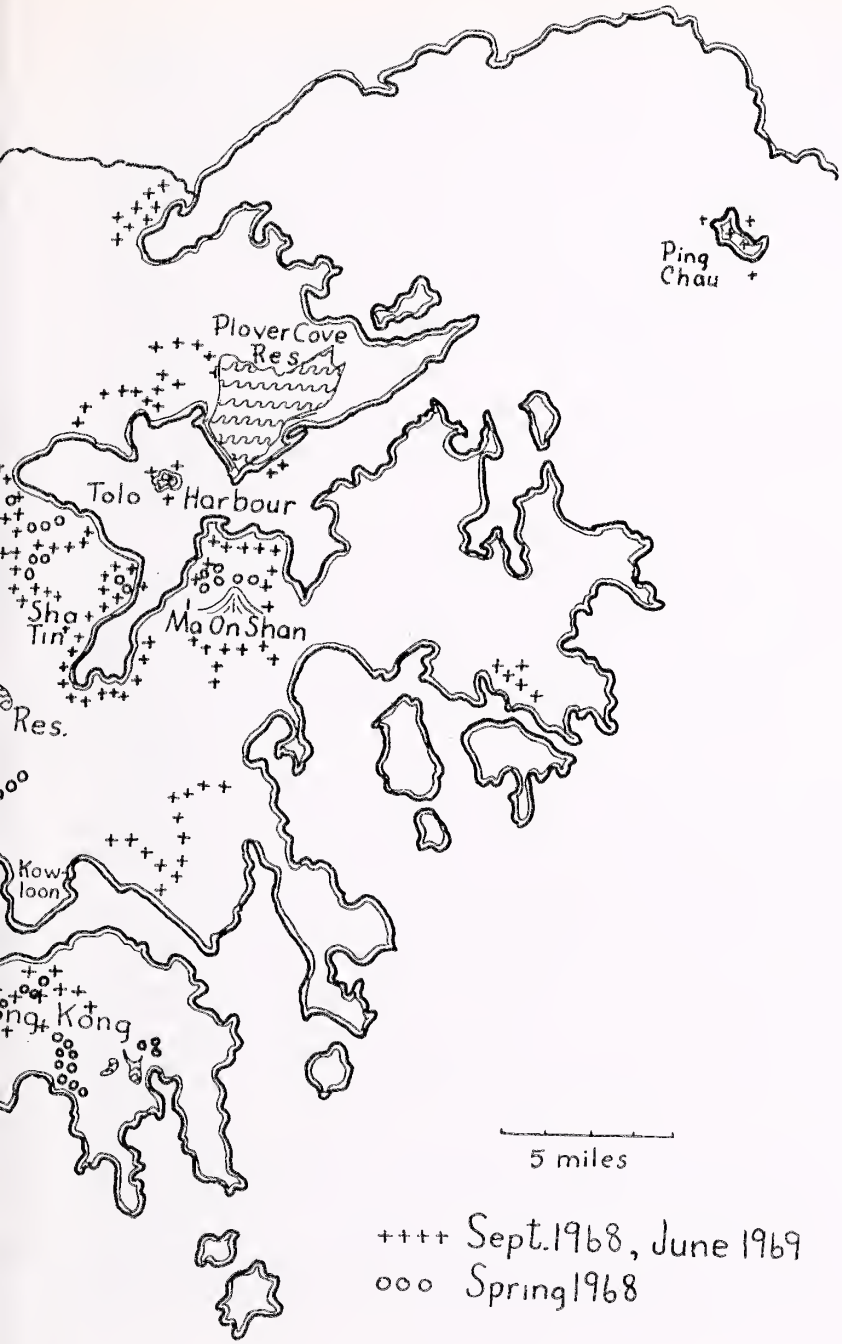
Dragon Pool, inland from Plover Cove, is indeed a collector's paradise. In this area I collected a specimen of the monotypic genus, *Lysidice rhodostegia* Hance. This species has never been reported previously from Hong Kong. I also collected *Buxus*, *Illicium*, and several orchids which I have not seen elsewhere. On this trip, as on several others, Peter Cheung, a geography major who is interested in plants, was my guide.

Dr. L. Trott teaches a course in ecology in the Biology Department. He generally has each of his students choose a special project. He specializes in oceanography, but his students may select any subject that interests them. Last year there was one student working on the vegetation of Dog Stomach Valley; one, working on the ecology of fresh water fish, needed to know the vegetation surrounding the pond; one explored the vegetation of a small railway tunnel; another studied the vegetation of an estuary. These students all guided me to collect specimens which, otherwise, I would have had little opportunity to collect. The most interesting studies concerned the vegetation of the estuary and the railway tunnel. I have a complete collection of the mangrove vegetation.

Dr. Trott has two boats by which he takes students to shores and islands. He was very kind and cooperative in allowing me to make collecting trips with his students. Thanks to him, I have a very good collection of plants from Central Island, a very small, uninhabited island in the middle of Tolo Harbour.

Teaching and lecturing. Biology majors who wish to obtain a British-recognized B.A. degree must take and pass a diploma examination in the Taxonomy of Angiosperms. At Chung Chi College this course consists of two lectures and a three-hour laboratory for two fourteen-week semesters. My class had seventeen people, all in their junior year. The competition for a college education begins at the kindergarten level; children starting kindergarten and first grade must take entrance examinations. All the way through school, they are trained to memorize and


The New Territories
Castle Peak
Tai Lam Chung Res.
Tai Mo
Ju
Lantau Is.
Peng Chau
Sunset Peak
Hei Ling Chau
Shek Pik Res.
Lantau Peak
Cheung Chau
Lamma Is.


Ping Chau
Plover Cove Res.
Tolo Harbour
Sha Tin
Ma On Shan
Res.
Kow-loon
ng Kong
5 miles
++++ Sept. 1968, June 1969
ooo Spring 1968

to take and pass examinations; otherwise, they have to stop school at any level. So all my students acquired the ability to perform well on examinations. They also appreciated the method and effort of a teacher who wanted to open their eyes to the structure, beauty, and variations in form of the plants around them, and to the significance of structures in the evolution and classification of plants. I had excellent students and I enjoyed teaching them. However, since I had not taught since 1946 when I came to Harvard for graduate work, I was out of practice and took time for preparation. My three years at Lingnan University as a teaching fellow and my experience in teaching plant taxonomy at West China University contributed to the success of my teaching here.

In January 1969 President C. T. Yung located financial aid to pay the salary of an artist, Teresa Fung. He has also provided a fund for building a drier which helped a great deal in drying the material I collected. The college had one wooden herbarium case before 1968. Now it has seven metal cases for the old collections and its set of my collections. On May 30, 1969, an Australian firm fumigated the herbarium with methyl bromide.

Meetings and conferences. In October 1968 my friend, Mrs. A. T. Roy, came to ask me a favor. She explained to me that some outstanding citizens of Hong Kong who were interested in conservation had asked her to participate in a meeting to be held at the British Council. Since she had a previous engagement for that day, she asked if I could take her place; she felt that my knowledge of the plants of Hong Kong would be of special value in this group. At the gathering I met about a dozen people who were college professors, bankers, businessmen, and a few ladies of society. Subsequently, I was asked to attend monthly meetings to discuss the problems of organizing a Conservancy Society of Hong Kong. This organization was legally established in February 1969.

Hong Kong University organized an international Conference on the Conservation of the Country Side in March 1969. Speakers were invited from England, the United States, and many southeast Asian countries. I participated in the opening tea given by the Governor, all the excursion trips, many lectures, the closing banquet, and I contributed a paper on the Natural Forest of Hong Kong. At the meetings one encountered the small number of British who control agriculture, forestry, fisheries, planning for land utilization, etc., for Hong Kong. There were, by contrast, very few Chinese participants. Because of this conference, I was able to see many places that I would not have

seen otherwise. I collected many interesting plants on the excursion trips. My collecting outfit and my activities attracted many people, including some newsmen. Consequently, my picture appeared in several English and Chinese newspapers. The publicity had a snowball effect. In April and May telephone calls from owners of gardens began to accumulate, and I received invitations to visit many people. Two gardens were of special interest to me. Mrs. Gloria Barretto and her sixteen-year-old son have a beautiful garden on a large hill-top, seaside estate where they have a collection of ninety different kinds of native Hong Kong orchids. She called to tell me when they were in bloom and arranged to show me her garden to see them. The other person I enjoyed visiting was an old fellow who has nine children and a garden of bonsai. He allowed me to take small plant samples. He had many exhibits in the Hong Kong Flower Show last spring.

Visits to Korea and Japan. On the request of Dr. George Darrow, Chairman of the Scientific Committee of the American Hemerocallis Society, with the financial assistance of that Society, and with the approval of the Director of the Arnold Arboretum, I stopped in Korea and Japan on my return trip to investigate species of *Hemerocallis*. I have prepared a report on my activities during these two weeks for the Committee, but there are several items which are also of interest to the Arnold Arboretum.

The time I had was much too short to go into the field to see the wild *Hemerocallis*. In Korea Dr. T. B. Lee,, a former student of the Arnold Arboretum and now a professor in the College of Agriculture at the National University of Korea in Suwon, and I took a taxi for field work for a day and a half. This was a very costly procedure. I spent a half day examining and determining the *Hemerocallis* material he collected. In return, he gave me duplicates for our herbarium. In Korea I saw *H. minor* growing in its natural habitat and sent some live material, through the American Embassy Air Service, to Dr. F. Meyer at the National Arboretum. I collected herbarium specimens for the Arnold Arboretum.

In Japan I stopped at Kyushu for two days and worked in the field. I brought back five living plants for the Arnold Arboretum collection of *Hemerocallis* at the Case Estates in Weston. I went to Kyoto and met Professor S. Kitamura, a wonderful administrator and a good botanist. He introduced me to two botanists who accompanied me to the alpine garden at Mt. Rokko and to the botanical gardens at the City University of Osaka and at

Kyoto University. I spent a day in his herbarium examining all the *Hemerocallis* and making sketches of the types and isotypes.

I obtained nine live plants and accompanying herbarium material from the Mt. Rokko Alpine Garden; I obtained eighteen more from the Botanical Garden at the City University of Osaka. The Rokko plants are all Japanese species; the Osaka plants are of special value. One of these, *H. exaltata*, was raised from plants transplanted from the type locality. Five others were raised from seed obtained from China (Peking) through exchange. One, *H. fulva*, was introduced to Japan from Nepal. The University of Kyoto Botanical Garden has a small triploid *H. fulva* var. *pauciflora*, the type plant of the variety. I obtained a live plant for the Arnold Arboretum collection. Altogether, I was able to bring back thirty live plants, and I hope that from these the Arboretum will have some good daylily material to offer American gardeners. In the alpine garden I saw American *Symplocarpus foetidus* growing side by side with the Japanese *Lysichiton camtschatense*. The latter makes a very beautiful rosette, and I thought it would be interesting to have some plants for our meadow at Jamaica Plain. I obtained two small ones which I sent to Mr. Fordham.

In Tokyo I worked in the herbaria of the National Museum and of the Botanical Institute of Tokyo University. Makino, Nakai, Ohwi, and Hara deposited their type specimens of *Hemerocallis* in these herbaria. I examined all the material and took pictures of the types of *H. coreana*, *H. exilis*, *H. littorea*, *H. micranthus*, *H. pedicellata*, *H. sulphurea*, and *H. yezoensis*. My camera was loaded with color film, so the pictures are slides. The photographs and my herbarium specimens will aid our understanding of the original descriptions by Japanese botanists.

In the Botanical Garden at the University of Tokyo I saw a *Hydrangea* with a ball-shaped habit, about 1.5 meters in diameter, covered with shiny, green leaves, and flat panicles of blue flowers surrounded by pink bracts. I have not seen such a beautiful *Hydrangea* anywhere though I have covered most of the trails that E. H. Wilson traveled in Western China. I learned that this cultivar has not been named yet. I was permitted to make cuttings for the Arboretum, and I sent them to Mr. Fordham under the name *Hydrangea* 'Tokyo Delight'.

In retrospect. Looking back over my life and work from March 1968 to June 1969, I can conclude with pride that I have been busy and productive. I made four trips over the Pacific and brought back over 2700 herbarium specimens with duplicates, and thirty live plants for the Arnold Arboretum. The 500 odd

Fig. 3: Lunch time on a field trip. The man eating his lunch organized a party to look for salamanders — at 1,000 ft. altitude. Photo: S. Y. Hu.

numbers of specimens collected in the spring of 1968 were identified that summer. The Herbarium Secretary typed the labels, and about 2000 duplicate specimens were distributed. I worked on identifying the 2200 new collections last summer. In comparing my collections with the named specimens in the combined herbaria, I found that most of them are valuable additions, either of new phases of development or because they represent new records for the area.

My first trip served as an exploration of the problems and possibilities of preparing a modern flora of Hong Kong. During my second trip I made extensive botanical investigations of Hong Kong and the New Territories. From the accompanying map one can see the areas which I covered in the spring of 1968, the fall of 1968, and the spring of 1969. Although, to a tourist, Hong Kong is a small, congested shopping area, to a botanist who wants to investigate its vegetation and botanical resources, it is big, wild, and fascinating. On my numerous trips I have retraced my steps only on two occasions, and then in different seasons. In every locality I visited, there were new things to see and to collect. Some of the material is very localized and hard to find.

I have been puzzled about one problem: the ferns. I examined all the fern collections in the Hong Kong Herbarium in the spring of 1968 and I prepared a key. From this work I formed a good idea of the ferns of Hong Kong. On my trips I tried to collect all the fern species, but I found less than a quarter of the number that was in the herbarium. Naturally, I wonder what

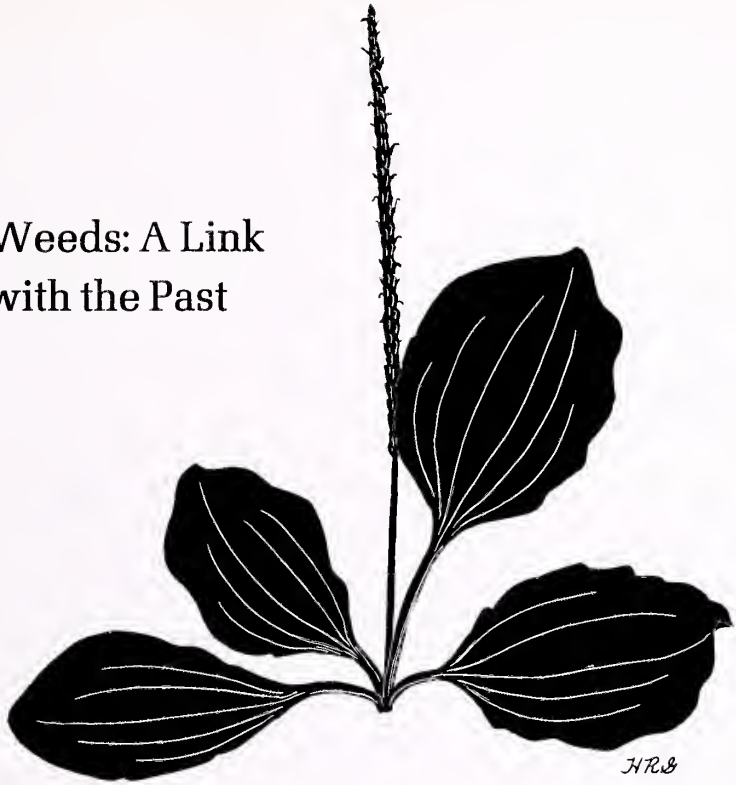
has happened to the ferns in the past one hundred years. There are three or four species which are common, but where are the others?

Regarding the preparation of an illustrated flora, I can report progress in three directions: (1) The collection and identification of specimens form a broad and sound foundation for the flora. (2) By helping a student who is interested in the medicinal plants of Hong Kong, I have accumulated a great deal of information on the economic uses of plants. With my help, Lee Fung Oi has collected over 300 samples from herbalists and has recorded their medicinal properties and methods of use. After I identified her material, the samples were stored in envelopes, with her original notes, in the herbarium of Chung Chi College. All this information will be incorporated into the flora as notes. (3) About 300 illustrations were drawn, each representing one genus. Teresa Fung, the seventeen-year-old artist, is very skillful. My only regret is that I could not spend more time with her to help her with detailed structures and with developing her ability to the fullest extent. The preparation of lecture notes and the care of specimens were more urgent than the supervision of her work. When I could not show her the details of certain genera, I had to ask her to make habit sketches. Consequently, there are many illustrations which I did not allow her to ink because I wanted to make corrections and additions.

Looking towards the future. At a time when the biological sciences swing strongly to cellular and molecular study, to some people it seems out of fashion to talk about a flora of Hong Kong. However, the preparation of a modern illustrated flora has a place — actually, an importance — in botanical research. That the people of Hong Kong feel the need of such a flora has been well expressed by the encouragement and support given to my work by Dr. C. T. Yung, President of Chung Chi College. Actually, a cry for an illustrated flora of Hong Kong was made by the residents forty years ago. In 1928, A. H. Crook, Headmaster of Queen's College, Hong Kong, published some illustrated, popular articles on Hong Kong plants. In 1930, he reprinted these articles in book form and called it *The Flowering Plants of Hong Kong (Ranunculaceae to Meliaceae)*. In a book review in the Hong Kong Naturalist, the reviewer wrote: "It is to be hoped that some one can be found to complete a work so admirably started. There is no doubt that an illustrated . . . flora of this Colony is badly wanted. If Mr. Crook's work could be brought to a successful conclusion it would fill a long felt want."

SHIU-YING HU

Weeds: A Link with the Past



1. The Plantain

Many of the common weeds found in the Arnold Arboretum were once known as useful plants, worthy of full-page engravings in the old herbals, the medical books of ancient and medieval times. Most of them are species of European or Asiatic origin; their histories can be traced back to a period when there were no books, word of their efficacy as remedies or charms spreading from place to place by wandering merchants and soldiers returning from foreign lands.

Plantain or pigweed (*Plantago major*), one of the commonest of weeds, has a long and colorful history. One of the first to mention it was Dioscorides, writing in the first century A.D. Dioscorides was a Greek physician who traveled widely and described many plants new for that time. He prescribed the leaves

of the plantain for the treatment of dogbite and recommended that the leaves be chewed to alleviate toothache.

Plantain was mentioned in the tenth century in a Saxon manuscript, the Leechbook of Bald, where, called by its Saxon name "waybroad," it was described as one of the magic herbs which occupied a prominent place in Saxon herb lore.

In the late 1500's John Gerard, a barber-surgeon and well-known horticulturist, listed plantain in his *Herball or General Historie of Plantes*, stating, "the juice dropped in the eies cooles the heat and inflammation thereof."

Plantain was so commonly used in the time of Shakespeare that it found its way into one of his plays:

Romeo: Your plantain leaf is excellent for that.

Benvoleo: For what, I pray thee?

Romeo: For your broken shin.

(*Romeo and Juliet*, Act I, Scene II)

Fifty years after the landing of the pilgrims John Josselyn, a British visitor to America, reported in his *New England Rareties Discovered* that the plantain, unknown in the Western Hemisphere before Europeans arrived, had already become common, and had been given a name by the Indians meaning "Englishman's foot" or "white man's foot," because it became established wherever Englishmen set foot.

Longfellow used this common name for the plant in his poem *Hiawatha*, speaking of the English settlers:

Wheresoe'er they tread, beneath them
Springs a flower unknown among us,
Springs the white man's foot in blossom.

Plantain was still being used medicinally in the nineteenth century. Plantain seeds, being mucilaginous, were used in pulmonary diseases, according to the *Cyclopedia or Universial Dictionary of Arts, Science, and Literature*, of Abraham Rees, printed in 1819. As recently as 1899 the *Century Dictionary and Cyclopedia* listed a medical use for the plantain: "The leaf is bound upon inflamed surfaces with a soothing effect."

Thus the plantain, which gardeners do their best to eradicate, comes down to us from the past, not only as a useful and respected plant, but also as quite a literary one.

HELEN ROCA-GARCIA

Notes from the Arnold Arboretum

A walk through the Arboretum on a mild day in winter can be a rewarding experience but, judging from the number of visitors we see at this time of year, few people are aware of this. Possibly the cold weather is responsible for such a seasonal lack of interest in plants, but it is more probable that we judge the beauty of a plant too much in terms of the flowers it produces, of the fruit it bears, or of its fall color.

It is true that climate places rather severe restrictions upon the types of plants that can be grown in this area. In comparison with milder parts of the country, we certainly cannot boast a long list of broad-leaved evergreens to brighten a dreary landscape. Smaller still would be a list of those plants which retain conspicuous attractive fruits or berries throughout the winter, and even smaller would be a list of flowers that could be seen in the few mild interludes between winter blasts.

What, then, does the Arboretum have to offer during nearly six months of the year when leaves are gone from the trees? Mainly, there is a chance to see many things which are either hidden or unnoticed at other times.

The true character of the shape and habit of growth of individual trees can be fully appreciated. The Phellodendrons along the Meadow Road present a remarkable picture with their wide, arching, ascending, corky branches supporting a delicate tracery of twigs posed against the blue winter sky. Further along the road ancient oaks in the natural woods somberly proclaim the grace and dignity which only age can impart. The picture is repeated in various ways throughout the Arboretum, and particularly good examples of diversity of form may be found among the lindens, maples, elms, oaks, and especially the conifers. It is difficult to imagine a lovelier view in any garden than that of the Pinetum after a heavy fall of snow.

Another favorite winter scene is that of the American Beeches on the bank of Bussey Brook opposite Hemlock Hill. Surrounded on three sides by dark conifers, the silver-gray trunks and branches literally glow in the sunlight and present a striking

example of the use of color in the winter landscape. Near the three ponds at the far end of the Meadow Road are extensive plantings of *Cornus sericea* and *C. sericea* 'Flaviramea'. Stems of the former are red; those of the latter, bright yellow. This pleasing contrast is enhanced by the dull red twigs of the Virginia Rose, *Rosa virginiana*, planted as a low informal hedge in the foreground.

Scattered throughout the Arboretum are noteworthy trees which, for one reason or another, have interesting bark characteristics. Some are brightly colored, some are striped, others exfoliate. The magnificent specimen of the Paperbark Maple, *Acer griseum*, on Bussey Hill should not be missed. The peeling cinnamon-brown bark which glows in the low rays of the winter sun provides about as much as any photographer could demand.

A walk past the shrub beds by the Centre Street wall will reveal a number of broad-leaved evergreens which are hardy at the Arboretum, and the dwarf conifers on the slope below the bonsai house deserve a visit to see the variations in color which these plants exhibit in winter.

ROBERT S. HEBB

Summary of weather data recorded at the Dana Greenhouses, January 1968–November 1969

1968			1969	
Precipitation	Avg. 8 a.m. Temp.		Precipitation	Avg. 8 a.m. Temp.
4.14	20	JAN	2.41	25
.82	22.5	FEB	5.45	27
9.20	36.5	MAR	2.41	33
2.16	51	APR	5.06	49.7
3.91	54.2	MAY	2.84	57.1
6.25	64	JUN	1.18	67.6
.61	71.9	JUL	3.01	68.7
1.86	66.1	AUG	2.28	68.5
2.14	58.6	SEP	4.90	58.6
1.75	51.3	OCT	1.97	48.1
7.26	39.3	NOV	9.72	40.4
6.15	26.8	DEC	——	——

Fig. 4, opposite: Arnold Arboretum, conifers in winter. Photo: P. Bruns.

Arnoldia Reviews

Making Things Grow, by Thalassa Cruso

Unquestionably, this book will be enormously popular. Few gardening books, in my memory, have had the advance and continuing publicity given to *Making Things Grow*. The inevitable popularity of this book makes one wish it had been more carefully prepared. Praise or criticism must fall on Miss Cruso's shoulders. No editor's name is given. No credits are given. There is no bibliography. The proofreading of the manuscript leaves much to be desired. A book reviewer is not supposed to *hunt* for errors, I am told, but when the errors jump at you from the pages, it is another matter. "Polydody" and "Rohea" occur more than once in the book. Other misspellings, like "zygocatus," "abutilion," "pulcherria," and "bilfurcatum," show up too frequently. And something called an "aeomema" is most puzzling; she probably means "aeonium."

Miss Cruso's ability to raise one's hackles while watching some of her TV shows has not diminished in this book. About as fast as she deflates old myths, she creates new ones. It is hard to accept such statements as "little plants must have each others' company to thrive;" or when speaking of ferns, "unlike any other plant making use of photosynthesis, they never bloom and set seed;" "pot soil remains in good condition only when it has active roots at work inside;" "flowering plants . . . need a drop by night of from 5 to 8 degrees if they are to continue opening their buds;" "roots will not stir into new growth unless they feel the pressure of earth against them;" or "sage, which is a close cousin both of lantana and salvia, . . ." One could go on quoting more of these flatly stated, very questionable pronouncements, but the above will suffice. It is strange, also, to read of lavish praise given to the use of bone meal in soil mixes.

In the introduction, Thalassa Cruso states her two reasons for writing the book: "to convince would-be gardeners that making things grow indoors is not too complicated for them to manage,

and to bring gardening back for the gardenless gardener." The chapters on "neglectable" plants and indoor lighting are extremely well done and certainly by themselves would bring about these two desired ends. Too many people approach the problems of using artificial lighting for indoor plants with great trepidation. Miss Cruso quite thoroughly allays their fears. The chapter on neglectable plants leaves one with no arguments for not growing some sort of house plants.

A wry sense of humor and a flair for the dramatic add to the pleasures of the book. But occasionally the drama gets a bit out of hand. Both on TV and in the book "potting back" a plant and the necessary chopping away of some of the roots becomes more a performance worthy of the Grand Guignol than a routine gardening procedure.

The drawings done by Grambs Miller are adequate, and only one error seems to have crept in regarding them. On page 116 a mislabelling of azaleas occurs. This is probably not the artist's fault.

One last request, Miss Cruso: please stop referring to cactus "leaves." Those things are really modified stems.

G. P.

Thalassa Cruso, *Making Things Grow*, New York: Alfred A. Knopf, Inc., 1969. $6.95

The Book of Spices, by Frederick Rosengarten, Jr.

Books on spices have been written by herbalists, botanists, historians, geographers, and cooks, but this uniquely beautiful, accurate, and readable volume has been written by a man who has grown, processed, and marketed spices and who clearly loves his wares. After identifying "What Are Spices," he treats the reader to a fascinating "Brief History of Spices" that melds the ancient and modern histories of these products of commerce. Thirty-five concise treatments of individual spices follow, identifying the plant botanically, the part of it which is used, its range in nature, and its use, culture, and processing. With each prospectus are a few welcome recipes, for who has not a little-used box of spice on the shelf and yearns for the recipe which

will demonstrate most effectively the characteristic of that single spice.

The author suggests that the first authentic, if fragmentary, records of the use of spices may be associated with the age of the pyramids in Egypt, nearly 4,000 years ago, where onions and garlic are depicted being fed to laborers to protect their health. Uses do not change; how very frequently today one smells onions and garlic still being used as a food, a spice, or — according to some — a sure cure for a cold. Another early use of spices, and perhaps the precursor of the pickling process, was for embalming, yet only in recent years have we proven the germicidal properties of many spice oils. Spicy odors improved the air in a period when sanitation was not what we know today, and the plain starchy foods of the period tasted better when spices were added. The claim that spices were aphrodisiacs was as prevalent then as now.

Whatever the basic reason for the use of spices, history shows us that spices were desired by slaves and kings, by churches and governments, and that they were attained by fair means and foul. Botanical gardens were established in many tropical areas to grow plants from stolen spices. One shares the anguish of a botanist who reported that the spice trees he grew from carefully imported seeds were all male plants incapable of producing the needed and valuable fruit. Commercial fortunes were made, and many lives lost, in the cultivation and trade of spices. New areas of the world were explored for safe routes for trade or new sources of the plant products that modern man buys without peril in the supermarket. The author has selected appropriate facts and presents them well.

Mr. Rosengarten has drawn information from many sources. One almost turns a page quickly to see who is quoted next, for Shakespeare precedes Chaucer or follows Keats. Reports from the Grete Herbal or Culpepper may be as appropriate in this text as a quotation from the Bible, or a table from the USDA or the Commonwealth Secretariat. So, too, with the illustrations in this handsome book. A crude drawing from a manuscript dated 512 A.D., a woodcut from the 16th century, an illustration from *Curtis's Botanical Magazine*, or a sensitive contemporary photograph of a very self-conscious little girl holding her dog near an herb grown in Guatemala are examples of illustrations well chosen and clearly appropriate to the subject. Special attention should be paid to the botanical plates reproduced from early German works completely unknown to botanists I have questioned. These are models of technical excellence of color repro-

duction; the captions are translated. An appendix consists of a few tables of supply and demand statistics, a short glossary, and a useful bibliography. Even the two indices, one to recipes and one to general subject matter, merit a compliment.

I do not know the relative roles of the author or the publisher in this production. Certainly both are to be commended, and I recommend this useful, interesting, and beautiful book.

R.A.H.

Frederick Rosengarten, Jr., *The Book of Spices*, Wynnewood, Pa.: Livingston Publishing Co., 1969. 489 pages, 330 illustrations, 73 color plates. $20.00.

Fig. 5: Bussey Brook. Photo: P. Bruns.

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Contents

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On the cover: Hamamelis mollis *at the Arnold Arboretum.*

What Can We Do About Pollution?

It is not easy to say anything new about pollution of the environment. It is a bad thing. We all oppose it in theory. Why, then, does it continue? Because, when it comes down to specific instances, specific pressures — generally economic — appear. Someone's self-interest is threatened. Each writer must approach the problem from his own experience and interests. The popular and technical press are now full of facts and figures about pollution. The legislatures and the executives are proposing programs right and left. Pollution can be controlled, here and now. The cost is greatly increased taxation and control of the size of our population. Neither, alone, will help. We must have both.

I am appalled by the unsanitary conditions that pollution forces our society to endure. I am aware of local needs and pressures to convert undeveloped land to "useful" purposes. I have to admit that some of these needs and pressures are valid. I realize that a balance must be struck between the preservation of open space and the needs of people for places to live. The sub-rural environment that I desire for my children is also desired by others, and so I have to admit that undeveloped land must be made available to others for housing. My concern is that the development of undeveloped land should be orderly and in the best interest of all.

Although the Boston-Washington megalopolis is the largest concentration of cities in the world, there is now more "wild" land in southern New England than there has been for more than 100 years Massachusetts, Rhode Island, and Connecticut are three of the four most densely populated states in the Union. Despite this, only 9% of the land area is devoted to industry, commerce, or residences; 17% of the land is devoted to agriculture; 65% of the land is in forest, and the remaining 9% is under water or covered by non-forested wetlands. One hundred and ten years ago 60% of the land area of Massachusetts was cleared and used for agriculture, residences, or industry; 20% was "waste," and only 20% under forest. Wildlife also has increased over the last hundred years, even over the last forty

years. In 1930 E. J. Palmer recorded that rabbits were rare or lacking in the Arboretum; they are common today. Within this same period the raccoon and opossum have become firmly established in the Boston metropolitan area.

This is not to say that all is well. All is not well, and we know it. But there is a larger picture that we must attempt to see. Urbanization and concomitant pollution, as they concern us, are localized in a few river valleys, in the Boston and Narragansett basins, and on the outer edge of the coastal plain from New Haven to New York. Our water resources (brooks, rivers, ponds, marshes, and sea coast) are badly polluted. The air over our larger cities is polluted. The effect of insecticides on wildlife, and on us, is a problem of considerable proportions. But, excepting these special cases, we are in much better shape than we might expect. Our greatest concern should not be Man's effect upon wildlife but, rather, Man's effect upon himself. Nature will survive; Man may not.

The problems that we face with regard to environmental pollution are serious. I do not think that overstating any facet of the situation does us any great good. What I would like to do is to present both sides of some environmental questions. I shall offer some comments and recommendations on the general problem. After that I shall deal with the consequences of a few specific problems.

General Considerations. Basically, all of our pollution problems are caused by what is currently called over-population. Our population is growing at a rate that is greater than our ability to provide municipal services for it. Generally, every new family in a community costs the town or municipality more for services than it can recover from that family in taxes. Hence, the taxes on all of us must continually increase. In the inevitable competition for funds the schools, rightly, are placed at the top of the list. Unfortunately, sanitation, which bears directly on environmental quality, is almost inevitably given a low priority.

Every animal or plant population pollutes its environment with its wastes. Under natural conditions, the total environment is able to accommodate the natural rate of pollution, converting wastes to useful nutrients. If any single species increases out of balance with the total environment, the population of that species is reduced, either by starvation, disease, or by strangulation in its own waste.

In the case of human population, the problem of waste dis-

posal is now acute, as are the problems of starvation and disease. It is doubtful that we can find money enough to construct waste disposal facilities fast enough to prevent further environmental deterioration. Indeed, we shall be lucky to keep pace with increasing population. Even if we could construct facilities fast enough, it is even more doubtful that trained personnel to operate them would be available. Like it or not, these are the problems we face. We cannot leave these problems and migrate to the frontier. We must stand where we are and fight this battle on this ground.

In Massachusetts, and in the country as a whole, the rights of the individual are correctly given prime protection by the courts. Unfortunately, these rights include the right to befoul our own property. Only when danger to the life or property of others can be clearly demonstrated will the courts be prevailed upon to act restrictively. If the amenity of open or underdeveloped land is to be securely protected and preserved, it must be accomplished by public or private ownership. We cannot, by law, impose our individual standards of amenity upon others.

Many laws and programs have been passed by the various legislative bodies to protect society from the abuses of individuals. Pollution, however, continues only slightly abated. Why? In Massachusetts, and probably in many other states, we do not need radically new legislation or programs. The problem in this state, and I believe in most other states, is that the present laws are neither obeyed nor enforced. The laws are not obeyed because the legislatures have not voted sufficient money to provide the trained manpower necessary to enforce them. Towns

and municipalities, even if they choose to attempt to obey the laws, do not have the personnel to enforce them. Further, the towns and municipalities have found that state agencies either will not challenge them or, if challenge occurs, the judicial process can be dragged out so as to make the challenge nearly meaningless. The single answer, then, is money: money on both the state and local levels to enforce compliance with the laws. Until manpower is available, legislation is futile. It appears that we will not have sufficient money for this task until the size of the population is stabilized. The problem is as simple as that.

It is dangerous to wait, however; we must face the situation in its current context. First, local government must be pressured to obey the laws with the exercise of police action by the state. Qualified engineers and other technicians must be prevailed upon to serve, *gratis*, on the appropriate town or municipal boards. The general population must be prevailed upon to learn the laws and to report problems as they arise. People must demand that local government act promptly to rectify the problems. Second, in the absence of appropriate local response the appropriate state agency — usually the state Department of Public Health — must be pressured to provide police action. In general, the state Department of Public Health is the primary agency charged with maintenance of environmental quality. In Massachusetts the Department has developed a series of minimum standards for the protection of the environment. Unfortunately, in Massachusetts the state pay scale is too low for the Department to hold the qualified personnel it needs. Also, the table of staffing provided by the legislature does not permit enough people for effective enforcement activities. The current work load of the present staff is such that a citizen's complaint must wait an average of three weeks before it can receive even a preliminary investigation. Resolution of that complaint may take three months or longer. The situation is intolerable.

Local complaints arise from the inability of local boards of health to deal with their own problems. The engineers employed by communities are not, in general, qualified to deal with public health problems. This problem is compounded by the lack of knowledge of the local boards of the long-term consequences of environmental deterioration — or, to be blunt, of the results of deviation from the requirements of the sanitary code.

Tactically, environmental problems should be handled as follows: (1) Determine the exact circumstances of the particular case, including the presumed deviations from local or state laws.

(2) Contact the local board of health (in writing, by certified mail) detailing the problem and requesting an answer, in writing, by a given date. (3) If satisfaction is not forthcoming from the local board, contact the district state sanitary engineer, in writing, (again, by certified mail) enclosing a copy of the letter sent to the local board, and request an answer by a given date. (4) If need be, contact the head of the state Department of Public Health (also by certified mail) enclosing copies of all relevant correspondence.

It is important to remember that, given the pressure of increasing population, development of undeveloped land cannot be stopped. It can only be regulated and directed into acceptable directions. In the long run land can only be preserved in its natural state by public or private ownership. The nature conservancy or local land trusts can accomplish this. Further, we have to accept the fact that any method of preserving land in its natural state will cost money. If sufficient public employees are to be engaged to protect the environment, the money must come from some source. Either taxes will have to be raised or some other activity will have to be curtailed. Perhaps roads will suffer, or perhaps we will have to do without a new municipal building or a sports stadium. This is the choice that the public has to make.

I am not particularly hopeful that local communities will solve their own problems by their own choice. Most people are not concerned with anything other than their own personal problems. By and large local officials will not act in the public interest — as distinct from their own private, financial, or prestige interests — unless there is the threat of police action from the state. The vast majority of the population will oppose the additional taxation that is necessary for pollution control. It is up to the state legislatures and executives to provide legislation and money to enforce that legislation for the public good. To date we have seen plenty of legislation but very little money for its implementation and enforcement.

Pollution of Soil and Water. A particular level of pollution can occur in one, or both, of two ways: a low level of pollution by a large number of sources, or a relatively high level of pollution by a few sources. It is easy to see the high level of pollution produced by an industrial establishment and equally easy to think that if only industrial pollution could be stopped our problems would end. However, the situation is not so clear-cut. Of course, industrial plants should curb their pollution of the en-

vironment. Yet if all industrial pollution were eliminated, our job would be only half done.

At least 50% of soil, water, and probably air pollution is produced by the individual home owner. At least half of the surplus nutrients that now befoul our lakes and rivers originate from the effluence of the sewage disposal facilities of individual home owners, the fertilizers they apply to their lawns and gardens, and farms. There is no question that industrial pollution can and should be controlled, but what of the balance? The home owner's dry well, cesspool, or septic tank is simply not an acceptable solution to the problems of household waste disposal. The ground water in many of our suburban communities is already hopelessly contaminated with bacteria and chemicals. The only satisfactory solution is for all homes to be connected to a public sewer system, and for the wastes to be treated in a modern, efficient sewage disposal plant.

Again, we are faced with the problem of money. Sewers are expensive to lay. Efficient sewage treatment plants are expensive to build, maintain, and staff. They seldom occupy a high place in the budget priorities of towns and municipalities. In the long run increased taxes are the only answer. Federal grants are not free. They are all paid for with taxes, yours and mine.

If the problem of sewage disposal is not enough, another one is forcing itself upon our consciousness: common table salt — sodium chloride — pollution. The use of salt is one of the most effective and economical techniques for clearing roads of snow and ice in winter. One frequent, observable result of this practice is the death of grasses and herbaceous vegetation along the sides of roads that have been salted during the previous winter. In addition, we may note the decline in vigor, or even death, of some roadside trees. The obvious line of reasoning is: (1) salt is used to clear snow and ice from the road; (2) we have used salt in the past to kill weeds and grass in driveways and paths; (3) salt has killed the roadside grasses and herbs; (4) salt is killing the trees. Unfortunately, like so many obvious lines of reasoning, this one is only partially valid. Statements (1) and (2) are obviously true, statement (3) probably follows, but statement (4) is questionable as a generalization, though probably true in individual cases. I can do no better than to quote from a talk by Dr. F. W. Holmes of the Shade Tree Laboratories of the University of Massachusetts: "Obviously a great many factors that are present along a road can harm a tree. Salt is only one of them. Others include fill, compaction of soil, absence of topsoil, limited surface area for air and water to

reach the roots, pavement over the roots, all the usual insects and infectious diseases (especially diseased root systems), natural drought, artificial droughts from alteration of the water table by drainage systems, increased numbers of injuries through artificial transplantings of trees (through automobile accidents and vandalism) cutting of roots in ditches for the sake of various installations, gas leaking into the soil, electrical injuries, herbicides and other chemicals and air pollution fumes; to lump it all in a single phrase, all the ills of civilization. After a decade of diagnostic work in Massachusetts, I am strongly inclined to say that 'civilization' is the most serious disease agent affecting shade trees, not standing second even to the famous Dutch elm disease! When we are faced with a tree which has undergone all of these site injuries, and which may therefore be especially subject to all those diseases and insect pests that preferentially attack weakened or wounded trees, then how are we to judge to what extent salt has played a detrimental role?"

Salt is definitely a factor in the decline in vigor and death of some roadside trees. The relationship may be direct, as in the case of species such as the sugar maple in which salt may be absorbed by the tree in lethal quantities; or it may be indirect, since it appears that salt-treated soils are low in soluble nutrients, and the tree may be literally starving. The problem of what to do about roadside trees is easy to handle. Salt-intolerant species should be replaced with salt-tolerant trees. Roadside soils should have a regular program of fertilization.

Since salt is very quickly leached through the upper levels of the soil, its effects on roadside vegetation are temporary. It reaches subsoil water tables quickly and gets into ponds and streams. In Massachusetts we are now beginning to have problems, which will undoubtedly continue and intensify, with salt contamination of domestic wells and water supplies. In addition, we will have to cope with salt contaminating streams and lakes, destroying fish and other wildlife, and polluting public water supplies. The problem of the selective killing of roadside vegetation is one that we can live with, but I am not sure that we can live with polluted reservoirs.

At present there is no economical method for removing common salt from water. It can only be diluted with unpolluted water to an acceptable level of palatability. With our present population growth and the resulting pressure on water supplies, it is questionable how long this technique will serve us. If we stop using salt to clear the roads, we will need to compensate with a vast capital expenditure for mechanical equipment to

plow and remove snow and to spread sand. Operating expenses will also rise, not only for drivers and mechanics, but also for personnel to clear the sand from roadsides and gutters at the end of the winter. Are we willing to accept more taxation for unpolluted water?

Air Pollution. Many, perhaps most, metropolitan areas have problems with air pollution. Boston is no exception. That our problems are not greater is due in part to nature — the lay of the land and the prevailing winds — and in part to a long history of legislation aimed at air quality control in our metropolitan area. However, inadequate funding has prevented the State Department of Public Health from employing a sufficient number of qualified engineers to assess the conditions to formulate adequate regulations promptly, and to enforce the regulations once they are established as law. The situation can, perhaps, be best described by quoting from a special report to the Massachusetts legislature prepared by the department, and submitted in September of 1968.

"Legislative authority for control of air pollution in the Commonwealth [of Massachusetts] by a responsible public agency was first established in 1869 at the time of the creation of the State Board of Health. Air pollution control was included in its environmental sanitation program. By the turn of the century certain aspects of air pollution control were recognized to be of a regional nature and the Legislature, in 1901, enacted a General Law to control the emission of dark smoke from sources other than locomotives and brick kilns However, 'special-interest' amendments to exclude public utility corporation, wood-burning plants, and pottery kilns reduced the effectiveness of this law, and brought about the formation of a citizens' committee for smoke abatement to protest to the legislature. . . . The Committee's efforts were rewarded when, as a result of its persuasion, the Boston Chamber of Commerce filed a petition to the General Court, titled 'An Act to Provide for the Abatement of Smoke in the City of Boston and Vicinity,' which became Chapter 651 of the Acts of 1910."

". . . It provided for a 'smoke district' comprising the cities of Boston, Cambridge, Somerville, Everett, Chelsea, and the town of Brookline, and encompassing an area of 66 square miles with a population of almost one million. . . . Enlargement of the 'smoke district' to include 29 cities and towns with a population of over 1,800,000 within an area of 290 square miles, took place in 1928. . . . In 1960, new legislation . . .

was enacted which replaced the 'smoke district' with a Metropolitan Air Pollution Control District . . . , comprising Boston and 29 contiguous cities and towns with an area of 320 square miles and a population of over two million people. . . . The Department of Public Health, under this law, was given authority to regulate all sources of atmospheric pollution within the District. In the Rules and Regulations subsequently adopted in 1961, 'atmospheric pollution' was defined as 'the presence in the ambient air space of one or more air contaminants or combinations thereof in such quantities and of such duration as to (a) cause a nuisance; (b) be injurious or, on the basis of current information, be potentially injurious to human or animal life, to vegetation, or to property; or (c) unreasonably interfere with the comfortable enjoyment of life and property or the conduct of business.' "

"A good air use management program should strive to keep in balance its efforts to reduce air contamination and its sufferance of reasonable use of its air (as a resource) to receive (and transport away) certain wastes resulting from man's individual and collective activities. Such use, however, must be in a manner compatible with, but to an extent no greater than, the capability of the ambient (outdoor) air to tolerate such use without undue detriment to man and his environment of concern. Expensive air pollution control measures for the preservation of pristine purity of air, for preservation reasons alone, and where lack of such would produce no significant hazard to man or to those elements in the environment for which man has a real concern is, per se, a waste of a valuable resource. . . ."

Two categories of pollution which have concerned the Metropolitan Air Pollution Control District have been "particulates," i.e., those particles such as soot and flyash which settle rather rapidly out of the air, and those particles which are so small as to settle very slowly, but cause soiling, odors, and reduced visibility; and sulphur dioxide, which causes sensory and respiratory irritation, corrosion of metal, stone and painted surfaces, and vegetation damage.

"Particulate air contaminants result principally from combustion for the production of heat, power and the destruction of wastes; from industrial (or commercial) processes involving abrasion, fuming, and loss of process materials; from abrasive phenomena such as automobile tire and brake wear; and by natural weathering, wind effects, pollen production and evaporation-condensation. . . . Particulates may be emitted from combustion processes as a result of gaseous suspension of ash, un-

Fig. 1: Boston's Prudential building disappears in smog. Photos: P. Bruns.

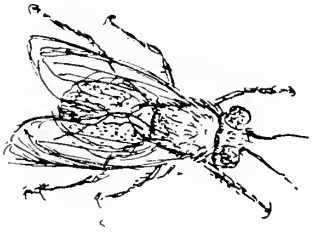
burned carbon, and carbonaceous compounds. The amounts vary depending on (1) the amount of ash in the fuel (up to 25% in refuse, 5-15% in coal and 0.5% in oil . . .); (2) the nature of the combustion process . . . ; (3) the efficiency of the process; and (4) the nature and efficiency of air cleaning equipment utilized. . . . The 'natural background' of such suspended particulate material in New England averages about thirty micrograms per cubic meter (30μ g/M^3). This level is the result principally from pollen-scattering, wind-disturbance of soil, other

natural phenomena, weathering of surfaces, evaporation of sea spray, and forest fires. . . ."

On the fringes of the Metropolitan Boston area total particulates average 50μ g/M^3. Close to the city center the average concentration rises to 60μ g/M^3. In the central core the average concentration is approximately 85μ g/M^3, with a winter average in South Boston of 128μ g/M^3. Reports of sulphur dioxide levels are available for the inner portion of the Metropolitan area. These average more than .03 parts of sulphur dioxide per million parts of air, a level which has been determined as being injurious to some vegetation.

Apart from particulates and sulphur dioxide, the atmospheric pollutant that is currently receiving much attention is so-called photo-chemical smog, a complex mixture of substances caused by the action of sunlight on the chemicals emitted as exhaust gases by automobiles. This is alleged to be the principal problem in and around Los Angeles and to be causing injury and death to pine forests on the mountain slopes some 40–60 miles from that city. Much has been written about the dangers of photo-chemical smog, and much damage has been attributed to it in other parts of the country. One has to say, in all honesty, that relatively few hard facts are available. Some damage to vegetation has been blamed on photo-chemical smog in the Boston area and, undoubtedly, some damage has taken place, but there is a notable absence of information about exactly how much smog produces what kind of damage on which plants. We are lacking measurements of pollution levels that would indicate that smog could have produced the damage reported. I, for one, have not seen any damage in the Boston area that could be unequivocally attributed to smog — drought, yes; salt, yes; but smog, no. On the other hand, Dr. William Feder, of the Waltham Field Station of the University of Massachusetts, has reported that ozone (one of the components of photo-chemical smog) is a problem in this area. He has said ". . . The sensitive tobacco plant used [as an indicator] will react to about 2½ to 5 parts per million of ozone in the ambient air. These same tobacco plants will react to 2–3 ppm of ozone and 0.2 ppm of sulphur dioxide to give another type of leaf reaction. Comparison of plant damage and meter reading information seems to indicate that during a summer like the summer of 1967 total oxidant in and around the Boston area may reach as high as 15–20 parts per hundred million (i.e., .15–.2 parts per million) for as long as 4–5 hours on a sunny day. This amount of oxidant is enough to injure marigold, petunia, and the very sensitive tobacco

plant." This is, however, probably not sufficient to damage most trees and shrubs. What does concern all of us is what effect long-continued exposure to low levels of these pollutants will have both on vegetation and on humans. At present, this kind of information is not available.



Pesticides. The pesticide controversy, like so many other controversies, is a battle fought on false premises. The agricultural chemical industry pictures itself as a knight in white armor fighting valiantly to provide food for mankind while picturing the anti-pesticide forces as trolls, fighting to deny mankind its daily bread. The conservationists see the picture just the other way.

In reality, very few people would deny that agricultural production must be increased. Increased agricultural production is dependent, among other things, upon protection of crops from injury or destruction by insects and other vermin. In the present state of our knowledge protection must be based on protection by chemical agents. Biological protective agents or strategies have been developed in the past for some pests and are now being studied for others. However, effective, widespread protection by biological agents lies sometime in the future. Since we must protect our crops now, the quarrel resolves itself into a choice of chemicals for present use.

Many chemical pesticides are presently available. Some of them are extremely toxic to all life forms. Some have short lifespans in the environment. Others are persistent in the environment and have already been demonstrated to have deleterious effects on various species of wildlife. In the past only two criteria seem to have influenced our use of pesticides: their effectiveness as pesticides and, to a lesser extent, their immediate toxicity to man. The agricultural chemical companies have a heavy investment in particular chemicals which are economically advantageous for them to produce. They also resent being made the culprits of environmental deterioration. They feel that they have played the game by the rules and they dislike having the rules changed to their disadvantage.

The pesticide problem, lest we forget, is not new. Before the Second World War great reliance was placed upon the use of pesticides containing arsenic, such as lead arsenate, Paris Green (copper aceto-arsenite), and calcium arsenate. In the 1940's and early 1950's it became apparent that agriculture was in

trouble. Following many years of heavy applications of arsenical sprays, compounds of arsenic had accumulated in the soil. The presence of these compounds reduced the yields of many crops that had been protected from insect attack. Further, it was found that some crops were accumulating arsenic to the amount of 14 ppm of their dry weight. Since arsenic and lead are both accumulated to lethal levels in the human body, and since the lethal dose for an adult is on the order one half to one teaspoonful, the inherent danger was very real. A radical change of insecticides was necessary, and the synthetic organic insecticides seemed an obvious answer. We were so relieved to have the arsenical problem solved that we chose to ignore the plain warnings that we had, even then, about the intrinsic dangers of the synthetics. Now, with the advantage of hindsight, we are only too ready to blame industry for doing exactly what we asked it to do fifteen or twenty years ago.

What we should do, at present, is determine what is safe — and economical — and concentrate on them. Arsenicals in any form, in my opinion, ought to be banned. That includes the arsenical rodent poisons and herbicides. We do not have to repeat here all that has been written of the ecological tragedies caused by modern synthetic insecticides. There is only one point to make. Among the vast number of chemical pesticides in commerce there are a few that are economically effective and relatively safe ecologically. (See Appendix, page 50.) We should concentrate on using them. It is within the capacity of the industry to produce other similar pesticides. We should stop the noise and get on with the business of producing food.

In general, the following pesticides are environmentally safe for use by the home owner or home gardener:

Malathion	Aphids, caterpillars, beetles, leaf hoppers, leaf miners, plant bugs, scale and mealy bug, springtails, thrips, white fly, cutworms.
Methoxychlor	Caterpillars, spittle bugs, apple maggot, codling moth, Japanese beetle, plum curculio, tent caterpillar.
Carbaryl (Sevin)	Beetles, rose chafer, periodic cicada, pickleworm, squash vine borer, stink bug, bagworm, fall canker worm, codling moth, grasshoppers.
Dicofol	Spider mites, cyclamen mites.

For household insects Malathion will control those listed below. Care must be exercised not to contaminate foodstuffs or eating or cooking utensils.

Ants
Bedbugs
Cockroaches
Fleas (dust dogs and cats with 5% carbaryl powder)
Flies (pyrethrum + piperonyl butoxide is even safer)
Silverfish and firebrats
Spiders
Ticks (dust dogs and cats with 5% carbaryl powder)

Although it is intensely poisonous to man, and the fumes are irritating, nicotine is effective against aphids, thrips and other soft-bodied insects and is safe environmentally. Dormant oil is effective against scale insects when applied during the winter. Summer oil sprays are useful against scale during the growing season. Pyrethrum and Rotenone are effective against many soft-bodied insects. Lime-sulphur, in strong solution, is effective against scale when applied in the winter. In the summer a weaker solution is used as a fungicide.

Summary. The problem of pollution control, then, can be summed up as follows: (1) we can dramatically reduce the present levels of pollution with present technology; (2) this reduction in pollution can be obtained only by greatly increased expenditure of money; (3) the only source of money is increased taxation; (4) beyond money, some activities, i.e., snow removal and pest control, may be considerably less effective than they are at present; (5) if industry and municipalities and private citizens rigorously control their pollution, much increased taxation can be avoided.

I believe that we must control pollution for our own survival and that we must accept increased taxation and reduced efficiency to pay for it. I also believe that, in the long run, we can save ourselves a great deal of taxation and grief by controlling the size of our population. This is the price that we must pay for our survival as a free society. *We must control the size of our population and we must reduce our present level of environmental pollution if we are to survive.* Or, put another way, will you settle for your pocketbook and your present amenities now, or will you sacrifice some of these so that your children and grandchildren can live in the kind of society that you enjoy?

GORDON P. DEWOLF, JR.

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Appendix.

The following table (pp. 50–55) has been compiled from a number of sources, notably *Agriculture Handbook 331* and the *Pesticide Information Manual*. It is intended to give some idea of the hazards to man and to the environment that are inherent in some of the insecticides in use today. LD_{50} is the amount of chemical in micrograms of chemical per kilogram of body weight needed to kill one half of a population of laboratory animals. As such it is a rough indication of toxicity to humans. The smaller the number, the more lethal the substance.

Pesticide	Toxicity						Hazards		
	LD_{50}	*Rats*	*Fish*	*Birds*	*Bees*	*Persistence*	*Wildlife*	*Environment*	*Applicator*
Abate I	2,000	slight	high	moderate	?	?	?	?	moderate
Acricide-see Binapacryl									
Aldrin I	39–60	high	10–14 high	high	high	long	yes	yes	yes
Allethrin I	480	slight	high	slight	slight	short	(fish)	?	slight
Anthon-see Trichlorfon									
Aramite A	3900	slight	480–730 slight	slight	slight	21–30 days	?	?	? known careinogen
Azinphosmethyl I	16–80	high	high	moderate	high	1 season	yes trained operator only	yes	yes
Baytex-see Fenthion									
Bidrin I	22	high	high	high	high	30 days	Not at recommended application		yes
Binapacryl I,F,A	58–63	moderate	high	slight	slight	several weeks	yes	yes	moderate
Black Leaf 40-see Nicotine									
Butocide-see Piperonyl butoxide									
Captec-see Dicapthion									
Calcium arsenate I	40–298	high			high	long			yes
Carbaryl I	500–850	slight	moderate	slight	high	3–4 months	relatively low		low
Carbophenothion I,A	10–30	high	moderate	high	moderate	7–21 days	yes trained operator only	yes	yes
Chlorbenside I,A	2,000	slight	?	?	?	one season	?	?	low
Chlordane I	335–430	moderate	high	moderate	high	long	yes	yes	moderate
Chlorobenzilate A	1040–1220	slight	moderate	slight	moderate	7–10 days	low	possible	low
Chlorthion-see Dicapthion									
Ciodrin I	125	high	moderate	moderate	high	1–3 days	low	?	yes

Compound 338-see Chlorobenzilate									
Co-Ral-see Coumaphos									
Coumaphos S,I	15–41	moderate	moderate	high	moderate	one season	yes	yes	low
Cygon-see Dimethoate									
DDD I	2280	slight	high	moderate	?	long	yes	yes	no
DDT I	113–118	moderate	high	moderate	moderate	long	yes	yes	slight
DDVP-see Dichlorvos									
Delnav-see Dioxathion									
Demeton S,A,I	2–6	high	moderate	moderate	minimum	one season	yes	low	yes
Diazinon	76–108	moderate	high	high	high	two months	trained operator only (birds)	?	yes
Dibrom-see Naled									
Di-Captan-see Dicapthon									
Dicapthon I	500	moderate	moderate	?	?	4–5 weeks	?	?	?
Dichlorvos I	56–80	high	moderate	slight	high	1 day	slight when used as directed		yes
Dicofol A	1000–1100	moderate	high	slight	minimum	months	no	no	low
Dieldrin I	46	high	high	high	high	long	yes	yes	yes
Dimecron-see Phosphanamidon									
Dimethoate S,A,I	215	moderate	moderate	high	high	1–3 months	yes	yes	yes
Dioxathion A,I	23–43	high	high	high	minimum	6 months	yes	yes	yes
Dipterex-see Trichlorfon									
Disulfoton	2–7	high	high	moderate	moderate	one season	yes	yes	yes
Di-Syston-see Disulfoton									
Dithio-Systox-see Disulfoton									
DNBP A,I	37–60	high	high	high	?	short	yes	yes	yes
DN-289-see									

Pesticide	Toxicity					Hazards			
	LD_{50}	*Rats*		*Birds*	*Bees*	*Persistence*	*Wildlife*	*Environment*	*Applicator*
DNBP									
Dylox-see									
Trichlorfon									
Elgetol-318-see									
DNBP									
Embathion-see									
Thion									
Endosulfan I	18–43	high	high	high	moderate	one season	yes	yes	moderate
Endrin I	5–18	high	high	high	moderate	long	yes	yes	yes
EPN I,A	7–36	high	moderate	high	high	3 months	yes	yes	yes
Entex-see									
Fenthion									
ERN-300-see									
EPN									
Ethion I,A	27–65	high	high	?	minimum	one season	yes	yes	moderate
Fenthion A,I	215–245	moderate	moderate	high	high	2–3 months	yes	yes	yes
Genite	500	slight	slight	slight	minimum	30 days	slight	slight	slight
Guthion-see									
Azinphosomethyl									
Heptachlor I	100–162	moderate	high	high	high	long	yes	yes	slight
HETP-see									
TEPP									
Isomeric-see									
Dicapthion									
Kelthane-see									
Dicofol									
Kepone I,F	125	moderate	high	moderate	?	one season	yes	yes	? no
Korlan-see									
Ronnel									
Lead arsenate I	10–1050	high			high	long			yes
Lindane I	88–91	moderate	high	moderate	high	long	yes	yes	? low
Malathion I	1000–1375	slight	high	high	high	2–4 weeks	yes	slight	yes
Marlate-see									

Methoxychlor									
Meta-Systox R-see									
Oxydemeton									
Methoxide-see									
Methoxychlor									
Methoxychlor I	5000	slight	high	slight	minimum	long	yes	?	slight
Mevinphos S,A,I	3–6	high	moderate	high	?	1–3 days	yes	yes	yes
							trained operator only		
Mitox-see									
Chlorbenside									
Morestan F,A	1100–1800	slight	?	moderate	minimum	2 months	yes	yes	low
Morocide-see									
Binapacryl									
Naled I	250	moderate	moderate	moderate	high	1–4 days	low	low	moderate
Nankor-see									
Ronnel									
Neguvon-see									
Trichlorfan									
Nialate-see									
Ethion									
Nico-Fume-see									
Nicotine									
Nicotine I	50–60 83	high	high	slight	minimum	one day	low	low	yes
Orthotran-see									
Ovex									
Ovex A	2000–2050	low	moderate	?	minimum	one month	?	?	low
Ovotran-see									
Ovex									
Oxydemetonmethyl I,A	65–75	moderate	moderate	moderate	?	3 weeks	yes	yes	yes
Pallethrine-see									
Allethrine									
Parathion I,A	3–13	high	high	high	high	1 month	yes	yes	yes
							trained operator only		
Paris green		high				long			yes

Pesticide	Toxicity						Hazards		
	LD_{50}	*Rats*	*Fish*	*Birds*	*Bees*	*Persistence*	*Wildlife*	*Environment*	*Applicator*
Piperonyl butoxide	7,500–11,000	low	high	low	?	?	?	?	?
Phorate I	1–2	high	high	?	moderate	2 months	yes	yes	yes
Phosdrin-see Mevinphos									
Phosphamidon S,I,A	16.5–23	high	moderate	high	high	3–5 days	yes	yes	yes
Pynamin-see Allethrin									
Pyrenone-see Piperonyl butoxide with pyrethrins									
Pyresin-see Allethrin									
Pyrethrins	1500	slight	high	slight	minimum	contact	no	no	no
Resitox-see Coumaphos									
Rothane-see DDD									
Rogor-see Dimethoate									
Ronnel I,A	1250–2630	moderate	?	slight	moderate	2 months	no	no	no
Rotenone I	50–75	moderate	high	slight	minimum	1 month	(fish)	(water)	no
SD 3562-see Bidrin									
Sevin-see Carbaryl									
Sodium arsenite						long			
Spectricide-see Diazinon									
Systox-see Demeton									
TDE-see DDD									

Tedion-see Tetradifon									
TEPP I		high	high	high	high	1–3 days	yes trained operator only	yes	very
Tetradifon I,A	14,700	slight	moderate	slight	minimum	2–4 weeks	low	low	low
Thimet-see Phorate									
Thiodan-see Endosulfon									
Thiodemeton-see Disulfonon									
Tiguvon-see Fenthion									
Toxaphene I	80–90	moderate	high	moderate	minimum	long	yes	yes	low
Trichlorfon S,I	450–500	slight	moderate	high	minimum	1 week	(birds)	?	moderate
Trithion-see Carbophenothion									
Trolene-see Ronnel									
Vapona-see Dichlorvos									
Vapotone-see TEPP									
Zectran	25–37	high	high	?	high	?	yes	yes	moderate

I = Insecticide
A = Acaricide
F = Fungicide
S = Systemic

Care and Preservation of Library Materials

This is the second in the series of talks presented at the Massachusetts Horticultural Society's conference on botanical and horticultural libraries in November 1969. Since Dr. Lawrence spoke from informal notes, the article is an edited version of the transcript prepared from a tape recording of his lecture. — Ed.

Conservation practices have to be recognized and put into effect within the modest limitations of space and staff. I do not want people to think that library records and materials are primarily books because, when you get into almost any library that we represent here, they go into at least five categories. I mention books, which are more or less obvious, and I separate pamphlets. John Reed talked about the small, ephemeral, peripheral publications that from a historical and archival standpoint are very important, yet they have always been shoved aside. They get into the pamphlet boxes and they are the dust-catchers. They get beaten up. Often they do not even get catalogued. Yet they may be the only publication on the subject. They may be the first publication.

I think of Charles Short, in Lexington, Kentucky, who published twenty-five or thirty papers as separate, private publications. He intended them to go into a periodical that was being published at Transylvania University but the periodical went bust. He had the papers written so he published them himself over a period of about five years. Each was published independently and sent around gratuitously to his friends. Today they are rare. They are not in good condition. Because he paid for them himself, they were economically published and printed on poor paper. But they are reports of the botany — the medical botany and ethnobotany — of that area that you will not find anywhere else. Pamphlets are important and, while from a librarian's standpoint they are books, they are subject to different conservation practices. Not only do they often have to be treated chemically to preserve them, to sanitize them, to get rid of the mildew, but they have to be put into some kind of a binding. They should be bound to open completely flat so that

we may make facsimile reproductions of them. What we at the Hunt Botanical Library do, for example, is to mount these small publications with an acceptable adhesive on a stub about ¾ inch wide of a heavy Permalife stock, and hinge it into a pamphlet binder.

A manuscript is any material that is not printed: typescript, holograph, or letters. In systematic botany we have the problem of identifying handwritten notes on botanical specimens, especially when the writer did not initial them or sign them. In this country there are a half a dozen large collections of representative handwriting of botanists. There is a very fine collection at the British Museum of Natural History, assembled for this purpose.

There is the matter of seeking, acquiring, and then taking care of the manuscripts of authors. John Hutchinson, a man now 88 years old, is still publishing and very active. When I wrote him three or four years ago for the manuscript of one of his books, he said he would be glad to give it to me. It arrived just as clean and nice as you could ask except for the printer's marks. I wrote back and said: "Dr. Hutchinson, this isn't the manuscript I want. I recall that you told me that, when you first submitted your manuscript, the publisher told you to cut it by a third because it was too long. That is the manuscript I want because I want to know what you left out and what you felt was not so important — where you had to trim." Hutchinson said, "Oh, I threw that one away. Who cares about that?" It is not the final but the penultimate manuscript that you are seeking. Conservation of this type of material is in a class by itself.

Then we have another area which I am afraid is where librarians — and I must quickly disclaim being a librarian — are not doing an adequate job. This is with collections of photographic material. Sadly enough, too often they are neglected because of lack of funds or because there is no one on the staff with the interest to care for them. From a historical standpoint, a wealth of material can be found in photographic prints. A great many photographs are now deteriorating because someone did not wash all the hypo out. If only their negatives had been saved, we might have had another source from which to reconstitute them. True, you can take a faded, deteriorated print and produce a fair print from it, but it costs money. This applies also to the photographs we get today. Do not think that because they come from a commercial photographer they necessarily are going to last.

Color transparencies, you may say, are hopeless; you cannot save them anyway. But there are conservation practices that can be used to preserve them. Back in 1939 we made a set of some 200 Kodachromes of macroscopic dissections of the insides of flowers. They were made in duplicate. One set was put in boxes, sealed, and put in cold storage refrigeration chambers at a temperature of about 30°F. About every five years that set was opened and examined. When looked at last year no deterioration was discernible.

We have heard about the limitations of the life of microfilm, conditions which also apply to microfische. More recently we have had to contend with the preservation of tape recordings, because the science of oral history is becoming increasingly important. Within four to five years, with normal tension on the tape, you may get an echo on cassette recordings. Therefore, they should be transferred to the archivally accepted mylar tape 1.5 mils thick.

We all know the limitations of paper and that the acid problems of paper are very real. But sometimes we forget that it is not just the paper of the book or the letter, but it is the paper in which paper materials are placed, bound, or filed. For example, in our library we have gone over to using Permalife paper stock for file folders and envelopes, because the folders obtained from most commercial companies have a pH varying from 4.7 to 5.5. (A pH of 7.0 is neutral; anything below that is acid.) These same acid papers will pick up chemicals from the atmosphere and, in combination with moisture, the pH will become lower over a period of, say, 25 years. We are switching over to Permalife papers which have, as you know, a pH of 8 to 8.2, and there are enough residual alkaloids that act as buffers against atmospheric chemicals and will hold the pH to about 7.0 for a period of 300 years or more. It is important that your file folders be as permanent as possible. The same thing applies to envelopes. We recently received from the Smithsonian Institution files of correspondence of botanists that were in the ordinary Government franked envelopes, so highly acid that you could take a pile of them and snap it in half.

There is a paper available for wrapping packages of archival records to give them the best protection. It is called Bagasse and is known also in the paper trade as Kraft Ayensee paper. Ordinary wrapping paper, cheap envelopes, and ordinary file folders are made from wood pulp, and one material in the wood pulp that causes damage is lignin, an inherent anatomical part of the wood, which is not removed in the papermaking process.

It breaks down to form one of the paper damaging acids. It is lignin that makes newspaper turn yellow after 48 hours of exposure to sunlight. However, the Bagasse paper is made in the Gulf area from sugar cane, which is a grass. Any paper made from a grass has no lignin in it. When available, it usually costs no more than the cheap, lignin-loaded, kraft wrapping paper. We use Bagasse paper for wrapping anything. It has a pH of 8.2 and flexibility. It does not discolor or get brittle, and it is not going to add any acids to whatever is wrapped in it.

The same consideration applies when you mat your prints. We file our watercolors, drawings, and prints matted — if they are large enough to have a mat. If not, we put a piece of pure cellulose acetate over the front of a piece of mat board and make an envelope in which the prints and drawings are individually stored. We are very particular to ensure that the materials we use have an acceptable longevity. We use a mat material, available in several thicknesses, tints, and surfaces, that is 100% rag with a pH of 6.8.

Do not be deceived by papers identified as rag paper. In early times rag papers were made from linen fiber, non-wood with no lignin. The name "rag" then meant that they used rags that had not been dyed or chemically bleached with chlorides. Today you have paper that is identified as "rag," but that identification is virtually meaningless. By contrast, some wood pulp papers, properly made and treated, are better than "rag" paper that is up to four times as costly. Most of today's so-called rag paper is of cotton fiber, from rags that invariably have been dyed. It has had various chemical treatments. So, when you read the watermark of a paper identifying it as of such and such rag content, or as having a given percentage of cotton fiber, the real test is whether or not the fiber means anything. It may mean greater strength but, even so, it can be very dangerous paper to use.

Binding leather may be good or bad depending on how it was tanned and dyed. English calfskins made before the 1930's were mostly improperly tanned. The residual acids and processing chemicals caused it to deteriorate. This is why in so many calfskin volumes — you pick them up and then have a devil of a time getting the reddish powder off your clothing — the leather has rotted beyond recall. Any leather binding of today will absorb injurious gases from the atmosphere, no matter how fine the skin may have been when it was put on the volume. For this reason, when you treat a leather binding it is well to treat it first with a deacidifying agent, such as a 7% aqueous

solution of potassium lactate. This will not deacidify the material itself, but it will counteract the acids which have come into the leather since the book was bound. After this has dried, apply the leather dressing that is your favorite.

You do not use the same leather dressings on vellum or parchment that you use on other leathers. If you do anything, the recommendation is to use a bland soap, such as Ivory, and to sponge the binding with a minimum of water to remove all the residual surface dirt. Then use something like a saddle soap for dressing. Do not apply excessive amounts of neats-foot oil, lanolin, or the usual leather dressings.

The big problem with vellum is its hypersensitivity to humidity changes. You have had vellum-bound books on your shelves whose covers have curled outwards. The reason for this is that the vellum, sensitive to humidity changes, will shrink and curl the boards. Usually, the inside of the board is covered only with paper. What is normally done to counteract this is to bind the inside of the cover with vellum. Then you have a counteracting situation and the side board remains flat. An alternative, and one we use, is to put such bindings in slip cases; the case will hold the sides from curling. But, if you have great fluctuations in humidity, you may put a book into the case and, after a sudden drop of humidity, may not be able to get it out again.

Inks also present problems in record preservation. In our work we have had considerable experience within the last year and a half in preserving newspapers. Some years ago I began "cultivating" a physician in Stockholm who had a collection of Linnaeus items, and we wished to have his library. He was a sixth generation descendant of Linnaeus and, for reasons of national pride, he wanted the collection to stay in Sweden. This was understandable. Some of you may know of the great Waller collection of medical books and medical history. Dr. Waller, also a Swede, had collected perhaps the second finest private collection of medical works anywhere. On his death he gave it to the University of Uppsala but had a two-volume catalogue prepared while it was still in his home. Today those books are in the same boxes, in the Library's basement, that they were in when taken from his home. Dr. Birger Strandell, the man who owned the Linnaeus collection, knew about this and he foresaw that the same thing could happen to his collection. I think this fear was one of the motivating forces that caused him to relinquish them to America. In the course of the negotiations for the Linnaeus collection, he would say, "Now

don't forget, I have six cartons of cuttings that go with it." I can remember my grandmother's clippings out of the newspapers, and when I thought about those six cartons of cuttings, I am afraid I was a little bit scornful of them. When they came with the collection to Pittsburgh, we made a catalogue of the collection. There remained the six cartons of cuttings. When all else was done, we began to process them and found that there were between five and six thousand clippings in that collection, tied up in bundles, year by year. We have now processed about six thousand and, out of that number — believe it or not — less than twenty lacked the identifying name of the newspaper and the date of publication! It has proved to be a fabulous collection, dating back into the early 1800's and ending in 1967, just before he brought it to this country.

These cuttings are now in forty-eight 11″ × 14″ looseleaf albums, having cellulose acetate envelope-type leaves. The black sheet inside each acetate envelope was removed and deacidified. A sheet of white Permalife paper was placed on each side of the black sheet, the latter being punched to fit the multi-ring album. The cuttings were mounted by "tacking" corners with 3M Magic Mending tape. All were arranged chronologically. When text of the clipping was on both sides, we would xerox the second side on Permalife paper, mounting it in its proper place to provide continuous copy.

The paper of a majority of these cuttings had deteriorated. We know that from about 1870 on all newsprint is full of acid. The cuttings had to be treated. I have been criticized for the treatment used on these cuttings because the process is not 100 percent reversible. As we all know, one of the fundamental precepts to any records conservation work is that anything added to or done with a document or a book must be reversible. This ensures that, if it is a bad technique, you can undo it and at least return the material to the poor condition it was in before you touched it. We deacidified these cuttings with a relatively new process that has not been widely publicized to date. It involves the application of a solution of 95% ethyl alcohol and a 4% solution of commercial 8% magnesium methylate in methanol. We atomize it, spray it on, diluting with ethanol when spraying it. To that solution we add 4% of soluble nylon. (When nylon is used, application is by brush or dipping.) This impregnates the cellulose fibers. It does not increase the folding strength of the paper but it does give a sizing to the paper and penetrates the interstices between the fibers as well as the fibers themselves. It increases the tensile strength — that is,

the tear strength — so that these acid-damaged clippings, now becoming fragmentary, are conserved and will remain so indefinitely. The process is not wholly reversible. I may, after I am below ground, be damned for it, but we have found no tests that indicate that it is dangerous or deleterious to paper materials.

The matter of pigments, particularly of hand-colored plates, is a very difficult one, and I am not going to go into details here, but I can say that there are more complicated techniques available for cleaning and deacidifying them. If you have a print that is badly foxed — foxing is due to a fungus whose spores are common in the earth's atmosphere — you can deacidify your materials, eliminate the fungus spores in them, and raise the pH to a level where the spores will not germinate. You can then bleach the plate very carefully to remove most or all of the foxing stains. I am not recommending bleaching at this time as a washing technique, because we know that for rare books you think many times before you do it. But if you have prints (not original art work) you can clean them up and then reinforce them by lamination on the back. There are techniques whereby you cover with a brush the colored material — the paints and the pigments — on a watercolor and then immerse it in an aqueous solution to clean up the paper, removing the protective coating later. These things can be done, but the material must be sufficiently important to justify the cost.

The subject of adhesives is one that we all should be very conscious of, and be concerned about. We have a rule in our library — once in a while I find it violated — that there shall be no rubber cement in the library. *No rubber cement.* I do not care what the label says about its permanence; there is not any such thing for any such product now on the market. It is not permanent. We have had paintings for which we paid very good sums of money that have come, unbeknownst to us, mounted or tacked with a gob of rubber cement. Then, four or five years later, that little brown stain comes right through the paper. No solvent or bleach has been devised that will remove it. We all know that rubber cement has a limited longevity — five, maybe ten, years — and then all adhesive quality is gone. We received from the Smithsonian Institution a collection of 600 or 700 drawings by a famous botanical artist, with all the floral dissections "pasted" on with rubber cement. When they arrived all the dissections had fallen down to the bottom of every envelope. We had to consult reproductions of them in the original publications to determine which

ones went with what and get the dissections with the right plate. All of this because rubber cement isn't worth a damn. It is a heinous material to have around. It ruins preservable materials in many ways. So stay away from rubber cement in any form. For the same reason, stay away from ordinary so-called Scotch tape. The 3M Magic Mending Tape does have a reasonably long life, is not known to stain materials, and is to be recommended for making minor repairs to leaves of books or other materials not expected to have the longevity of archival records.

Use any adhesive that retains those qualities, that can be removed at any future time, and which is known to be free of properties damaging to the bonded materials during the period it is in use. Common flour paste, often known as library paste, remains one of the best for bonding paper materials. It is, perhaps, best to select a commercial product from a supplier of book binding materials, choosing it on the basis of desired consistency, drying-rate, and strength. When greater strength is required of an adhesive than is to be had from a flour paste, then choose an archivally acceptable polyvinylacetate adhesive (known in the trade as a PVA adhesive).

The Barrows Research Laboratory made a study of PVA adhesives in 1967 and found only one then on the market that has an acceptable degree of longevity, completely satisfactory for the equivalent of 300 years of aging, with no breakdown and no acid-producing disintegration. It is made by the Southern Adhesives Corporation (4105 Castlewood Road, Richmond, Va.), and sold under the name Longlife Bookbinding PVA Adhesive. Now there is also a British-made product available domestically from Process Materials Corporation (329 Veterans Blvd., Carlstadt, N.J.) and sold under the name of Promatco Adhesive No. A–1023. It is a water-dilutable emulsion, having a basic consistency of molasses. This extra "body" or consistency is an advantage for many users.

For mounting prints or drawings on an acceptable board, one may use the dry-mount method as for photographs, an adhesive liquid or paste, or best of all, one may hinge them. The dry-mount method involves an overall application of heat to melt a paraffin-impregnated tissue into the surfaces of both print and mount board. Adequate adhesion demands that the heat be just right — not too high or too low — or the bonding will not hold long. It is an archivally accepted process. The use of liquid or semiliquid adhesives requires a combination of speed and skill to avoid wrinkles.

Next, as to photographic films, the subject of film base and

negative emulsions has taught us that the old nitrate base of film is not only explosive, but has a relatively short life. We know that there is no such thing today as a permanent film. If you talk to people at the Library of Congress, concerned with the large collections of motion picture films, you will learn that they plan to remake prints about every 35 years because, not only is there the question of the life of the film base itself but, in the case of movies, there is shrinkage so it may not fit the projector sprockets; or when you put the film in it will break when you try to project it. There is no form of longevity, even within our generation.

Now as to the agents that are responsible for the deterioration of our library records: man, of course, is the primary one; man, by his decision to use cheap stuff to begin with; man, in the way he handles things. There is something to be said concerning whom you permit to handle your rare books. Recognizing the fallibility of man, we have in our library a rule that everything in it belongs to the University; the question that gets to me time and time again is, who can use these books? We say, anyone can use them who has the competency to do so. That does not necessarily mean that all librarians can handle them.

Ultraviolet light is very damaging, as we know, to many library materials, particularly to pigments in leathers, prints, and paintings. As a rule of thumb, a print gallery that is illuminated by fluorescent light, unprotected by any filter, is using a light source that is eight times as damaging to paintings and bindings as is a gallery illuminated with tungsten lamps. There are counteracting filters; Rohm and Haas makes one that is reasonably effective. But fluorescent lighting sometimes is used because architects say that it will cut down the heat. I would rather counter the heat with air conditioning than to try to eliminate this large output of ultraviolet light. For example, in 1962 we had acquired the library of the great 18th century French scientist, Michel Adanson. I thought it would be nice to have all the books and manuscripts that had to be boxed done in bright green leather. Within two years after this was done the leather of those once beautiful boxes became a dull olive-green yellow. Leather dyes in greens and purples just do not hold fast under ultraviolet light, even of the normal intensity we have in our library stacks. Fluorescent light, when lighting colored materials, is to be recognized and treated as a serious villain. When you have exhibit material in cases illuminated by fluorescent light, if you are not using filters to restrict the

ultraviolet portion of its spectrum, please, please, turn the pages every day.

Air, with its chemical pollutants, is always working against us, and this is why we have papers that are impregnated with buffer materials to counteract the acidity generated from sulfurous gases in the air. Books may be printed on perfectly good paper, paper with an acceptable pH of 6 or 6.5 that, after 25 years begins to deteriorate just from pollutants in the air.

Heat, moisture, air conditioning, and humidification are of utmost importance to a library. If you must make a choice between temperature and humidity control, take off your coat and suffer the heat but have controlled humidification. Of the two, the control of humidity is more critical to the preservation and conservation of all kinds of library materials.

It is our experience that if you can control the percentage of relative humidity within limits of 45° to 55° the year round, this is fine. Remember also that air conditioning equipment with built-in humidification provisions and controls is a mechanical device. It must have what the engineers call "down-time" for service and replacement of worn parts. If you have a downtime of 24 hours and a simultaneous drop or surge of outdoor humidity, you can still create havoc with your collections.

Mildew is a factor in conserving of library materials. It is a fungus that thrives at a relative humidity range of 65% and above. For some institutions, particularly those along the eastern seaboard, dehumidification of library spaces in the summertime may be of greater importance than any other environmental control. Forget about the temperature, but keep that humidity constantly below 60% because mildew spores are always in the air and, when in an environment of 65% or above for three hours, they begin to germinate. No chemical that will inhibit or prevent the germination of mildew spores is known that will remain an active fungicide in the material for more than a year. Thymol is a good inhibitor. A 5% solution of thymol in alcohol applied to the outside of a volume will kill the mildew spores that are there and it will deter their germination for a period of eight or ten months.

The proverbial rodents and insects are something to watch for. We have in our library an installation permitting fumigation under vacuum. Such a system is essential to an active conservation program. You may not have silverfish running around, or you may, yet their eggs may be there. You may have a collection loaded with mildew spores or other fungi that need to be killed. If you have a flood situation, this moisture and

the temperature immediately become optimum for germination of mildew spores and, apart from drying the materials properly and salvaging what you have, there is a responsibility first to kill those fungus spores by fumigation.

This survey treats only some of the problems we face as custodians of library materials. The technical aspects of restoring materials are subjects only for the skilled specialist. No librarian or library assistant should attempt to take major corrective measures on his own. To do so can cause greater damage — even loss — of precious materials. The important thing is to know the areas of risk, the destructive agents, and where to turn when help is needed. Conservation of these materials, as opposed to restoration, means rejection of impermanent papers of any kind, of damaging adhesives, and avoidance of undue exposure of materials to ultraviolet light. Give humidity control a higher priority than air conditioning. Take a personal responsibility for the treasures in your charge so they may be available to tomorrow's scholars.

George H. M. Lawrence
Director,
Hunt Botanical Library

Notes on the Genus *Ilex* Linnaeus

The American Horticultural Society and the Holly Society of America are going to publish a revised edition of the *Handbook of Hollies*. For the revision of the chapter on Eastern Asian Hollies, I found it necessary to publish the following notes in advance.

Name Change

Since the publication of the *Handbook of Hollies* in 1957, a species of *Ilex* has been introduced into the United States of America under the name *Ilex insignis* Hook. f., first by Mrs. F. Leighton Meserve from Sikkim, and again by Dr. F. G. Meyer from gardens and nurseries of England. These materials have been used in holly hybridization in America. Since Hooker's specific epithet is a later homonym, its use should be discontinued. The correct name is *Ilex nobilis* Gumbleton, which is not listed in the *Index Kewensis*. The nomenclatural history of this species is as follows:

Ilex nobilis Gumbleton, Gard. Chron. III. 1: 177. 1887.

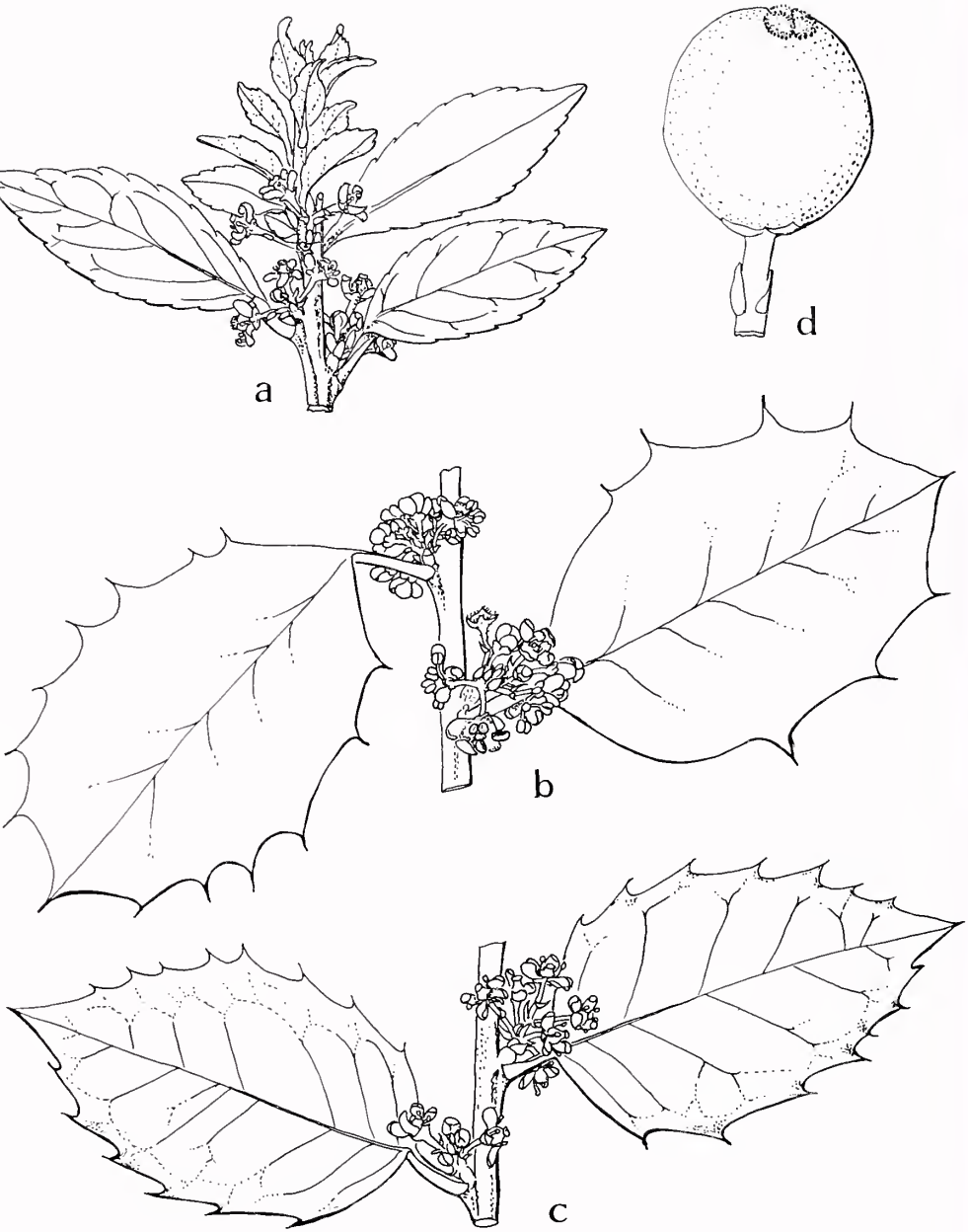
Ilex insignis Hook, f., Fl. Brit. Ind. 1: 599. 1875, non *Ilex insignis* Heer, Fl. Foss. Alask. 37. t. X. 1869.

Ilex kingiana Cockerell in Torreya 11: 264. 1911.

In a short article on "Hardiness of *Ilex nobilis* or *insignis*," Gumbleton gave the origin of the plant: "a native of the Darjeeling hills." He also characterized it as having "leaves from 10 to 11 inches long, of a rich deep shade of green, and deeply toothed along the edges." Regarding hardiness he said, "when grafted on a stock of common holly . . . it becomes almost, if not perfectly hardy."

A New Hybrid

Recently several members of the American Holly Society have tried to produce hollies of distinct horticultural merits by hybridizing species from widely separated phytogeographical regions. In the United States National Arboretum, Mr. William Kosar has produced many interesting new hybrids. In St. James, Long Island, New York, Mrs. F. Leighton Meserve has had wonderful results in hybridizing Asiatic species with the English


a
d
b
c

Holly, *Ilex aquifolium* L. So far as I know, only two clones selected from one hybrid population of the Meserve products are in the market. These have been distributed by Jackson & Perkins Co. since 1964. For inclusion of this hybrid in the revised edition of the *Handbook of Hollies*, it is necessary to name and describe it properly.

Ilex × meserveae (*I. rugosa* F. Schmidt × *I. aquifolium* L.), S. Y. Hu, hyb. nov.

Frutex ramosus, 1–2 m. altus; ramulis erectis vel patentibus, hornotinis sparse puberulis; foliis ovatis vel ellipticis, 1.8–5 cm. longis, 0.7–3 cm. latis, margine spinoso-dentatis, basi rotundatis, acutis vel obtusis, apice acutis et spinosis, coriaceis, costa media et nervis lateralibus supra impresso-insculptis; inflorescentiis fasciculatis, axillaribus; floribus 4-meris; fructibus rubris, globosis, 8 mm. diametro; pyrenis 4, subsemiellipsoideis, 4 mm. longis, dorso 2.5 mm. latis, lignescentibus durescentibusque.

Specimens examined (all deposited in the Arnold Arboretum); Group A. F_1 hybrids of *I. rugosa* (I) × *I. aquifolium* (I): *S. Y. Hu 7792*, a compact shrub 1.5 m. high; leaves ovate, spinose; flowers white (May 4, 1964), fruit red (Dec. 31, 1964); nursery name 'Blue Girl' (Type, AA) (Plant Patent 2434)[1]. *S. Y. Hu 7793*, a selection from the same hybridization, nursery name 'Blue Girl 2'; endosperm of fertile seeds white like coconut meat. *S. Y. Hu 7794*, a compact shrub, ca. 1 m. high; leaves ovate, deep green, spinose, the nerves insculped above; flowers white, fragrant (May 4, 1964); nursery name 'Blue Boy' (Plant Patent 2435)[2]. *S. Y. Hu 7796*, a staminate plant with elliptic leaves, 5–8 spines on each side. *S. Y. Hu 7797*, a staminate plant with ovate spinose leaves; nursery name 'Yellow Boy'. *S. Y. Hu 7798*,

[1] *American Nurseryman* 120 (7): 109, 1964.
[2] *American Nurseryman* 120 (7): 106-107, 1964.

Fig. 2: a. *Habit sketch of the seed parent,* Ilex rugosa *F. Schmidt, showing the crenulate serrate leaves, few-flowered inflorescences, and conspicuously impressed veins* (S. Y. Hu 7810). *Scale: X1.*
b. *Habit sketch of the pollen parent,* I. aquifolium *L., showing the oblong sinuate spinose leaves, many flowered inflorescences, and rather inconspicuous mid-ribs and lateral nerves* (S. Y. Hu 7811). *Scale: X1.*
c. *Habit sketch of* Ilex x meserveae *S. Y. Hu, showing the spinose leaves, abundant flowers, and conspicuously impressed veins* (S. Y. Hu 7792). *Scale: X1.*
d. *A fruit of* Ilex x meserveae. *Scale: X3.*

a staminate plant with ovate spinose leaves 3–3.5 cm. long, 1.7–2.3 cm. wide, base rotundate; nursery # 4–53. *S. Y. Hu 7799*, a staminate plant with small elliptic leaves 2–3 cm. long, 1.2–1.6 cm. wide; nursery # 1–57. Group B. F_1 hybrids *I. rugosa* (I) × *I. aquifolium* (II): *S. Y. Hu 7795*, compact shrubs with elliptic strongly spinose leaves; nursery numbers M–3 for the staminate plant, F–1 for pistillate plant. *S. Y. Hu 7800*, a very compact staminate plant with small elliptic spinose leaves, 1.8–3 cm. long, 0.7–1.5 cm. wide, acute at the base; nursery # 2–57. *S. Y. Hu 7802*, a pistillate plant with rather large elliptic spinose leaves 3–4.5 cm. long, 1.3–2.3 cm. wide, green with purplish tint; fruits abundant, pyrenes all fertile; nursery # F–1. *S. Y. Hu 7803*, a pistillate plant with elliptic spinose leaves 2.5–3.5 cm. long, 1.3–2 cm. wide, base acute or obtuse; fruits sometimes in cymose clusters, nursery # F–2. *S. Y. Hu 7804*, a staminate plant with weakly spinose elliptic leaves 3.5–4.5 cm. long, 1.4–1.9 cm. wide, approaching the shape and spines of the leaves of *I. ciliospinosa* Loes.; nursery # M–5. *S. Y. Hu 7805*, containing two branches, one a staminate plant and the other a pistillate plant, both with rather large elliptic leaves, strongly spinose, 3–5 cm. long, 1.7–2.5 cm. wide; nursery numbers F–2 for the pistillate plant and M–4 for the staminate plant. Group C. F_1 hybrid of *I. rugosa* (II) × *I. aquifolium* (I): *S. Y. Hu 7801*, a very compact staminate plant with elliptic or oblong spinose leaves 2.5–3 cm. long, 1.1–1.8 cm. wide, base acute or obtuse; nursery # 2–58. Group D. F_1 hybrids of *I. rugosa* (I) × *I. aquifolium* (III): *S. Y. Hu 7806*, a pistillate plant with elliptic weakly spinose leaves rather loosely arranged on the stem, 3–4.5 cm. long, 1.3–2 cm. wide, base acute, rarely obtuse, approaching the appearance of *I. ciliospinosa* Loes.; fruiting pedicels rather long, almost equal to the diameter of the fruit in length. *S. Y. Hu 7807*, vigorously growing pistillate plant shy of flowering and with rather large elliptic spinose leaves, 5–5.3 cm. long, 1.8–2.3 cm. wide, obtuse at the base, 5–10 spines on each side. Group E. F_1 hybrid of *I. rugosa* (II) × *I. aquifolium* (II): *S. Y. Hu 7808*, a staminate plant with elliptic leaves strongly spinose, 3–4 cm. long, 1.1–1.6 cm. wide, base obtuse or acute; nursery # 1–58. Group F. Parent plants: *S. Y. Hu 7809*, *Ilex rugosa* F. Schmidt (I), a low shrub ½ m. high, top flat, with elliptic or ovate-elliptic crenulate-serrate leaves (Fig. 2a), glabrous stem and pedicels; said to be introduced from Japan by the Arnold Arboretum, 6 plants went to the Westbury Rose Company, Long Island, New York. Paul D. Vossberg, Propagator of the Company gave Mrs. F. L. Meserve one plant which became the mother

of many of her hybrids. *S. Y. Hu 7810*, the flowering stage of the same plant. *S. Y. Hu 7811*, a staminate plant of *Ilex aquifolium* L. (I), small tree 3 m. high, with purplish puberulent branchlets, pilose peduncles and pedicels, ciliate calyx lobes; oblong sinuate strongly spinose leaves (Fig. 2b). *S. Y. Hu 7812*, a staminate plant of *I. aquifolium* L. (III) with puberulent branchlets, rather large elliptic or rarely obovate leaves 5–8 cm. long, 2–4.3 cm. wide, strongly spinose with 4–9 spines on each side.

From the material cited above, it is apparent that *Ilex* × *meserveae* includes many F_1 hybrids made between *I. rugosa* and *I. aquifolium* which have rather small spinose leaves, fasciculate puberulent inflorescences, ciliate calyx lobes, and red globose fruits with 4 woody pyrenes each.

For the seed parent, the hybridizer used two plants of *I. rugosa* which she called 'Long Island' = (I), and 'Arnold Arboretum' = (II), and for the pollen parent she used three plants of *I. aquifolium* which she called 'Lawrence White' = (I), 'Fisher's Island' = (II), and 'Goliath' = (III). All the plants of the F_1 generation acquire the characters of low stature and the impressed nerves on the upper leaf-surface from the seed parent, and the characters of spinose leaves, puberulent stems and inflorescences, and abundance of flowers from the pollen parent.

There are two distinct leaf-forms, i.e., plants with ovate leaves and plants with elliptic leaves. The clones in the market, *I. meserveae* 'Blue Girl' (Plant Patent 2434) and *I. meserveae* 'Blue Boy' (Plant Patent 2435) both have ovate leaves.

SHIU-YING HU

Notes from the Arnold Arboretum

One of the most satisfactory and remarkable of the conifers which are hardy at the Arnold Arboretum is the Serbian spruce, *Picea omorika.* The Arboretum introduced this tree into cultivation in the United States as long ago as 1881 and, despite its availability in nurseries today, it is still not planted as frequently as it should be.

The outstanding feature of the Serbian spruce is its narrow and nearly columnar habit of growth. Well grown specimens can be easily recognized from a considerable distance and stand out from all other trees in the landscape in much the same manner as the less desirable Lombardy poplar.

Young plants have a pyramidal shape not unlike many other conifers, but they grow fairly rapidly and taper more and more with age until the spire-like habit of the older tree is reached. A distinctly graceful touch is added by the position assumed by branches on various parts of the tree. The lower branches are pendulous with upward arching tips, those in the middle are more nearly horizontal, and the shorter topmost branches point in an upward direction.

A close examination will reveal several other interesting features. The needles are flat in cross section, not four-sided as the needles of most other spruces. Further, they are a deep glossy-green above and whitish below. This pleasing contrast is easily seen as the branches move in the wind.

To extend the list of virtues which the Serbian spruce possesses, one must add that it is extremely hardy and can be expected to thrive where temperatures reach −10°F. or lower. A modern plant in every sense of the word, it will tolerate a considerable amount of atmospheric pollution and grow on a fairly wide range of soil conditions, even near the sea.

Fig. 3: Picea omorika *at the Arnold Arboretum. Photo: P. Bruns.*

Young plants have been reported to suffer occasionally from attacks of the white pine weevil, an insect which causes serious damage by boring into the terminal shoots. Although this a difficult problem to control, it has not stopped us from planting white pines and should not be that important a factor in limiting the desirability of the Serbian spruce.

Careful consideration should be given to the placement of *Picea omorika* in the landscape. It is best seen as a single specimen or as a group planting in the distance. It is a mistake to place it too close to other large plants because shading will eventually cause the loss of lower branches. This should also be taken into account when making a group planting and, where possible, a minimum space of twelve to fifteen feet between plants is desirable.

Several excellent specimens of the Serbian spruce may be seen in the Arboretum at the top of the slope occupied by the conifer collection in Kent Field. Six of our plants are over eighty years old, and fifty to sixty feet in height.

ROBERT S. HEBB

Summary of weather data recorded at the Dana Greenhouses, December 1969 and January 1970.

	Precipitation	Avg. 8 a.m. Temp.
December	10.14	28.2
January	1.07	16.1

Editors' note: We regret that, in our anxiety to produce an error-free issue in January, we left Mr. Fordham's name off the staff list.

Arnoldia Reviews

Dr. Alexander Garden of Charles Town, by Edmund Berkeley and Dorothy Smith Berkeley

The Quest for Plants, by Alice M. Coats

The Early Horticulturists, by Ronald Webber

The past decade was one of the most productive of this century in horticultural publishing as witnessed by the scores of titles from both sides of the Atlantic. The history of horticulture has come in for special attention during this period. In the last months of 1969 two titles appeared which should be of very great interest to the American horticultural audience. The third, though published in 1968, merits attention here.

The first of these is the biography of a Scottish naturalist and doctor, Dr. Alexander Garden, who practiced medicine in Charleston between 1752 and 1782. As he had supposed as a youth, Dr. Garden found ample opportunity to flourish in the New World. After thirty years' residence he had accumulated a town house and plantation, twenty-five household slaves, and debts due him of nearly sixty-five thousand pounds sterling. In addition to family duties, a heavy medical practice, and the burdens of Establishment status, Dr. Garden managed to collect and send specimens to Linnaeus, Gronovius, and Ellis. He maintained a lively correspondence with these men and with Bartram and Collinson. Since he was a Loyalist, Dr. Garden was banished from South Carolina in 1782. He was not to return to America or to his beloved Otranto, the plantation celebrated in George Ogilvie's "The Planter." The relationship between Dr. Garden and his son, along with his origins in Scotland — both of which have been mythologized (see U. P. Hedrick's *A History of Horticulture in America*) — have been clarified in this book. A convincing case is made here that, if allowed to remain, Dr. Garden might have contributed much toward the foundation of learning in the South. His scholarship and intimate familiarity with the Linnean system could have

meant much to the fledgling studies of the natural history of the New World.

Already acclaimed for their biography of John Clayton, Edmund and Dorothy Berkeley have done more than add another carefully researched and engaging story to American history, for they have snatched from almost total obscurity an American naturalist long ago given his due by Linnaeus and his eighteenth century contemporaries. Dr. Garden, whose burial place is still unknown, is commemorated by the genus *Gardenia*.

With admirable tenacity, Alice Coats has produced a work, encyclopedic in scope, which should find a wide readership among horticulturists in the United States. The concern here is with plant collectors who were professional gardeners but, fortunately for the value of the book, gardeners who botanized are included. The author divides the world into ten areas and procceds chronologically to give capsule histories, both personal and professional, of one hundred and seventy-two collectors and their significant introductions. Of particular interest to American gardeners will be those New World collectors from Tradescant II through Lyon in the east of North America, to Fremont through Jeffrey in the west. The incredibly bad luck and physical discomforts of many of these explorers are difficult to imagine in our day of partial technological control over nature.

There are twenty-six excellently reproduced illustrations from original portraits, engravings, and maps. The six-page bibliography is excellent, although periodical citations have been omitted. There are both person and plant indices. The latter contains over a thousand plant names which include many of the favorites of garden and greenhouse today. Every gardener can use this work to enhance his knowledge by sharing the experiences of the discoverers.

Less exhaustive and weighted toward commercial gardening, the short history by Ronald Webber presents vignettes of thirteen horticulturists of England from the seventeenth through the nineteenth centuries. Readers will be delighted with the story of the development of such firms as Rochford's in the Lea Valley; the success of Robert Smith, an outstanding market gardener; Thomas Smith, who introduced the intensive cultivation techniques termed "French gardening" to England; Wills and Segar, the flower supplier to the Court. The introductory chapter is devoted to an essay on English horticulture to 1900. Here we learn of the development of the greenhouse and of the influence of Dutch, Flemish, and Walloon emigrants of the eighteenth century on the course of English horticulture.

All three of these works are remarkably free from gross or trifling errors. All the authors are to be congratulated on the quality of their works in three neglected areas. Serious gardeners and the public at large will want to consult each while winter-time still abounds.

C. R. L.

Edmund Berkeley and Dorothy Smith Berkeley, *Dr. Alexander Garden of Charles Town*, Chapel Hill: The University of North Carolina Press, 1969. $10.00.

Alice M. Coats, *The Quest for Plants*, London: Studio Vista, 1969. 84/.

Ronald Webber, *The Early Horticulturists*, Newton Abbot: David & Charles, 1968. 40/.

The powers-that-be at the American Museum of National History in New York decided to celebrate the institution's centennial, 1869–1969, with the theme "Can Man Survive?" and a show of the same name. The decision is thought-provoking, as is the somewhat circumstantial and recent arrival of a moon rock which is on display nearby, in cunning juxtaposition. The moon rock, by the way, is very pretty.

"Can Man Survive?" launches a multi-media attack on pollution, over-population, and other evils of modern and, particularly, urban civilization. Because of the special character of the show, the Museum built a temporary exhibition area in the huge main hall off the Eighth Avenue entrance. The performance goes on inside this ungainly structure, and it is really very well done. One progresses through a series of spaces, sees films which are continuous, informative, and brief enough to fend off boredom or physical fatigue. There are also slides projected onto interesting forms, "Pop" style industrial sculptures, and occasional things to read. Most people were observed to neglect the latter because the light is variously dim or confusing. The last section of the show, devoted to air pollution, is wonderfully effective. Slides of garbage, spewing chimneys, traffic jams, and other offensive scenes flash on and off in controlled chaos;

there is a full-scale model of the rear end of a New York bus; the pungent odor of hydrogen-sulfide fills the air. (I am, frankly, mystified as to how they managed to isolate the odor in a single area.) The exit is dramatic and, like the end of a Hitchcock movie, should not be spoiled for those who have not yet seen the show.

"Can Man Survive?" surveys the problems of air and water pollution, food and population, and upsets in what is left of our natural environment. While the content of the show may seem elementary to those familiar with the current literature, it is well to remember that most people do not realize that these *are* problems. The Museum has found a compelling, appropriate form in which to publicize them, and this show will undoubtedly win sympathy for cleaner air, purer water, and birth control.

My single objection to the presentation is that the Museum has found it necessary to charge ad admission fee of $1.00 for non-member adults (50¢ for children). This is a great pity because the cost excludes a number of people who simply cannot afford it. Many New York children take profitable refuge in the Museum on cold afternoons and would find much to amuse and educate them in this show. Minor compensation: the moon rock is free.

In a brochure which accompanies the show, Gardner Stout, President of the Museum, writes: "That man will survive is likely. When the chips are down, he is astonishingly adaptable, cunningly expert. But the concept of survival by itself is a minimal and chilling one. Survival can be appallingly rudimentary. Our concern is with the quality of survival, and our hope is that this exhibit will nourish in all of us a sense of self-evaluation, of self-perspective, and primarily a sense of the good life."

If you are in New York, see "Can Man Survive?" It will be there through 1970.

S. S.

Fig. 4: Galanthus caucasius. Photo: P. Bruns.

Lecture Series: "Meet the Staff"

In the fall of 1968, the Arnold Arboretum instituted a series of talks by some members of the staff. This spring's program will allow six more members of the staff to speak about subjects that interest them as well as you.

Time: 8 P.M., Tuesday evenings: March 24 to April 28, 1970

Place: The Schoolhouse, 133 Wellesley Street, Weston, Massachusetts

March 24: *In Panama with the Colorful San Blas Indians*
Thomas Elias, Ph.D., Assistant Curator

March 31: *Plants and Birds of Some Central Pacific Islands*
Charles R. Long, A.M., Librarian

April 7: *American Gardens*
Donald Wyman, Ph.D., Horticulturist

April 14: *A Plantsman in the British Isles*
Robert S. Hebb, B.S., Assistant Horticulturist

April 21: *In the Mountains of Jamaica*
Dulcie A. Powell, M.A., Botanist

April 28: *Two Sides of Everest*
George H. Pride, M.A., Associate Horticulturist

Refreshments will be served at 7:30 P.M., and the lecture will begin promptly at 8. Please park in the areas indicated behind the barn. Limited space makes it necessary to restrict the size of this group to 30 members.

This series requires a registration fee of $5.00 for Friends of the Arnold Arborteum*; $10.00 for others. Any member of the immediate family of a "Friend" may register for these meetings but a registration fee of $5.00 must be paid for each person.

* Information on how to become a "Friend of the Arnold Arboretum" can be obtained by writing or calling the Arnold Arboretum, Arborway, Jamaica Plain, Massachusetts 02130. Telephone: 524–1717.

1970 Spring Classes of the Arnold Arboretum

Practical Gardening for the Homeowner *Mr. Robert S. Hebb*

This series is designed to teach gardening skills as they relate to plantings usually found around the home. Although it will be a continuation of the course presented last fall, more emphasis will be placed upon supervised practical work, utilizing the various plantings at the Case Estates in Weston. Newcomers are welcome.

Five classes: Wednesdays April 29–May 27, 2 to 4 P.M.

Field Class in Ornamental Plants *Dr. Donald Wyman*

The month of May is the peak of the flowering period for most of the trees and shrubs in the Arnold Arboretum. Field classes will permit observation of most plants as they come into flower. Discussions will include an evaluation of many plants, with suggestions on their availability, culture, and proper use. In case of rain, the meetings will be held indoors.

Five classes: Fridays May 1–29, 10 to 12 A.M.

Each of the above 2 series of talks requires a registration fee of $5.00 for Friends of the Arnold Arboretum; $10.00 for others.

Elementary Techniques of Bonsai *Mrs. Ara R. Derderian*

This series will consist of three two-hour lectures during which the basic principles of bonsai will be explained, such as soil preparation, potting-up procedures, pruning techniques, and general design. The last Saturday will be an all-day workshop at which participants will be given a small tree and a container to make a bonsai of their own. Classes will be conducted at the Dana Greenhouses at the Arnold Arboretum.

Saturdays May 2, 9, 16, 10 A.M. to 12 Noon
Saturday May 23, 10 to 3 P.M.

The above course requires a registration fee of $25.00 for Friends of the Arnold Arboretum; $35.00 for others.

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ARNOLDIA

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Contents

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On the cover: Malus *'Katherine' at the Arnold Arboretum. Crab apple cultivar named by Donald Wyman and distributed by the Arnold Arboretum. Photo: H. Howard.*

Horticulture at the Arnold Arboretum, 1936-1970

The new editors of Arnoldia *take real pleasure in dedicating this issue to Dr. Donald Wyman, Horticulturist at the Arnold Arboretum, who will retire from active service to the Arboretum in August of this year. For most of the past thirty-five years, Dr. Wyman has been largely responsible for the care and maintenance of the living collections of the Arnold Arboretum. During this period he has also advanced the knowledge and appreciation of hardy woody plants by the horticultural public through his books and through his articles, published in* Arnoldia *and elsewhere. We observe with satisfaction that he has received many symbols of recognition of his activities from both European and American horticultural societies.*

Since 1936 Donald Wyman has been intimately associated with Arnoldia, *as author and editor. It is only fitting, then, that this issue should contain a condensation of a longer report that he has written as a record of his horticultural activities at Jamaica Plain and at the Case Estates of the Arnold Arboretum in Weston. — Ed.*

After the deaths of Charles Sprague Sargent, in 1927, and Ernest H. Wilson, in 1930, staff interest in horticulture at the Arboretum was at an all time low. For the next several years plantings made under the direction of these two men were considered sacrosanct and were not changed or removed. When the author was appointed Horticulturist in 1935 he found that there was much work to be done. At that time interest seemed to be directed primarily to fields other than popular horticulture. Planting of the grounds as well as the introduction of seeds, plants, and cuttings had continued chiefly because of the interest of William H. Judd (the former propagator), but it had become obvious that space for the display of new materials on the grounds was in short supply. Some of the trees, notably the caryas, had originally been set out to simulate forestry plantings. They had become overcrowded. In some other areas many old trees, in poor condition, had not been removed merely because they had been placed by either Sargent or Wilson. Finally, plants which had been unidentified when set out remained unidentified.

Because of the lack of staff interest in the living collection, the card index of plants on the grounds had not been properly

checked for many years. As a result, there was no true record of what plants were actually alive. It became obvious that the only way to remedy this was to map the grounds thoroughly, an operation which took the full time of two men for nearly two years. When this job was finished, in 1938, the card files were brought up to date. It was then easy to see the large number of duplicate plants of some species which had been planted over the years. Since that time the planting of new plants and removal of old ones has always been carefully integrated through the mapping department, and all files and the master set of maps are kept up-to-date. This entails several closely unified operations done by one individual. These operations are absolutely necessary if the collections are to be kept the best labeled and mapped anywhere in the United States. When the big hurricane of 1938 blew down 1500 trees in the Arboretum, it was obvious, even to the most critical observers, that judicious

Fig. 1: Donald Wyman at the Arboretum, 1950.

thinning out of old and decrepit specimens could add much to the beauty of the grounds. At this time the Horticulturist took careful steps in this direction.

With the increased interest in the grounds on the part of the staff after 1938, another change in planting policy was made. The old method of planting only in botanical sequence or in botanical groups was not followed as rigidly as it had been before. When valued ornamental species or varieties would show off well at a turn of the road, on a bank, or as a focal point at the end of a vista, such planting was done regardless of where the plants entered into the botanical sequence.

Good color charts became available at this time. As a result, in the early 1940's, studies were made of the large collections of *Syringa, Weigela, Philadelphus, Deutzia, Chaenomeles, Malus, Spiraea*, etc., in order to make reasonably certain that the hundreds of varieties in these genera were properly labeled. This was not the easiest thing to do in groups with large numbers of hybrid varieties, but it was done by the Horticulturist and Assistant Horticulturist (Heman Howard), and checkups of these groups in the past two decades have been greatly hastened by the painstaking work done earlier in the 1940's.

Many of the plants which had gone unlabeled for many years were excellent specimens. Until his retirement in 1948, Ernest Palmer had the task of collecting herbarium specimens of them, adding the individual plants to the accession records, and identifying those that he could with the assistance of Alfred Rehder. Large numbers of previously unlabeled plants were soon properly tagged and recorded. However, the identification of many other plants is a difficult task that is still to be done.

After studying our records, the Weather Bureau temperature records, plant injuries after the severe winters of '34–'35 and '42–'43, and redrawing the Arboretum hardiness map, it became evident that it was a waste of propagating time and display space to continue to plant shrubs, trees, and vines which experience had shown were not completely hardy. Consequently, all Zone VII plants, and many of those hardy in Zone VI — especially if they had been repeatedly injured by winter cold — were removed from the collections and have not been grown again. This policy was formulated in the mid 1940's. Now, with more nursery space available in Weston, plants in the doubtful category — i.e. clones supposedly more hardy than the species — can be tried. It is not necessary to give such plants valued display space in the living collections until their hardiness has been proved in the nurseries.

During the war years of 1941–45 the plantings suffered from lack of attention. Part of the time there was no one in the labeling department, and labeling was almost completely neglected. General maintenance was at an absolute minimum, and little pruning was done, a fact which was especially noticeable in the rhododendrons, which quickly became lanky and overgrown. After the war it was necessary to adopt a heavy pruning program. The rhododendrons were severely reduced in size, but they came back into fairly good form after only a few years.

With a developing interest in economic botany, land of the former Bussey grounds at the corner of South Street and the Arborway was assigned, in 1941, to the Massachusetts College of Pharmacy for a display garden of medicinal plants. This plot was maintained until the late 60's when the land was taken by the State for the Blood Laboratory. A crab apple survey was made by the Horticulturist at this time, and *Crab Apples for America* was first published in 1943.

In 1944 an estimated seventy-five fires occurred on the grounds. It was noted that many of these occurred in the fall in the old *Crataegus* collection on Peters Hill. Here the trees grew close together, mowing was difficult, and the grass, especially under the trees, grew tall. These factors prompted the consideration of removal of the major part of this collection — accomplished in 1948–49 by means of a special donation from John S. Ames. The area was then fertilized and plowed, and a special creeping red fescue grass mixture originally used in Rhode Island was sown. This grass stayed green much later in the fall and did not burn as readily as the previous grasses. Also, the crab apple trees which were planted on the hill were spaced so that mowing could be easily accomplished. This operation materially reduced grass fires in this area.

In 1954 the crab apple collection was extended across the road from the hill to the area beside the railroad tracks formerly occupied by a collection of poplars. Since poplars are short-lived, susceptible to disease, easily blown over by storms, (and none too ornamental), it was decided to reduce this collection to a minimum and replant the area with crab apples which would be a colorful sight for those many daily commuters on the adjacent railroad.

Landscaping

Since 1880, when the grounds were originally laid out by Frederick Law Olmsted, no landscape architect had been responsible

for any major planning, although many had tried to obtain permission to become consulting landscape architects. In 1946, near the end of his administration, Dr. E. D. Merrill was prevailed upon to appoint Mrs. Beatrix Farrand as the landscape architect for the Arboretum. It was most unfortunate that, even with her extensive experience, she sometimes failed to comprehend the practical needs of the Arboretum. One of her most successful suggestions was the azalea border along the Meadow Road, planted in 1949. However, when she recommended that the shrub collection be removed and the shrubs planted in small groups in the same area, it became obvious to both Dr. Merrill and Dr. Karl Sax that some of her ideas, if carried out, would cost far too much in day-to-day maintenance.

It has always been my strong conviction that landscape planning should be left to those on the staff who have had landscape training and who understand the diverse practical problems of maintaining the plantings. The landscape architect's contribution comes in planning the original lay-out, not in revamping an arboretum such as this after it is tightly planted.

In practice, the Horticulturist and the Superintendent (Robert G. Williams) have been responsible for the policies governing the care and placing of the plants since 1940. Prior to this time a "committee of three" had been appointed by Dr. Merrill, but it is most difficult for someone without horticultural training to work smoothly in a practical situation. In any event, the "committee of three" did not work satisfactorily, so the Horticulturist and the Superintendent took it upon themselves to move and place plants at the proper times. They decided, for example, on a long-range lilac planting plan by which, eventually, the 100 best lilacs would be located between the road and the walk in the lilac collection. Many mediocre to poor varieties have had to be removed in the years since, and the better ones have been placed here and at the base of the bank on the other side of the walk.

Introduction and Distribution of New Plants

The introduction of new plants into the Arboretum has always been the prime responsibility of the Horticulturist. Each year seed lists sent from botanical gardens and arboreta all over the world are scrutinized for new plants, and requests are sent for seed of those we do not have and which give promise of success under our conditions. Unfortunately the germination of much of the seed received has been most disappointing. The Horticulturist noted, as early as 1939, that a surprisingly small per-

Fig. 2: Foreground, Rhododendron yedoense *var.* poukhanense; *center,* Cytisus praecox. *Photo: H. Howard.*

centage of seed obtained from foreign sources was viable. Botanic gardens were to blame as well as botanists collecting in the field. Many an institution has not learned that seeds of many plants need special treatment as soon as they are ripe if they are to retain their viability. The practice has been to collect all seed, dry it, and store it until such time as complete shipments could be made. As a result, for example, only 8% of 585 seed packets received from the Yu Expedition in China (1938) had seed which germinated. This represented a great loss to the collector and also to the Arboretum, which had to process all of these seeds. An issue of *Arnoldia* (vol. 13:41–60, 1953) was written and sent to collectors and certain botanic gardens, explaining the viability of seeds and listing those which should be handled in specific ways to ensure germination. There is still missionary work to be done in this field with many botanic gardens.

All too many institutions list seed which will not come true.

Seed collected from clones, for example, is unlikely to produce plants like the parent. Much seed collected in botanic gardens will not come true to name because of the great incidence of cross-pollination in large collections of related plants. Much of this seed will produce hybrids, and one must recognize this fact. Also, in some collections, the parent plants are not accurately named. It is extremely important that seedlings resulting from such seed be carefully re-identified as they mature and be withheld from display collections until their identity is certain.

Every few years the Horticulturist has requested the latest catalogues from what he considers to be the best nurseries in the country. These have been searched carefully for new plants. The nursery industry is extremely lax in using proper nomenclature, so one must always be on the lookout for synonyms as well as for the nursery which has a penchant for placing new or queer names on old, established varieties. In the past thirty-four years well over 98% of the nurseries approached have been glad to donate new plants for trial in the Arnold Arboretum. Sometimes it has seemed advisable to request propagation wood only of plants in short supply, since we are well equipped to handle any type of woody plant propagation.

The record for three recent years, in which the Horticulturist located nursery sources for species and varieties of woody plants which were not represented in the collections at the time, shows the following:

1958–59	380 species and varieties
1959–60	480 species and varieties
1960–61	586 species and varieties

Specific requests were made for all these plants.

Correspondence often turns up new plants because many of our correspondents know of our interest and are anxious to report novelties to us as soon as possible. Frequently the Arnold Arboretum combines with other institutions in subsidizing, or partially subsidizing, collecting trips to various parts of the world. These trips may result in collections of seeds as well as specimens for the herbarium. If the seeds or plants we receive from such expeditions are known not to be hardy here, they are given to other botanical gardens in warmer climates.

All staff members are always on the lookout for new plants. The Horticulturist has made three trips to Europe, searching in the larger private gardens and botanical gardens for new material or for varieties once grown at Jamaica Plain but lost for some reason or other. The trip in 1951 netted about 500 species

and varieties, and the trip in 1965 resulted in the introduction of 930 species and varieties. Many of these were introduced into the United States for the first time. Although such plant introductions often go unrecorded as far as the American horticultural press is concerned, the Arnold Arboretum has a long record of activity in this field. This activity is not being neglected even now when individual "plant hunting" in the Orient is largely dormant.

There are many pitfalls connected with such a program of plant introduction. All of the plants so introduced do not live. Some plants are in poor condition when they arrive, others prove not to be hardy. The Propagator must exert extreme care to propagate these new acquisitions as soon as possible, so that at least a few have a chance to grow into sturdy specimens. Though not always possible, this is always the objective.

It is one of the chief functions of the Arboretum to see to it that worthy new plants which it has introduced are distributed in America and in other parts of the north temperate regions of the world. Propagating material is always available to other scientific institutions if our plants are large enough. It is available to most commercial growers if the plants requested are unavailable elsewhere and if the particular nursery concerned eventually works up its own propagation stock from what we send.

Many years ago it was decided that Arnold Arboretum plants would not be used as a stock block for commercial growers who requested the same things year after year. On rare occasions the Arboretum does supply propagation material of commercially grown plants to certain growers who are interested in obtaining "true-to-name" plants (i.e. certain varieties of lilacs, crab apples, weigelas, etc.). The amount of propagation material given is usually reasonably small — a dozen cuttings may be offered rather than the 1,000 that some commercial growers request. No plants or plant materials are sold.

No seed list is published. Rather, the responsibility is on the individual plantsman to request specific things at the right time or to write in advance of seed collecting time. It has been felt that a lengthy seed list would only whet the appetite of lazy growers who figure that checking them is the easiest way to obtain plants. This would create considerable extra work for the hard-pressed Arboretum staff. It is best to rely on the truly interested individual to ask for specific plant items. We also attempt to inform those people who obviously do not know that seed of particular items they have requested is likely to prove to be of hybrid origin and will not yield true-to-name

plants. Most plantsmen know this, but there are many who do not. Crab apples are a case in point. We dislike to see stock of *Malus arnoldiana*, for example, offered in a nursery catalogue as coming originally from the Arnold Arboretum, when we know that the original propagating material was seed.

Plants are offered by the Arboretum to nurserymen with the understanding that they may be neither patented nor sold. Propagations from these plants, however, can be sold. In our regular program of plant distribution, started in 1941, ten to a dozen species and varieties are offered each year. The Horticulturist writes a paragraph about each, noting its prime ornamental properties, the ease of propagation, and the length of time it takes to produce salable plants. Nurserymen have been selected, throughout this country and Europe, and asked if they wish to participate in the program. They are not urged to take any plants, but to request those that they think might fit well with their customer requirements. Usually three to six plants of a kind are given to the nurserymen. Sometimes, with easily propagated plants, seeds or cuttings are offered. To qualify for this program, the "Cooperating Nurserymen Program," a nurseryman must publish a catalogue and do business on a national scale. One hundred and ninety-six plants have been offered in this program since it was initiated. Most of these species and varieties are now listed in the catalogues of many commercial nurserymen throughout the country.

From 1936 until 1945 the nursery area for the Arboretum was a small plot of ground beside the State Laboratory Building on the old Bussey Institution property. There was also an area with a board fence on three sides next to the greenhouse, where some of the less hardy plants were wintered. At one time posts were erected and a lath roof constructed to reduce light intensity in summer. There was also one "cold pit" (about 50′ × 8′) where material could be wintered over. When the Commonwealth "took" the major nursery area in 1945, giving only a week's notice for plant removal, an additional nursery was made on the South Street tract, but the area, not properly fenced in, proved to be susceptible to vandalism.

In 1942, with the acquisition of the Case Estates in Weston, plenty of nursery space became available. In 1962, when the new Dana Greenhouses were built, a relatively large nursery area was developed adjacent to them. The policy established at this time was to grow on all recently propagated plants for a number of years in the Dana Greenhouse nursery and then to move them out to the Case Estates for further growth. This move is always done in the spring so that the plants have a

growing season to become accustomed to the new conditions. The nursery at the old greenhouse on the Bussey land generally held several hundred species and varieties at one time. Today the nurseries at the Case Estates alone may contain as many as 2,000 species and varieties.

When it came to making the nursery area at the Dana Greenhouses, we found that the heavy equipment used in the greenhouse construction had compacted the soil to such an extent that the water drainage was impaired. After the original planting in 1962 the nurseries had to be completely redug, the top soil moved away, and twenty inches of gravel put in. A tile drain was laid, the top soil was replaced, and the drainage has been satisfactory ever since.

Labor

On July 2, 1935, the Arboretum employed fourteen men on the grounds crew and met a payroll of $360.00 for a fifty hour week. In 1969 we had a crew of approximately twelve with a payroll of $1,450.00 for a forty hour week — or 220 man hours per week less than in 1935. In the interim supervisory staff have done everything possible to acquire the best machines, to use the best chemicals for weed killers and spray materials, and to improve general working practices to reduce hand labor. Much has been accomplished in this field. However, one example of maintenance problems is the following: In 1936 the Arboretum was *paid* to allow horse-drawn equipment to cut hay and remove it. A few years later it was removed in the same manner without payment. A few years later still the Arboretum had to pay to have the hay removed. Finally, a few years following this, we had to cut it ourselves when no one could be found either to buy or take it. After the war we started to cut it several times a year, with tractor-drawn equipment, and to maintain it as it is today.

Even by 1947 there were 1,000 man days *less* per year spent on the grounds than in 1931. This had occurred largely because of an extremely tight labor budget which had been cut to the bone during the war years and because of a reduction in the number of hours in the work week.

In 1936 there was little differentiation in labor pay, and men were selected from the crew — at no additional pay — to do specialized jobs such as pruning. After the labor was unionized in 1947, specially trained pruners did the climbing at higher pay. Now it is extremely difficult for us to hire young men for pruning.

The "crew" has always been a good one. Many a young fellow has stayed only a few years, then left to branch out on his own as a "landscape contractor." In this way, the Arboretum has served as a training center with an educational program. In recent years high school or college boys have been taken on for the three summer months to work both in the Arboretum at Jamaica Plain and in Weston. In both areas the local high schools have sent us good workers. In Weston, particularly, preference is given to local boys.

Flower Shows

In the past thirty-four years the Arboretum has cooperated with the Massachusetts Horticultural Society in "showing" some of

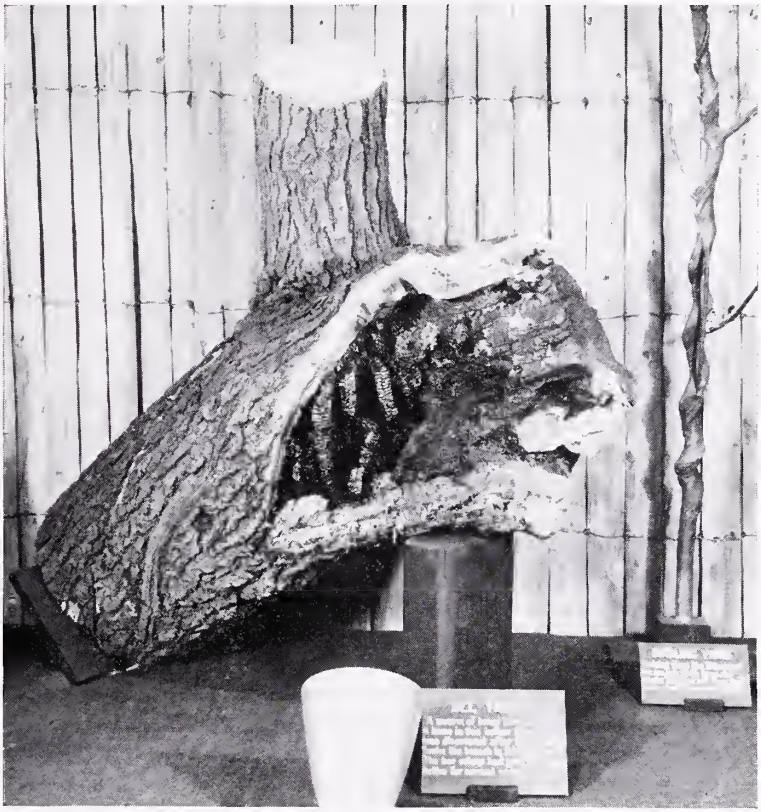

Fig. 3: "Bee Tree" and "Girdling Vines." Part of Arnold Arboretum exhibit at the 1970 Spring Flower Show. The exhibit won first prize in the educational category and a gold medal. Photo: H. Howard.

the plants it grows at some of the smaller flower shows. It has also entered the large spring flower shows with these major exhibits:

1953 Pruning
1954 Larz Anderson Collection of Dwarf Plants
1955 Ground Cover Plants
1956 Propagation
1957 Plants Introduced by the Arnold Arboretum
1958 A Hobbyist's Rhododendron Garden
1959 Bonsai
1960 Pruning
1961 Cultivated Plants in Their Places of Origin
1962 Dwarf Evergreen Plants
1963 Seeds and Seed Germination
1964 Mulching
1970 Pruning

Since 1953 the Arboretum has also exhibited in New York, Detroit, Cleveland, Philadelphia, Washington, D.C., Worcester, Massachusetts, and at the Floriade in Rotterdam, Holland, in 1960.

The Case Estates

The Arnold Arboretum began its horticultural work in Weston in 1942 when Miss Louisa Case gave to Harvard University, for the purposes of the Arnold Arboretum, 59 acres of land on which were a greenhouse, a large barn, and a large house. While no propagation work was done in the greenhouse at this time, a nursery of woody plants was started, and quite a few ornamental trees and shrubs were planted on the grounds. In 1945 Miss Marion R. Case left an adjoining ninety acres, much of which had been used in previous years to grow vegetables and fruits as crops. Somewhat later Miss Louisa Case left forty-one acres more. These combined properties became known as the Case Estates of the Arnold Arboretum.

On the two estates there had been a vineyard with several hundred grape varieties; orchards containing 156 apple trees, eight crab apples, five plums, and ten pear trees; 700 varieties of *Iris*; and several perennial gardens. Many of the shrub plantings had become weedy and overgrown during the war years, and the devastating effects of the 1938 hurricane were still very evident in the wooded areas. It became the task of the Horticulturist to mold these holdings into a valuable horticultural entity for use by the Arnold Arboretum.

After considerable thought and discussion it was decided to

make the Case Estates function in three ways for the benefit of the Arnold Arboretum. First: the land was to be used as the major growing-on area for plants eventually to be planted on the grounds at Jamaica Plain. Second: it was to be used for experimentation which would add to our knowledge of ornamental horticulture. Also, new materials for maintenance could be thoroughly tested before they were adopted in the general maintenance program at Jamaica Plain. Third: the grounds should be ornamentally developed with special plantings and demonstration plots of particular interest to suburban home owners, landscape architects, tree wardens, nurserymen, and other plantsmen.

It was decided not to plant another arboretum here, but rather to include types of ornamental plantings that would not be made at Jamaica Plain. All these things have been accomplished.

Horticulture at the Case Estates

When the two estates were first given to the Arnold Arboretum in 1945 the *Iris* collection was reduced to plants of 100 of the best varieties. Stock of some 500 varieties was given to the Boston Park Department. Other varieties were donated to various other institutions which were able to make use of them in their landscape plantings. Most of the grapes were removed, and many of the fruit trees were eliminated. Over the years, as more space became necessary for nursery plantings, more of the apple trees have been removed. Land which had been used for vegetable crops was turned into use for woody plant nurseries.

The best of the perennials from the several perennial gardens were dug and planted in what is now the Low Maintenance Garden. It had been known as the Peony Garden, featuring only peonies, inter-planted with annuals. Mrs. Wyman was most interested in this project and agreed to be responsible for it. She enlisted the aid of the Weston Garden Club, many of whose members were then actively interested in obtaining flowers to decorate the rooms of the several large veterans' hospitals in the vicinity. These garden club members agreed to work in this over-grown garden, in return for the privilege of cutting flowers on special occasions for the hospitals.

Over the years literally hundreds of different shrubs, dwarf evergreens, perennials, and bulbs have been planted in the Low Maintenance Garden under Mrs. Wyman's direction. Both Mrs. Wyman and the Horticulturist have spent many hours in

this garden, weeding, replacing, and moving plants, and labeling them. The inventory of plants here runs at nearly 200 species and varieties at any one time. It must be admitted that, because of its location in a frost pocket, winter losses are often high, and replacements must be made during April before many visitors come to inspect the garden. (Labeling in the future must be done by someone who knows the plants, as the work crew cannot be expected to do it.)

Beginning in the late fifties new mulching materials were tried and demonstrated in the Low Maintenance Garden. Later it became expedient to restrict the mulch here to pine needles. In 1966 the Director had a series of mulch display plots laid out in the neighboring field by Henry Draper (then the Superintendent of the Case Estates), demonstrating twenty different kinds of mulching materials.

Beginning in 1945, and continuing until 1952, much of the seed propagation and some of the softwood propagation were done in the small greenhouse attached to the barn at 135 Wellesley Street. This did much to relieve the crowded conditions at the old greenhouse on the former Bussey property near the State Antitoxin Laboratory in Jamaica Plain.

Planting about the grounds was not neglected. A hedge of hemlock was planted in front of 102 Wellesley Street, and the rhododendron planting there was greatly augmented. Many plants were added at the rear of this property. A line of *Malus* 'Henrietta Crosby' was planted along the north side of Wellesley Street to conceal the nursery area; across from this a hedge of *Prinsepia sinensis* and plantings of *Viburnum* and *Syringa prestoniae* varieties were placed to screen the fields beyond.

One hundred and thirty-eight crab apple trees of seventy-one species and varieties have been set out in the big field bordering Newton Street, making a striking display when in flower and fruit. A most interesting planting of eighty-seven miscellaneous ornamental trees of twenty-nine species and varieties has been made in the same big field. All of these are labeled, and it is interesting to note that more and more people stop in this field to scrutinize these plants. Another planting of crab apples was made along Ash Street, just inside the stone wall, and has been greatly admired by Ash Street residents during the past years. Also, various ornamental plantings have been made around the Case Estate houses.

While these plantings conform with the policy established for the Case Estates, most of them have been made with an eye to beautifying the grounds for the townspeople. The Case Estates

are in a conspicuous location in the geographic center of Weston, and these colorful plantings have gone a long way to make this area a decided asset to the community.

In 1950 about seventy plots of ground cover plants were laid out near the old cow barn. This planting proved so popular that it was enlarged and now encompasses over 200 plots. It is of interest that nearly all of the original plots are still in existence. In 1951 a small tree demonstration plot was laid out immediately behind the collection of ground covers. At a later date the Boston Edison Company became interested in these trees and contributed over $100.00 for the purchase of additional trees of the varieties listed in "Trees for Your Community," a publication of the New England Electrical Services Council which the Horticulturist helped to write.

Fig. 4: Magnolia × loebneri *'Merrill'. Photo: H. Howard.*

In 1947, with the removal from the Arnold Arboretum in Jamaica Plain of the major part of the *Berberis* and *Ribes* collections to the Case Estates, the "permanent" nursery area was started. Studies had been made in some of the large collections at Jamaica Plain, and it had become obvious that continued planting there was impossible for lack of space. It was decided that the Horticulturist would select some of the mediocre-to-poor species and varieties for removal to the Case Estates, leaving only the better ornamental types at Jamaica Plain. At

first there were 202 plants in this "permanent" nursery. Now there are approximately 1,000 species and varieties in this permanent planting, all labeled, all properly indexed, and all recorded in the master file at Jamaica Plain.

Three genera were worked out to show the tremendous amount of prime display area that has been saved by this policy decision:

	Number to Weston	*Number left at Jamaica Plain*	*Duplicate plants Discarded*
Weigela	28	24	27
Deutzia	50	27	62
Spiraea	68	36	61

This system reduced the number of plants in the three genera at Jamaica Plain from 383 to 87 — a decided improvement. No species, varieties, or clones were discarded; plants of all were kept, the better species and clones for ornamental display were left at Jamaica Plain where they should be, receiving much better care and display space than they formerly had. This policy has been kept over the years as the Horticulturist and Assistant Horticulturist have studied succeeding groups.

Special Collections

Between 1951 and 1953 eighty-three plants of thirty-seven species and varieties of hollies were planted in the woods back of the evergreen nursery. This was done because of partial shelter here in the winter and because of increasing vandalism at Jamaica Plain, where it was impossible to keep well-fruited plants of evergreen, red-berried hollies in good condition. Summer watering, a definite spray program, fertilizing, and mulching have resulted in increasingly good crops of fruit in recent years.

In 1960 the New England branch of the American Daffodil Society was allowed the use of a small space for the planting of varieties of *Narcissus*. All of the collecting was done by that organization, chiefly by Dr. Helen Scorgie, of Princeton, Mass., with labor supplied by the Arboretum. Now nearly 300 varieties are growing at the Case Estates. During the past few years Dr. Scorgie has been rearranging the collection almost annually, so that the arrangement of the varieties in the beds differs from year to year.

In 1963 the Horticulturist became interested in lilies, and a demonstration plot of over 200 of them — later increased to 250 — was planted. For the first few years they were outstand-

ing, but unfortunately a major part of this collection was destroyed by rodents. In 1963, also, the *Hosta* collection was started, chiefly at the instigation of Mrs. Frances Williams of Winchester. At the present time there are over 100 species and clones growing in this one collection.

The Hemerocallis Society wished to cooperate in the planting of a *Hemerocallis* collection and, since it supplied a large number of plants, the beds were laid out and planted in 1965. The supervisory committee consisted of Mrs. Percy L. Merry of Needham, Mr. George Pride of Worcester (now Associate Horticulturist at the Arboretum), and Mrs. S. P. Shaw of Weston. The beds now contain over 200 varieties, among which are 63 clones from a collection of old-fashioned cultivars given to the Arnold Arboretum about 1950 by Professor Stephen Hamblin, formerly of Harvard University.

One of the staff members became interested in the genus *Allium*, and in 1967 a display bed consisting of 60 species and varieties was planted near the lily collection. All plants were labeled, and they attract much attention from visitors. Many onions are excellent ornamentals, and few gardeners have realized that there are so many species and varieties available today. In 1964 a planting of about 180 *Chaenomeles* of 130 species, varieties, and cultivars was made in the lower nursery as a result of studies made by staff members responsible for assembling the International Registration List of *Chaenomeles* published in 1963.

Experimental Research

The plantings and wooded areas of the Case Estates have been used for various experimental purposes, not the least important of which has been the trial of new weed killers. When a weed killer was studied thoroughly enough so that we understood what it would and would not do, it was used on the plantings in Jamaica Plain if it had proved satisfactory; but, in the course of these experiments, several weed killers proved to be too unreliable to be used on the display plantings and were discarded after the first trials at the Case Estates.

Other organizations affiliated with Harvard University have been allowed the use of portions of the Case Estate property at various times. In 1946 an agreement was made between the Arnold Arboretum and the Harvard Graduate School of Design which allowed the landscape department to use a small piece of land bordering the woods, above the former vineyard, which was not immediately adaptable for Arboretum use. The Bussey

Fig. 5: Hosta *plot at the Case Estates. Photo: D. Wyman.*

Institution was allowed to use, temporarily, two acres of other land for growing corn, and in 1948 the Cabot Foundation planted seven acres, in the big field bordering Newton Street, with forest trees under special study. Finally, in connection with Dr. Sax's studies of dwarfing techniques and dwarfing rootstocks for apples, a series of experimental plantings were made in 1948, 1952, and 1959.

In 1966 an experimental nursery of over 130 different kinds of trees was planted in the large field along Newton Street to allow them to grow to a large size. It was anticipated that they might be needed for planting at Jamaica Plain.

Thirty-four wisteria vines were planted on the vine trellis at the Case Estates in the spring of 1946. These had all been propagated asexually from one double-flowered vine. Various pruning and fertilizing practices were carried out on these vines up until 1962, the main object being to note which ones aided flowering. Similarly, other trellises in this general area were utilized with nearly thirty different varieties of *Celastrus* vines in

a series of studies to learn more about sex changes and pollination methods for producing more fruit on plants of this genus.

The field on the east side of Wellesley Street was used for a series of experiments to determine the best pruning and fertilizing practices to aid the growth and color of fruits, flowers, and autumn foliage of some twenty different ornamental shrubs. Each group of plants was asexually propagated from a single plant. Later, these same plants were used in field demonstrations of different methods of pruning.

These are only a few of the more evident types of experiments which have been carried out here over the years. In recent years an "open house" day each year has done much to increase interest in the plantings.

Referring back to the policies established in 1945, we can see that the Arnold Arboretum land at Jamaica Plain and the Case Estates in Weston has been welded into a harmonious unit, of benefit to staff members and of considerable interest to the general public.

DONALD WYMAN

The Holly Society of America and the International Registration Authority for cultivated *Ilex* (holly) wish to announce a change in the place of the registration authority *from* the College of Agriculture and Environmental Science, Rutgers, the State University, New Brunswick, New Jersey, with Dr. E. R. Orton, Jr. as registrar, *to* the U.S. National Arboretum, Washington, D.C., 20002, with Mr. G. K. Eisenbeiss as registrar.

All future national and international holly registrations and inquiries are to be sent to Mr. G. K. Eisenbeiss.

Plant With Nature[1]

Readers of the works of the late Louis Bromfield will remember that in his series of books about his experience in farming at Malabar he repeatedly stressed farming with nature rather than against nature. Mr. Bromfield was a man who came to agriculture late in life, became tremendously excited by it and in some ways could almost be characterized as an agricultural mystic.

Many of the theories that he embraced with such passion did not withstand the proof of careful objective testing in the field. However, his basic reverence for nature resulted in attempts to adjust agricultural practices to conform to the natural way in which the soil or plant behaves, and these attempts have not received the serious attention that they deserve.

Scientifically trained agriculturists in particular are put off by the intemperate enthusiasm and broad generalizations that characterize much of his agricultural writing. Still the basic kernel of his thinking is valid. It is cheaper, more efficient and more profitable to farm with nature. It is at best an uphill struggle to try to farm in a way which violates natural ecological principles.

Nurserymen are agriculturists too, even those who do nothing but landscape planting and do not own an acre of land in field production. Frequently they are dealing with plant material that is infinitely more exacting in its ecological requirements than the traditional farm crops. Most of these crops have, during the thousands of years they have been cultivated, become wholly artificial creations completely dependent upon man's plowed fields for existence and unable to survive in the wild. No matter what part of the industry in which a nurseryman is engaged, his profits and, indeed, his very survival are dependent upon how well the plants he produces or sells survive and grow.

[1] Reprinted from the December 15, 1969, issue of the *American Nurseryman* with the permission of the editor and the author.

Natural Cycle of Growth

Young men studying at horticultural schools often wonder why they are required to learn so much "theory," when they are really interested in the "practical" parts of an education, how to do those operations that obviously and quickly relate to a dollar earned. They resent the seemingly dull theoretical parts of plant physiology and ecology and the apparently "obvious" facts describing the natural cycle of plant growth.

Yet in our temperate zone, in which most of the world's nursery operations are conducted, the seasons alternate between a period of active growth in the spring and summer and a period of dormancy deepening in the fall to almost complete quiescence in the winter. Complex biochemical changes take place within the plant as it goes through these recurrent cycles.

To ignore these natural phenomena in the very practical operations of propagation and transplanting is to court disaster in some operations or at best to do things the hard way with the resulting increased costs and diminished results. Consequently approaching with an eager and open mind these "theoretical" questions as to how a plant behaves and why it does so has a most practical application after all.

Propagating with Nature

For countless years, gardeners idly observed that many kinds of flowers bloomed only at a certain time in the year, and no amount of irrigation or fertilizing would induce them to depart from this pattern. Eventually curious minds began to wonder why this was so, and these investigations led Garner and Allard to formulate the principle in 1920 that such plants behaved this way in response to variations in the length of the daylight at different times in the growing season. This discovery and its refinements have been of the greatest practical value to the florist industry.

The photoperiodic response of woody plants is less dramatic than that of many herbaceous plants, but it is there, and adjusting propagating schedules to it will greatly improve results. Indeed, some plants, like certain deciduous azaleas and the so-called French hybrid lilacs, are virtually impossible to root except during their spring cycle of growth, which coincides with the longest days of the year.

Transplanting Nature's Way

During the early spring, just when woody plants are breaking into growth, is the best time to transplant in the nursery

or to plant on a landscape job. However, the ideal part of this best time is of very short duration, often a mere couple of weeks. It is of course impossible to compress enough work into this brief period to support a business for the remaining majority of the year.

Therefore it is important to separate trees for example, into groups composed of those which are easy, fairly easy and difficult to transplant. Fortunes have been lost in the landscape contracting business through ignorance or willfulness in insisting on planting the "difficult" trees at the wrong time of the year.

Two particularly cranky trees are the willow oak (*Quercus phellos*) and the tulip tree (*Liriodendron tulipifera*). The tulip tree, a member of the magnolia family, has, like magnolias, fleshy roots, which are slow to regenerate. If transplanted in the late fall or winter, the severed roots will decay back from the cut ends until the next cycle of growth in the spring, and heavy losses will result.

Move at Optimum Time

In one well-known landscape contract that featured hundreds of large-caliper tulip trees, they were a total loss, and the contractor was bankrupted by the job. By delaying the execution of this job and working with nature by moving these trees at the optimum time in the spring just as growth was commencing, 100 percent survival could have been achieved, and a handsome profit would have replaced the disaster.

The willow oak is very difficult for a quite different reason. It is both thin-barked and extremely twiggy. If moved in the late fall or winter when no root regeneration can occur, the trees simply dry out and perish. If moved in the spring just before or just as new growth is beginning, there is no chance for drying out to proceed very far because new root growth occurs immediately and supplies water to the branches. Thus knowledge of the idiosyncrasies of certain difficult trees and the implications of their growth cycles is of the utmost importance in scheduling nursery operations and landscape contracting.

Ecological Requirements

Nurserymen and landscape architects often do not pay sufficient attention to the ecological requirements of the plants commonly used in landscape planting and thus attempt to fight nature rather than work with her. Such a course is fraught with disappointment. Either the plants die outright, with costly losses to the contractor, or else they merely survive in a sickly

condition which disappoints the owner who expected a beautiful planting and thus cast doubts on the ability of the designer.

Many ornamental plants are adaptable to a great variety of growing conditions, and there is usually one in which they look exactly "right." Others, however, have exacting ecological requirements which cannot be ignored. Although they will not thrive in all sites even though they are perfectly hardy in that climatic zone, they are very useful precisely because of their special requirements.

With the science of ecology at its present developed state, it should not be possible to find the flagrant violations of nature still to be seen in a few landscape plantings. But there they are — the bed of shrunken rhododendrons baking on the south face of a big building, the creeping junipers battling it out with phomopsis blight as a ground cover in the shade of big trees, or the yellow-brown mass of pachysandra struggling to survive on a dry, sunny bank.

The Happy Reverse

At the other end of the spectrum, the happy reverse is to be seen, designed by an architect or landscape consultant with an instinctive "feel" for plant requirements. His are the results of planting with nature — the lush foliaged *Rhododendron maximum* on the sheltered north face of the building, the mass planting of thriving yuccas on the "impossible" dry knoll or the thicket of myrica on the highway bank where salt spray is a problem each winter. On such a job, establishing the plant material is easy, and the results are lasting and beautiful.

Solving Poor Drainage

Next to neglect in watering during the first season after planting, more losses on landscape jobs result from poor drainage than any other cause. Every elementary botanical textbook says that roots require water and oxygen for survival and growth. Both landscape designers and landscape contractors far more often consider supplying water than air.

The reason that drainage is such a problem on so many landscape sites is that the soil has been so frightfully abused during the construction of the buildings or of the facility itself. Bulldozers, trucks and the feet of the workmen themselves cross and recross the area to be planted, often in wet, muddy weather, until not a vestige of granular soil structure remains. Unless generous planting pits are excavated and filled with good soil and under-drainage is supplied (see fig. 6a), neither plant survival nor subsequent growth will be satisfactory.

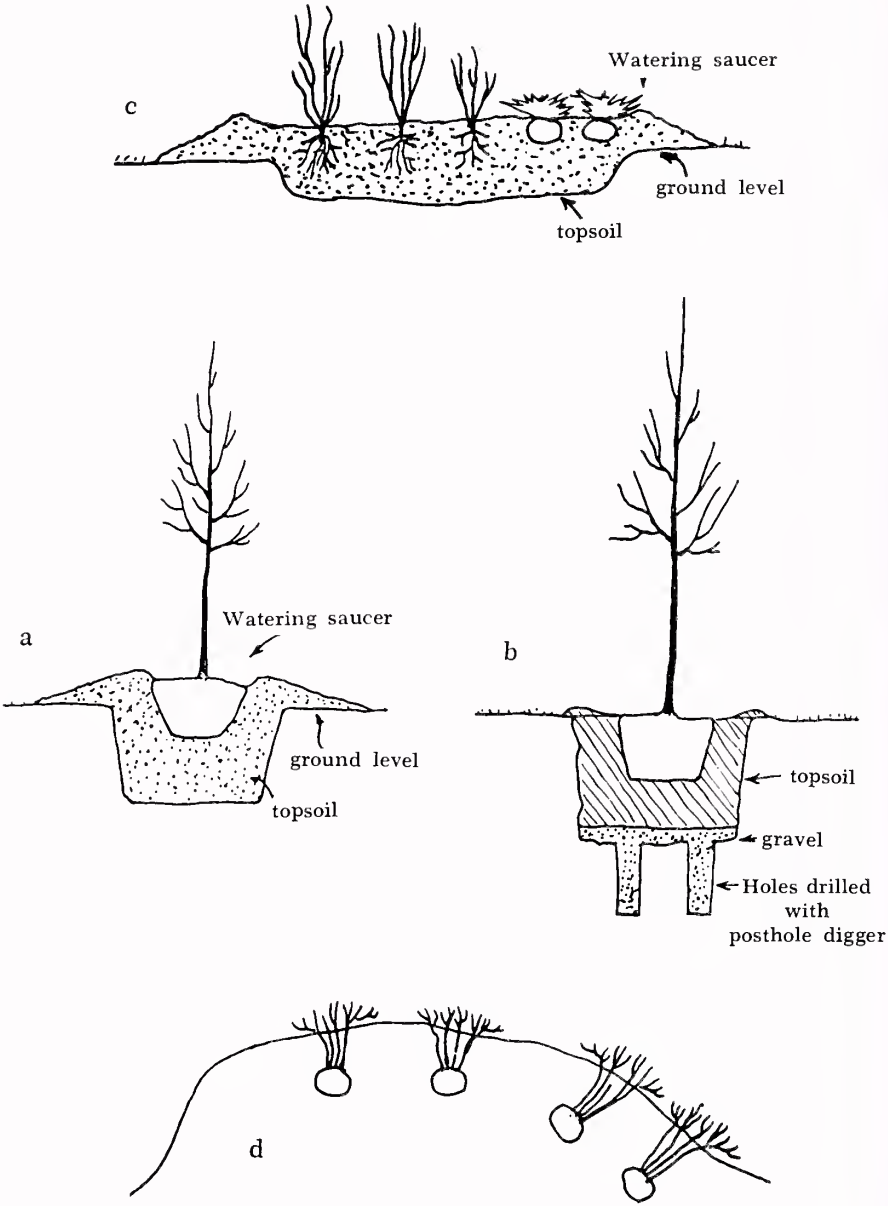

Fig. 6: *a. Planting in compacted soil.*
b. Planting trees in wet areas.
c. Planting shrubs in wet areas.
d. Sand dune planting. For seashore: Rosa rugosa, Prunus maritima, Myrica pensylvanica, Elaeagnus umbellata, *etc.*

Of still greater challenge to the landscape contractor is the low, wet planting site with little opportunity to install underdrainage. Here also nature points the way to a solution, which can be observed in any young maple swamp on really wet ground. The trees will be observed each to be growing on a small projection of soil. The seeds which gave rise to each surviving tree germinated originally on tussocks or other soil projections above the surrounding wet soil. Later when the trees grew older they gradually extended their roots downward and outward into the surrounding soil and successfully invaded and utilized it for growing substrate.

This natural method can be used with great success in landscape planting under similar conditions. Beds of shrubs or the soil balls of shade and ornamental trees can be placed partially raised above the grade level (see figs. 6b,c). As in planting at grade level, a saucer-shaped depression must be provided for watering during the first growing season after planting. It goes without saying that species adapted to wet soils must be used for landscaping such sites.

Such a partially raised planting will look somewhat peculiar for the first couple of years after planting, but in a surprisingly short period of time the soil of the mounds seems to settle down or level out. Before very long the slight raise which remains from the little hill necessary to establish the planting will be a quite unnoticeable feature of the whole planting.

Planting in Sand

Nature also points the way to an intelligent observer in the problem of establishing successfully a planting in extremely sandy porous soils such as found in many areas at the seashore.

Wherever a beach plum or another seaside shrub has been uncovered by a shift in the sand dunes or big excavation, the stem of the plant will be found to be enormously long, extending far down for many yards into the sand to where permanent moisture is to be found.

When one plants under such sandy conditions the root mass should be set several times deeper than would be normal (see fig. 6d). Often leggy plants which would be unacceptable for regular landscaping can be used for sand dune planting with fine results.

Human Predation

A real problem exists in trying to establish and maintain landscape plantings in areas of heavy pedestrian traffic and dense

occupancy, such as municipal building grounds and public housing projects. Here also observation of how nature solves these problems is of value to the landscape architect. In desert areas or steppes where woody plant life is hard pressed to survive and animal browsing is a severe adverse factor, successful woody plants are spiny and thorny to ward off potential destroyers.

The landscape designer must adopt the same solution for plantings of shrubs and small trees so susceptible to vandalism. Where a hedge of Japanese holly will not survive a single growing season, a hedge of *Berberis julianae* will grow on to a ripe old age. Where a flowering crab apple or cherry will be torn to pieces the first time it blooms, a Washington or cockspur hawthorn will be perfectly secure and provide a fine display of flowers and colorful fruits each year. Where a birch would soon lose all its bark, a thorny honey locust will grow untouched to maturity.

In all aspects of the challenging and infinitely rewarding nursery profession, intelligent observation and comprehension of nature's way indicate the easy way and the profitable way to perform nursery and landscape operations. When does a seed ripen? Usually that is the time to sow it. Does it pass through the digestive tracts of birds before it falls to the ground? Then it should be cleaned of pulp before it is sown. Does a plant occur on moist northern exposures in the wild? That is the location it will do best in on the landscape planting.

Is the plant a xerophyte under natural conditions? Here is the solution for that dry, sun-baked location. Does a plant thrive at the salt-lashed seashore? It is a possibility for northern highway planting. Is a very desirable tree very difficult to transplant? Landscape planting schedules should be juggled if possible to permit transplanting it at the limited optimal planting time, or else it should be dug and heeled in under special care so the shock of the move has been overcome before it goes to the landscape site.

Landscape and nursery transplanting is an unnatural phenomenon for any plant, and it is easiest and safest when natural considerations are working for, rather than against, the nurseryman.

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Basic Books for the Library

This is the final article taken from the series of talks presented at the Massachusetts Horticultural Society's conference on botanical and horticultural libraries in November 1969. — Ed.

An institutional library, whether a public, college, or society library, is the place to go when one wants an answer to "any" question. There are two basic kinds of library tools needed to answer such questions. One is subject matter materials: books, magazines, and bulletins. Then there are the indices, atlases, dictionaries, encyclopedias, and textbooks that are needed to get at the information in the subject matter materials or to supplement those materials. Because subject matter libraries tend to be weak with regard to supplementary materials, it has seemed useful to compile a list of references.

The following titles are, in my experience, the basic references needed to make a subject matter botanical and horticultural library work. Those titles preceded with an asterisk are absolutely essential; there can be no substitutes for them. The other titles on the list are extremely useful, but not absolutely essential. This list does not include purely subject matter books.

Dictionaries

Brown, R. W. *Composition of Scientific Words.* Baltimore: Privately printed, 1954.

*Flood, W. E. *Scientific Words, Their Structure and Meaning.* London: Oldborne, 1960. Perhaps not the most complete, but certainly the best value for the money.

*Henderson, I. F., and W. D. Henderson. *A Dictionary of Scientific Terms.* (7th ed.) Princeton, N.J.: Van Nostrand, 1960. Good for newer terms. Earlier editions are not particularly useful.

*Jackson, B. D. *A Glossary of Botanic Terms.* (4th ed.) London: Duckworth & Co., 1928. The basic work in English. There is a 1949 reprint of this edition.

*Schneider, C. K. *Illustriertes Handworterbuch der Botanik.* Leipzig: Wilhelm Engelmann, 1905. Probably the best one-volume dictionary; illustrated.

*Stearn, W. T. *Botanical Latin.* London: Nelson, 1966. Grammar, glossary, and much else of interest.

*Willis, J. C. *A Dictionary of the Flowering Plants and Ferns.* (6th ed.) Cambridge: University Press, 1931. Full of useful miscellaneous information. Edition reprinted in 1960.

Wood, R. S. *An English-Classical Dictionary for the Use of Taxonomists*. Claremont, Calif.: Pomona College, 1966.

*Foreign language-English dictionaries for all of the modern European languages, Latin, and classical Greek.

Bibliographies & Nomenclators

Arber, A. *Herbals, Their Origin and Evolution*. (2nd ed.) Cambridge: University Press, 1938.

**Bibliography of Agriculture*. Washington, D.C.: U.S. Department of Agriculture, 1942 +. Title and reference listings of articles in the various fields of agriculture. Coverage of botanical and horticultural titles is probably more extensive than *Biological Abstracts*, but it is not an abstracting journal.

**Biological Abstracts*. Philadelphia: Biological Abstracts, 1926 +. Abstracts of biological publications. Useful.

Blake, S. F. *Guide to Popular Floras*. ("Bibliographical Bulletin," No. 23.) Washington, D.C.: U.S. Department of Agriculture, 1954.

*———, and A. C. Atwood. *Geographical Guide to the Floras of the World*. 2 vols. ("U.S. Department of Agriculture Miscellaneous Publications," No. 401, 797.) Washington, D.C.: Government Printing Office, 1942 (vol. 1), 1961 (vol. 2). Essential. The introduction to the second volume contains an annotated list of reference works which supplements this list.

Blunt, W., and W. T. Stearn. *The Art of Botanical Illustration*. London: Collins, 1951.

Dalla Torre, K. W. and H. Harms. *Genera Siphonogamarum & Indexband*. Leipzig: Wilhelm Engelmann, 1907, 1908. Useful as a source of information about synonomy of generic names. Essentially replaced by 7th edition of Willis' *Dictionary*. Edition reprinted in 1958 and 1963.

Dunthorne, G. *Flower and Fruit Prints of the 18th and Early 19th Centuries*. Washington, D.C.: Privately printed, 1938.

*Frodin, D. G. *Guide to the Standard Floras of the World*. Knoxville, Tenn.: Department of Botany, University of Tennessee, 1964. Mimeographed. Useful list of the floras which should be in any botanical or horticultural library.

*Jackson, B. D. *Index Kewensis plantarum phanerogamarum*, 2 vols. & 13 supplements. Oxford: University Press, 1893–1966+. Essential in a botanical library, very useful in a horticultural library. Lists the places of publication of binomials.

Lawrence, G. H. M. *An Annotated Guide to Reference Works for Advanced Plantsmen.* Pittsburgh: Hunt Botanical Library, 1966. Mimeographed.

*Massachusetts Horticultural Society. *Dictionary Catalog of the Library.* Boston: G. K. Hall, 1962. Catalog of the largest American horticultural library. Useful.

*Merrill, E. D., and E. H. Walker. *A Bibliography of Eastern Asiatic Botany.* 2 vols. Jamaica Plain: Arnold Arboretum, 1938 (vol. 1); Washington, D.C.: American Institute of Biological Sciences, 1960 (vol. 2). Almost absolutely essential. Useful far outside of its stated geographical area. The subject lists at the end are particularly valuable.

Nissen, C. *Die Botanische Buchillustration.* 2 vols. & supplement. Stuttgart: Hiersemann, 1951, 1966. Essential if you are going to do anything with illustrated books. The notes on authors, illustrators, engravers, and publishers are very useful.

*Pritzel, G. A. *Thesaurus Literaturae Botanicae.* (2nd ed.) Leipzig: Brockhaus, 1871. This is the one basic, essential library tool. One simply cannot function without it. Authors and their dates, titles and dates of publication, size, numbers of pages, and miscellaneous notes. Also extensive systematic lists of titles at the back. Reprinted in 1950.

*Rehder, A. *Bibliography of Cultivated Trees and Shrubs. . . .* Jamaica Plain: Arnold Arboretum, 1949. Very useful, as far as it goes, listing extensive synonomy for accepted names.

*Smith, R. C., and R. H. Painter. *Guide to the Literature of the Zoological Sciences.* (7th ed.) Minneapolis: Burgess, 1966. Very useful annotated list of publications of general biological interest.

Stafleu, F. A. *Taxonomic Literature* ("Regnum Vegetabile," No. 52.) Utrecht: Privately printed, 1967.

*Stapf, O. *Index Londinensis to Illustrations of Flowering Plants, Ferns, and Fern Allies.* 6 vols. Oxford: University Press, 1929–1941.

**Union List of Serials.* (3rd ed.) New York: H. W. Wilson, 1965. Location of periodicals in U.S. libraries.

United States Department of Agriculture Library. *Botany Subject Index.* Boston: G. K. Hall, 1958. A useful subject index, but very incomplete.

*Willis, J. C. *Dictionary of the Flowering Plants and Ferns.* (7th ed., revised by H. K. Airey-Shaw.) Cambridge: University Press, 1966. Essentially an annotated list of generic names. Very useful.

*Woodward, B. B., and A. C. Townsend. *British Museum (N. H.), Catalogue of the Books, Manuscripts, Maps, and Drawings.* 8 vols. London: British Museum, 1903–1940. Basic. One can survive — though not very happily — if one has Pritzel. Reprinted in 1964.

Synoptic Works and Dictionaries

*Bailey, L. H., ed. *The Standard Cyclopedia of Horticulture.* 6 vols. New York: Macmillan, 1914–1917. Still standard, reprinted several times, including a three-volume edition. The keys for identification in vol. 1 are very useful.

*———. *Manual of Cultivated Plants.* (2nd ed.) New York: Macmillan, 1949. The standard work.

*———, and E. Z. Bailey, compilers. *Hortus Second.* New York: Macmillan, 1941. Very useful for common names.

Bentham, G., and J. D. Hooker. *Genera Plantarum.* London: Lovell Reeve, 1862–1883. Useful. Many people consider this to be indispensable; I don't.

*Chittenden, F. J., ed. *The Royal Horticultural Society Dictionary of Gardening.* 4 vols. & 2 supplements. Oxford: University Press, 1951–1969. There are keys for the identification of the species of some genera, as well as lists of cultivars.

*Dallimore, W., and A. B. Jackson. *Handbook of Coniferae and Ginkgoaceae,* ed. S. G. Harrison. New York: St. Martin's Press, 1967. Probably preferable to Krüssmann for those whose native language is English.

*Davis, P. H. and J. Cullen. *The Identification of Flowering Plant Families.* Edinburgh: Oliver & Boyd, 1965. Essentially a set of keys for identification.

*DeCandolle, A. P., A. DeCandolle, & C. DeCandolle. *Prodromus Systematis Naturalis Regni Vegetabilis.* 17 vols. in 20. Paris: Masson, 1824–1873. The latest comprehensive treatment for many groups of dicots.

Encke, F., ed. *Parey's Blumengartnerei.* (2nd ed.) 2 vols. & Index. Berlin: Paul Parey, 1958–1960. Useful for plants cultivated in northern Europe.

*Engler, A., and K. Prantl. *Die Naturlichen Pflanzenfamilien.* (1st ed.) 4 vols. in 24. Wilhelm Engelmann, 1887–1914. If only one work of this kind can be had, this should be it! Particularly valuable for the illustrations. A second edition has been started but is not complete — and is very expensive. Reasonably priced copies of the first edition can still be found in the second hand book market.

*Graf, A. B. *Exotica 3, Pictorial Cyclopedia of Exotic Plants.* Rutherford, N.J.: Roehrs Co., 1968. Useful for identification. The names need to be checked.

*Hooker, J. D., ed. *Le Maout and Decaisne, A General System of Botany, Descriptive and Analytical . . .* Translated by Mrs. Hooker. London: Longmans Green, 1876. The illustrations are excellent and abundant, and the text is useful. Basic for a teaching library.

Hutchinson, J. *The Families of Flowering Plants.* (2nd ed.) 2 vols. Oxford: University Press, 1959. I prefer Rendle.

*Krüssmann, G. *Handbuch der Laubgeholze.* 2 vols. Berlin: Paul Parey, 1959–1962. Useful for cultivated forms. Good line drawings.

*———. *Die Nadelgeholze.* (2nd ed.) Berlin: Paul Parey, 1960–1962. Useful.

*Loudon, J. C. *Arboretum et Fruticetum Britanicum.* (1st ed.) 8 vols. London: Longmans, Orme, Brown, Greene and Longmans, 1838. Full of interesting information.

*Miller, P. *The Gardener's and Botanist's Dictionary.* (9th ed., by T. Martyn.) 2 vols. London: Law & Gilbert, 1807. This is the most useful edition for all save nomenclatural purposes for which the 8th ed. is essential. It has extensive synonomy, as well as much information about economic uses.

*Ouden, P. den, and B. K. Boom. *Manual of Cultivated Conifers.* The Hague: Martinus Nijhoff, 1965. Useful.

*Rehder, A. *A Manual of Trees and Shrubs Hardy in North America.* New York: Macmillan, 1954. Standard for the area north of latitude 35°.

Rendle, A. B. *The Classification of Flowering Plants.* 2 vols. Cambridge: University Press, 1925, 1930. A good textbook, with a bias toward the British flora. Reprinted in 1963.

*Werdermann, E., and H. Melchior. *A. Engler's Syllabus der Pflanzenfamilien.* (12th ed.) 2 vols. Berlin: Borntrager, 1954 (vol. 1), 1964 (vol. 2). Preferable to either Rendle or Hutchinson. Written in a German which is not difficult to follow. Especially valuable for the bibliographies.

Economic Plants

*Burkill, I. H. *A Dictionary of the Economic Products of the Malay Peninsula.* 2 vols. London: Crown Agents for the Colonies, 1935. Essential; full of information. Reprinted in 1966.

*Council of Scientific and Industrial Research, India. *The Wealth of India.* Vol. 1+. New Delhi: Council of Scientific and Industrial Research, 1948+. Extremely useful treatment of economic plant material of the tropics and sub-tropics. Particularly valuable because of bibliographies appended to the articles.

DeCandolle, A. *Origin of Cultivated Plants.* (2nd ed.) London: Kegan Paul, Trench & Co., 1886. The basic work. Reprinted in 1959.

*Hedrick, U. P., ed. *Sturtevant's Notes on Edible Plants.* Albany, N.Y.: State Printer, 1919. A basic work.

*Kingsbury, J. M. *Poisonous Plants of the United States and Canada.* Englewood Cliffs, N.J.: Prentice-Hall, 1964. The standard work. Essential.

Watt, J. M., and M. G. Beyer-Brandwijk. *The Medicinal and Poisonous Plants of Southern and Eastern Africa.* Edinburgh: Livingston, 1962. Full of information. Valuable far outside the stated geographical limits.

Plant Anatomy

*Esau, K. *Plant Anatomy.* (2nd ed.) New York: Wiley, 1965. A textbook, but just about encyclopedic in scope.

*Metcalfe, C. R., and L. Chalk. *Anatomy of the Dicotyledons.* 2 vols. Oxford: University Press, 1950. Supplements and brings up to date the work of Solereder.

*———, and P. B. Tomlinson. *Anatomy of the Monocotyledons.* Oxford: University Press, 1960+. A series of essentially family anatomical monographs.

*Solereder, H. *Systematic Anatomy of the Dicotyledons.* Translated by L. A. Boodle and F. E. Fritsch. 2 vols. Oxford: University Press, 1908. The basic work.

Textbooks and Miscellaneous References

Atlante Internazionale del Touring Club Italiano. (5th ed.) Milan: Touring Club Italiano, 1936. In my opinion, this is the best of the older atlases. Many people, however, prefer Haack or Scobel.

*Bartholemew, J., ed. *The Times Atlas of the World.* 5 vols. Edinburgh: Bartholemew, 1955–1959. This is the best general atlas in print. The one volume edition does not open well.

Black, C. A. *Soil-Plant Relationships.* (2nd ed.) New York: Wiley, 1968.

ESSA. *World Weather Records 1951–1960.* Vols. 1–7. Washington, D.C.: Government Printing Office, 1965+.

Haack, H. *Steiler's Hand-Atlas.* (10th ed.) Gotha: Justus Perthes, 1930–1931.

Hartmann, H. T., and D. E. Kerster. *Plant Propagation.* Englewood Cliffs, N.J.: Prentice-Hall, 1968.

Johansen, D. A. *Plant Microtechnique.* New York, McGraw-Hill, 1940. This is the basic work in print. Zimmermann's work is still useful.

Kingsett, C. T. *Chemical Encyclopedia.* (4th ed.) New York: Van Nostrand, 1928.

Lawrence, G. H. M. *Taxonomy of Vascular Plants.* New York: Macmillan, 1951. Valuable for the annotated lists of recommended books.

McLean, R. C., and W. R. I. Cook. *Plant Science Formulae.* (2nd ed.) London: Macmillan, 1952.

———, & ———. *Practical Field Ecology.* London: George Allen and Unwin, 1946. An essential "cookbook" for anyone planning to do simple ecological surveys.

Moldenke, H. N. and A. L. Moldenke. *Plants of the Bible.* Waltham, Mass.: Chronica Botanica, 1952.

Pirone, P. P., B. O. Dodge, and H. W. Rickett. *Diseases of Ornamental Plants.* (3rd ed.) New York: Ronald Press, 1960.

Purvis, M. J., D. C. Collier, and D. Walls. *Laboratory Techniques in Botany.* (2nd ed.) London: Butterworth's, 1966.

**Royal Horticultural Society Color Chart.* (1st or 2nd ed.) London: Royal Horticultural Society, 1938–1939, 1966. There are other color charts, but this seems to dominate the field.

Scobel, A. *Andree's Allgemeiner Handatlas.* (4th ed.) Bielefeld & Leipzig: Velhagen and Klasing, 1910.

**Strasburger's Textbook of Botany.* Rewritten by R. Harder, W. Schumacher, F. Firbas, and D. von Denffer. Translated from 28th German edition by P. Bell and D. Coombe. London: Longmans, 1965. The best botanical textbook for reference available.

*United States Board on Geographic Names. *Official Standard Names Gazetteers.* Nos. 1–110+. Washington, D.C.: Department of the Interior, 1955–1969+. Indispensable for finding locations of place names and also for the listing of standard maps in the introduction to each part.

*Weast, R. C., ed. *Handbook of Chemistry and Physics.* (48th ed.) Cleveland: Chemical Rubber Co., 1967.

Zimmermann, A. *Botanical Microtechnique.* Translated by J. E. Humphrey. London: A. Constable & Co., 1896.

GORDON P. DEWOLF, JR.

2. Purslane

Purslane, wild portulaca, or pusley (*Portulaca oleracea*), is a small plant which appears each spring in the Arboretum, growing flat against the ground in the nurseries surrounding the greenhouses.

The origin of purslane is buried in prehistory. Alphonse De Candolle, in *The Origin of Cultivated Plants*, wrote that *Portulaca oleracea* was "one of the kitchen garden plants most widely diffused throughout the old world from earliest time," and was found in India, Greece, and Persia.

Purslane was mentioned in the "Natural History" of Pliny as one of the vegetables used by the Romans. Pliny, or Gaius Plinius Secundus, usually referred to as Pliny the Elder, was a Roman living about 23–79 A.D. He compiled an encyclopedia,

Historia Naturalis, which dealt with many subjects as they were known at that time, including geography, the fine arts, zoology, and botany. He also included food and food plants — among them cabbage, cucumber, turnip, parsnip, and purslane.

In the 16th century John Gerard described the use of purslane: "Rawe Purslane is much used in salads with oile, salt, and vinegar." John Parkinson, a writer and herbalist who lived about the same time as Gerard, had a more colorful use for purslane. He wrote that purslane was not only a remedy for a crick in the neck, but also for "blastings by lightning, or planets, and for burnings by Gunpowder or otherwise." This somewhat dramatic information was revealed in a guide to gardening entitled *Paradisus in Sole Paradisus Terrestris.* Parkinson appears to have been fond of puns, because the title may be translated from the Latin as "Park in Sun, Park on Earth."

What was perhaps the first "Salad Cook Book" was written in 1699 by John Evelyn, a London gentleman-farmer. Called *Acetaria, a Discourse of Sallets*, it gave, among other things, instructions for making purslane pickle. In this country one of Bernard McMahon's seed catalogs which was printed in Philadelphia about 1800 listed two kinds of purslane: "Green Garden Purslane" and "Golden Purslane, a variety."

However, not everyone agreed about the virtues of purslane; in 1821 William Cobbett wrote in *The American Gardener*, perhaps a little unkindly, that purslane was a "mischievous weed that Frenchmen and pigs eat when they can get nothing else. Both use it in salad, that is to say, raw."

Henry Thoreau, in *Walden, or Life in the Woods* (1854), mentioned the use of purslane: "I have made a satisfactory dinner on several accounts, simply off a dish of purslane which I gathered in my cornfield, boiled and salted."

Last summer when I discovered a crop of purslane growing in one of my flower beds, inspired by my reading, I allowed the plants to grow. In a month they became large and sturdy, with succulent triangular leaves and thick juicy stems. I harvested them and boiled them gently just a few minutes until they were barely tender. Drained, salted lightly, and generously buttered, they make a delicious vegetable, more tender than the most delicate young spinach leaves, the stems tasting slightly of acid.

Perhaps those of us who raise our own vegetables, struggling with temperamental plants, fertilizing, dusting, and spraying, are overlooking a good vegetable when we pull purslane up by the roots and fling it on the mulch pile.

HELEN ROCA-GARCIA

Notes from the Arnold Arboretum

Malus 'Donald Wyman'

During the past few years staff members have become interested in a crab apple tree which was first noticed on the grounds of the Arnold Arboretum as a spontaneous seedling prior to 1950. The reason for our recent interest results from observation of its ability to retain its fruit, in good condition, well into the winter months when the fruit of nearly every other crab apple in the collection has either dropped, been eaten by the birds, or has turned brown and unattractive.

Under our conditions the tree flowers annually and has consistently produced a heavy crop of glossy, bright red fruits which average 1 cm. in diameter. As winter progresses the color will fade, but even by the end of March enough red is retained to classify the fruits as having definite ornamental value throughout the entire winter.

The tree will also be of interest to those who plant crab apples as a source of food for birds. We have noted during the past two winters that the fruits seem to mature or become palatable to birds at varying times throughout the season. They are not taken all at once as is the case with some of the other crab apples that have persistent fruit; therefore, it may be considered as a source of "slow-release" bird food.

The buds are pink but they open to single, white flowers which are 4.5 cm. across when fully expanded. During four years in which detailed observations were made, heaviness of flowering was rated from moderately heavy to very heavy. Our specimen is a small tree, sixteen feet tall, of compact growth habit. It may be seen on the SW side of Peters Hill just across the road from the *Alnus* collection.

A tree of this sort will be a valuable addition to the winter landscape, and for this reason we are naming it in honor of Dr. Donald Wyman as a small tribute to his many years of interest in this fine group of ornamental trees. *Malus* 'Donald Wyman' has been propagated in limited quantity during the past winter and will soon be made available to nurserymen who participate in our Cooperating Nurserymen Program. We hope that, before long, it may become available to the general public.

Robert S. Hebb

The International Plant Propagator's Society — Nineteenth Annual Meeting

The Eastern Region of the International Plant Propagator's Society met for its annual program on December 3, 1969, at the Hotel Commodore in New York City. Meetings of this society move about each year and are held in various parts of the eastern United States. The 1967 meeting, for example, was held in Mobile, Alabama, while that for 1968 took place in Toronto, Canada. To celebrate the society's Twentieth Anniversary, the Eastern and Western regions will gather at middle ground for a combined meeting to be held in September of this year at St. Paul, Minnesota. This will be the first joint session for the two regions, and a delegation from the newly formed region of Great Britain and Ireland also plans to attend.

The first day of the meeting was devoted to a tour of the various horticultural organizations in the Long Island area with the initial stop being at Planting Fields Arboretum, Oyster Bay. A few statistics relative to Planting Fields — formerly the renowned William Robert Coe Estate — show that it is a year-round horticultural center about one hour from New York City by car. Included in its 409 total acres are 160 permanently preserved as an arboretum, 200 devoted to fine woodlands, and five to a synoptic garden which includes over 400 species of woody taxa. In the bulb collection are over 80,000 plants, including 140 varieties of daffodils. A number of service greenhouses are used to raise plants for the 22,000 square foot display houses. When we visited poinsettias were being readied for a Christmas show; at Easter lilies are featured.

The next stop was at the Christie Estate located in Muttontown. An outstanding collection of abnormal conifers had been brought together here. On viewing these remarkable specimens one gets the impression that they were planted many years ago. However, this is not the case. L. K. Christie, who met an untimely death several years ago, sought large specimens throughout Long Island and had them moved to the location at great expense. Among these oddities are conifers that are dwarf, slow-growing, pendulous, fastigiate, variegated, etc. The future of this unique collection had been in question since the owner's demise. However, a recent arrangement has been made whereby the Nassau County Park System has agreed to take over. Therefore, it will not be lost to horticulture.

During the afternoon we visited two commercial nurseries. At the Johnson Avenue Rare Plant Nursery there was a large collection of unusual plant material. Mr. Joseph Cesarini, the

proprietor, is a natural born plant collector and displays many rarely seen specimens in his miniature arboretum. Mr. Cesarini certainly does not spend time in wasted motion, for at his establishment are twenty-five large plastic houses of container-grown plants which are managed with only one full-time and two part-time employees.

On December 4th we began the first of five formal sessions which were to cover two and one-half days. The emphasis of this opening session was placed on research techniques. The highlight was an excellent talk on the "Principles of In Vitro Culture," given by Toshio Murashige, University of California, Riverside, California.

During the second session, devoted to "Propagation Techniques" and moderated by Joseph Cesarini, procedures used in the vegetative propagation of plants were discussed. Included among the presentations were papers on production of "Juvenile Shoots from Root Pieces," "Outdoor Softwood Cutting Propagation," "Softwood Cuttings under Polyethylene Tents," and "A Practical System of Cold Frame Propagation," by Mr. P. D. Orum of D. Hill Nursery Company, Dundee, Illinois. Many were interested in the latter because of the relatively inexpensive techniques recommended. Much interest was also indicated in the production of juvenile shoots from root pieces. That presentation dealt with a successful method of propagating several plant species which cannot otherwise be rooted from cuttings.

Plant nutrition and growth came in for their share of attention during the second session of the afternoon. In addition to other topics, two papers dealt with regulators which retard growth and their effect on budding and hardiness of rhododendrons. These were particularly interesting because of their importance to those concerned with raising rhododendrons and azaleas.

During the morning of December 5th attention was focused on the propagation of specific plants. Perhaps a safe statement to make here is that a plant must be difficult to propagate and offer some important asset in order to receive consideration at this session. Included were discussions on *Prunus serotina*, *Acer griseum*, and *Hamamelis*, and the techniques involved in handling cuttings from white pine witches'-broom seedlings. It is good to note the greater trend toward cooperation among the various groups who are interested in the same plants. An example of this was the paper on "Mist Propagation" of black cherry (*Prunus serotina*). This subject is of great importance to the lumber industry, and the vegetative propagation of specific

clones with desirable characteristics is, therefore, significant. *Acer griseum* is a tremendously appealing plant, and the presentation dealing with its propagation was based on factual information which came about through research.

Problems of management and cultural practices are often overlooked at meetings such as these. Not so here, however, for the entire Friday afternoon session was devoted to managerial problems. Such items as cost analysis, schedules, mechanization, water usage, stock scion hardiness relationships, and breeding of woody ornamental plants were covered in considerable detail.

The final portion of the afternoon program featured the regularly scheduled presentation of "New Plant Introductions" moderated by Alfred J. Fordham.

Both the authors feel that "bull sessions" are often among the most rewarding parts of these meetings. The evening of December 5th would fit this category, for it was then that the question and answer period was held. A question box is set up at the start of the meetings, and throughout the sessions the participants are urged to contribute questions which are then posed by a moderator and answered from the floor. This part of the program has great appeal, and attendance is always high. It is a rare occasion when someone from this group of specialists cannot furnish an answer to any question.

Alfred J. Fordham

Robert C. Kennedy
Mercer Fellow

Summary of weather data recorded at the Dana Greenhouses, February and March 1970.

	Precipitation	Avg. 8 a.m. Temp.
February	4.97	26.75
March	3.71	33.8

Editors' Note: In the review on page 77 of our March 15th issue, the American Museum of "National" History should, of course, be the American Museum of Natural History. Our apologies to our readers and the institution.

Man, Nature, and History, by W. M. S. Russell

This volume is the current offering in the Nature and Science Library sponsored by the American Museum of Natural History. The Nature and Science Library is a series of books designed, so the jacket blurb says, for readers of junior high school level. The books are, in fact, eminently readable for adults. The subject matter of the series is natural history in its broadest sense. The individual volumes each treat some particular facet of nature, or man's interaction with nature. Previous volumes have dealt with zoos, archaeology, water, the human body, and premechanical human cultures. Each volume, handsomely designed and copiously illustrated in color, is written by an author with academic or professional competence in the particular field. It is of some interest to note that most of the authors are British.

I originally subscribed to the series thinking that the books might be suitable for my children. I find that, in most cases, I am the one who reads each book as it arrives.

The current volume is essentially a history of European man and the effect that changing agricultural practices have had on him and on his culture. It begins, at the beginning, in the Near East, and there are excursions onto all of the continents. Famines, pestilence, and wars all find their place in the story, and the final chapter ends on the sober problem of current overpopulation.

Why did civilization rise in the dry belt of North Africa, the Near East, and China? Why did it fall? What is the relevance of the legend of Cain and Abel? One explanation is given here — and most persuasively. What effect did the kind of plow have on field size and shape and on village planning in western Europe? And why and how did the forest expand and retreat in response to the activities of man in western Europe? What effect has pestilence had on this, and what other effects does it seem to have on human population and civilization? Who knows the role played by Elisha King Root in the clearing of the American frontier? All these questions and many more are not ignored in this little book.

The subject is timely, and the book is very much to the point. This volume, and indeed the entire series, is highly recommended to the readers of *Arnoldia*.

G. P. De W.

W. M. S. Russell. *Man, Nature, and History*, Nature and Science Library, Garden City, New York: Natural History Press, 1969.

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On the cover: Taxus baccata *in the churchyard of Painswick, Gloucestershire. Photo:* © *Mark Silber 1970.*

The Dahlia: An Early History

In 1934 Marshall Howe, of the New York Botanical Garden, compiled a list of *Dahlia* cultivars containing more than 14,000 names. This number represents an astonishing average of over 100 newly named cultivars during each of the 143 years since 1791, when dahlias were first brought into cultivation in the gardens of Spain following their arrival from Mexico. Today dahlias are among the most familiar and cherished subjects of gardens in all parts of the globe. Interest in the garden dahlia has, in its brief modern history, generated the founding of dahlia societies on both sides of the Atlantic, with memberships in the thousands; produced an industry with annual revenues in the millions of dollars resulting from the sale and exchange of living plants and seeds; spawned horticultural shows designed exclusively around home-grown and professionally grown dahlias on the local, reigonal, national, and even international levels; and created scores of books and hundreds of published articles covering dahlia history, cultivation, and the classification of the garden forms as well as the more formal taxonomy of the wild species.

Despite such intense interest and attention, the history of our garden dahlia has been treated in a sketchy and piecemeal manner. At the present time no definitive history exists which spans the entire period for which records are known. Many errors and much fiction lie scattered in the literature of the past and present, relating to the dahlia. Some of these have been picked up and repeated as fact by subsequent authors who have failed to authenticate their information by going to original source materials. Some writers of the past have made sweeping judgments of the validity of certain facts and details of dahlia history while providing not a word of reasoning in support of their conclusions.

During the past several years I have been concerned with preparing a treatise on the systematics and classification of the genus *Dahlia* as a whole, with particular emphasis upon the data from the wild species.[1] While principally a "botanical" project, this effort has involved extensive reading in both the

botanical literature as well as in that literature otherwise deemed horticultural. Such a survey became necessary because there were times in the past when a careful distinction was not made between the naming and classification of wild and domesticated plants. Thus, I became inadvertently aware of many facts concerning the history of the *Dahlia* in cultivation. In several instances the sources of some of the errors alluded to above became apparent to me, and some interesting new facts were brought to light, which proved worthwhile in clearing up our view of the origin of *Dahlia* cultivation.

One may, for the sake of convenience, divide *Dahlia* history arbitrarily into several periods, each of which serves to focus attention upon one or a few major developments:

1) Prehistorical and early historical period (c. 1552–1790)
2) Period of early scientific description (1790–1796)
3) Early introduction and distribution of first modern cultivars and species (1796–1804)
4) Early breeding period (1804–1814)
5) Controlled breeding period (1814–1929)
6) Genetic breeding period (1929–present)
7) Period when nutritional control in cultivation was applied (? – present)

The present account is devoted to consideration of the first three periods. The first of these, as we shall see, concerns developments which took place in the dahlia's native land, Mexico, while the second and third periods belong to Europe, as do the remaining periods. One must keep in mind that at times the dahlia has had a dual history, one relating primarily to botanical endeavors and the other to horticultural. The above periods emphasize the horticultural side of the genus.

Formal *Dahlia* history begins in the late 18th century in Spain, where Antonio José Cavanilles gave the genus its Latin name in commemoration of Andreas Dahl, a Swedish botanist and pupil of Linnaeus. Cavanilles, then a senior member of the staff of the Royal Botanic Garden in Madrid (not its director as often stated [2]), had received seeds of Mexican plants.[3] Plants grown from these seeds were cultivated in Madrid and comprised the materials upon which Cavanilles based his description of the first "dahlia," *Dahlia pinnata*. Thus, even from the earliest days of the scientific period of its history, the dahlia was a cultivated plant. As we shall see, the cultivation of dahlias really begins much earlier. At the appropriate time I shall come back to further discussion of Cavanilles' dahlias.

Fig. 1

Our garden dahlia seems so familiar that few among us are aware of its nativity in Mexico. Most persons learning this for the first time express considerable surprise, usually having thought the dahlia to have originated in Europe (which, in a certain sense, it did, inasmuch as the great majority of our horticultural forms were created through various kinds of plant breeding in Europe by European plantsmen). But all of the species known of the genus are native within the borders of Mexico and adjacent countries of Central America. Long before Cavanilles described the genus, these species — there are now twenty-seven known — existed as unmolested members of the flora occupying mostly the great central plateau or highlands of Mexico. Even today one can see them during the months of August and September in profusion along the highways, growing out of cliffs, among boulders, in cultivated fields alongside the *milpa* or maize which we call corn, and on open slopes of the volcanic mountains. If dahlias grew in New England and behaved here as they do in Mexico, we would surely regard them as weeds. These weeds of Mexico are the progenitors of our garden dahlias, and the early history of these garden plants is closely linked to the history of Mexico, especially that period which passed before and soon after the Spanish conquest.

Our interest centers on the Aztecs and Moctezuma.* This young prince gained the throne in 1502 and ruled for eighteen years before his fall when he was made a captive of the Spanish conquerors led by Hernán Cortés in 1520.[4] A few extant eyewitness accounts indicate that the Aztecs of this period engaged in horticultural practices. Recently, Zelia Nuttall has written about the gardens of Mexico.[5] In her review we learn that the construction of gardens was one of the principal activities to which the ruling classes devoted themselves. As in our own society, Aztec gardens were each specialized to fulfill a single purpose. There were gardens for ornamental plants, special

* The name has several variations, including the more familiar Montezuma.

ones for plants which gave off a pleasing fragrance, gardens for medicinal plants, some for cut flowers, orchards, and vegetable gardens. Gardening in Aztec society was an activity conducted solely at the behest and pleasure of the noblemen, the labor being carried on by slaves. Moctezuma himself owned many gardens. Hernán Cortés, in a letter to his Emperor, Charles V, describes one of Moctezuma's gardens at Iztapalapa, a town several miles from the capital, Tenochtitlán: "There are . . . very refreshing gardens with many trees and sweet-scented flowers, bathing places of fresh water . . . He also has a large orchard . . . Toward the wall of the garden are hedges of lattice work made of cane, behind which are all sorts of plantations of trees and aromatic herbs." Bernal Diaz, Lieutenant of Cortés, wrote about Iztapalapa saying: "The garden and orchard are most admirable. I saw and walked about in them and could not satiate myself sufficiently looking at the many trees and enjoying the perfume of each. And there were walks bordered with the roses of this country and flowers and many fruit trees and flowering shrubs."

The most wonderful of all Moctezuma's gardens was the tropical one at Huaxtepec. It was with the use of this garden that Moctezuma's father instituted an elaborate program of plant introduction. Huaxtepec lay in the tropical valley south of the Valley of Mexico and occupied an elevation 2,000 feet lower, with a climate somewhat ameliorated from that of the capital, which was about 7,400 feet above sea level. It made an ideal place in which to try out the cultivation of introduced plants. Requests were dispatched to all the lords of the empire, especially to those who ruled settlements along the coasts, that they send a selection of plants from their regions for cultivation in Huaxtepec. Great ceremony accompanied the planting of each introduction, which arrived "balled and burlapped!" their roots enclosed in earth and the whole wrapped with richly decorated mantles. Priests were summoned to make animal sacrifices for each planting, spilling blood of the offering as well as some drawn from their own ears onto the soil prepared for the plant.

Cortés visited the garden in Huaxtepec and reckoned its size at two leagues, or six and one-half miles, in circumference — roughly two times the size of the Arnold Arboretum in Jamaica Plain. When he and others in his company saw it "and promenaded in it for a while they were filled with admiration and said that even in Spain they had never seen a finer kind of pleasure garden." It's a pity that precious little remains of this

horticultural splendor. At Huaxtepec there could be seen, as recently as 1925, a few aging monarchs of *Taxodium*, or cypress trees, which had been planted in long colonnades. By now even these may be gone.

As a natural corollary to developing skills in the horticultural arts, the Aztecs also devoted much effort to the practice of medicine utilizing remedies prepared from plants.

In the years following the Spanish conquest of Mexico, which was completed in 1552, many Europeans came to the New World from the monastic schools of Spain and France to teach in the new convents and schools which had been established for the education of the sons of Aztec noblemen. Some of the friars recognized that Aztec medical arts contained many remedies superior to those they had learned in Europe. Some of them endeavored to study the uses of native medicines and to acquire the skills of the Aztecs in their preparation. Others became engaged in learning the Aztec language, Nahuatl, and eventually they contrived a Nahuatl grammar which greatly aided in their grasp of Aztec culture. At the same time the development of a Nahuatl grammar had the result of hastening the instruction of Aztec pupils in their study of Latin and Spanish. With this the stage was set for an important event which relates to our review of dahlia history.

The Earliest Record of a "Dahlia". One of the earliest institutions of learning in the New World dedicated to improving the education of Aztec boys was established in 1536. The college of Santa Cruz was constructed in the native quarter of the ancient city of Mexico at the Convent of Tlaltelulco. It attracted many gifted teachers. An Aztec pupil at the college, given the name Martinus de la Cruz, there learned to write his native Nahuatl and, through his interest in medicine, eventually rose to become "Physician of the College" and to give instruction in medicine to other native sons. Also among the Indian boys who distinguished themselves by their ability was a young man from Xochimilco, a place which then, as today, was a horticultural and agricultural center. This young man had been given the name Juannes Badianus. He had mastered Latin sufficiently to be made a "Reader of Latin" at the college.

Having been reared in the region of the horticulturally important Xochimilco, an area south of the city of Mexico, Juannes Badianus brought to the college an intimate familiarity with the plants cultivated by the Aztecs. Badianus and Martinus — the one skilled in the cultivation of plants and fluent in the Latin

Fig. 2: The Cohuanenepilli *found in* The Badianus Manuscript. *Reproduced from the facsimile edition by Emmart. This represents the world's first illustration of a dahlia.*

language, the other trained in medical knowledge and practices — co-authored an illustrated herbal, considered the first book written about the medicinal plants of the New World, *The Badianus Manuscript, An Aztec Herbal of 1552.* This important manuscript was written first in Nahuatl by Martinus de la Cruz and then translated into Latin by Juannes Badianus. It lay forgotten and unknown for nearly 400 years until its rediscovery at the Vatican Library in 1931. The fascinating historical events attending the writing of this simple little book have been fully investigated by Emily Emmart and published in her detailed introduction to the facsimile edition of the manuscript.[6] *The Badianus Manuscript* contains what may be taken as the earliest illustration of a *Dahlia* that has thus far come down to us. We are doubly fortunate that this *Dahlia* illustration is in full color in the facsimile, assisting greatly in our recognition of the plant (see Fig. 2, reproduced here from Pl. 59 of the facsimile). As will be shown later, nearly 300 years intervene before a colored picture of a *Dahlia* again appears in botanical literature.

The Martinus-Badianus illustration of the dahlia is somewhat contrived and stylized in a manner typifying most of the drawings in their book. Because of this it would be presumptive to assert its correspondence with any of the wild species as we

know them today. That it is a *Dahlia* at all is a matter of judgment. In *The Badianus Manuscript* we are shown a picture of a plant with three flowering heads, each producing eight ligulate or ray florets and each borne singly at the end of a branch. The pinnately compound leaves are opposite each other across the stem (though some are shown arranged alternately). Except for the few alternate leaves, the other characteristics displayed are all those one usually associates with the genus *Dahlia.* It is unfortunate the best known and probably most characteristic feature of the genus, namely the tuberous root, is poorly drawn and rather non-descript. The generalized portrayal of the roots may be a reflection of the emphasis the authors have placed upon the stems as the most important part of the plant. Only the stems are used in the medicinal preparations they describe. One should, perhaps, not search too deeply for any significance in the authors' omission of the tuberous roots. Emmart has pointed out that the manner in which roots are portrayed in the manuscript is intended to convey in symbolic form the respective natural habitats of each plant. Thus the roots of their dahlia are shown penetrating the symbol for *rocks* or *stones*, thereby accurately asserting the plant is to be found among the rocks of nearby mountain slopes.

The color of the rays as reproduced in the facsimile is of such a tint that one cannot determine whether it represents a shade of purple or a shade of scarlet. The same color appears in the illustrations of other plants throughout the book and is also used by the writers for the lettering of all the names and subtitles. If pressed for a specific determination of this *Dahlia*, I should likely choose to call it *Dahlia coccinea.* In so doing I can scarcely avoid taking into consideration that *D. coccinea* is the most widespread of the species. One finds it particularly abundant on the mountain slopes surrounding the Valley of Mexico. Other species occur in this region as well, but these tend to have more restricted ranges and would be less well known.

Regarding medicinal properties, it is worthwhile to note briefly the early uses Aztec physicians found for dahlias as revealed in *The Badianus Manuscript.* Emmart [7] has carefully analyzed the Latin text and offered her own English translation and commentary. Stems of the dahlia, in combination with extracts and ground up seeds of other plants, were used principally in a preparation for the treatment of a disorder called the "closed urinary meatus." According to Martinus de la Cruz, the Aztec's name for the dahlia used in this way was "Cohuanenepilli,"

which means "serpent tongue." Emmart explains that nothing about a dahila resembles a serpent's tongue, rather the name is a reference to the *use* of the plant. Other species with this vernacular name were used in the treatment of the same disorder. One such, recognized as a *Passiflora* and identified by Martinez [8] as *P. jorullensis*, bears leaves vaguely suggestive of a snake's forked tongue.

These early Aztec herbalists provide us with a record of the medicinal plants of Ancient Mexico but tell us nothing about their cultivation. At best we can only guess that in a culture where medicinal plants were grown in special gardens, as those created by Moctezuma for his court physicians, the dahlia would have been a likely subject.

The "Dahlias" of Francisco Hernandez. Interestingly, our second historical encounter with a dahlia is in a source similar to that of *The Badianus Manuscript* — a medical book. By the middle of the 16th Century Europeans regularly received reports from the fabulous lands the Spanish had colonized across the Atlantic. Woodcuts of the period reveal the exaggerations of some tales told about the New World. Such excessiveness aroused curiosity among Europeans and undoubtedly hastened further exploration. His interest perhaps awakened by such reports, King Phillip II of Spain commissioned his personal physician, Francisco Hernandez, to travel to Nueva España and prepare an account of "the natural history of the land." King Phillip honored Hernandez with the title "Protomedico of the Indies" and provided a generous sum of money to support his work. Hernandez sailed from Spain in 1570 with five years allotted him to complete his task.

The salient facts of Hernandez' travels have been recorded by Standley,[9] where we read that five years were scarcely enough to complete his work. By 1575 he had sixteen folio volumes ready for publication, but he remained in Mexico two more years, continually engaged with the objects of his commission. In September 1577 he returned to Spain hoping to address himself immediately to the problem of publishing his book. Difficulties arose to thwart his efforts, and he died in 1578 without seeing his work in print.

Nearly a century elapsed before work again began on publishing the manuscript. Meanwhile, other persons had extracted from it certain portions which they thought important, and these received further attention from students and scholars who added their annotations. When at last the book did appear,

published in Rome about 1651, one wonders how much of it was the work of Hernandez and how much that of others.

The title of Hernandez' book is *Rerum Medicarum Novae Hispaniae Thesaurus seu Plantarum, Animalium, Mineralium Mexicanorum Historia* (happily, often abbreviated simply *Thesaurus*). It contains the enormous quantity of detailed observations he made as well as the sketches he produced of the landscape, plants, and animals. Considering the magnitude of the task, it was a very complete work for that period, and at times has been called the world's first natural history.

Our interest here with Hernandez' *Thesaurus* is that in it are found sketches of three dahlias, introduced by their vernacular Nahuatl names, *acocotli* and *cocoxochitl*, which Safford [10] translates as follows: ". . . [the names are] derived from *cocotli*, signifying the word 'syringa' a hollow-stemmed plant; *acocotli* literally translated becoming 'water-cane' or 'water-pipe'; *cocoxochitl*, 'cane-flower' or 'hollow-stem-flower.'" Of particular significance are the characteristics of the dahlias revealed in these sketches. On page 372 of the *Thesaurus* (redrawn here in Fig. 3) is a dahlia essentially like many contemporary cultivars, in that the capitula or heads are shown with multiple whorls of ligulate florets. Such heads are called, in the terminology of today's horticultural trade, "double-flowered." Wild individuals of *Dahlia* species do not normally produce such heads but rather produce heads with a uniform single whorl of eight ligulate florets or rays (Fig. 1). Double-flowered forms seem to be extremely common among cultivated genera of Compositae, the plant family to which *Dahlia* belongs. Strains producing double-flowered heads are usually derived through selection from variants, of which some or all of the tubular shaped disc florets occupying the center of the heads are abnormally modified into florets developing an elongate ray or strap-shaped ligule composed of the fused petals of the corolla. Many of the common cultivated genera of Compositae are known to modern gardeners only in their double-flowered form, but this type is rare among wild populations. During the course of two 8,000-mile collecting trips by auto through Mexico and Central America, I visited and collected from hundreds of wild populations of *Dahlia* species without seeing a single individual bearing double-flowered heads. Moreover, of the more than 2,000 herbarium specimens which I examined for my studies of the genus, the only double-flowered specimens were those of cultivars collected from garden-grown plants, mostly from Europe and the United States.

In Hernandez' *Thesaurus* there appear, in all, three separate illustrations of dahlias. These figures were reproduced by woodcuts, worked from the original sketches made by Hernandez. The quality of the figures varies somewhat. For example, the illustration reproduced here in Fig. 3 has very well drawn heads which show the principal diagnostic features of the dahlia capitulum. First of all the heads show clearly their degree of doubleness, and in this regard they may be compared to many of those produced on our modern cultivars. More importantly, or of more diagnostic value, are the reflexed outer involucral bracts. The position of these bracts is a trait present in well over half the wild species and all of the modern cultivars. These bracts, usually five in number, but ranging within the genus from four to six (rarely to seven or more), surround the capitulum tightly in the young bud. As the buds near anthesis the bracts begin to be reflexed and remain so during the flowering period and later. Ultimately, as the fruits or achenes reach maturity, the inner whorl of bracts subtending the non-functional ovaries of the ligulate florets also become reflexed. When this happens the ripe achenes dislodge and are dispersed short distances by the wind.

The leaves on this illustration are not clearly drawn. It is difficult to relate the plant in the figure to any known species of the genus solely on the characteristics of the leaves as they are portrayed. The accompanying description may only be misleading in this respect. Hernandez, in reference to the leaves, writes, "*Folia Aquilegiae.*" On first appearances this would seem to mean the leaves resemble those of *Aquilegia*, but one ought not assume this too readily as this description was written in 1570 — long before a uniform usage of generic names was in practice. Nor do the leaves in the woodcut resemble those of *Aquilegia* in the present application of that name. It must be recalled that this woodcut is a "second-hand" interpretation of the original sketches which Hernandez made. Indeed, even the description may be the interpretation or annotation of one of the compilers.

The reverse problem of identification is true for the two figures which appear on page 31 of the *Thesaurus* (see Fig. 4). In this pair of woodcuts the leaves are quite clearly drawn, but the characteristics of the double-flowered heads are obscure. Payne,[11] has made it clear he does not believe there are in these illustrations sufficient details to assert their specific — or even their generic — identity. I would agree that one might justifiably retain some skepticism concerning their relationships to

Fig. 3: A "double-flowered" dahlia, called Acocoxochitl. *Redrawn from Hernandez'* Thesaurus, *p.* 372.

known *Dahlia* species. However, there are at least three extant species of the genus which bear leaves roughly corresponding to those in the figures. These are *Dahlia coccinea, D. pinnata,* and *D. brevis*. Also, in the remarks about the figures the brief description states "*stellatos flores e pallido rubiscentes*," or "flowers star-shaped, from pale [i.e. yellow] to red," and "*Radix gustu odorata, amara, & acris est*," or "the root is sweet-smelling, bitter, and sharp in taste." The description of the root is apt and agrees with my own reaction to the taste and odor of the tubers of the more widely distributed species such as *Dahlia coccinea*. On the other hand, the description of the flowers (meaning head) "from pale to red," may be interpreted in two ways, each of which can relate the description to *Dahlia coccinea*. First: Hernandez may have been considering the two-colored nature of the heads in which the centrally placed yellow disc florets are surrounded by the red ligulate florets; or he might have been referring to the color of the ligules themselves which, in different individuals, often within the same population, ranges from yellow to scarlet, frequently with parti-colored intermediates. Second: Hernandez mentions the geographic location of the plants he observed. He calls them "*De acocotli Quauhnahuacensi & Tepoztlanensi*," or "The *acocotli* of Cuernavaca and Tepoztlán." These cities, located in the present-day State of Morelos and known to have been well-established pueblos in pre-Hispanic times, are 18 kilometers apart and are situated in the midst of rich *Dahlia* country, where frequently one encounters, from mid- or late July through September, entire hillsides given over to large populations of these striking plants.

In the foregoing assessment of the *Dahlia* sketches which appear in Hernandez' *Thesaurus*, I have referred to the comparisons one may draw between them and the wild species of the genus. The question remains, were the plants Hernandez observed wild or domesticated? Did he sketch them from spontaneous natural populations or did he use as his subjects individuals found under cultivation in an Aztec garden? In the text accompanying the figures of *acocotli* Hernandez makes no mention of the cultivation of the plants he sketched.

I have found no direct evidence that Hernandez' dahlias were of garden origin. Most authors who have offered summaries of dahlia history state that Hernandez' plants *were* from an Aztec garden. One early writer came to the conclusion that Hernandez wrote about garden plants; since then all writers have repeated this conclusion without further substantiation. On the other hand, the conclusion that Hernandez described dahlias from

Fig. 4: Two double-flowered dahlias, called Acoctoli and Cocoxochitl. *Redrawn from Hernandez'* Thesaurus, *p. 31.*

gardens has a sound basis. Hernandez may very well have seen his *acocotli* in an Aztec garden, for it is known he spent the bulk of the time devoted to his writing at the Convent of Huaxtepec where, as described earlier, one of Ancient Mexico's largest and most elaborate gardens was located. When the first double-flowered *acocotli* was discovered by the pre-Hispanic people of Mexico or Central America, either among the spontaneous plants in the mountains or among offspring of plants the early gardeners had brought into cultivation, it must have been at once treasured and given careful protection. To a people who derived medicine from these plants, the rare occurrence of an abnormal double-flowered form surely aroused enormous interest and was considered a phenomenon of grave significance. Might one not guess that an Aztec apothecary, seeing a double-flowered dahlia for the first time, would have reasoned its healing powers to be also "doubled?"

Every society has had its panacea. Remembering that Hernandez was a physician, we note he has taken cognizance of many Aztec remedies. About the use of dahlias he writes, "[The tuber] when consumed in a weight of one ounce, alleviates stomach pain, dissipates blowing, draws forth urine, invokes perspiration, drives out coldness, strengthens the stomach weak because of the cold, turns aside cholic, opens what has been blocked, and when moved to the swellings, disperses them."

The "Aster" of Thiery de Menonville. Nicolas Joseph Thiery de Menonville served the King of France as a thief. This French botanist and pupil of de Jussieu lived in the colony of Santo Domingo whence he was commissioned to perform a secret service in Mexico in 1777. His mission: to secure living specimens of the jealously guarded cochineal insect and the Nopal cactus on which the insect lived. He was to smuggle these to the French islands in the Caribbean, where it was hoped a dye industry would flourish. Whereas Hernandez was a physician who regarded plants from the viewpoint of their medicinal properties, Thiery de Menonville was a botanist whose orientation was scientific and esthetic. Once in Mexico he traveled from the city of Veracruz to the city of Oaxaca and, in a very interesting written account of his travels, describes the plants and the vegetation he observed, both in the wild and under domestication. He writes of a visit to a local merchant's garden in the mountains where he had gone to observe the Nopal: "I was struck at once by a double violet aster, as large as those of France, but produced on a shrub resembling, by its pinnate

leaves, that of our Elder, and which created a very good effect. . . ." [12] Here is a clear reference to the early cultivation of an "improved" plant which roughly describes *Dahlia tenuicaulis*, a species native to Cerro de San Felipe, which towers over the city of Oaxaca.

Some authors have credited Thiery de Menonville with the introduction of dahlia seeds into France,[13] but I find this accreditation wholely obscure. The only plant materials he mentions carrying with him on his departure from Oaxaca were cuttings of the Nopal cactus, which he carefully concealed. Thiery de Menonville died in Santo Domingo in 1780 and may never have returned to France. There seems to be no record that dahlias, in fact, reached the Old World until about 1788 or 1789, when an event occurred to awaken Europeans to the ornamental possibilties of the genus.

Dahlias Reach Europe. Late in the eighteenth century, Vincente Cervantes, a man associated with a Mexican botanic garden, consigned to Antonio José Cavanilles, in Madrid, a shipment of seeds of Mexican plants. Cavanilles, who was then Professor and later Director of the Royal Botanic Gardens of Spain, raised from among these seeds the plants he used to describe the first three species of the genus *Dahlia.** He published his finding in six books called *Icones et Descriptiones Plantarum.* The first volume (1791) contains his drawing and description of *Dahlia pinnata.*[14] The importance of this first scientifically recognized species of the genus *Dahlia* warrants further comment.

The precise origin of *Dahlia pinnata* is not known. Cavanilles, in his remarks on the nativity of the species, states merely that it grows in Mexico. Knowledge of its origin would be very revealing to us because this early record *is also of a double-flowered form.* Could it be this plant was discovered in the wild by Cervantes or someone in his employ? Perhaps Cervantes gathered the seeds from plants cultivated in an Aztec garden. More likely, the seeds were gathered from plants in a botanic garden of Mexico City where the Spanish had undoubtedly assembled many of the wild and domesticated plants of the land during the 200 years of colonial occupation.

In a later volume (1796) of his *Icones*, Cavanilles described and illustrated two additional species of *Dahlia, D. rosea* and *D. coccinea.* The flowering heads of both these species as seen in the plates drawn of them bore ligulate florets in a *single*

* It is unlikely tubers could have survived the voyage.

whorl.[15] The origin of the seeds from which these plants grew is equally as obscure as the origin of the seeds of *Dahlia pinnata.* They could as well have come from wild populations as from a garden, since their single-flowered heads indicate they had not undergone selection for "improvement."

During the latter half of the eighteenth century Europeans developed a great enthusiasm for plants of the New World. Because of Spain's role as a colonial power, botanists and plantsmen of other European countries were eager to maintain correspondence with the Royal Botanic Garden in Madrid, where each returning vessel delivered an increasing and bewildering number of new and unusual plants from the floras of Nueva Hispania. Regular exchanges of plant materials between individuals and institutions were established so that, in a short time, new introductions of plants with particular merit received a wide distribution.

As reported in an article by Thouin, Cavanilles sent seeds of his three dahlias to M. Thibaud of France in the year 1802.[16] Thibaud conveyed these seeds to the botanists of the Paris Museum of Natural History where they were grown and tested. For his article, believed to be the first ever dealing with the modern procedures for the cultivation of dahlias, Thouin provided the world's first published colored portrait of these plants. This portrait created a great interest in itself, for it was soon reproduced in several other European journals and horticultural magazines, and undoubtedly helped to create further enthusiasm for these new garden plants.

Exactly how widely seeds of dahlias were disseminated from Madrid is not fully known. What is known is that dahlia seeds were received at Montpellier, in Berlin, in St. Petersburg, and at Kensington, England. No doubt other places — such as the horticultural capitals of Brussels, Leiden, Copenhagen, Edinburgh, and Kew — were not neglected in this distribution. In Montpellier, the French botanist, Alphonse de Candolle, received seeds in 1802 from Cavanilles.[17] Seeds were also received in Berlin about 1802, and there, in the following year, Willdenow prepared a revision of the genus for the fourth edition of Linnaeus' *Species Plantarum.* With this revision Willdenow introduced the genus under a new name, that of *Georgina*, believing that the name *Dahlia* (Cavanilles, 1791) had already been used for a genus of the Hamamelidaceae described by Thunberg in 1792. This error in dates, and the substitution of the name *Georgina* for *Dahlia*, took many years to correct. The name *Georgina* became firmly established in the literature and horti-

culture of the countries east of the Rhine, where even today it persists as a common name for the garden dahlia.

For many years it was thought that dahlias were first introduced into Great Britain in 1789 through the auspices of one Lady Bute. Few stopped to consider that the genus had not even been described until 1791. An enthusiastic "detective" by the name of C. Harman Payne, of England — about the time of what was thought to be the 100th anniversary of the arrival of dahlias in England — grappled with this problem.[18] He studied the events and records of the 18th century and discovered that the error could be traced to an edition of *Hortus Kewensis* by Aiton (1813), in which the date of introduction was given as 1789. This turned out to be an error of the printer who had transposed the last two digits of 1798. The error had been noted and corrected in a supplement to this work published a few years later, but the correction went unnoticed. Payne also deduced that *living* plants had not been introduced in 1798; rather, what had been received in England, at Kew, were three herbarium specimens of dahlias. These had been sent to the (by then) Marchioness of Bute by Dr. Ortega, Director of the Royal Botanic Gardens, Madrid. The Marchioness in turn gave them to the herbarium at Kew.

The first authenticated introduction of *living* dahlia materials into England occurred in 1803 — and on this date many authors agree. The source of the information is volume 6, plate 408, dated November 1804, of *Andrew's Botanist's Repository*, where the world's second published colored portrait of a dahlia appears. The accompanying text states that the illustration was made from a plant grown from seeds sent from Madrid *the year before* to Lady Holland of Holland House, Kensington. The picture is that of *Dahlia pinnata.*

Having placed living dahlias in the hands of plant breeders in the horticultural centers of Europe, the portents of a new floral industry were assured. The results of the flourishing period which followed are some we all still share and enjoy.

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[14] Cavanilles, *op. cit.* 1: 57, *tab.* 80, 1791.

[15] Cavanilles, *op. cit.* 3: 33, *tab.* 265 & 266, 1796.

[16] Thouin, Andre, "Memoire sur la culture des Dahlia," *Annales du Muséum National d'Histoire Naturelle, Paris* 3: 420–423, *illus.*, 1804.

[17] André, Edouard, "Le centenaire du *Dahlia*," *Revue Horticole*, 61; 523–524, 1889.

[18] Payne, C. Harman, *loc. cit.*

Mr. Heman A. Howard, Assistant Horticulturist, will resign from the staff on August 31st of this year. Mr. Howard, who came to the Arboretum in 1929, has been responsible for a multitude of duties — labeling, mapping, checking, and photographing the plants on the grounds for the past several years. Needless to say, the staff will miss his hard work and good humor. We wish him well in his new position as Horticulturist at the Heritage Plantation, Sandwich, Mass.

Yews in Fiction and Fact

> Of vast circumference and gloom profound
> This solitary Tree! a living thing
> Produced too slowly ever to decay;
> Of form and aspect too magnificent
> To be destroyed.
>
> *Wordsworth*

Yew trees first caught the photographer's attention during a summer auto tour of England and Wales.* He was particularly drawn to them when he arrived in the small town of Painswick in Gloucestershire. As one drives into the center of the village, one sees that it is dominated by its churchyard. The church — a beautiful, old stone edifice dedicated to St. Mary the Virgin — is surrounded by some ninety yew trees, each meticulously trimmed and manicured into free-standing forms, shaping paths and walks throughout the yard.

The characteristic deep green, dense foliage of the trees contrasts with the grays of the church and gravestones to create a mood that borders between enchanting and haunting. According to tradition, the Painswick yews are clipped faithfully, on September 8, during the feast of the nativity of Our Lady. On the following Sunday — known locally as "clipping Sunday" — the parishioners march in procession around the churchyard and join hands, forming a ring around the church. Following that, they gather at the foot of a flight of steps leading to a tower door from which a sermon is preached.

Yews in History and Literature. It is difficult to think of the English countryside without conjuring up some images of old churchyards, resplendent with *Taxus baccata.* The trees are so abundant in certain areas that they are called the "Hampshire weed." According to some references, the yews are even older than the churchyards themselves and may be the only surviving vestiges of medieval times.

* Mark Silber, a professional photographer, is co-author of this article and was formerly a student in Professor Richard Schultes' Economic Botany class at Harvard. Mr. Silber is especially interested in ancient literary references to plants and animals.

The association of the churchyard yew with the emblem of immortality most probably came into Christian tradition from pagan Britain. The yew is believed to have been but one of many pre-Christian symbols of nature that influenced later religious beliefs. It is easy to understand why the yew was selected for such meaning when one considers that it was, in early times, one of the only evergreen trees in England and Wales. Therefore, its foliage was not only decorative but "everlasting." The yew was probably planted on religious sites and was a survival of pre-Christian tree worshippers. It is perhaps remarkable that it survived the transition from pre-Christian to Christian times, since Christian councils of the sixth and seventh centuries restricted the veneration of trees.

In a short and interesting book titled *The Churchyard Yews and Immortality*, V. Cornish tells of his efforts to arrange the records of distribution and ages of yews found in Great Britain and, to a limited extent, on the Continent. In so doing, Cornish discovered that the distribution of these trees has been partly determined by the soil and rainfall available. In Wales, a country of heavy rainfall, the yews were abundant. Cornish estimates the age of some of these trees as about 900 years. He also recorded local legends which assigned to yews ages of somewhere between one and two thousand years. The traditions are repudiated by certain botanical experts who report that there

is no proof that any trees now in existence date back to Druidical times.

Although historians do not always agree on the origins of the use of yews in association with religion, it is generally accepted that the early Roman invaders of Britain used the yew in their funeral rites in place of the usual cypress and pine. Like the cypress, the yew was considered as a symbol of the resurrection and of immortality. Yew branches were used to line graves and to blanket caskets. Yew branches were also worn in hats and in buttonholes by mourners.

It is also fairly certain that the yew was used by some in place of palms for Palm Sunday celebrations. In the English churchyards of Kent, and in parts of Ireland, yew trees are referred to as palms because of their use in the palm services.[1] The yew was also used in church decoration along with the male catkins of *Salix caprea*, the goat willow.[2]

The very fact that yews are so often found in churchyards and graveyards has given rise to numerous superstitions about them. In Dallimore's book, *Holly, Yew & Box*, he quotes, from R. Turner, one of the more interesting of these stories:

[1] Ernest H. Wilson, "The Romance of Our Trees, IV. The Yew," *The Garden Magazine* 30: 213–217 (January 1920).

[2] W. Dallimore, *Holly, Yew & Box*, London: John Lane, The Bodley Head, 1908.

Fig. 5: T. baccata *in the Painswick, Gloucestershire churchyard, where there are some ninety specimens. Photo: © Mark Silber.*

> . . . if the Yew be set in a place subject to poysonous vapours, the very branches will draw and imbibe them, hence it is conceived that the judicious in former times planted it in churchyards on the west side, because those places, being fuller of putrefaction and gross oleaginous vapours exhaled out of the graves by the setting sun, and sometimes drawn by those meteors called *ignes fatui*, divers have been frightened, supposing some dead bodies to walk, etc.

It was undoubtedly this very superstition that moved Lord Tennyson to write in his poem "In Memoriam" the following lines:

> Old Yew, which graspest at the stones
> That name the underlying dead,
> Thy fibres net the dreamless head,
> Thy roots are wrapt about the bones.

In his book Dallimore cited numerous writers and passages from literature that show the association of yews with death and immortality. These writers include Dryden, Virgil, Pliny, John Fletcher, Shakespeare, Wordsworth, Dyer, and Sir Walter Scott.

Dallimore also suggests that the poisonous nature of the foliage has probably caused some of the undesirable associations to be made with yews. The toxic qualities were exaggerated in writings to the extent that there are authors who claimed that anyone who lay down to sleep beneath a yew would die. Such would also be the fate of those who were so cursed as to dream of the yew tree.

While yews have had their longstanding association with things religious and superstitious, they have also long been associated with matters more specifically utilitarian. For centuries the wood of these trees has been coveted for the purpose of making archers' bows. It was used for the crossbows and long bows that warriors bore in the battles of Cressy and Poitiers. And it is still used in the sportman's bow.

An interesting few lines from "The Song of the Bow," by Sir Arthur Conan Doyle, read:

> The bow was made in England,
> Of true wood, of yew wood,
> The wood of English bows.

Taxus baccata *and Other Species.* The genus *Taxus*, to which the commonly cultivated yews belong, consists of some eight

species of evergreen, needle-leaved shrubs or trees. The species are native to forest areas scattered over the North Temperate Zone. Of the eight species, only two and the hybrid between them are commonly cultivated in North America. Three more may be found in the collections of specialists or in botanical gardens. The differences listed in the books between the species do not seem to be very great. It must be admitted that some botanists, in the past, have considered them all to be merely varieties of a single species. However, the technical differences, combined with the differences of habit and habitat, do seem to be sufficient justification for keeping the entities separate. The five species that may be met with in cultivation may be distinguished as follows:

Leaves gradually pointed; scales of the winter buds obtuse, without a keel, persistent at the base of the branchlets; mature branchlets greenish (Zone VI, except one var. to Zone V) ..... *T. baccata*

Leaves abruptly pointed; scales of the winter buds obtuse or pointed, keeled or not, not persistent at the base of the branchlets

Scales of the winter buds not abruptly pointed, not keeled; leaves 2–4 cm. long, mature branchlets yellowish green (Zone V) .... *T. chinensis*

Scales of the winter buds abruptly pointed, keeled

Leaves with a broad, prominent midrib, 2–3 mm. broad, 1.5–2.5 cm. long; mature branchlets reddish brown (Zone IV) ....*T. cuspidata*

Leaves with only a slightly raised midrib, 1.5–2 mm. broad

Plant generally a low, frequently straggling, shrub; leaves 1.3–2 cm. long; seed broader than long; mature branchlets green (Zone II) ..... *T. canadensis*

Plant a tree; leaves 1–2 cm. long; seed longer than broad; mature branchlets yellowish green (Zone VI) .... *T. brevifolia*

Taxus × *media* Rehder (*T. cuspidata* × *T. baccata*) is a hybrid that is commonly met with in the nursery trade. It originated about 1900 in the Hunnewell Arboretum in Wellesley, Massachusetts. Various forms are in the trade, but perhaps the most common are two erect forms, *T.* × *media* var. *hatfieldii* Rehder and *T.* × *media* var. *hicksii* Rehder. The technical characters are, in general, intermediate between the parents, except that the mature branchlets are olive green, frequently reddish above.

A second hybrid, *Taxus* × *hunnewelliana* Rehder (*T. cuspi-*

data × *T. canadensis*) is much less commonly seen. This resembles *T. cuspidata* but generally has narrower, lighter green leaves. In winter the leaves usually take on a reddish cast, as do those of one of its parents, *T. canadensis*.

Though usually of dioecious nature (individual plants being either male or female), yews are found which bear both male and female reproductive organs. The female structures are small and greenish and, until ripe, inconspicuous. The male "catkins" are also small, but when pollen is shed they become yellow. The pollen is wind borne and abundantly produced — so copious, indeed, that the ground under the plants may be completely discolored by it. The fruit is a nut-like seed partly enclosed in a pinkish or reddish succulent cup. With the exception of the cup, which is apparently only slightly poisonous, all parts of the plant are intensely poisonous to all classes of livestock and to humans. The poisonous principles seem to be two alkaloids and a volatile oil, which is a slowly acting irritant. Children are attracted by the brightly colored, fleshy cup in the fall. In cases where children have ingested the fruit, it is probably wise to induce vomiting or to have the stomach pumped. In any event, a physician should be contacted.

The following passage, quoted from Thomas Martyn's edition of Phillip Miller's *Gardener's Dictionary* (1807), is too touching to pass without sharing with the modern gardening public:

> A clergyman, who was a curate in Sussex, informed me, that a young lady and her servant, his parishioners, being seized with an ague, were advised to take a decoction of Rue, which they unhappily mistaking for Yew, sent to the church-yard, where a large old tree grew, and gathered a quantity of the leaves, of which they made a decoction, and drank it upon going to bed. The next morning they were both found dead. This was sunday: on the thursday following, the clergyman was called upon to bury them: he performed the office on the servant, but the young lady had so fine a bloom on her countenance, that they entertained hopes of her being in a state of suspended animation, and accordingly tried the experiments usual in such cases, but without success: they determined however not to bury her at that time, but kept her till the ensuing saturday, and even then the corpse remained totally unchanged. What made it more remarkable was, that the accident happened in november, and the weather was of that damp murky kind in which the flesh keeps worst.

The name *Taxus canadensis* was first used by Humphrey Marshall in his sales catalog "Arbustum Americanum, the American Grove, or an Alphabetical Catalogue of Forest Trees and Shrubs Native of the American United States," published at Philadelphia in 1875. The plant had, of course, been known much earlier, but had been treated as a form of *Taxus baccata.* It is alleged to have been introduced into cultivation in England in 1800, though where, and by whom, seem not to have been recorded. Although by far the hardiest of the yews, it seems to be cultivated relatively seldom. Unlike *T. baccata* and *T. cuspidata*, it appears to require some shade to do well. Various gardening authorities suggest that its great value may be as a ground cover under evergreens. Rehder, writing in Bailey's *Cyclopedia of Horticulture*, says it is a "Prostrate shrub, with wide-spreading slender branches, rarely more than 3 feet high. Leaves . . . assuming in winter usually a reddish tint . . . In cultivation it becomes usually a more upright and less straggling shrub." In nature it occurs from Newfoundland to Manitoba, southward through New England to western Virginia, through west central Indiana, northern Illinois to northeast Iowa.

Taxus brevifolia, named by Thomas Nuttall, is a tree of the forests of the west coast of the American continent, ranging southward from British Columbia to California and eastward to Montana. It was introduced into English gardens in 1854 by William Lobb. It seems to be little cultivated and has the reputation, among gardeners, of being a difficult plant to grow. The name is said to be erroneously applied in the trade to *T. cuspidata nana.*

Taxus cuspidata was named by P. F. von Siebold and J. G. Zuccarini in their great *Flora Japonica* of 1826–70, though it was first described as *T. baccata* by Thunberg in 1784. It was introduced into cultivation in England by Robert Fortune in 1855. Fortune received it from a Mr. Beale, in Shanghai, who, in turn, had received it from Japan. It was introduced into the United States in 1862 by Dr. George R. Hall. In Japan it occurs naturally in the mountains of the islands of Hokkaido, Honshu, Shikoku, and Kyushu. In Japan the timber has been used in water tanks, pails, and baths, and it is used for carved trays, chopsticks, clogs, and the bows of the Ainos.

In nature this is an erect, broadly conical tree, to fifty feet tall. This form is known in the trade as *T. cuspidata* var. *capitata.* Most authorities record that cuttings taken from lateral branches of the *capitata* variety do not develop a leader and grow instead into spreading shrubs. E. H. Wilson, however,

asserted that these "shrubs" generally produce a leader after some years and assume the typical tree form. Whatever the case may be, there are now more than a dozen horticultural forms in the trade which do seem to maintain the shrub habit. Indeed, it is possibly the most common yew in cultivation in the United States, where the various forms are often used in foundation plantings. In common with the European *T. baccata*, it responds well to shearing, making a dense hedge or, if the gardener has the patience, making an excellent plant for topiary work. In addition to all these virtues, it is easy of cultivation and in most situations grows relatively rapidly.

T. baccata Linnaeus occurs in nature from latitude 63°10′ north in Sweden, Norway, Scotland, Estonia, multitudinously throughout Great Britain and France, down to the Mediterranean and the Atlas mountains in Algiers. Toward the east, yew inhabits the plain and the hilly countries to Asia Minor, and up to the Ural mountains in Russia.

In the old books several names for the tree occur: Yeugh, Eugh, Iw, Ewe, Yewgh, Ugh, and Yw are designations for the same plant. Yw is said to be the Welsh, and Iw the Anglo-Saxon. Many years of cultivation of *T. baccata* give a definite advantage to this evergreen in its use as a garden decoration. Indeed, there are about 100 named forms of the species in cultivation. The leaves are approximately 1–1½ inches in length and from 1/16–3/16 of an inch in width, varying in color from holly-green to an almost black green. One of the most interesting characteristics of the tree is its adaptability to pruning. When pruned to a desired shape, the tree's remaining branches let out new shoots in great numbers to fill out the general composition and empty volume of the tree crown.

The yew has been used for ornamental gardening as far back in English history as Tudor times. Not only were the trees used to form hedges, they were also clipped into the forms of animals, birds, and geometric shapes. The art of training and trimming trees — known as topiary art — gained popularity during the seventeenth century, to die down in the eighteenth. Such gardening tastes have not been regenerated with any comparable enthusiasm since.

Some experts estimate that the growth of the trunk, being very slow, does not exceed the rate of one foot in diameter in sixty to seventy years.[3] Yews reach diameters of twelve to fifteen feet and a height of up to eighty feet. It has been said that

[3] Sir Herbert Maxwell, "The Principles and Prospect of British Forestry, XIV," *The Garden* 84: 258, 1920.

some specimens in England are well over 1,000 years old. This longevity is in part due to the peculiar characteristic of yews to grow healthy tissue around decayed, rotten, or hollow core.

The wood used in antiquity, especially for bows and arrows, is said to be the finest for this purpose. However, in use for furniture, not only is it difficult to handle and carve, but due to the above mentioned characteristics, one never knows whether a particular stem is solid or hollow, strong or decayed. And one does not know until the wood is felled. The yew's remarkable ability to survive in spite of the frost-induced decay has been attributed to the old beliefs in the tree's divine protection and association with everlasting life. It is one of the reasons that the yew is so frequently found cultivated in the churchyards and near graves. Having seen them in such locations so often, the photographer can testify to their majestic and haunting appearance.

MARK SILBER
GORDON P. DEWOLF, JR.

Malus 'Donald Wyman'. Many comments have been received since publication of the description of *Malus* 'Donald Wyman' in the last issue of this journal. Perhaps the most interesting one came from Mr. Ralph H. Smith, Associate Wildlife Biologist at the Wildlife Research Laboratory in Delmar, New York. Mr. Smith was given propagating material from our specimen a number of years ago.

His observations are as follows:

"Perhaps you will be interested in some comments on its performance. We top-grafted it onto volunteer common apple and also budded it onto *Malus sieboldi* and common apple. It grows vigorously, flowers well every year and fruits even in the years when common, volunteer apple has no fruit.

Its bright red, glossy fruit, if undisturbed, persists in good color until late March, and in a shriveled state until the flowers appear in May. The returning robins, catbirds and starlings remove the fruit in April and May.

On the hilltops in southwestern Albany County, at 1900 feet, the pine and evening grosbeaks found our tree behind our office building and cleaned it in about a week. 'Profusion' is almost as long lasting in fruit but is not as colorful for so long. Only 'Sissipuk' holds fruit longer, because nothing touches the fruit, so far."

R.S.H.

Frances Williams and Her Garden Adventures

Some plant lovers find adventure in far-away places, on distant mountains and in wild valleys, or in ancient exotic gardens. Others, although they may dream of these alluring spots, are able to find adventure at their doorsteps. Frances Ropes Williams was one of the stay-at-homes, in Winchester, a suburb of Boston. But on her small property of only a third of an acre, shaded by several large trees, she gardened for many years, first in the time she could spare from her growing family, then, when her children were grown, much more intensively.

Mrs. Williams was a graduate of the Massachusetts Institute of Technology in landscape architecture, and her studies there, she said, gave her a background in horticulture. (How many landscape architects can say that of their training?) She was in her middle years when she entered into the concentrated phase of her gardening adventure, and she tackled it with a keen and observant mind, and, apparently, with boundless energy, both physical and mental. Her activities extended on both sides of the doorstep. Not only was she active outdoors. She kept voluminous records, and had a wide correspondence.

Since her yard was shady, Mrs. Williams started accumulating plants that would thrive under her conditions. She found that there were many that she could grow well. She enjoyed those with gray leaves and those with white or yellow variegations that added summer interest, as well as many other ground covers — lamiums, artemisias, wild-gingers. Plantainlilies (hostas) flourished under the big trees, and she found pleasure in making groupings of ground covers around them that accentuated their characteristics. A variety of *Hosta sieboldiana* with yellow-edged leaves, for example, was surrounded by a form of *Vinca minor* with yellow-edged leaves. Under and around all these were small spring bulbs. Texture, form, and scale and the changes of the seasons all were subjects of her attention, as well as growth behaviors.

She found that there were herbs that she could grow in the

shade and, through her interest in herbs, she became active in the Herb Society of America. She became corresponding secretary and continued serving in this office for many years, finally, in recognition of her devotion, being made Honorary Corresponding Secretary. She also served the Society as curator of its herbarium. In 1952 she received the first Award of Merit given by the Society, and in 1956 the New England Unit of the Society made her an honorary member.

It was the genus *Hosta*, however, that began to occupy more and more of her time and attention. It was in the early 1930's that she began collecting hostas, which proved to be well adapted to the somewhat damp shade of her partial acre. She bought some from local nurseries, and friends in Salem, where she grew up, gave her plants from old gardens.

Her interest in the plants grew, so that she looked up nurseries farther away to acquire more kinds. She began photographing plants at different stages of growth, and her record-keeping grew in importance. Each plant, when she acquired it, received a number. Each photograph bore the record of the number of the plant, its source, and the date the picture was taken. In her notebooks, plants were entered with names, numbers, sources, and other information connected with them. Through forty years she kept up all this information and added to it. She noted growth and bloom habits. She investigated the differences of root structure. The peculiarities of sporting did not escape her attention. In the fall of 1967 she wrote (at the age of 84): "I have been much interested this fall in the shoots with leaf buds at the ends of some hemerocallis roots. And in the fact that some of my hosta roots have leaf shoots on them, either at the end of the root or as fat little 1/16-inch buds that grew as perky little plants . . ."

At another time she wrote: "In several cases *Hosta undulata* (different plants) have sent out shoots that have become what is called *Hosta erromena*, big leaves, long stems two to three feet, and leaf blades five by ten inches, plants five feet across." The validity of this observation was confirmed when *H. erromena* was reduced to a variety of *H. undulata* by Maekawa.

As the years went by, seedlings began to appear in the garden that were attractive enough to be singled out for increase. At first Mrs. Williams shared these with others designated only by the numbers she had assigned to them. Later she named a number of plants that were introduced by Mrs. Thomas Nesmith of Fairmount Gardens. Unfortunately, plants given away under number were often given Latin names or descriptive designa-

tions by the recipients. Mrs. Williams also shared other hostas, including the offspring of seed she received from the Nikko Botanic Garden in Japan in 1950.

Her exhibits at the shows of the Massachusetts Horticultural Society won awards, including, in 1953, a bronze medal. Her photographs appeared among those in the study, *The Genus* Hosta *in Swedish Gardens*, by Nils Hylander (Uppsala, 1954). Her articles appeared in the Brooklyn Botanic Garden's *Plants and Gardens*, and in other gardening magazines.

She also did some hand crossing, and several of the plants that were grown from the seed of the pollinated plants were named and introduced.

Hosta *Cultivars of Mrs. Williams.* In the following list, I use the names used by Mrs. Williams.* They will be understood by those who have a serious interest in hostas, and I do not wish to wander into the maze of *Hosta* taxonomy, described by Prof. Hylander as a nightmare. Where quotes are used, I am repeating Mrs. Williams' written words. I have included Mrs. Williams' numbers with the cultivar names.

'Beatrice', #1399A. Seedling of *H. lancifolia albomarginata*, planted 1958. "May 1962 — one leaf variegated with yellow stripes. 1965 — plant had five variegated leaves." 'Beatrice' tends to give variegated seedlings, which make it of great interest to those who like to play with hostas.

'Betsy King', #502. (Introduced 1960) Mrs. Williams thought this to be a *decorata-lancifolia* hybrid. It starts growth early in the spring like *lancifolia*, and the flower shape is very like that of *decorata*. It is light to moderate purple, the color solid outside and solid inside except for six white stripes at the joinings of the perianth segments. The leaf mound is to 14 inches, the scapes reach 20 inches. It is an effective garden plant, neat and well proportioned, the color darker than that of most hostas, blooming in early August. It is one of Mrs. Williams' best.

'Carol', #1429. A clone with white-edged leaves, a sport cut out of *H. fortunei* #152 in 1967.

* The nomenclature of cultivated hostas is somewhat complex. Those who wish to pursue the subject further should consult: Hylander, Nils, "Genus *Hosta* in Swedish Gardens," *Acta Horti Bergani* 16: 339–420, 1954.
———, "The Genus Hosta," *Journal of the Royal Horticultural Society* 85: 356–366, 1960.
Hensen, K. J. W., "Preliminary Registration Lists of Cultivar Names in *Hosta* Tratt," *Mededelingen van de Landbouwhogeschool te Wageningen* 63 (7): 1–12, 1963.

'Dorothy', #511. (Introduced 1961) Mrs. Williams guessed the parents to be *fortunei* and *decorata.* The leaves are gray underneath, and the shape of *decorata*, though more cordate. The flowers are like those of *H. fortunei.* They are light purple outside, striped a little deeper inside. The plant is well proportioned, with 30-inch scapes. The leaves are about 5½ inches wide by 7 inches long.

'Frances Williams', #383. Named by G. W. Robinson, superintendent of the Oxford Botanical Garden (*Journal* of the Royal Horticultural Society, February 1963). Mrs. Williams picked this out of a batch of *H. sieboldiana* seedlings at Bristol Nurseries in 1936. It is included with her plants because it was through her efforts that it was singled out, propagated, and introduced into commerce as a special clone. It has been known as *H. sieboldiana* 'Yellow Edge' and *H. sieboldiana aureo-marginata.* A large clump is a handsome and effective accent in a shady place. It still commands a good price, as much as nine or ten dollars, after almost thirty-five years.

'Golden Circles', #1141. Seedling found in 1954 under 'Frances Williams'. Mrs. Williams said the yellow edge was broader; otherwise it, too, is typical *H. sieboldiana.*

'Green Pie Crust', #1290. Seedling found in 1951. The large leaves have neatly ruffled margins. The flowers are pale purple, almost white. The beautifully crimped leaves of this large, handsome plant make it especially choice, and it is sure to be ardently sought after when it becomes better known.

'Green Ripples', #851. (Named 1967–68) Seedling of *H. fortunei gigantea* #128. Mrs. Williams' photograph of #128 shows rather wavy foliage. A large plant, the light green leaves with crinkled edges, the flowers very pale.

'Kathleen', #1528. (Named 1968) Seedling. "Lovely soft pinky flowers — similar to *H. fortunei*, gray leaves."

'Louisa', #537. (Introduced some years ago, but not named by Mrs. Williams until 1969.) This charming little hosta found its way into gardens under several designations. Gray and Cole introduced it, calling it *Hosta lancifolia albomarginata alba.* The white-edged lanceolate leaves are about 4½ inches long by 1½ inches wide, making a mound about a foot high. The white flaring flowers on two-foot scapes begin to bloom in mid-August. It has also been called *Hosta* "minor alba" white edge, and F. R. W. #537. It, too, gives interesting seedlings, some variegated, some white-flowered. Combinations of both traits are likely. 'Louisa' is a choice, dainty plant.

Fig. 6: Hosta sieboldiana *'Frances Williams' with yellow edged leaves. Photo: Frances R. Williams.*

'Sentinels', #1350. (Introduced 1966) Seedling found in 1954. "Profuse purple flowers, upright flower stalks. Very early shiny green leaves like *lancifolia*." Blooms in late August.

'Sprite', #795. Seedling found about 1946. "Low, six inches, flower eight inches, leaf thickened. Mosaic?" This was not introduced, perhaps because of the possible mosaic, or perhaps it lacked the proper attraction.

'Sunlight', #1142. A sport of 'Frances Williams' with yellow-green leaves. It is rather weak because of its lack of chlorophyll, with a tendency to brown at the edges. It reverted to green in Mrs. Williams' garden, but still exists in the collection at the Case Estates of the Arnold Arboretum.

Mrs. Williams' Crosses. In 1949 Mrs. Williams pollinated a plant of Hosta "minor alba" (I use the double quotes and lack of italics to indicate that this well known and widely used name has no botanical standing) with pollen from *H. plantaginea.*

She considered the offspring to be the result of this cross, but I can see no trace of *H. plantaginea* in the plants that she named and introduced. They may well be hybrids, however. Plants similar to the ones she named often appear in our garden, where many hostas have been growing together for several decades. However, 'Sweet Susan', result of another hand cross, is the unmistakable hybrid it is supposed to be.

'Lavender Lady', #1025. (Introduced 1964) "Very pale pinky lavender flowers, stalk 1½ to 2 feet." Mid-August.

'Purple Profusion', #1024. (Introduced 1962) "Dark purple flowers, stalks 30 to 37 inches." Leaves a little broader than those of 'Lavender Lady'. Mid-August.

'Slim Polly', #1155. (Introduced 1964) Flowers pale purple, late August. Purplish red in base of petioles.

'Snow Flakes', #1154. (Introduced 1964) White flowers in early August. Taller, with wider leaves than typical "minor alba." Flowers slightly inflated toward base of tube.

'Tinker Bell', #1156. (Introduced 1963?) White flaring flowers in early August. The leaves are more slender than those of 'Snow Flakes', and the plant is smaller and weaker.

'Sweet Susan', #1383. (Introduced 1966) The only plant resulting from the 1958 cross of *H. lancifolia albomarginata* by *H. plantaginea.* This is an interesting hybrid, as it is such an obvious blend of the two parents in size of leaves, flowers, and seed-pods. The number of well formed capsules is surprising, but there are few seeds. I planted some last fall but had no germination. The flowers of 'Sweet Susan' are somewhat fragrant, their color pale purple, deeper than those of the well known hybrid of *H. plantaginea*, 'Honeybells'. Mrs. Williams' granddaughter, Susan Williams, did the actual pollen-dabbing of this cross.

Another cross made by Mrs. Williams in 1948 involved *H. plantaginea* and *H. decorata.* She records but one resulting seedling.

'Pancakes', #1023. She says of it, "Squat, dumpy . . . leaves flat, oval and round . . . lovely gentle purple flowers." I have never seen it, and do not know anything more of it than this. Mrs. Williams does not mention any scent.

The Moral of a Long Tale. The moral of all this is that Mrs. Williams had a very good time in her little garden. Within the confines of what seems to have been an ordinary suburban housewife's horizons, she found adventure. The moral is further that we owe her some very fine plants, that she loved to share

plants and information with others, and that she kept records! How often in horticulture do we hear the sad refrain, "He kept no records." So anxious was Mrs. Williams to pass on information that in the last years of her life, with her eyesight failing, she wrote out notes on her plants with a felt pen, only a few large words to a page.

She gave plants to several institutions as well as to many individuals. She gave seventy-five, all with her numbers, to the Arnold Arboretum, and these can be seen in the hosta collection at the Case Estates in Weston. Her daughter, Miss Constance Williams, writes that her family plans to give a collection to her *Alma Mater*, M.I.T.

The Herb Society will always claim her as its own. After she died in the autumn of 1969 at the age of 86, the Appalachian Mountain Club noted that it had lost a life member. The other societies and organizations to which she belonged must feel poorer without her, but richer for having known her.

The American Hosta Society, born in 1968, gave her a citation in the summer of 1969, "for inspiring others with the love of *Hosta*." But perhaps the loveliest tribute came from one who had long known her through the Herb Society. With deepest feeling she said, "I never knew her to say an unkind word about anyone."

As for those records, there are boxes and boxes of them. No doubt there is much that will not be preserved. They cover her other plants, not only *Hosta*. But as far as *Hosta* goes, there are enthusiasts who will willingly comb them over, gleaning out all that is of permanent value to add to our store of information about Mrs. Williams' plants, and *Hosta* in general.

We shall always be grateful to Frances Williams for her generosity, for the lovely plants she has given us, and for those voluminous records.

GERTRUDE S. WISTER
Swarthmore, Pa.

Summary of weather data recorded at the Dana Greenhouses, April and May 1970.

	Precipitation	Avg. 8 a.m. Temp.
April	3.84	46.93
May	3.79	57.19

Notes from the Arnold Arboretum

Spring Planting Program. Planting activities this spring have concentrated upon the renovation and landscaping of several key areas which, for one reason or another, were in need of special attention so that the grounds may be in the best possible condition by 1972, when the Arboretum will celebrate its 100th anniversary. In conjunction with this, certain mass plantings of the more showy spring flowering shrubs, especially azaleas, have been enlarged to provide more color during the time of year when public attendance is highest.

This has necessitated the planting of nearly two thousand shrubs of various sizes and represents a temporary departure from the normal spring sequence of moving plants to Jamaica Plain from the growing areas at the Case Estates. For a project of this size, it was necessary that the Arboretum obtain most of the plant material from commercial nursery sources, and it should be noted here, with gratitude, the good will that was shown by all the nurserymen we approached. Nearly all the plants were specially selected and offered at reduced prices for Arboretum use.

The planting season started in late April when workmen from a commercial tree company arrived on the grounds to move seven large specimens of the longstalk holly, *Ilex pedunculosa*, from the *Ilex* plantings at the Centre Street beds to new positions in front of the Administration Building. The need for evergreen material in the vicinity of the Administration Building and the Jamaica Plain Gate has been realized for some time, and the opportunity to make such plantings came as a result of the disastrous snow and ice storm which occurred in the winter of 1968–69. Among other things, this storm severely damaged several large plants of *Magnolia stellata* in the border in front of the Administration Building. Two of them were so badly broken that they had to be removed. They were replaced with three specimens of *Ilex pedunculosa*, approximately 9 feet tall. Three more, of large dimensions, were placed as free standing specimens at the southeast corner of the Administration Building where they serve to soften the rather harsh lines at that corner of the Building. The largest plant is 12 feet high, 10 feet wide, and weighed approximately 2½ tons. These plants presented a most unusual sight as they moved slowly through the Arboretum, on special equipment, from their old site to the new one.

7: *George Robert White Medal of Massachusetts Horticultural Society, rded to Dr. Donald Wyman, "author any books and innumerable articles, fatigable teacher and lecturer, ener- holder of executive office at various s in national horticultural organiza- , worthy recipient of many of the est awards in horticulture at home abroad. . . the virtual embodiment of culture in New England."*

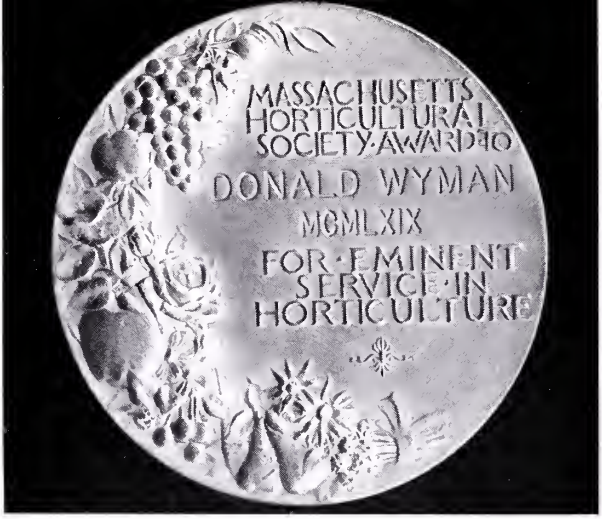

Fig. 8: Ilex pedunculosa *en route to its new home. Photo: P. Bruns.*

A matching planting of three 9 foot specimens of the umbrella pine, *Sciadopitys verticillata*, was made at the opposite corner of the building. It was particularly fortunate that such large specimens of this handsome and slow-growing conifer could be located, for we are now able to display, in a prominent place, two of the best exotic evergreens which are hardy in this area.

Sciadopitys is valued for its dark green leaves which are arranged in whorls and, more particularly, for its very dense habit. *Ilex pedunculosa*, an Arnold Arboretum introduction from Japan in 1892, is one of the hardiest of the evergreen hollies and, despite its availability in nurseries, is all too seldom seen in gardens. It forms a large shrub or small, slow-growing tree with dense shiny leaves and glossy red berries which hang downward on stalks nearly an inch long.

Much other evergreen material has been used in this area. A bed of *Pieris floribunda*, the mountain andromeda, was made at the entrance to the driveway near the main gate. Although this plant is fairly common, it deserves the prominent placement allotted to it here as it is perhaps the most attractive and dependable of all the broad-leaved evergreen shrubs for the north. The erect clusters of white flowers, perfect hardiness, evergreen leaves, and prominent flower buds all winter long provide a combination of good attributes difficult to beat in any other plant.

Across the road, on the south side of the main gate, a large mass planting of *Rhododendron carolinianum*, the Carolina rhododendron, has been made. The pale rosy-purple flowers should provide an attractive welcome to vistors who use this gate at lilac time. When these grow a bit larger an especially pleasing effect should be evident in the contrasting flower colors of the rhododendrons and a nearby specimen of *Forthergilla major*, a relative of the witch-hazels with interesting white flowers in mid-May.

Another major project which was started is the renovation of the extensive azalea border which lines one side of the Meadow Road, starting opposite the Administration Building and running nearly to the shrub collection, a length of almost a quarter of a mile. This border was planted in 1949 at the suggestion of Mrs. Beatrix Farrand, who served as a landscape consultant for the Arboretum. The original idea was to display the various species and cultivars of azaleas hardy at the Arboretum according to the sequence in which they blossom, with the earliest flowering species starting diagonally across from the Administration Building and finishing at the other end of the road with the later flowering varieties.

Many factors have necessitated the task of renovating the border at this time. It has been found over the years that very poor soil conditions in several places have contributed to the decline of some of the plants. A number of these, in poor condition, were discarded in early spring; others were removed to the nursery for rejuvenation. Soon after this many tons of soil were removed to a depth of about two feet and, after a layer of gravel was laid to provide drainage, better soil was brought from another part of the Arboretum to fill in the holes. Approximately one third of the azalea border has now been replanted and, where possible, the plants have been rearranged according to the proper sequence of blossom. Much work remains to be done at another time, especially the planting of a large number of cultivars which are new to the collection and still in the nurseries

A new planting was made around the large pond near the shrub collection. This includes *Rhododendron vaseyi*, the pinkshell azalea, *R. prinophyllum*, the roseshell azalea, and *R. periclymenoides*, the pinxterbloom azalea. These species were selected because they bloom at the same time as the lilacs nearby and should, as they increase in size, reflect nicely into the pond.

The last major azalea planting to be undertaken was the placing of 50 *Rhododendron schlippenbachii*, the royal azalea, next to the older planting on Bussey Hill. The grouping is now situated in such a way as to be visible for some distance along the road which leads to the top of the hill.

Finally, two slopes at the Weld Street Tract were planted with ground covers. This is planned to be a demonstration of plants which can be used to cover a dry slope, also to provide an interesting view for motorists traveling along Centre Street or Weld Street. Over a thousand small plants were placed on these two banks. They include the following:

Akebia quinata
Coronilla varia 'Penngift'
Euonymus fortunei 'Coloratus'
Juniperus chinensis 'Sargentii'
Juniperus horizontalis 'Douglasii'
Lonicera henryi
Lycium chinense
Parthenocissus quinquefolia
Rhus aromatica
Rosa wichuraiana
Stephanandra incisa 'Crispa'

ROBERT S. HEBB

Arnoldia Reviews

Orchids, by Floyd S. Shuttleworth, Herbert S. Zim, and Gordon W. Dillon

When one of the greatest orchidologists of all time, Oakes Ames, wrote, "Few genera of plants have played greater havoc with human pride: few genera of plants have so humbled men of science," he was thinking of Charles Darwin and John Lindley and their well documented troubles with the orchid genera, *Catasetum* and *Cycnoches*. This huge, eccentric family has not only humbled and confused but delighted and entertained perhaps a greater number of people the world over than any other family of plants. There seems to be no end to surprises in the orchid family. It is pleasing to find in this sprightly little book, modestly titled *Orchids*, a large number of orchids excellently illustrated and carefully described. In addition to *Catasetum*, *Cycnoches*, and many other genera, one finds the "bucket orchids" like *Coryanthes*; cucumber orchids; "blue" orchids; orchids involved with pseudo-copulation, as in the genus *Ophrys*; "weed" orchids; and, perhaps one of the most incredible of all, the recently discovered Australian orchid that grows and flowers entirely under the ground.

"This book surveys the great Orchid Family as it illustrates and describes those selected wild forms that best show the family characteristics and diversities. It also attempts to show those species most commonly cultivated and often used in breeding." So states the foreword. This promise is well carried out. It is difficult to imagine that any other publication costing as little as $1.25 can possibly bring as much enlightenment and pleasure regarding orchids as this booklet. It deserves to sell by the hundreds of thousands.

Vividly depicting the orchid family from an evolutionary standpoint, the book fairly explodes with a multitude of skillfully done color illustrations by Elmer Smith. Mr. Smith confesses that he does not grow orchids. He must have spent a great amount of time in painstaking research in order to produce as remarkable a series of scientifically accurate and aesthetically pleasing studies of the several hundred species that we find here. An enormous quantity of botanical information is tied in nicely with the illustrations. Additional pleasant tidbits are liberally scattered throughout the text. It was a happy collaboration when Gordon Dillon, who edited the American Orchid Society *Bulletin* for more than twenty-five years, Dr. Herbert Zim, an outstanding authority on science education, and the late Dr. Floyd S. Shuttleworth, of Wisconsin State University, prepared the text for the Golden Nature Guide series.

It should come as welcome news to the owners of this small volume that the publishers are already at work on a "coffee table size" edition, in which much more information can be given and larger reproductions of the excellent plates will be possible.

G.H.P.

Floyd S. Shuttleworth, Herbert S. Zim, and Gordon W. Dillon, *Orchids*, New York: Golden Press, 1970. $1.25

The Oxford Book of Food Plants, by G. B. Masefield, M. Wallis, and S. G. Harrison; illustrations by B. E. Nicholson.

This is a book written in Great Britain for a British audience. It claims to deal with 420 varieties of food and/or condiment producing plants. When it treats plants cultivated in Britain (nearly half the text and plates) it seems to be quite good. When it deals with plants unfamiliar in the British Isles it leaves — at least occasionally — something to be desired. For example, the description of "sugaring-off" maple sugar (p. 16) is surely confused. The pecan (p. 29) has 11–17 (not 7) curved (not straight) leaflets — very distinct from other caryas and not at all like the illustration. Both the butternut and the American walnut have the basal leaflets much smaller than the others; in the butternut all the leaflets are sessile, while in the American walnut they are stalked. The colors of the carrots (p. 175) and the 'Summer Crookneck' squash (p. 123) seem to be inaccurate. These are only a few small complaints, perhaps, but one cannot feel completely confident about the treatment of plants with which one is unfamiliar if one knows that erroneous statements or illustrations are given for plants with which one *is* familiar.

It is disappointing that this book, with its limited frame of reference, does not inspire more confidence. It is regrettable that the style is so pedestrian. Exciting work is being done on the origins, wanderings, and chemistry of economic plants. Particular economic plants have molded the history of civilizations and influenced the development of whole cultures. One looks in vain for such information here.

The value of the book lies in its illustrations, and, despite what has been said above, they appear to be, for the most part, accurate. The colors could have been better, and it is regrettable that they are not. All in all, this book does fill a gap in the popular literature. One must, say, even though without enthusiasm, that it is useful.

G. P. DeW.

G. B. Masefield, M. Wallis, and S. G. Harrison, *The Oxford Book of Food Plants*, London: Oxford University Press, 1969.

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On the cover: Phellodendron armurense *at the Arnold Arboretum. Photo: P. Bruns.*

Facing: View of Cork Trees along Meadow Road. Photo: P. Bruns.

The Cork Trees

Along the road which follows the meadow south from the Administration Building is a stand of large trees — their green flowers tinged with pink attracting bees in the late spring, the yellow leaves adding a gay note in the fall, and the gnarled open branches making interesting patterns against the snow in winter. The deep green foliage with pinnately compound leaves may suggest walnut trees, but their rough furrowed bark and dark blue-black berries identify them as Asiatic Cork trees or Phellodendrons.

These trees belong to the Rutaceae, the family to which the orange and other citrus fruits belong, and like them they have leaves which are aromatic when bruised. The glands which produce these volatile oils can be seen with a magnifying glass as clear dots along the margins of the leaf.

The *Phellodendron* trees are dioecious, having male and female flowers on separate trees and the flowers of both sexes, small and green with varying amounts of pink, are borne on panicles at the ends of the branches. In the flowers of one of the species, *Phellodendron chinense*, the green petals are noticeably streaked with rose and the densely flowered panicles are quite decorative.

Inside the female flower the five united carpels are borne on a short stalk (gynophore) of glandular tissue which produces the nectar. This glandular area also appears beneath the rudimentary carpels in the male flower and in other genera of the family may appear as a disc or ring.

In autumn the Phellodendron leaves turn a light clear yellow; they fall quickly, leaving in the female trees bunches of black fruit hanging from the ends of the branches like small grapes. These fruits have a strong aromatic odor and contain five or six dark seeds. The fruits stay on the trees most of the winter, providing food for starlings, robins, and other birds.

The oldest of the Cork trees in the Arnold Arboretum is an Amur Cork tree, *Phellodendron amurense*, with gnarled and bent trunk, the thick branches spreading from about four feet above the ground. Here and there on the ground are exposed

large flat areas of woody root. The light grey bark is thick and furrowed, and although the tree gives the appearance of age, it is age accompanied by strength and grace. This patriarch of the group came as a seed from the Imperial Garden of St. Petersburg, Russia, and was planted here September 14, 1874, two years after the beginning of the Arboretum. Next to it stands another tree which was grafted from a piece of the first tree in November 18, 1882. This species is originally from northeast Asia, and gets its name from the great Amur river of that area.

There are several Chinese cork trees, *P. chinense*, in the Arboretum collection. In parts of China the bark of this tree is called Huang-po and is used as a general remedy. One of these trees was grown from seed collected by Ernest H. Wilson in 1908 during his travels in China. The seed was from Western Hupeh, and Wilson described the area in his book, *A Naturalist in Western Asia*: "In the gorges the main river is joined by numerous lateral streams, branches of which flow through glens of wondrous beauty. These riverlets in winding their way usually fill nearly the entire bed of the glen and are bounded by walls of cliff from 300 to 1000 feet sheer. Waterfalls are numerous and wherever it is possible vegetation is rampant." In 1919 Wilson became Assistant to the Director of the Arboretum and later he was made Keeper (his own term) under Oakes Ames.

The Arboretum has several examples of the Lavalle Cork tree, *P. Lavallei.* Two are from seed collected in Azuma, Japan, in 1905, by John George Jack, Assistant Professor of Dendrology at the Arboretum. The third, planted in 1919, is from seed collected by Wilson in Tokyo.

Two of the Sakhalin Cork trees (*P. sachalinense*) in the Arboretum are grafts made in 1919 of a tree which came from Germany in 1905 and is no longer living. The third Sakhalin Cork tree is a small tree, a comparative newcomer, raised from seed sent from the University of Tokyo in 1952. The name Sakhalin is from the name of an island north of Japan; the species is native there, in Korea, northern Japan, and western China. Another tree of this species which grew for some years in the Arboretum but is no longer living was grown from seed sent by William Smith Clark, president of Massachusetts Agricultural College, from Hokkaido in northern Japan in 1877. Clark went to Japan to establish an agricultural college at Sapporo, and while he was there he sent back seeds of many native trees and shrubs. Among these were the tree lilac (*Syrin-*

ga reticulata), the Sakhalin Cork tree, the evergreen Bittersweet (*Euonymus radicans* var. *vegeta*) and others.

The Pearfruit Cork tree (*Phellodendron piriforme*), is from seed received from the Botanical Institute of Leningrad, Russia, and was planted here in 1926. A graft of this tree is in the collection also.

The two comparatively small trees of the Japanese Cork tree (*Phellodendron japonicum*) came as seed from the Botanic Garden, Berlin-Dahlen, Germany, in 1956. However, this species was represented much earlier in Cambridge, Massachusetts, by a tree now dead about which John Singer Sargent wrote in *Trees and Shrubs*, "It was raised before 1870 in the Botanic Garden of Harvard University at Cambridge, from seed from the Imperial Garden at St. Petersburg and probably collected by Maximowicz in Japan." C. J. Maximowicz was chief botanist at the Imperial Botanic Garden in the nineteenth century. From 1860 to 1864 he travelled in Japan and accumulated a large collection of Japanese plants.

In addition to far and romantic places, the Cork collection represents the work of a large number of anonymous men who collected fruit and seeds and kept careful records, men who planted the seeds or grafted young cuttings on to sturdy rootstocks, men who tended the young plants from germination until they were ready to be put out in the Arboretum. Each individual tree has a number and a filing card, and a record is kept of its growth until it dies.

Recently a study was made of Phellodendron seeds. Groups of one hundred seeds were planted under varying conditions to determine the best method of germination. And at the Case Estates in Weston, Massachusetts, there are several young Cork trees which were started within the past few years at the Arboretum greenhouse as seeds. Some of the seeds came from the Botanical Garden at the University of Bucharest, others came from England, Germany, and Russia. After a year or two at the greenhouse and at the nursery, they were transferred to Weston, where they are now young trees up to seven feet high. In this way the Arboretum is assured of replacements when the present trees grow old and die.

HELEN ROCA-GARCIA

Backing: *Phellodendron amurense*. Photo: H. Howard.
Facing: *Malus sargentii*. Photo: H. Howard.

Notes from the Arnold Arboretum

Autumn Interest

The following charts are intended to serve as a brief guide to some of the many features of seasonal interest to be found in the Arboretum from mid-September to November. Even for the most casual observer, these can be months of intense interest. The subtle interplay of changing leaf colors combine with a rich harvest of fruits and berries to provide a spectacle of color which can be as striking in its own way as the flush of flowering in the spring.

The plants mentioned in the following tables are but a selection from those plants which are of interest in the autumn garden.

Shrubs in Flower

Name	*Common Name*	*Flowers*	*Effective*	*Location*
Elsholtzia stauntonii	Mint Shrub	Lilac-purple	August-September	Shrub Collection
Franklinia alatamaha	Franklinia	White, yellow stamens in center	September	Bussey Hill, Centre Street Beds
Hamamelis virginiana	Common Witch-hazel	Yellow, ribbonlike petals	Early October	Administration Building
Lespedeza bicolor	Shrub Bush-clover	Rosy purple	September	Shrub Collection

Trees with Vivid Autumn Color

Name	*Common Name*	*Color*	*Location*
Acer japonicum & vars.	Fullmoon Maple	Bright red	Maple Collection
Acer nikoense	Nikko Maple	Brilliant red or purple	Maple Collection

Acer palmatum & vars.	Japanese Maple	Scarlet	Maple Collection
Acer pensylvanicum	Striped Maple or Moosewood	Yellow	Maple Collection
Acer rubrum	Red or Swamp Maple	Brilliant red	Maple Collection
Amelanchier species	Service berries	Yellow, orange, red	Meadow Road
Betula species	Birch	Yellow	Betula Collection
Cercidiphyllum japonicum	Katsura tree	Yellow to scarlet	Meadow Road
Cercis canadensis	Eastern Redbud	Yellow	Behind Celtis Collection
Cornus florida	Flowering Dogwood	Scarlet	Many places along roads
Crataegus nitida	Glossy Hawthorn	Orange to red	Peters Hill
Crataegus phaenopyrum	Washington Hawthorn	Bright red	Peters Hill
Fagus grandifolia	American Birch	Golden bronze	Beech Collection
Fagus sylvatica	European Beech	Golden bronze	Beech Collection
Franklinia alatamaha	Franklinia	Brilliant orange to red	Bussey Hill, Centre St. Beds
Ginkgo biloba	Ginkgo or Maidenhair Tree	Clear yellow	Conifer Collection
Liquidambar styraciflua	Sweet-gum	Scarlet	Across road from Viburnums
Nyssa sylvatica	Black Tupelo or Black Gum	Brilliant scarlet to orange	Pond Area
Oxydendrum arboreum	Sorrel Tree or Sourwood	Brilliant scarlet	Meadow Road Kalmia collection
Parrotia persica	Persian Parrotia	Brilliant scarlet to orange & yellow	Centre Street Beds
Prunus sargentii	Sargent Cherry	Red	Administration Bldg.
Pseudolarix amabilis	Golden Larch	Golden yellow	Conifer Collection
Quercus coccinea	Scarlet Oak	Brilliant scarlet	West Slope — Bussey Hill
Quercus palustris	Pin Oak	Scarlet	West Slope — Bussey Hill
Quercus rubra maxima	Red Oak	Red	West Slope — Bussey Hill
Quercus velutina	Black Oak	Red	Meadow Road
Sassafras albidum	Sassafras	Brilliant orange to scarlet	Opposite Syringa Collection
Sorbus alnifolia	Korean Mountain-ash	Orange to scarlet	Peters Hill
Sorbus aucuparia & vars.	European Mountain-ash	Reddish	Peters Hill
Stewartia koreana	Korean Stewartia	Orange-red	Bussey Hill

Trees with Interesting Fruit

Name	*Common Name*	*Fruit Color*	*Effective*	*Location*
Ailanthus altissima	Tree of Heaven	Red keys, similar to Maples	Mid-July to November	Meadow Road
Aralia elata	Japanese Angelica-tree	Small black berries	Mid-August to Mid-October	Pond Area
Cornus florida	Flowering Dogwood	Bright red	September	Many places along roads
Crataegus crus-galli	Cockspur thorn	Bright red	September to February	Peters Hill
Crataegus lavallei	Lavalle Hawthorn	Brick red or orange red	November-December	Peters Hill
Crataegus monogyna	Single Seed Hawthorn	Red	September thru Mid-December	Peters Hill
Crataegus nitida	Glossy Hawthorn	Dull red	September to February	Peters Hill
Crataegus oxycantha	English Hawthorn	Scarlet	September thru Mid-December	Peters Hill
Crataegus phaenopyrum	Washington Hawthorn	Bright red	Mid-November to April	Peters Hill
Diospyros virginiana	Common Persimmon	Yellow to orange edible after frost	Mid-August to November	Pond Area
Evodia danielli	Korean Evodia	Red to glossy black berries	September-November	Bussey Hill
Gleditsia triacanthos	Common Honeylocust	Brown pods	August to December	Pond Area
Gymnocladus dioica	Kentucky Coffeetree	Large dark brown pods	July to December	Pond Area
Halesia monticola	Mountain Silverbell	Dry winged pod	July to December	Centre Street Path
Ilex opaca	American Holly	Red berries	September thru December	Greenhouse Area
Ilex pedunculosa	Longstalk Holly	Bright red on slender stalks	October thru December	Centre Street Path, Administration Building

Kalopanax pictus	Castor-aralia	Small black seeds quickly eaten by birds	July thru March	Pond Area
Koelreuteria paniculata	Golden-rain Tree	Light yellowish to brown, bladder-like pods	August thru November	Meadow Road
Liquidambar styraciflua	Sweet-gum	Round, horned balls	Remain all year	Across road from Viburnum collection
Malus species & cultivars	Crabapples	Red, yellow, purple	Mostly September to December	Peters Hill, Bussey Hill, Forest Hills Bank
Oxydendrum arboreum	Sorrel Tree or Sourwood	Dried capsules	July to November	Meadow Road Kalmia collection
Phellodendron amurense	Amur Cork Tree	Black	August thru December	Meadow Road
Platanus species	Plane Tree	Pendulous ball-like clusters	All year	Platanus Collection

Shrubs and Vines with Vivid Autumn Color

Name	*Common Name*	*Color*	*Location*
Aronia species	Chokeberry	Red	Shrub Collection
Cotinus obovatus	American smoketree	Scarlet to orange	Meadow Road
Euonymus alatus	Burning bush or Winged Euonymus	Scarlet	Euonymus Collection
Fothergilla species	Fothergilla	Brilliant yellow to scarlet	Main Gate
Hamamelis species	Witch-hazel	Yellow to reddish	Shrub Collection
Parthenocissus quinqefolia	Virginia creeper	Brilliant red	Near Administration Building
Parthenocissus tricuspidata	Boston ivy	Scarlet	Forest Hills Gate
Rhodendron vaseyi	Pinkshell azalea	Light red	On Administration Building
Rhus aromatica	Fragrant sumac	Yellow and scarlet	Meadow Road & Pond Area
Rhus copallina	Shining sumac	Scarlet	Meadow Road
Rhus glabra	Smooth sumac	Bright red	Meadow Road
Rhus typhina	Staghorn sumac	Red	Meadow Road
Rosa rugosa	Rugosa rose	Orange	Bussey Hill Overlook
			Shrub Collection

Rosa virginiana	Virginia rose	Scarlet to orange	Pond Area
Spiraea prunifolia	Bridalwreath spiraea	Red to orange	Shrub Collection
Vaccinium species	Blueberry	Scarlet	Meadow Road
Viburnum acerifolum	Mapleleaf viburnum	Purplish	Viburnum Collection
Viburnum lantana	Wayfaring tree	Red	Shrub Collection
Viburnum lentago	Nannyberry	Purplish red	Viburnum Collection
Viburnum prunifolium	Black haw	Shining red	Viburnum Collection

Shrubs and Vines in Fruit

Name	*Common Name*	*Fruit Color*	*Effective*	*Location*
Baccharis halimifolia	Groundsel bush	White	Sept.	Shrub Collection
Berberis julianae	Wintergreen barberry	Bluish black	Aug. to Oct.	Shrub Collection
Berberis koreana	Korean barberry	Bright red	Aug. to March	Shrub Collection
Berberis thunbergii	Japanese barberry	Bright red	Sept. to March	Shrub Collection
Berberis verruculosa	Warty barberry	Violet-black with greyish bloom	Sept. to Nov.	Rockery
Callicarpa japonica	Japanese beautyberry	Violet to metallic purple	Oct. & Nov.	Bussey Hill
Clematis dioscoreifolia robusta (syn *c. paniculata*	Sweet autumn Clematis	Plumy seed heads	Sept.	Fence, Administration Building, Parking Lot
Cotoneaster species	Cotoneaster	Red, black	Sept. to Nov. for most	Bussey Hill
Elaeagnus umbellata	Autumn elaeagnus	Silvery to red	Sept. & Oct.	Elaeagnus Collection
Euonymus species	Euonymus	Red to orange	Sept. to Nov.	Euonymus Collection
Ilex crenata	Japanese holly	Black	Sept. to Dec.	Centre Street Beds
Ilex glabra	Inkberry	Black	July to March	Opposite Kalmia Collection
Ilex verticillata	Black-alder, winterberry	Bright red	Aug. to Oct.	Meadow Road
Ligustrum spp.	Privet	Black	Sept. to Nov.	Shrub Collection
Magnolia stellata	Star magnolia	Red, podlike	Sept.	Administration Building
Magnolia virginiana	Sweetbay magnolia	Dark red, podlike	Sept. & Oct.	Near Main Gate

Myrica pensylvanica	Bayberry	Grey	Mid-Aug. to March	Shrub Collection
Rhus species	Sumac	Red, scarlet, crimson	Sept. to Nov.	Meadow Rd. & Bussey Hill Overlook
Rosa species	Rose	Red, orange, to nearly black	July to Jan.	Shrub Collection
Symphoricurpos albus	Snowberry	White	July to Nov.	Shrub Collection
Symphoricarpos x chenautlii	Chenault coralberry	Red	Sept. to Oct.	Greenhouse Area
Symplocos paniculata	Asiatic sweetleaf	Metallic blue	Sept.	Near Elaeagnus Collection
Taxus species	Yew	Red	Aug. to Dec.	Conifer Collection
Viburnum cassinoides	Witherod	Green, red, & black; often all colors in same berry cluster	Aug. to Oct.	Viburnum Collection
Viburnum dilatatum	Linden viburnum	Bright red	Aug. to Dec.	Viburnum Collection
Viburnum dilatatum xanthocarpum	Yellow linden viburnum	Red	Aug. to Dec.	Shrub Collection
		Scarlet	Aug. to Dec.	Shrub Collection
Viburnum opulus	European cranberrybush	Yellow	Aug. to Dec.	Viburnum Collection
Viburnum setigerum aurantiacum	Orange-fruited tea viburnum	Orange	Sept. to Nov.	Viburnum Collection
Viburnum trilobum	American cranberrybush			

ROBERT S. HEBB

Suburban Economics

This is being written during the first heat wave of the season in the Boston area. It is being written while much of the East Coast area is suffering the effects of air pollution. It is being written while a shortage of water has resulted in a ban on outside watering in many communities (this in spite of the fact that the first six months of this year had 2.1 inches more rain than the same period last year). It is being written while the Northeast has an enforced decrease in electrical voltage. We are entitled to ask why, in the richest nation on earth, we, the enlightened middle class, must suffer these inconveniences.

The answer is, simply, that we are reaping what we have sown. Our population has become too large, too rapidly, for our resources, natural and artificial, to cope with our demands. We have the technology to solve our problems. We can change our sources of energy or change our methods of generating energy to clean up our air. It will be expensive, it will take some years, but we do have the technology to do it. We can clean up our rivers and streams and lakes and ponds. We can enlarge our reservoirs and build larger pipelines to bring the water to our cities. We can increase our supply of electricity. It will be expensive and it will take some years, but we do have the technology to do it. All of our technological capacity will be to no avail, however, if we do not control the size and growth of our population. At present our population is growing too rapidly for our technological capacity to cope with it.

Let us take a homely example. In the suburban town in which I live we have just had a proposal for the construction of a 24-unit apartment complex. This will, the builders say, bring to the town some $12,000.00 in new real estate tax revenue annually. Let us do the arithmetic and see what really will happen.

We are told that about 50% of our tax dollar goes for support of the schools, the other 50% for running the town. If our per student school cost is about $700.00, and the number of students approximates the number of taxable units, then each family (or taxable unit) must be assessed, on average, some $1,400.00 per year. This is, in fact, the approximate assessment on a $30,000.00 property. However, the families living in our 24-unit apartment complex will be paying no real property

Facing: *Elaeagnus multiflora*. Photo: H. Howard.

tax, and will have on the average only about $2,000.00 of assessable personal property. At our current rate of about $40.00 per thousand, this will return to the town only about $80.00 per family per year. In other words, each family will cost the town some $1,320.00 per year. For our 24-unit complex this will total some $31,680.00 per year. Real property assessment on the complex we are told will bring in only $12,000.00. Therefore, the complex will cost the town some $19,680.00 annually. If we assume that each $100,000.00 of costs adds $1.00 to the tax rate, then this apartment complex will cost each family in town about $0.20 per thousand of valuation, or $6.00 per year on a $30,000.00 property.

Make no mistake. The only people who benefit from an increase in population in your town are the real estate agents, the developers, and the builders. The town does not benefit from them, and you, as a taxpayer, only stand to lose money.

At our present level of taxation my town cannot keep up with its responsibilities to its citizens. It cannot afford the new schools that are necessary now. It cannot afford to hire the teachers it needs for best educational conditions. It cannot maintain its roads and streets in good condition. Local sources of water are now being exploited to maximum capacity. It could not afford to buy water elsewhere even if alternative sources were available — which they are not. And our 24-unit apartment complex will require at least 6,000 gallons of water per day.

We are told that we must preserve our environment. What is it that we must preserve? When the first settlers arrived in New England they found a countryside characterized by vast stands of white pine. They found sandy coasts with stands of pitch pine. They found rocky hills covered with scrub oaks. They also found forests of white and red oak, and hickory. The pines and scrub oak are maintained in our area by burning. Under natural circumstances they would have been replaced in a few hundred years by oak and hickory. Forest land is able to sustain a relatively small population of animals, including man. Man is an animal of forest edges and adjacent grasslands. The first settlers cleared the forests, burning many of the felled trees. Through the colonial period and after, this clearing continued. One hundred and fifty years ago 80% of southern New England was cleared, or at least cut over. As the land wore out and as population increased, large numbers of farmers left the land, either moving to the cities or moving westward. The fields grew up to trees. Only the most fertile

lands within reach of the cities and towns remained in farmland. Beginning in the 1930s even these farms became unprofitable and many of them were abandoned. Again the fields grew up to trees. Today, we are planting subdivisions in these areas. The scrubby woodlots that now blossom with houses were, not too long ago, fields and pastures. What is it that we wish to preserve? Second growth scrub? Farmland? What?

The songbirds that we wish to maintain are not creatures of the forest primeval, the climax forest, but are denizens of second growth scrub and woodland margins. So are the deer and the rabbits and the foxes. So, we might add, are the pink lady slippers and the trailing arbutus, the hepaticas and the violets. The fact of the matter is that we do not want to preserve nature in its primeval condition. We desire to preserve an environment that can only be created in nature by "disasters." Under natural conditions such things as hurricanes and forest fires exercise this function. In an agrarian society this is maintained by the farmers. In our society which suppresses natural disasters and agrarian clearing our human environment disappears, going back to forest. Much of southern New England is now unsuitable for human habitation, Dense forest, albeit second growth scrub, covers more than 60% of the land surface. We maintain our dense populations of songbirds and deer by artificial feeding in the wintertime. We lament the disappearance of the pink lady slipper and the trailing arbutus — but we suppress the environment in which they can survive.

The environment that we live in is not stable. It is not natural for a large population of any organism, *Homo sapiens* included, to maintain itself indefinitely without deleterious effects upon other organisms. To maintain a large population of people we must clear land for habitation and industry that would otherwise be in forest or grassland. We must clear additional land to raise crops and to raise cattle. We must maintain unnaturally large populations of food producing organisms — and to do this we must ruthlessly exterminate those organisms that would destroy our crops. If we do not do this we will starve. We must remove our wastes and deposit them somewhere else in the environment. If we do not do this we will suffer pestilence. The environment which we create is also suitable for other organisms. Rats and cockroaches share our habitations. Potato bugs, gypsy moths, and rabbits share our gardens. Deer share our orchards. We destroy predators — weasels, foxes, bobcats, owls and hawks — which would help to control the vermin and pests because they also threaten (we think) "our"

animals and plants. We have built up an artificial environment to preserve our own lives — and, if we are to survive at our present standard of living, we must preserve this artificial environment by artificial means.

In the past, when the human population was smaller, our present means of pest control and waste disposal were sufficient for our needs. Today, with a large and rapidly increasing population of humans, yesterday's techniques are not sufficient. We must use pesticides to preserve our crops so that we will not starve. We must use more effective methods of waste disposal so that our excreta does not sterilize our land and water. Simple reduction in the percentage pollution, accompanied by an ever increasing number of individuals will result in a net increase of pollution. If we wish to preserve our artificial environment so that we may survive, we must reduce the size of our population.

We are told that we live under the threat of atomic extinction. We are probably much closer to extermination by starvation, or thirst, or pestilence. Quite possibly, the limitation of our water resources will be the factor that first sets a limit on the size of our population. For example, the town of Stoughton has imposed a five-year ban on new building because it does not have sufficient water to support additional population. Many other communities have had to impose a ban on outside water use. In my town we are assured that we have plenty of water, it is *just* that we cannot pump it fast enough to supply peak demand. Four years ago our town fathers employed an engineering consultant firm to study our water needs. They estimated that by 1986 our town would need to pump 3.4 million gallons of water per day. During the last week our water department has been pumping 3.8 million gallons per day. Over the period 1959–1965 our water requirements were 1.84 million gallons per day or less. Obviously, something is seriously wrong with our expert study. If other towns are in the same position, and it is fair to suspect that they are, then our water supply situation is critical. If we add to this the serious threat of salt pollution from winter salting of our roads, our problems of water supply are compounded.

We are told that the suburbs must accept some of the excess population of the core cities. In theory this is an acceptable thesis — but in practice it is clear that this will only hasten the arrival of our time of crisis. We must have fewer people, not more. We must limit the size of our population.

This past year has seen a number of efforts sponsored by

citizens groups to improve the quality of the environment. Many of these movements, however, have not taken into consideration the effects of specific programs on the total problem. For example, we in the Boston area now have a ban on all outdoor burning. As a result, in my town the amount of rubbish taken to our sanitary land fill has increased by 41%. Disposal of solid wastes was already a problem in eastern Massachusetts before the ban on burning was imposed. This will only increase the seriousness of the problem.

A second citizen effort has been to ban the use of sprays for street trees in a nearby town. One can confidently predict that within a year or so this town will have a serious problem with birch leaf miner. It will be more difficult and more costly to control dutch elm disease. Aphids on lindens will become a serious nuisance. And it is quite possible that the gypsy moth will move in to defoliate all of the trees.

This is not a plea for business as usual. It is a plea for reason and moderation. We must develop and utilize pesticides and pesticide techniques that are specific for the pests that trouble us. We must develop strategies and techniques for effective disposal and/or reuse of solid wastes. We must extend domestic sewer lines to serve all of the properties in our suburbs — and build modern sewage treatment facilities that will serve all of our cities and towns. If we started today we could not have these facilities in operation sooner than five years from now. (It would take at least a year for planning and drawing up specifications, the better part of another year for the production of building plans, and at least three years to construct the facilities.) These are the realities of the situation. In the meantime, unless we change our ways overnight, our total population will have increased by at least three per cent, and our volume of waste by an astronomical figure. All of this will cost us money in the form of additional taxes. We must stop our growth. We must change our ways. One last word. It is not the poor who have done this to us. It is the middle class families who can afford $30,000 houses, and who fill those houses with three, five, or ten children. People who insist on having dishwashers and washing machines and dryers and air conditioners and three cars in their garages. In short, we have done it to ourselves. We are the ones who must change our ways.

GORDON P. DE WOLF, JR.

Actinidia Chinensis, the Kiwi Fruit

Specialty food stores and supermarkets with imagination have recently been featuring something called Kiwi fruit. Food columnists — perhaps in desperation for a story — have tried it, been agreeably surprised by its taste and texture, and written glowing reports; it seems to be catching on. Kiwi fruits have made occasional appearances in gourmet shops for several years as Chinese gooseberries, Cape gooseberries, and sometimes — perish the thought — under their correct botanical name, *Actinidia chinensis*, but it took a fetching epithet like Kiwi fruits to take the housewife's fancy. So far as we know, New Zealand's ambulatory *Apteryx* with hairy feathers and the fruit named after him have nothing to do with each other.

The Arnold Arboretum has a sentimental attachment to *Actinidia chinensis* by virtue of the plant's association with the late Ernest Henry Wilson. A climbing shrub in the family Actinidiaceae, *Actinidia chinensis* is, as its specific name suggests, a native of China and does not, as the commercial name could lead one to believe, originate down under. The earliest record for collection of the species belongs to the Jesuit priest, Father d'Incarville, a pupil of the French botanist, Bernard de Jussieu. Around 1741, d'Incarville sent de Jussieu a specimen of *A. chinensis* which he found in the vicinity of Macao. The latter, however, either did not know what to make of it or somehow overlooked it, because the species was not described until more than a hundred years later when Jules Planchon wrote a brief diagnosis of it based on a collection by Robert Fortune from the Chinese mainland. Fortune's specimen had flowers but no fruit, and Planchon did not say anything about the fruit being edible nor did Fortune remark at all upon this fact in his accounts of his Chinese adventures. This omission is surprising, for Fortune was a keen observer and reporter of strange fruits and flowers. One can only surmise that, in fact, he never saw the fruits either in the marketplace or on the dinner table.

The Chinese, however, knew and used *Actinidia chinensis* fruit as food, and there are references to it in ancient herbals as

refreshing and thirst quenching. Wilson, on his first expedition for the Veitch nurseries at the turn of the century, was — if not the first westerner to taste the fruit — the first to record its edibility; its delicate flavor enchanted him.[1,2,3]

> "A climber called 'Yang-tao' in Hupeh and 'Mao-erh-tao' in Szechuan (*Actinidia chinensis*) is very abundant from 2500 to 6000 feet altitude. It produces excellent fruit of a roundish or oval shape, 1 inch to 2½ inches long, with a thin, brown, often hairy skin, covering a luscious green flesh. This is an excellent dessert fruit, and makes a fine preserve. In 1900 I had the pleasure of introducing this fruit to the foreign residents of Ichang, with whom it found immediate favour, and is now known throughout the Yangtsze Valley as the 'Ichang Gooseberry.' . . . It is a good garden plant; the only drawback is that the flowers are polygamous, and it is necessary to secure the hermaphrodite form to ensure fruit."

Wilson sent seeds back to the Veitch nurseries in England, and the seeds germinated. *A. chinensis* thrived in its new environment, and in 1906 the Veitches described it enthusiastically as "a rapid grower, valuable for very handsome foliage, covered with bright red hairs in a young state. The flowers, not yet seen in cultivation, are bright yellow, very handsome, and followed by edible fruits about the size of walnuts with a flavour resembling ripe gooseberries." ("Bright yellow" seems a bit of an overstatement but, after all, the Veitches had not seen flowers yet.) One remarks that the nursery emphasized the plant as an ornamental rather than as a fruit producer.

As far as we can tell from our old accession records, the Arnold Arboretum first received shipments of *A. chinensis* from the Veitch nurseries in 1905; Wilson subsequently sent a batch of seeds in 1908 during his first expedition under Arboretum auspices. In 1904, however, the U.S. Department of Agriculture Bureau of Plant Industry, which publishes very thorough records, listed the receipt of seeds of an *Actinidia sp.* called Yang-taw by the Chinese, with a "fruit said to be very fine, has flavor of gooseberry, fig, and citron"; this was obviously *A. chinensis*. Wilson shipped it to the USDA through the American Consul-General in Hankow, and the Bureau of Plant Industry forwarded it to the Plant Introduction Garden in Chico, California, for trial.

The practice at the Arboretum was to distribute a portion of seeds or cuttings to selected nurseries and individuals, and one may safely assume this happened with Wilson's 1908 shipment. Hopefully, *Actinidia chinensis* fared better in other milder areas — or in nursery greenhouses — than it did outdoors at Jamaica Plain. The material which Veitch sent in 1905 died by 1912; the 1908 seed lot expired in 1914. *A. chinensis* simply could not take New England winters, though other *Actinidia* species survive them. Meanwhile, the USDA lot at Chico came along very nicely, producing fruit in 1910. The Arnold Arboretum still makes an occasional attempt to cultivate *A. chinensis*. Last fall Mr. Al Fordham, the propagator, remarked on some growing along the greenhouse fence, but pessimistically predicted it would winter-kill. It did.

There is an interesting footnote to the introduction of the plant into Western horticulture. Both Veitch and Sargent measured the species from an ornamental viewpoint. Like crabapples, its fruit production was simply an agreeable factor complimenting its decorative possibilities. Though far from being a

spectacular species, *A. chinensis* has many desirable qualities. In a favorable climate it grows vigorously and produces a handsome foliage with creamy white flowers, one and a half to two inches in diameter, rapidly fading to buff yellow. (At no time are they the bright yellow advertised by Veitch.) Due to its lusty growth, the English and Europeans plant it frequently, and it is available in American nurseries. Naturally, the selection of ornamental plants for the home garden is, to a large extent, a question of personal taste. Alfred Rehder thought *A. chinensis* "the most beautiful of the Actinidias" and a good garden plant. By contrast, Dr. Donald Wyman does not get very enthusiastic about it, and he recommends it for someone in a rush for a large climber, perhaps to cover some unsightly object.

While the Arnold Arboretum by tradition, and Sargent as its first Director, evaluated *A. chinensis* as an ornamental, the USDA eyed it as a potential source of fruit. This attitude once led Sargent to make the withering and somewhat unjust remark that Department of Agriculture officials were only interested in what they could eat. Personally, Sargent took a dim view of introducing new food products to the American dinner table and recognized the reluctance of the average person to experiment with exotic tastes. But people may be more adventurous in their dining habits now. For example, after half a century as an abused curiosity, (a situation which one author blames on the use of the old uncomplimentary name, alligator pear) the avocado has come into its own. Kiwi fruits may be gaining popularity and, unlike other food products, their price is descending.

Actinidia chinensis fruits, or berries, are ovoid and about the size of an egg. While not particularly appetizing on the exterior, peeled or in section their color is a clear jade green. Many tiny, purple seeds surround the inner core, and they are small enough so that one need not remove them. The fruits resemble melon in texture; in taste, they are sweet and succulent, not at all like the gooseberry, and have been compared to strawberries, blackberries, melons, rhubarb, bananas, and so on, without any general agreement except that most people who have tried them, like them. They are reported to be richer in Vitamin C than oranges.

The fruit on the market today is not American-grown but comes from New Zealand. (Hence, one presumes, the name Kiwi fruit.) Although the USDA began its trials of *A. chinensis* about two years earlier than the probable date of introduction of the species into New Zealand, for some reason it caught on as a crop plant there while it never got out of trial gardens in

the United States. Despite efforts to convince independent growers of its potential, the Department of Agriculture has failed to stimulate commercial interest. Yet there is ample evidence that *A. chinensis* grows well in California, north Florida, and the Gulf states. Meanwhile, New Zealand raises and sells several thousand tons of fruit annually.

New Zealanders did not begin commercial cultivation of the species until about 1940, many years after it had been introduced. By 1964 they were producing 840 tons of fruit in a single year at the rate of four tons per acre. Out of this crop, 80 tons went as exports to Britain, Australia, Canada, and the United States. Picked before they ripen, the fruits keep very well: eight weeks in common storage and more than four months in cold storage (31–32 degrees F. at 90 per cent relative humidity). The New Zealand growers have been enterprising in developing improved cultivars of *A. chinensis* with bigger and better fruits. An extra large fruited cultivar with superior flavor, Hayward is used exclusively for export to the United States. This, then, is what we see in the markets.

If the American public displays any sign of real interest in the fruits, domestic growers may be encouraged to raise *Actinidia chinensis*. But, thus far, no one has been that adventurous.

For further reference see:

Schroeder, C. A. and W. A. Fletcher, "The Chinese Gooseberry (*Actinidia chinensis*) in New Zealand," Economic Botany: Vol. 21, No. 1, 81–92. January–March 1963.

Menninger, Edwin A., "Actinidia chinensis; A Promising Fruit and Some Related Species," *The American Horticultural Magazine*, Vol. 45, No. 2, 252–256. April 1966.

Smith, Robert L., "Kiwi — A Potential New Crop for California," *Lasca Leaves*, Vol. 20, No. 1, 8–10. March 1970.

STEPHANNE SUTTON

1. *Jade Jewel* (supplied by The New Zealand Fruit Growers Federation Limited)
12 oz tin pineapple
¼ cup quick cooking tapioca
¼ teaspoon salt
1 cup water
¾ cup sugar
3 tablespoons lemon juice
3 kiwi fruit
Drain the pineapple and reserve both juice and fruit. In a saucepan, put the tapioca, salt, water, and pineapple juice. Cook over low heat with regular stirring until the tapioca is clear. Add sugar. Remove from the

heat and add the lemon juice, stirring it in well. Leave to cool. Peel the kiwi fruit and cut into large chunks. When the tapioca mixture is cold, fold the pineapple pieces and kiwi fruit through it. Spoon into dessert glasses and chill. (Serves 6)

2. *Greenstone Pie*
1 cooked 7- to 8-inch sweet short pastry pie shell
4 to 6 kiwi fruit
2 egg whites
4 tablespoons sugar
Peel the kiwi fruit and cut into quarter-inch rings. Whip the egg whites until stiff, then beat in the sugar gradually to form a thick meringue. Immediately before serving, pile the sliced fruit into the cooked pie shell and cover with the meringue. Place in 400° oven and cook for about 5 minutes to brown the meringue. Serve at once. (Serves 6)
3. *Kiwi Fruit Upside Down Cake*
2 oz *butter*
⅓ *cup sugar*
1 teaspoon grated lemon rind
3 or 4 kiwi fruit
1¼ cups flour
2 teaspoons baking powder
¼ *teaspoon salt*
½ *cup sugar*
1 egg
½ *cup milk*
2 oz. *butter, melted*
Select an 8-inch round cake tin and in it melt the first measure of butter. Sprinkle with the first measure of sugar and spread over the bottom of the tin so an even layer is formed. Sprinkle with lemon rind. Peel the kiwi fruit and cut in rings ¼ inch thick. Place these in a pattern over the bottom of the tin. Sift the flour, baking powder, and salt into a bowl and add the sugar. Beat the egg and blend in the milk, then tip all the liquid into the dry ingredients and stir until completely blended. Pour in the melted butter and mix well. Carefully pour the batter over the fruit and topping in the tin. Bake at 350° for about 45 minutes or until cooked. Remove from the oven and allow cake to stand in the tin for 5 minutes before inverting on a plate. Serve warm or cold with cream. (Serves 6 to 8)

Climate at the Arnold Arboretum

Climate has been defined as a generalization of weather conditions of a region. Factors such as temperature, pressure, humidity, precipitation, sunshine, cloudiness, and wind throughout the year, averaged over a series of years, comprise the climate. Climate is the principal factor that limits which plants may or may not be grown in a specific region. At the Arnold Arboretum some woody plants cannot tolerate the heat and dryness of summer, but the survival of most plants is determined by various aspects of temperature which involve cold. Some plants which start growth early can be injured by spring frosts. Others may be killed by freezing in autumn before they have properly hardened in preparation for winter. The principal determining factor, however, is severe winter cold.

Arboretum Weather Station. Climatological records are significant to botanical institutions that are concerned with living plants. With such data, it becomes possible to compile information which adds to the knowledge concerning the climatic tolerances of plants. Frequently, the exact date when winter injury occurred can be determined.

Since August 15, 1962, the Arnold Arboretum has maintained a simple climatological substation in cooperation with the U.S. Weather Bureau. A representative of the Weather Bureau approved a site for the instruments, supervised their installation, and checked the thermometer for accuracy. Daily at 8:00 A.M. observations of temperatures and precipitation covering the previous 24 hours are entered on forms which the Weather Bureau provides. Mr. Artur Norietis, a member of the Dana Greenhouse staff and resident watchman, has been largely responsible for operating the station. Despite the fact that records only apply to a relatively short seven-year period, some interesting data have been accumulated.

Equipment. The equipment consists of a maximum and minimum self-registering thermometer furnished by the Arboretum and an eight-inch nonrecording precipitation gauge provided by the Weather Bureau.

Microclimates. Those familiar with the Arnold Arboretum are aware of the wide variety of topographical features that are present within the bounds of this relatively small 265 acre area. Elevations range from 50 to 233 feet. The terrain is comprised of summits, ridges, valleys, slopes of varying degrees, flat areas, and so on. These features lead to an assortment of exposures which face all points of the compass. With such geographical variation there is also a wide diversity of climatic differences. Some are subtle and others are obvious. These deviations from the overall climatic picture are known as microclimates and can occur within feet and even inches of one and other.

In November 1934, Dr. Hugh M. Raup, then a member of the Arboretum staff, chose eight locations in the Arboretum and set up a station at each where temperatures could be recorded. Some of these records remained when Dr. Raup left and from them have been extracted some interesting microclimatic data.

Station 1 was positioned at the southwest side of the Administration Building where the land slopes gently toward the meadow and where the station was sheltered from the north, east, and west.

Station 2 was situated on flat land in the shrub order. The shrub order is in one of the lowest areas of the Arboretum and the land slopes toward it from all directions, making it an ideal location for a cold pocket.

Station 3 was located on Bussey Hill about 50 yards south of the summit and on a crest — an ideal position for good air drainage.

A site for Station 4 was chosen on a gentle southeast slope near the Centre Street Path. It was well protected from the north and west by higher elevations and has proven to be one of the most favorable microclimates in the Arboretum.

Station 5 was located in the Juniper collection on a small plateau well sheltered from wind by surrounding slopes and hills. It is of interest that many Indian artifacts were found here. This would indicate that an Indian camp site existed there despite the fact that it proved to be one of the Arboretum's coldest microclimates according to the Raup records. Indians lived close to nature and though they had no knowledge of microclimates, they did know that some sites were more suitable to comfort than others. This awareness would be of prime importance to those living through a harsh New England winter under primitive circumstances. Several considerations may well account for their choosing this location. Nearby to

The Weather Station in the Dana Greenhouse Nursery. Rain gauge at left. Box for thermometer at right.

the south was a free-flowing brook and to the north was a spring. The area is well sheltered from bitter winds of winter and they could avoid the chill factor which can lead to much greater human discomfort than severe cold. Together with these features it seems reasonable to suppose the area at that time was wooded and, therefore, could have a climate which differed somewhat from that shown by the Raup records.

Station 6, the most sheltered site of all, was placed on Hemlock Hill. The area then was populated by massive hemlocks, many of which were later lost in the 1938 hurricane.

At Station 7 in the isolated Peters Hill area, observations were recorded for about one month when they were discontinued with the notation, "thermometer stolen."

Station 8 was near the Arboretum greenhouses which were then located off South Street on property of the Bussey Institution. The site was a small plateau with the land falling away in all directions. The discovery of numerous Indian relics reveals that a camp site also existed here. Although shown by the Raup records to be the most favorable microclimate of all,

it was exposed to the wind from all directions. Again, the area was perhaps wooded, a condition that would tend to mitigate the chill factor associated with winter winds.

Interpretation of Some Temperature Gradients. The following examples of temperature gradients have been selected from the Raup records. Each morning during the winter of 1934–35 observations pertaining to the previous night were recorded at about 9:00 A.M. For purpose of illustration, easily interpreted extremes have been chosen and they concern only minima.

Table 1 shows low temperatures and wide variation in the gradients. They are typical of calm, clear nights. Under such conditions air loses heat to outer space through radiational cooling. Temperature drop is often greater during winter than at other seasons because the long nights which prevail allow radiational cooling to take place over a maximum period of time. With the absence of wind, cold air drains from the higher elevations and settles in lower areas (frost or cold pockets) leading to wide diversity of minima in the microclimates. These are the nights during which our lowest temperatures occur and they are the most damaging to plants. At such times, the shrub collection usually had the coldest temperature while the area near the greenhouse had the warmest. It is interesting that the temperature stations which showed the greatest extremes were the closest together — about 200 yards. However, the topography is such that the same differences would prevail at the edge of the greenhouse plateau and in the flat area below which contains the shrub collection — a distance of about 90 or 100 feet with a difference in elevation of 30 feet.

TABLE 1

Minima Under Clear Conditions, Winds Light to Very Light

1	2	3	4	5	6	7	8
−16.0	−26.0	−16.9	−20.7	−25.1	−17.8		− 7.5
− 6.9	−15.4	− 8.3	− 9.2	−19.4	− 6.8		− 5.3
− 3.7	−14.3	− 2.9	− 7.0	−12.0	− 3.8		− 6.0
16.7	8.0	17.8	15.0	9.6	18.0		18.0

These examples are typical of calm, clear nights when heat is lost to atmosphere through radiational cooling. In the absence of wind, cold air drains from higher elevations and settles in the low areas.

Table 2 shows minimal differences in temperature. Brisk winds led to a mixing and stirring of the atmosphere and therefore minima showed only slight variation at all stations. Under

conditions of high winds, Station 8, which usually had the warmest microclimate, often showed lower temperatures due to its exposed position.

TABLE 2

Minima Under Clear Conditions, Estimated Wind Velocity Medium to Brisk

Station	1	2	3	4	5	6	7	8
	8.0	7.1	6.9	7.2	6.4	7.3		6.1
	11.7	11.2	10.5	11.3	10.3	11.5		10.2
	11.2	11.0	10.1	11.0	10.1	11.5		10.8
	17.8	17.0	16.2	17.0	16.1	17.4		16.1

Brisk winds led to a mixing and stirring of the atmosphere and therefore temperatures were quite similar at all stations.

Table 3 illustrates the uniformity that was evident in the minima under cloudy conditions. If calm nights such as these had been clear, there would have been wide variations. However, the cloud blanket intercepted and prevented the radiation of heat from below. In the absence of radiational cooling, there is a pattern of uniformity despite light winds. As would be expected, similar gradients frequently came about during periods of rain and snow.

TABLE 3

Minima Under Cloudy Conditions, Estimated Wind Velocity Light to Very Light

Station	1	2	3	4	5	6	7	8
	28.0	28.0	27.4	28.0	28.0	28.0		—
	16.3	17.1	17.0	15.1	15.9	15.9		19.5
	17.1	17.0	16.0	16.9	16.2	17.0		16.5
	28.0	28.0	27.5	28.0	27.7	28.0		29.3

The cloud cover intercepted and prevented the radiation of heat from below. In the absence of radiational cooling, only slight differences appeared in the minima despite relative calm.

TABLE 4

Average Minimum Temperatures at Arboretum Stations January 1935

Station	1	2	3	4	5	6	7	8
	14.2	11.6	14.0	13.0	10.9	14.2		15.9

Those responsible for planting the Arboretum in its early years were aware of the more favorable microclimates in the vicinities of Stations 1, 3, 4, and 6 and set out many plants of questionable hardiness in those areas.

Factors which Influence the Climate at Boston. In the Annual Summary of Boston Climatological Data (1968), published by the U.S. Department of Commerce, the Boston climate is described as follows:

> "Three important influences are responsible for the main features of Boston's climate. First, the latitude (42'N) places the city in the zone of prevailing west to east atmospheric flow in which are encompassed the northward and southward movements of large bodies of air from tropical and polar regions. This results in variety and changeability of the weather elements. Secondly, Boston is situated on or near several tracks frequently followed by systems of low air pressure. The consequent fluctuations from fair to cloudy or stormy conditions reinforce the influence of the first factor, while also assuring a rather dependable precipitation supply. The third factor, Boston's East Coast location, is a moderating factor effecting temperature extremes of winter and summer."

Boston's official weather station is located at Logan International Airport in East Boston. It is situated seven miles northeast of the Arnold Arboretum. Its climate is modified by proximity to the sea and is quite different from that at the Arnold Arboretum. Temperatures are usually cooler in summer, warmer in winter, and have less range in the extremes. To show these differences data concerning the past three years have been brought together in *Table* 5.

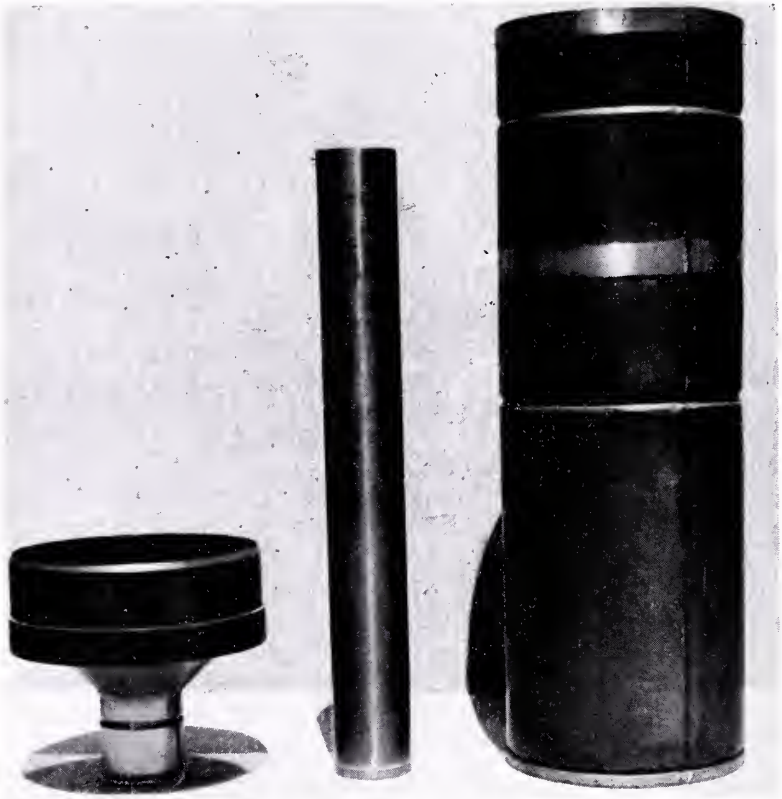
TABLE 5
Comparative Data Official Boston and Arnold Arboretum Weather Stations

	1966		1967		1968	
	A. A.	Logan	A. A.	Logan	A. A.	Logan
January	24.5	28.8	29.8	35.1	20	25.6
July	73.6	74.9	74.5	73.0	76	75.2
Maximum	100	97	97	94	98	98
Minimum	−1	3	−9	−3	−6	−4
Growing season (days)	169	216	154	210	172	249
Last frost	Apr. 27	Mar. 29	May 7	Apr. 13	May 8	Mar. 26
First frost	Oct. 13	Oct. 31	Oct. 8	Nov. 9	Oct. 27	Nov. 30

Growing Season. The growing season is defined as the number of days between the last day of killing frost in the spring and the first day with killing frost in autumn. This time

is determined by the last spring and the first fall temperature of 32 degrees F. or lower.

Those concerned with gardening realize the considerable year-to-year variation that can occur in length of the growing season. During one year in the Boston area, frost may take place in early September while it might not occur until November in the more favorable microclimates. Note in Table 5 that Boston



The eight-inch nonrecording precipitation gauges. Left to right: funnel to be attached at top of gauge, gauge proper, reservoir in which the gauge is set.

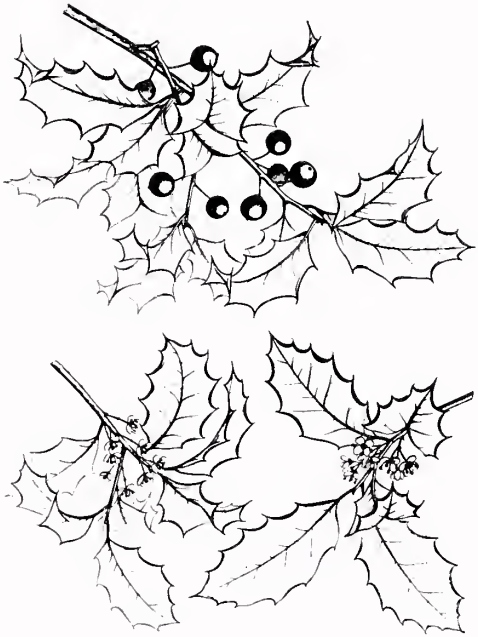
was favored with 47, 56, and 77 more growing days during the three years concerned than the Arboretum.

Importance of Small Differences in Temperature. On occasion, small differences in temperature can be of critical im-

portance. During a two-day period on December 28 and 29, 1968, precipitation amounting to 1.29 inches was recorded at the Arboretum. Temperatures at that time flirted with the freezing point — 30 to 34 degrees F. There was little if any build-up of ice and no damage occurred in the plant collections. However, at the Case Estates of the Arnold Arboretum, 13.5 miles further inland at Weston, conditions were quite different. The temperature there is usually a few degrees colder than at Jamaica Plain. Precipitation which fell as rain in Jamaica Plain became freezing rain at Weston. Enormous weights of ice formed on the branches of trees until they could no longer support the burden and snapped or split.

On the other hand, the Arboretum in Jamaica Plain may suffer damage while the Case Estates at Weston may not. On February 9, 1969, snow began to fall at 5:30 A.M. The temperature was 31 degrees F. Snow continued through that day, the following night, and finally stopped at 1:00 P.M. on February 10, leaving an accumulation of 15.8 inches temperatures during the period showed a maximum of 32 degrees F. and a minimum of 30 degrees F. The near-freezing temperature resulted in snow that was heavy and moist. Each flake seemed to remain where it fell. Plants became so overburdened with the accumulation of wet snow that damage was devastating. Many trees of weak structure such as magnolias, Douglas firs, and carpinus were broken and split to pieces. A lace-bark pine, which is an especially weak-wooded tree, broke off at ground level. Evergreens, which hold their foliage and therefore have more snow catching surface, were particularly vulnerable. Some junipers were broken in half and some were literally pulled out of the ground by the great weight of the snow. Much of the Arboretum was in shambles. Meanwhile, the temperature at the Case Estates was apparently a bit colder and the snow was drier. It did not cling so did no harm. It is interesting that at this time the temperature along the shore south of Boston was slightly warmer and precipitation was in the form of rain.

ALFRED JAMES FORDHAM



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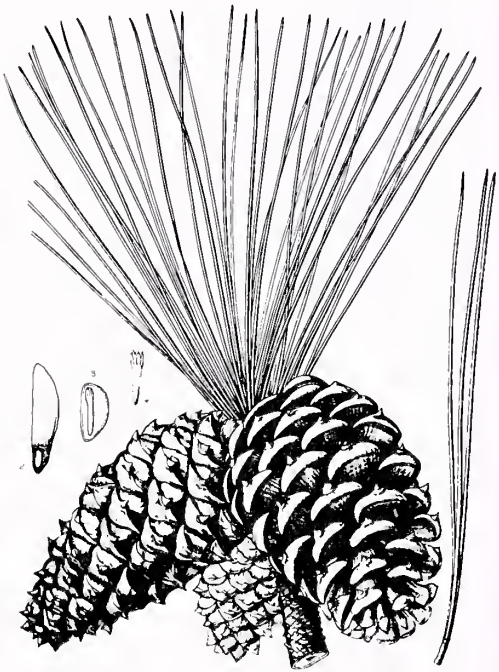

4

Faxon Drawings for Christmas

The staff of the Arnold Arboretum has selected four of Charles Edward Faxon's botanical drawings, originally published in *The Silva of North America*, for Christmas cards. The cards and envelopes are available in boxes of 20 (five of each of the four cards) or individually. The drawings are in black and white, printed on heavy card stock.

The four illustrations are:

1. *Ilex opaca*, American Holly
2. *Larix occidentalis*, Tamarach
3. *Thuya occidentalis*, White Cedar
4. *Pinus ponderosa*, Yellow Pine

Price:	Box of 20 cards (four illustrations) —	
	Friends of the Arnold Arboretum*	$3.00
	Others	$3.50
	Single cards —	
	Friends of the Arnold Arboretum*	.20
	Others	.25

* Information on how to become a "Friend of the Arnold Arboretum" can be obtained by writing or calling the Arnold Arboretum, Arborway, Jamaica Plain, Massachusetts 02130. Telephone: 524–1717.

Arnoldia Reviews

A Photo Guide to the Patterns of Discoloration and Decay in Living Northern Hardwood Trees, by Alex L. Shigo and Edwin vH. Larson.

Judging by its title this ought to be a formidable treatise — but it isn't. For the forester for whom it is probably primarily intended, it is a straightforward explanation of what causes defects and discoloration in the wood of commercial forest trees. For the homeowner, the landscape gardener, the town tree warden, it gives an indication of the amount of internal damage caused to a tree by a particular kind of injury. Put another way, it suggests what kind of injury is best treated by removing the tree and what injuries are unlikely to weaken a tree unduly. It provides a visual explanation of the reasons why aborists place such great emphasis on clean flush cuts — why branch stubs should not be left on the tree to decay. Injuries by squirrels (yes!), sapsuckers, and porcupines are shown.

Fifty-nine reproductions of color photographs show what the inside and outside of the tree looks like with the various injuries. Dr. Shigo's basic tool is the chain saw, which allows longitudinal sections of a tree trunk to be made easily. This is, if you will, the results of tree autopsy. It certainly demonstrates the value of the method.

Highly recommended for homeowners interested in the well-being of their trees.

G.P.DEW.

U.S.D.A. Research Paper NE-127. Northeast Forest Experiment Station: Upper Darby, Pennsylvania. 1969. Available on request.

1970 Fall Classes of the Arnold Arboretum

Elementary Techniques of Bonsai, Indoor Material

Mrs. Ara R. Derderian

This series will consist of three 2-hour lectures and a workshop at the last meeting. The basic principles of bonsai will be explained, such as soil preparation, potting-up procedures, pruning techniques, and general design. Classes will be conducted at the Dana Greenhouses at the Arnold Arboretum. Containers and plant material will be provided.

Thursday mornings 10:00 to 12:00 September 17, 24, and Oct. 1

Thursday, Workshop, 10:00 to 2:00 October 8

Registration fee for Friends of the Arnold Arboretum,* $25.00; others, $35.00.

Two Meetings for Advanced Bonsai Enthusiasts

Mrs. Ara R. Derderian

Each class will be independent of the other. The September class will concentrate on design and the October class on pruning. Members may bring one plant for criticism to each session. Each class will involve a fee of $7.50 for Friends and $10.00 for others.

Saturday mornings 9:00 to 12:00

September 26 and October 3

Propagation of Woody Plants from Seed

Mr. Alfred J. Fordham

A discussion of methods used to collect, clean, and pretreat seeds to prepare them for germination. Seeds to take home will be provided from the Arboretum collection. Suitable footgear should be worn since part of the session involves walking

* Information on how to become a Friend of the Arnold Arboretum can be obtained by writing or calling the Arnold Arboretum, Arborway, Jamaica Plain, Massachusetts 02130.

around the grounds. One meeting, Tuesday morning, 10:00 to 12:00, September 22. Class limited to 20. Free, but open only to Friends of the Arnold Arboretum. Meet at Dana Greenhouses.

Propagation of Woody Plants from Cuttings

Mr. Alfred J. Fordham

A discussion of methods used to collect and prepare cuttings for most effective results in propagation. Cuttings will be supplied by the Arboretum to take home. One meeting, Thursday morning 10:00 to 12:00, October 29. Class limited to 20. Free, but open only to Friends of the Arnold Arboretum. Meet at Dana Greenhouses.

Practical Gardening For the Home Owner

Mr. Robert S. Hebb

This is a series of five classes designed to teach gardening skills as they relate to plantings usually found around the home. Emphasis will be placed upon the various aspects of planning and maintaining a perennial garden with its associated plantings. This will include an opportunity to participate in the renovation of the Low Maintenance Garden at the Case Estates. Newcomers are welcome. Class limited to 20. Parking is available near the barn at 135 Wellesley Street, Weston. All classes will meet first at the Red Schoolhouse at 133 Wellesley Street.
Wednesdays, 1:00 to 4:00 September 30–October 28.
Registration fee for Friends of the Arnold Arboretum, $5.00; others, $10.00.

Fall Field Course In Ornamental Woody Plants

Dr. Gordon P. DeWolf

Five informal outdoor talks and field trips on the Arboretum grounds under the supervision of Dr. DeWolf and the horticultural staff make up the Fall Field Class. Different plant groups and areas of the Arboretum are studied on each trip. During the sessions the berried trees and shrubs, autumn color, the evergreens, and similar topics will be considered. There are opportunities for questions and answers relating to the identification and culture of ornamental woody plants which are at the Arboretum or are suitable for culture in New England. Meet at Administration Building. In case of rain or cold weather, meetings are held indoors.
Friday mornings, 10:00 to 12:00 October 2 to October 30
Registration fee for Friends of the Arnold Arboretum, $5.00; others, $10.00.

Evenings With Friends II

In the Fall of 1969 a series of talks called Evenings With Friends was so successful that a similar series will be offered this fall. The speakers are all members of a group known as the Friends of the Arnold Arboretum. In this group now numbering more than 1,100, there are many fine speakers with extremely interesting and varied subjects. We will hear from 6 Friends in this series. Full details of the program have been mailed out to all members of the Friends. All sessions will meet at The Red Schoolhouse, 133 Wellesley Street, Weston.

Five Tuesday evenings at 8:00 October 13 to November 10

Registration fee for Friends of the Arnold Arboretum, $7.50; others, $15.00.

Summary of Weather Data Recorded at Dana Greenhouse

Al Fordham's timely article on climate in this issue highlights the vagaries of the weather. For the interest of readers of *Arnoldia* we present below a tabular summary of some precipitation and temperature data for 1969 and 1970.

It is of interest to note that January 1970, was very much colder (about 9°F) than last year. We have seen some of the results of that in winter killing of some of our shrubs.

It is also well worth noting that through July we had 2.17 inches of rain more than we had during the same period last year. June was especially wet.

1969			1970	
Precipitation	Average 8 A.M. Temp.		Precipitation	Average 8 A.M. Temp.
2.41	25	Jan.	1.07	16.1
5.45	27	Feb.	4.97	26.75
2.41	33	Mar.	3.71	33.8
5.06	49.7	April	3.84	46.93
2.84	57.1	May	3.79	57.19
1.18	67.6	June	4.07	65.3
3.01	68.7	July	3.08	71.32
2.28	68.5	Aug.		
4.90	58.6	Sept.		
1.97	48.1	Oct.		
9.72	40.4	Nov.		
10.14	28.2	Dec.		
22.36	Total	Jan.-June	24.53	

An Index to *Arnoldia*, Volumes 1–29, (1941–1969)

Dr. Donald Wyman will retire at the end of August 1970, ending his role as Horticulturist at the Arnold Arboretum which began on January 1, 1936. For this service, a total of 34 years and 8 months, the President and Fellows of Harvard College, the Trustees of the Arnold Arboretum, have voted to honor Dr. Wyman with the title of Horticulturist, *Emeritus*. We, the staff, wish also to honor him and dedicate to him this Cumulative Index to *Arnoldia* which we have prepared cooperatively.

When Dr. Wyman joined the Arboretum staff he accepted the editorship of the *Arnold Arboretum Bulletin of Popular Information*, the earlier issues of which had been edited primarily and successively by Charles Sargent, Ernest Wilson, and Edgar Anderson. Between 1936 and 1940 Dr. Wyman wrote 39 articles for the *Bulletin*. In 1941 the title of this publication was changed to *Arnoldia* at the suggestion of the director at that time, Dr. E. D. Merrill, who observed that the one-word title would be easier to cite. Dr. Wyman served as editor and principal contributor to *Arnoldia* throughout the period covered by this cumulative index, with the exception of a two-year respite in 1967 and 1968. The articles he wrote were based largely on his own observations of the plants grown at the Arnold Arboretum in Jamaica Plain and the Case Estates in Weston. Many articles were timely suggestions to the readers on what was in flower, what was to be seen on the grounds, or how to handle the injuries plants suffered in winter storms or hurricanes. Other articles dealt with the classification of cultivated woody plants, the sources of unusual plants, or the methods of propagating and caring for these materials. Perhaps the general theme of all his writing was an evaluation of the plant from a horticulturist's point of view. The words "recommended," "not recommended," or "of merit" are frequent in his papers. His articles were often revised after an interval of a few years to add information or to make comparisons with newer introductions recently tested in Massachusetts. Finally, many of these observations were incorporated in his several books — *Trees for American Gardens*, *Shrubs and Vines for American Gardens*, and *The Saturday Morning Gardener*, to mention only the best-known volumes.

Each Friend of the Arnold Arboretum is entitled to a complimentary copy of the Index. Copies are available to others for $1.50.

Staff of the Arnold Arboretum

Richard Alden Howard, Ph.D., *Arnold Professor of Botany, Professor of Dendrology, and Director*
Karl Sax, S.D., *Professor of Botany, Emeritus*
Donald Wyman, Ph.D., *Horticulturist, Emeritus*
Pamela Anne Bruns, B.A., *Artist*
Jeanne Caldwell, B.A., *Library Assistant*
Michael Anthony Canoso, M.S., *Senior Curatorial Assistant*
Constance Elizabeth Derderian, *Honorary Curator of the Bonsai Collection*
Elsa Dorfman, M.A., *Editor, ARNOLDIA*
Gordon Parker DeWolf, Jr., Ph.D., *Horticulturist*
Thomas Elias, Ph.D., *Assistant Curator*
Alfred James Fordham, *Propagator*
William Ed Grime, B.A., *Curatorial Assistant*
Thomas Gordon Hartley, Ph.D., *Associate Curator of Pacific Botany*
Robert Stephen Hebb, S.B., *Assistant Horticulturist*
Shiu-Ying Hu, Ph.D., *Botanist*
Thomas Matthew Kinahan, *Superintendent, Case Estates*
Charles Robert Long, A.M., *Librarian*
Lorin Ives Nevling, Jr., Ph.D., *Curator and Supervisor of the Herbaria*
Dulcie Alicia Powell, M.A., *Assistant Curator*
George Howard Pride, M.A., *Associate Horticulturist*
Helen Roca-Garcia, A.M., *Research Assistant*
Bernice Giduz Schubert, Ph.D., *Curator and Editor*
Stephanne Sutton, B.A., *Research Fellow*
Robert Gerow Williams, B.S., *Superintendent*
Carroll Emory Wood, Jr., Ph.D., *Curator*

Printed in the U.S.A.

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ARNOLDIA

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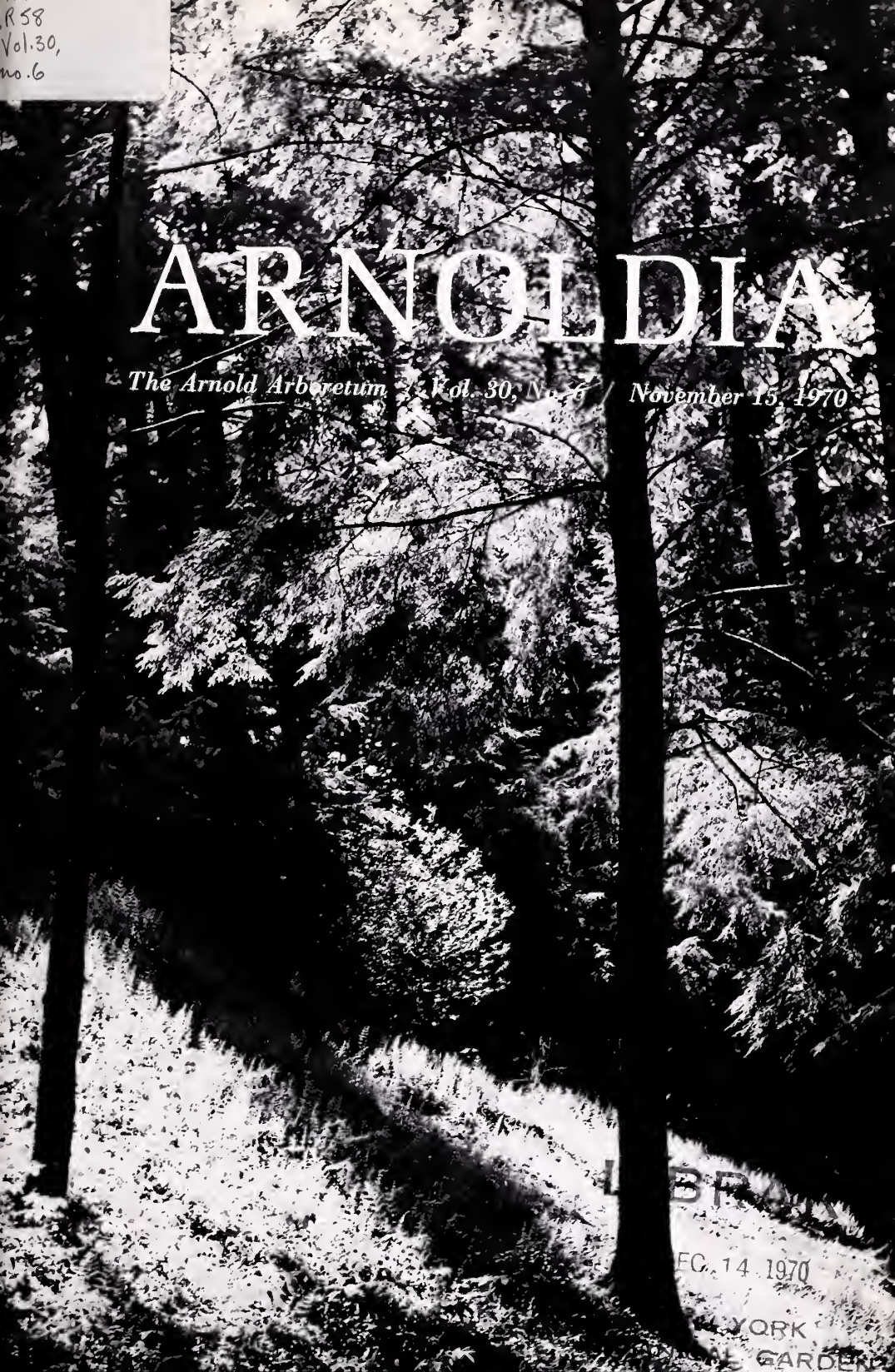

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On the cover: A view on Hemlock Hill.
Photo: P. Bruns.

All photographs by Pamela Bruns except where indicated.

The Director's Report

The Arnold Arboretum During the Fiscal Year Ended June 30, 1970

Many adjectives have been used to describe the events of the past year. It has been a disturbing year — a year of student unrest and rebellion, a year of inflation, a year that could not fail to provoke a reappraisal of values. The staff of the Arnold Arboretum, our physical plant, and our activities have not been immune nor isolated from the turmoil. The Arnold Arboretum is many things: to some people it is an oasis of relative peace and quiet, to some a place of horticultural beauty, and to others a place of scientific achievement and contribution. However in this year there have been changes; there have been challenges and difficulties; but there has been progress as well, and opportunity to reflect and plan ahead. I wish to report on many of these activities.

The Arnold Arboretum is administratively a part of Harvard University. While it is unique in being privately endowed, dependent on a public interested in its activities for financial support, at the same time the rules of its operation are incorporated with an educational institution of considerable repute for its standards and its procedures. The grounds are also listed in the inventory of park lands held by the Boston Parks and Recreation Department. Today student and public unrest has affected the staff of this institution and we have seen an increased disregard for public or personal property on the grounds; on the other hand, the demands for basic and relevant information have increased during the year. The knowledge of the staff, the reference collections, and the records of what grows where on this earth have become increasingly valuable and have been called upon more frequently than ever in this year of sudden awareness of the environment.

Since the establishment of the Journal of the Arnold Arboretum 50 years ago the Annual Report of the Director has been published in the October issue as a record of scientific accomplishments and activities of the staff. In the last decade the

report has been reprinted and distributed to the Friends of the Arnold Arboretum. This report now appears in the new format of Arnoldia to acknowledge directly the support of the Friends of the Arnold Arboretum. Reprints will be distributed to scientific organizations associated with us in the study of plant life.

The Staff

Dr. Donald Wyman, horticulturist for the past 34 years and 8 months, retired officially on August 31, 1970, the anniversary of his first appointment. Dr. Wyman's contributions to the development of the living collections, his editorship of Arnoldia, his books and many articles, his spring and fall classes, and other lectures have helped increase the knowledge of plants grown in New England and have helped define and establish the role of the Arnold Arboretum itself. The President and Fellows of Harvard University approved the recommendation of the Director and the staff that Dr. Wyman receive in retirement the title "Horticulturist, Emeritus."

On the occasion of Dr. Wyman's last class on May 29th, the staff invited former staff members and his associates in professional organizations to a luncheon in his honor. Representatives of the Visiting Committee, the Massachusetts Horticultural Society, the Boston Horticultural Club, the American Horticultural Society, and the American Association of Botanic Gardens and Arboreta were present. The Visiting Committee presented him with a handsome inscribed silver tray. The staff dedicated to him a special publication, "A Cumulative Index to Arnoldia, Volumes 1–29"; and presented a symbolic plant to him: *Malus* 'Donald Wyman.' The members of the ground crew, with Mr. Charles Mackey as spokesman, made their own presentation of a desk set. We are pleased to report that Dr. Wyman will continue to use the offices, library, and collections of the Arnold Arboretum.

On July 1, 1970, Dr. Gordon P. DeWolf officially assumed the role of Horticulturist of the Arnold Arboretum. Dr. DeWolf has been horticultural taxonomist for the Arboretum since 1967. His background includes training and associations at the University of Massachusetts, University of Malaya in Singapore, the Bailey Hortorium, the University of Cambridge, England, and the Royal Botanic Gardens, Kew.

Mr. Heman Howard, Assistant Horticulturist, selected early retirement to accept a position as Horticulturist at the Heritage Plantation. Mr. Howard who joined the Arboretum staff in 1929 has had a continuous and important role in mapping, labelling,

Presentation of gift from Grounds Crew to Dr. Donald Wyman by Charles J. Mackey.

Dr. Wyman presenting a corsage to Mrs. Wyman at the luncheon given in his honor.

and photographing the living collections. We also lose the services of Mrs. Elsie Howard who has been the head mounter at the Arnold Arboretum.

Three staff members completed their term appointments and have assumed new positions. Dr. A. Linn Bogle and Dr. Norton Miller, who have assisted Dr. Carroll Wood on the Generic Flora of the Southeastern United States project, accepted posts at the University of New Hampshire and the University of North Carolina, respectively. Dr. Paul Sorensen, Horticultural Taxonomist, has joined the faculty of Northern Illinois University.

Mr. Victor Marx, a joint appointee with the Gray Herbarium as librarian of the two institutions, accepted an appointment at the University of Oregon libraries and was succeeded by Mr. C. R. Long, in September. Mrs. Alice Miczo, horticultural secretary, resigned and was replaced by Mrs. Rosemary Walsh. Miss Stephanne Sutton, who wrote the biography of Charles Sargent, resigned to devote herself to a new book. She has been appointed an Honorary Research Fellow to permit her to continue her studies of the life of Dr. Joseph Rock, at one time a plant

collector for the Arnold Arboretum. Mrs. Robert Hebb resigned as herbarium assistant.

Staff honors

The Massachusetts Horticultural Society awarded Dr. Wyman the George Robert White Medal with the citation:

> "for 35 years horticulturist to the Arnold Arboretum, author of many books and innumerable articles, indefatigable teacher and lecturer, energetic holder of executive office at various times in national horticultural organizations, worthy recipient of many of the highest awards in horticulture at home and abroad. It is indeed fitting that in this year of his retirement from the Arboretum, this Society which he served as Trustee for 16 years, until becoming a Vice-President last year, should in making this award recognize him as the virtual embodiment of horticulture in New England."

This year Mr. Robert Williams, superintendent of buildings and grounds, reached his 25th anniversary with Harvard University. Regretably, student disturbances forced the cancellation of the annual recognition celebration.

Community and Professional Service

Mr. Robert Hebb as advisor to the Brookline Massachusetts Conservation Committee is helping the town develop a 35-acre tract as a wildlife sanctuary.

Mr. George Pride is a member of the Garden and Grounds Committee of Old Sturbridge Village. He has been elected a director of the American Rock Garden Society.

Dr. Bernice Schubert was appointed Supervisor of the Harvard University Herbaria building for a three-year term. She was also elected to the council of the Society for Economic Botany.

Dr. Richard Howard was elected a Fellow of the Linnaean Society of London and continues as chairman of the Plant Records Center Committee of the American Horticultural Society.

Dr. Gordon DeWolf is chairman of the Committee on Vandalism established by Mayor Kevin White and the Boston Parks and Recreation Department of the City of Boston, and consultant to the Cambridge Model Cities program concerned with the planting of trees and the establishment of parks. He is a member of the Library Committee of the Massachusetts Horticultural Society and reviews books for "Choice," a periodical of the Association of College and Research Libraries devoted to the proper selection of books for college libraries.

Dr. Wyman's field class.

Horticulture

The effects of adverse weather reported for previous years, dry summers and severe winter ice storms, coupled with several serious fires due to vandalism were revealed in increasing signs of damage in individual plants and in collections on the grounds in Jamaica Plain. Dr. DeWolf and Mr. Hebb with the cooperation of Mr. Williams and Mr. Fordham undertook the planning of a work program for the continued development of plantings on the grounds. A favorable spring season permitted early access to the grounds and the accomplishment of many initial improvements. The most conspicuous program centered around the area near the Administration Building and the principal entrance to the grounds. A new foundation planting for the Administration Building is in the process of development including seven specimens of *Ilex pedunculosa* which were moved from the grounds to the front of the building by a commercial contract. [One plant was estimated to weigh three tons, heavier than could be handled by our equipment]. Three large *Sciadopitys verticillata* filled gaps left by the storm-damaged plants of *Magnolia stellata*. A mass planting of *Pieris floribunda* has been established at one side of the Arborway gate and a planting of *Rhododendron carolinianum* on the other side. Plants of *Kalmia latifolia* will help screen the fenced-in parking area. A large storm drain was placed from the Administration Building to the Meadow Road which we hope will handle the drainage problem which has long plagued us. The meadow to the left of the Administration Building was regraded by commercial contract; this area will be seeded in the fall and should offer a pleasing vista from the entrance gate. The upper slope of this open area is in the process of development. Several Magnolias and three *Picea ormorica* have been planted here; *Ilex glabra* has been planted under the Liriodendrons as a focal point of green for midwinter.

The azalea planting along the Meadow Road which was designed to show a sequence of bloom has been uneven in its growth and a test trench revealed a shallow water table and a hard pan of heavy clay. We have removed the top soil, added drainage and fill, and increased the top soil before replacing the plants, hoping to improve the appearance of this area.

The area of the three ponds adjacent to the shrub collection also received attention. One pond had been previously cleared and deepened to remove the concentrated growth of aquatic plants. The border planting of small-flowered *Vaccinium* species

was removed and 80 plants of *Rhododendron vaseyi*, *R. prinophyllum* (*R. roseum*), and *R. periclymenoides* (*R. nudiflorum*) were added to provide a color accent here about the time the lilacs are in bloom. In the same area a new planting of herbaceous *Hibiscus* species will provide summer color.

As plantings at the Overlook Path on Bussey Hill which had been severely damaged by fires in previous years were not recovering properly, additional plants of *Rhododendron schlippenbachii*, *R. prinophyllum*, and *R. periclymenoides* were added to improve the mass color effect.

The Kalmia border at the foot of Hemlock Hill has been damaged severely in winter ice storms and dry summers of previous years, and 25 plants of *Kalmia latifolia* were added to fill in conspicuous gaps. Extensive fire damage to the rockery in June 1969 required the removal of many plants from this collection and partial replanting was completed during the spring.

The newly graded road on the Weld-Walter tract was sealed with an oil surface during the spring. The new road has already proved to be an effective fire barrier for the frequent burnings experienced in this area. Along the banks of Weld and Centre Streets some 1100 ground cover plants were set out to serve as a demonstration area for bank planting and roadside areas. These 15 acres were resurveyed and new maps prepared for all plantings within this zone.

In 1969 the Arboretum staff, as a matter of policy, stopped using DDT and 2–4–5–T. Safer insecticides are now being used, notably Sevin and Methoxychlor. We have also shifted to Sovasol (a petroleum distillate) as a weed killer and increased the use of heavy applications of wood chips as mulching material. The use of Casoron to control weedy grasses continues but is being reduced. New England is experiencing a severe plague of tent caterpillars at the present time, but the Arboretum collections have escaped the infestation by constant attention and early physical removal and burning of any nests which developed.

During the past winter rabbits caused extensive damage in many beds, especially those on Bussey Hill. The collections of *Cotoneaster* and *Fothergilla* were particularly hard hit. In the coming winter, control of this damage by the use of a repellant spray will be tried.

Increasing vandalism remains a problem. Twenty-five panes of glass in the Administration Building have been broken by stones or bullets and these are being replaced by Lexan, a break-resistant glass substitute. A large bronze plaque was stolen from the entrance gate and six of the bonsai were stolen. Litter has

become more abundant, and deliberate breaking of beer bottles increased to such a point that during May approximately 10% of the working hours were spent in pickup. To remedy this situation, and in addition because of the aggregation of unkempt individuals on the grounds in the late afternoon hours, we retained the Burns Detective Agency to provide some protection through the early evening hours. A uniformed guard now patrols the grounds in a three wheeled Cushman vehicle which we purchased.

Labelling and mapping the grounds is a continuous activity for the staff. A portion of the grounds is checked every year for the accuracy of the maps and the condition of the plants and labels. (The ground crew prepares duplicate labels during the winter). With the new plantings under way, over 42 sectional maps have had to be redrawn this year. The overgrowth of understock and the development of weed trees from seeds distributed by birds is also a constant problem.

The Arnold Arboretum participated in the Spring Flower Show of the Massachusetts Horticultural Society. This year a pruning exhibit was prepared under the direction of Mr. Williams and Mr. Heman Howard which featured whole shrubs painted to show which branches should be removed for proper growth, as well as examples of pruning to remedy other frequent problems. The exhibit won a gold medal as well as first prize as an educational exhibit. It was used, in part, again in a Boston show in June, and was restaged in part within the Administration Building for the groups which visited the Arboretum in the spring. A display of fruiting branches prepared by Mr. Heman Howard at the Fall Harvest Show of the Massachusetts Horticultural Society was awarded an educational certificate and the John S. Ames trophy. A similar display prepared by Mr. Pride and Mr. Smith at the Worcester County Horticultural Society Fall show won a special award. An exhibit of wreath-making materials prepared by Heman Howard was given an Award of Appreciation by the Garden Club Federation at their show at Christmas. Several plants from our bonsai collection were exhibited by Mr. Hebb and Mrs. Derderian at the Bonsai exhibit and workshop of the Massachusetts Horticultural Society. Finally, the "Best Specimen of the Show" ribbon of the American Iris Society was won by Mr. Pride for a stalk of 'Winter Olympics' grown in a display collection at the Case Estates, during the Worcester County Horticultural Society's Iris show.

The greenhouses of the Arboretum supervised by Mr. Alfred

Site preparation for planting of several large specimens of Ilex pedunculosa *in front of the Administration Building.*

Fordham, the propagator, are used primarily to propagate plants for the living collections and for the research and teaching of the staff. The greenhouses are open to the public one afternoon a week and on special open house days during the year. The Arboretum staff members request seeds or propagating material from other institutions for the collections or for research programs, and in turn try to fill requests from other botanical gardens or individual scientists for materials we grow or can acquire in New England or in areas of staff field work.

During the past year the propagator received 85 shipments of seeds of 232 species and varieties from the United States and 22 other countries. Living material such as stems, plants, or roots represented an additional 138 shipments of 524 species and varieties from nine countries. Although most of this material was requested by the staff, a sizeable amount was contributed by persons interested in our work. In response to requests or to distribute material from our collections of new introductions, unusual or rare plants, we sent out 47 shipments of seeds of 110 species and varieties to 10 countries. Living plant material was distributed in 148 shipments of 631 species and varieties to scientists or botanical institutions in 13 countries.

The living collections of the Arboretum often contain a single or only a few specimens of a given plant and a regular program is conducted to ensure proper representation of such items within the collection. Last year 373 species and varieties were propagated to prepare replacements for specimens which seemed to be failing or were in insufficient numbers in the collections. To provide the staff with material for taxonomic or analytic work, including studies in cytology and anatomy or simply for herbarium vouchers, the propagation department processed 79 taxa. Another 330 items were processed simply to acquire additional data on dormancy, root development, or response to variation in treatments preceding germination.

The greenhouse area and the activities in plant propagation are of interest to many professional visitors or groups. All guided tours of the Arboretum have a stop at the greenhouses and in addition student groups from other universities have regularly scheduled visits. Each year a class open to the Friends of the Arnold Arboretum has one or more meetings at the greenhouses on the subject of plant propagation.

Mr. Fordham is chairman of the committee on new plant introductions of the International Plant Propagators' Society. At the last annual meeting he presented papers on the propagation of juvenile shoots from root pieces and on the propagation of *Acer griseum*. He served on a question and answer panel at the 24th American Horticultural Congress and was a speaker at the short courses held in Rhode Island and in Massachusetts, as well as at the eastern regional meeting of the American Rhododendron Society.

The grounds of the Arnold Arboretum in Jamaica Plain are closed to driving on weekends throughout the year but are open to pedestrians. Although few visitors enter the Administration

Completed planting of Ilex pedunculosa

Moving a large specimen of Ilex pedunculosa *from the Centre Street area to a new site at the Administration Building.*

Building, we have been aware of frequent attempts to reach us by telephone on weekends; therefore we initiated a program of staff duty on Saturdays and Sundays. The telephone questions ranged from calls related to poisonous plants directed here from the Boston Poison Center through all types of horticultural queries to simple requests for directions. Since these clearly cannot be handled by an answering service it appears desirable to continue staff duty on weekends during the spring.

Again this year a bill was filed in the legislature of the Commonwealth to build a major recreational facility within the Arnold Arboretum, this time to consist of formal play areas including a swimming pool. State Senator Oliver Ames and Representative Mrs. Mary Newman were instrumental in opposing these bills.

The Herbarium

An herbarium is a scientific collection of dried plants or representative portions of a plant, arranged in a systematic order so that the specimens are readily available for reference and study. The organization of an herbarium at the Arnold Arboretum was almost simultaneous with the founding of the Arboretum and was intended to be a record of what was growing in Jamaica Plain before plant introductions were begun in 1872. Subsequently, the collection has grown to include the native, introduced, and cultivated plants from all parts of the world. In 1954 the herbarium was divided, the specimens representative of the native floras of the world being housed in Cambridge, and those representing plants under cultivation, particularly ornamentals, continued to be housed in Jamaica Plain.

New specimens are obtained in a variety of ways: by individual staff members in the course of their research; by gifts or purchases from collectors, often on special expeditions; or through an extensive exchange program with sister institutions. Properly prepared specimens, with accompanying labels which supply pertinent information, can be expected to last for long periods of time. The specimens can yield large quantities of data by general observation and, with special techniques, details of anatomy and chemistry. Some specimens are an historical record of areas which have been lost to highways, the site of buildings, or agricultural areas. Other specimens demonstrate the range of variation to be found in a plant population, or indicate the range of soil types on which the plant grows, or the extent of geographic distribution of particular plants.

A view in the Dana Greenhouses.

Use and Growth of Specimens Collected

During the past year 26,974 dried specimens were mounted and added to the herbarium, bringing the total collection to 935,839 sheets. Of this total, 143,365 specimens of cultivated plants are housed in Jamaica Plain. The Arboretum received 22,536 specimens by exchange, gift, or subsidy, for identification, or as the result of staff field work. The largest numbers came from Asia, with the United States ranking second. We distributed to other herbaria 15,607 sheets, primarily duplicate specimens. Thus, the herbarium continues to increase in size and in value. This growth continues to present a problem in Cambridge where materials in the standard steel herbarium cases become ever more crowded. The necessity of housing the specimens in cardboard boxes on top of the steel cases was begun two years ago and at present over 766 boxes, the equivalent of 42 steel cases, are in use. The opportunity for physical expansion of the building is remote and the expedient of cardboard boxes, absolutely undesirable, must be continued.

The use of the herbarium by the staff and visitors is continuous and reflects the need and the value of the collections. The number of scholarly visitors increased during the year due primarily to increased activity in the field of systematic botany. We prefer our specimens to be used in place yet we recognize the need for individuals to borrow specimens when they can not visit. We in turn borrow materials from other institutions. During the past year we sent on loan 14,764 specimens, as 161 loans, averaging 91 specimens, to 43 United States institutions and 31 in foreign countries. For staff and student use we borrowed 9,129 specimens as 178 loans from 65 institutions, 33 in the United States and 32 abroad. An analysis of these loans revealed that 34 percent were for student use which accounted for 58 percent of the total number of specimens borrowed. This reflects the broad nature of student thesis problems.

Fumigation

Because herbarium specimens are subject to attack by insects, curatorial procedures involve fumigation of lots of specimens in the course of handling material upon acquisition for loans or transfers, and their storage in steel cases. Occasionally, fumigation of larger amounts of material is required and during the past year the entire Harvard University Herbaria building was fumigated. With the cooperation of the University Department of Buildings and Grounds, a contract was made with the Waltham Chemical Company for the fumigation. The staff was

required to remove certain furniture and equipment from the building, which was then sealed and fumigated; a police guard was maintained to prevent entry. Employees of the Waltham Company then opened the building and began procedures to remove residual fumes by fans and with the air conditioning system. Officials of the company and the University Environmental Health Unit checked the building independently before the building was declared ready for reoccupancy. The fumigation program was accomplished under the direction of Dr. Bernice Schubert.

Research

Four separate floristic studies are being conducted by staff members of the Arboretum. These include studies of the Southeastern United States; the state of Veracruz, in Mexico; the Lesser Antilles of the West Indies; and the Territory of Hong Kong:

Dr. Carroll Wood and his associates, with a grant from the National Science Foundation, continued their studies towards a Generic Flora of the Southeastern United States, with portions of the study being published regularly in the Journal of the Arnold Arboretum. Treatments of the families Basellaceae, Cannabidaceae, Portulacaceae, and Ulmaceae along with the tribe Mutisieae of the Compositae were published. Completed and in press are studies of the Acanthaceae, Aizoaceae, Fagaceae, Molluginaceae, and Urticaceae.

Dr. Lorin Nevling, Supervisor of the combined herbaria of the Arnold Arboretum and the Gray Herbarium, was awarded a grant by the National Science Foundation to cooperate with botanists of the National University of Mexico to undertake floristic studies of the state of Veracruz. The grant will be administered by the Gray Herbarium. Dr. Arturo Gomez-Pompa, formerly a Mercer Fellow of the Arnold Arboretum, and Dr. Nevling will coordinate this new project. Graduate students of both universities will be involved in the field work as well as the herbarium and library studies. Several innovative techniques employing computer aids are being employed, and special collections of the cultivated plants are being made.

Dr. Shiu-Ying Hu has spent the past year as a visitor to the Department of Botany, Chung Chi College in Hong Kong. With the cooperation of the members of that college, field studies in Hong Kong and the New Territories have resulted in the collection of representative plants. Dr. Hu is preparing a new flora of the area which will include keys and descriptions, and will

be illustrated with drawings made from fresh materials.

Dr. Richard Howard and Miss Dulcie Powell have continued their work on a Flora of the Lesser Antilles of the West Indies. Dr. Howard made a short field trip to Montserrat in February to collect plants. With the cooperation of interested individuals in the area, new and often exciting collections of plants are being received for identification. Final editing of a manuscript dealing with the ferns and fern allies of the area prepared by Mr. George Proctor of the Institute of Jamaica is underway.

Other research

Miss Powell's studies of the plants introduced by Capt. William Bligh to the West Indies and to Europe was completed and submitted for publication. Additional papers on the mossy or elfin forest on Pico del Oeste in Puerto Rico by Dr. Howard and his collaborators have appeared in the Journal of the Arnold Arboretum, and others completing the series are in preparation.

Monographic or restricted studies of genera or families of plants involve all of the staff. Dr. Bogle continued his work on the Hamamelidaceae in addition to his studies of the Nyctaginaceae for the Generic Flora of the Southeastern United States. A special cooperative study of *Geocarpon* of the Caryophyllaceae is nearing completion. Dr. DeWolf is studying genera of the Moraceae, especially *Ficus* and *Dorstenia*. Dr. Elias is investigaing the foliar nectaries of various genera of the subfamily of the Mimosoideae of the Leguminosae, with particular reference to *Inga* and *Pithecellobium*. His studies also include the American genera *Calipea* and *Angostura* of the Rutaceae. Dr. Hartley has finished a manuscript on the collections he made in New Guinea as part of a larger phytochemical study of the flora. This material will be submitted for publication jointly with chemists from the CSIRO chemical research laboratory in Melbourne. He is continuing his work on the Malesian-Australasian Rutaceae and with Dr. Perry is examining material of the New Guinea species of *Syzygium*. Drs. Nevling and Elias have collaborated in palynological studies of the Mimosoid Leguminosae, especially the genus *Calliandra* where the type of pollen polyads were found to be correlated with an array of morphological features. Dr. Schubert has completed work on two floristic treatments of *Desmodium* in Africa.

Systematic Plant Anatomy

The wood collection of the Arnold Arboretum received additional curatorial attention during the year when portions of the

collection were placed in plastic bags for easier filing. The uncatalogued collections of Guiana woods made by Stahel and those of A. C. Smith made in the Fiji Islands were classified, and other smaller collections previously retained as separate units for special studies were returned to the general collections and arranged systematically. Microscope slides of North American Woods prepared cooperatively at North Carolina State University were added to the collections, as were slides of wood of China collected by and obtained from Syracuse University.

Anatomical studies of the floral nectaries of two species of *Marcgravia* from Puerto Rico were completed by Dr. Howard and Mrs. Roca-Garcia. This work was reported at the International Botanical Congress and has been published in the Journal of the Arnold Arboretum. Considerable progress continues in the studies by Dr. Howard of nodal and petiolar anatomy in a survey of patterns and variations in woody Dicotyledons. During the summer Mrs. Tissa Herat, a graduate student at Occidental College, aided Mrs. Roca-Garcia in this work. A special search was made for other occurrences of the "split lateral" trace pattern which appears to be common in the Gesneriaceae and Zygophyllaceae. A paper on this topic has been prepared for publication.

The work of Dr. Elias on the vascularization of foliar nectaries in *Inga* and other genera of the Leguminosae was reported at the meetings of the American Institute of Biological Sciences. Mr. Mario Sousa-Sanchez has worked with seedlings and the development of vascular patterns in successive leaves in his studies of Central American species of *Lonchocarpus*.

Library

The library of the Arnold Arboretum is divided between locations in Cambridge and Jamaica Plain in a way similar to the herbarium. That is, the material essential to work in horticulture and forestry is housed in Jamaica Plain while the essentially non-horticultural material is housed in Cambridge.

In September Mr. Charles Robert Long was appointed jointly as head librarian of the Arnold Arboretum and Gray Herbarium to replace Mr. Victor Marx. Miss Jeanne Caldwell was appointed library assistant of the Arnold Arboretum with primary responsibility for the library materials housed in Jamaica Plain. Part-time staff employees have included Mrs. Heidi Duda as cataloguer, Mrs. Yvonne Brown and Mrs. Kathy Bye as library assistants and Mrs. Joan Retsinas as secretary. Student labor is used to shelve, clean, and treat bindings of volumes.

A staff library committee to aid the librarian consisting of Dr. L. I. Nevling and Dr. Gordon DeWolf, and Dr. Rolla Tryon of the Gray Herbarium staff, was appointed during the year. The committee will advise the librarian and his staff on the selection of books and the problems faced by the expanding library collection. There is a steady increase in new periodicals, new volumes, new reproductions, and in the costs of materials and services. Careful decisions are necessary to ensure the quality of the library for modern research.

We have serious limitations of space in the library areas in Cambridge. Free shelf space is currently estimated at 13%. Professional librarians recommend a minimum of 15% for space in which proper housing of volumes, adjustments to additions and expansion can be accomplished at a minimum of cost. As a temporary measure additional shelving has been purchased which will extend the library stacks into space previously used for study tables. Additional space for shelving is also available in Jamaica Plain.

The Arnold Arboretum library receives 498 periodicals which are issued weekly to annually. During the past year we have added 926 volumes and 376 pamphlets, bringing the total library accession to 77,648 titles. We share the purchase of microfilms and microfiche with the Gray Herbarium and with other Harvard libraries so that 138 microfilm reels and 9,187 microfiche are available for study.

A survey of the library materials of the Arnold Arboretum during the year has indicated gaps in our holdings of important floras, monographs, and periodicals, and steps have been taken to acquire the missing items. This study revealed the necessity for the development of a shelf list for the library in Jamaica Plain, for the treatment of leather-bound volumes which show signs of ageing, and for the binding of many items within our holdings. For example, at the present time there are 3,027 unbound volumes of periodicals and 1,400 monographs in Cambridge, and 1,343 periodicals in Jamaica Plain. This will necessitate increased expenditures in binding during the next few years.

The library receives on a regular basis issues of the Gray Herbarium Index, Index Genericorum, the Torrey Index, and additions are made to the shelf list, author and title cards, and the Rehder Index of cultivated plants. It is estimated that 9,000 cards are filed annually in our current program.

Cataloguing of new volumes is handled in part by our own staff, but where catalogue card copy can be obtained from the

Witches' Broom seedlings on White Pine (Pinus strobus), *all from same seed lot germinated in 1964.*

Library of Congress or the New York Botanical Garden in duplicate form, this method has also been employed. A new classification of field notes, plant lists, and collectors data has been added to the library during the year to handle these important historical items. The Arboretum also has miscellaneous materials of archival value of former staff members and associates which number around 20,000 items.

The volumes on the subject of forestry belonging to the Arnold Arboretum, which had been housed at the Harvard Forest in Petersham since World War II, were returned to Jamaica Plain two years ago. The reclassification of these volumes was completed during the year and the titles are now included in the appropriate catalogues.

Work continues on the process of cataloguing the collection of forestry volumes transferred to the Arboretum from the Widener Library.

The new format for Arnoldia offers the opportunity of accepting library books for review. A notice of the willingness of the staff to accept volumes for review has been sent to appropriate publishers and it is expected that review volumes may add to our library in several areas where we hesitate to purchase volumes. The library staff will accept the responsibility for many of the reviews or notices of publication while the professional staff will handle the technical volumes.

Mr. Long attended the Librarians' and Cataloguers' luncheons held under the auspices of the Widener Library which furnish close contact with the many libraries of Harvard University. A new national organization of librarians of Botanical and Horticultural Libraries was formed during the year with meetings at various centers planned after the initial meeting at the Massachusetts Horticultural Society; Mr. Long serves as chairman of the Secretariat of this group. He is also chairman of the Public Relations Committee of the New England Library Association and chairman of the nominating committee for the Alumni Association of the Simmons College of Library Science.

Travel and exploration

The XI International Botanical Congress was held in September 1969 on the campus of the University of Washington; Drs. Bogle, Howard, Nevling, Schubert, and Wood attended. Three presented papers in sessions of contributed papers or symposia. Normally, an international meeting abroad is the opportunity to visit botanic gardens, to acquire pictures for teaching pur-

Brush Chipper. Wood chips are used for mulch.

Lightning damage to a Canadian Hemlock on Bussey Hill.

poses, or to consult herbaria and libraries. The west coast of the United States offered a similar opportunity for consultation or visits to the University of Washington Arboretum, the Universities of California, the California Academy of Sciences, or places between the West Coast and Boston. Many foreign scientists en route to and from the Botanical Congress made stops at the Arboretum to use or see our collections.

Dr. Schubert and Dr. Sorensen attended the Fourth Mexican Botanical Congress held in Monterey and Saltillo where Dr. Schubert was invited to act as chairman for one session and to present a paper on her work with Mexican species of Dioscorea.

Mr. George Pride used his vacation to travel around the world visiting botanical gardens, again photographing plants and scenes useful in our education program. He was able to acquire some plant material of potential use in our greenhouses or sufficiently hardy to live outdoors in the Arboretum collections.

His stops included the Hawaiian Islands, Australia, New Guinea, the Trobriand Islands, Philippines, Singapore, Thailand, and Denmark.

During the past year Dr. Shiu-Ying Hu has continued field work associated with her project to revise a flora of Hong Kong.

Dr. Nevling and Mr. Sousa made independent trips to Mexico for their respective studies of the Flora of Vera Cruz and of the genus *Lonchocarpus*. Each acquired considerable material basic to his studies.

Dr. Howard visited Puerto Rico to continue his periodic observations on the dwarf forest on Pico del Oeste in the Luquillo mountains, and extended his trip for a week of collecting on the summits of the mountains of Montserrat searching for alpine plants on these rarely explored peaks.

Dr. Howard also represented the Arnold Arboretum at the festivities associated with the 300th anniversary celebrations of the founding of the Royal Botanic Garden in Edinburgh, Scotland. Following formal meetings, a special group made a study tour of Scottish gardens. Dr. Howard was able to visit the Botanical Garden in Brussels, Belgium, and the Royal Botanical Gardens at Kew, primarily to obtain additional material for his anatomical studies from the greenhouse collections of these institutions. The courtesies extended by the directors of each garden are gratefully acknowledged.

Education

The professional members of the staff of the Arnold Arboretum, as members of the Faculty of Arts and Sciences and the Department of Biology at Harvard, are available to advise undergraduate and graduate students in special research courses. At intervals they also offer formal courses within the University and participate in the Harvard University Extension Course program. In addition, members of the staff prepare flower show exhibits and conduct tours of the grounds; participate in lecture series and offer special lectures to clubs at the Arboretum or elsewhere; participate in scientific meetings; speak at colleges; and take part in panel discussions or short courses held for horticulture.

Mr. Hebb gave an Arboretum-sponsored course in "Practical Gardening for the Home Owner" at the Case Estates and a special short course in "Garden Maintenance" in Hanover, New Hampshire. Dr. Howard participated in the Cornell University — University of New Hampshire Summer Program in Marine Sciences at the Isles of Shoals and taught the systematic sec-

tion of a Tropical Botany Seminar in cooperation with the University of Miami and the Fairchild Tropical Garden in Miami, Florida. He was sponsored by the American Institute of Biological Sciences as a speaker at six colleges and universities in programs associated with Earth Day during the spring. The Association of Tropical Biology sponsored a symposium on Adaptive Aspects of Insular Evolution on the campus of the University of Puerto Rico in Mayaguez. Dr. Howard presented a paper on the alpine plants of the Antilles and then, with Roy Woodbury, led a field trip to the Maricao Forest in Western Puerto Rico followed by one the next day in the Luquillo Mountains in eastern Puerto Rico.

Mr. Pride reported on his experiences in plant hunting around the world to the American Rock Garden Society and the Worcester Horticultural Society as well as to several garden clubs.

Dr. Nevling and Dr. Schubert and a graduate student, Mr. Rodman, conducted the luncheon seminars in systematic botany held weekly in Cambridge. Dr. Schubert and Dr. Wood gave a seminar designed especially for graduate students preparing their first scientific papers for publication. Dr. Wood and Dr. Howard offered an Arboretum course for the Friends called "Botany in Boston's Restaurants" in reality a practical course in the economic botany of foods. Dr. Wood spoke to the botanical staff at Cornell on the relationships of the flora of eastern North America. He took part in a symposium at the International Botanical Congress on "Some floristic relationships of eastern North America," and at Virginia Polytechnic in Blacksburg, Virginia, on the distributional history of the biota of the Southern Appalachians. Dr. Wyman, Mr. Hebb, Mr. Fordham, and Mrs. Derderian all offered individual courses at the Arboretum or the Case Estates for the Friends.

The Arboretum staff has also worked with student employees from other colleges in training programs using our facilities. These involved cooperative work-study programs with Antioch College of Yellow Springs, Ohio; Goddard College in Vermont; and Smith College in Northampton, Mass. Also the staff sponsored the winter meeting of the New England section of the American Society of Horticultural Sciences in Cambridge. Eleven staff members served as guides on buses during the annual meeting of the Garden Club of America during their visit to the Arnold Arboretum. The staff offered a prevue showing of an exhibit of Margaret Stones' drawings of Tasmanian plants published as the *Endemic Flora of Tasmania*; the exhibit was open to the public for two weeks in the lecture room

Class presented at the Dana Greenhouses by Mrs. Ara Derderian in elementary techniques of Bonsai.

of the Administration Building.

A gift of money by a Friend who wishes to remain anonymous permitted the staff to offer the Arnold Arboretum Achievement Award for Botanical and Horticultural Excellence to a student selected by nomination from schools in the Boston area. The Award in 1970 was made to Mr. Mark Saunders of Jamaica Plain High School who received a selection of books of his choice which would be useful in continuing his education. Mr. Saunders requested that the gift plants offered by the Arboretum as part of the award be given to the Jamaica Plain High School for plantings on the grounds to aid in the class work at the school.

Although these are but a few of the many activities of the staff, they are indicative of its role in public education, an important function of a modern arboretum.

Bonsai Rhododendron indicum, *which was received in March 1966 from Ofuna Botanical Garden, Kanagawa-Ken, Japan.*

Bonsai House.

Case Estates

The extensive work on the grounds in Jamaica Plain altered the Case Estates' normal planting and transplanting schedule. Small plants propagated in the greenhouses can be set out at the Case Estates to grow to a larger size. Normally planting and transplanting is done in the spring and in the fall. As the plants develop in Weston they are pruned to acquire a satisfactory form and if they flower they are checked for accuracy of identification, and their need is considered for the plantings in Jamaica Plain.

In anticipation of the Centennial of the Arnold Arboretum in 1972, the staff has prepared a larger than usual number of special plants for distribution to other botanical gardens, to special groups for possible commemorative plantings, and as gifts to the Friends. Three new areas of land were opened during the spring, two of which were immediately filled with container-grown stock for further growth. All of these trees were staked and have received special attention. A third area which will be used during the next planting season was ploughed and sown to rye grass.

Nearly every year we find some material in the nurseries that are surplus to our needs. This material is offered to Harvard's other educational institutions; to the Boston Park Department and to the town of Weston. This year plants were accepted by the Medical School area. Additional plants were given to Wellesley College, the State College at Bridgewater, and to the Friends of the Arnold Arboretum. Special plants of *Metasequoia glyptostroboides* were supplied to Franklin Pierce College for instructional use on their grounds. Two truckloads of trees and shrubs were contributed to the Roxbury-Dorchester beautification program as a part of the continued interest of Mrs. Augusta Bailey. Nine selected groups of plants were made available to WGBH-TV Channel 2 for their annual benefit auction; we are pleased that these plants, most of which are not available through local nurseries, draw high bids.

Plants in the display beds of mulching materials had grown beyond desirable size for the educational exhibit and accordingly one-half of the display was renovated. Several kinds of edging strips are being employed to separate areas of mulch materials. (Small shrubs have been used in the mulch beds to emphasize the proper use of mulches.)

The perennial garden, which has been called a low maintenance garden, reached the point where additional maintenance was required. Again, individual shrubs had grown beyond a

desirable size for demonstration purposes. Mr. Hebb began a study of the perennial garden with the idea of using the necessary redevelopment as a project for one of next year's class programs. Many plants are scheduled to be removed from the perennial garden and younger plants have been purchased or propagated for fall planting.

Herbarium specimens from the rock garden, the greenhouses, and the vegetable and flower gardens on the Case Estates, as well as from the nurseries, were prepared in multiple sets for the Arboretum herbarium and for distribution to other institutions.

Each year a larger number of requests are received for special meetings or tours of the Case Estates. The lecture room in the Red School House is made available to such groups as the American Hemerocallis Society, the American Rock Garden Society, or the Worcester County Horticultural Society, when such a meeting is associated with a tour of the grounds or a study of the special plantings. Lecture series and classes open to the Friends are also held in this room, which regrettably cannot accommodate more than forty people. The Harvard University College Teas Association has met in Jamaica Plain during the past two years; this year they requested that their spring meeting be held in Weston. Fortunately, a fine spring day coincided with their scheduled meeting and the event could be held outdoors. When the weather is inclement, the barn, where mechanical equipment is maintained, can be used in lieu of a large meeting room. Several garden clubs from the New England states received guided tours of the Case Estates, and the grounds were used for special meetings by the Harvard Law School and the Harvard Librarians Association.

A general Open House for the public was held in May with good attendance. We have noticed that when an Open House is announced in the Boston and suburban papers, visitation increases noticeably on the days before and immediately after the event.

Additional plantings have been made in the rock garden area maintained at the Case Estates. Mr. Pride, during a tour around the world, was able to obtain seeds and plants from native locations as well as from other botanic gardens for trial in the Case Estates plantings. Members of the American Rock Garden Society have been particularly generous in supplying unusual plants for this collection. A large selection of species and clones of *Sedum* and *Sempervivum* taxa for trial were the gift of the Oakhill Gardens of Dallas, Oregon.

George Pride and Mrs. Augusta Bailey inspecting Seaver Street area in Roxbury for potential community park.

Michigan Avenue community garden after four years of hard work.

Fence finally installed around Seaver Street area.

Beauty spreads to the next corner on Michigan Avenue. One year's effort

Getting children involved in "Window Park," Norwell Street area in Dorchester.

Inspecting children's efforts in Norwell Street "Window Park" area.

Mercer Research Fellows

A portion of the income from the bequest of Martha Dana Mercer to the Arnold Arboretum is applied each year to bring scholars to the Arboretum to work with specific staff members and to use the collections of living plants, the herbarium, and the library. Applications for these awards, known as Mercer Research Fellowships, may be submitted at any time and are awarded as funds are available for a few months or for periods not exceeding two years. Candidates may be undergraduates, predoctoral students accepted in the Graduate School of Arts and Sciences, or postdoctoral students. The following persons received Mercer Fellowships for all or part of the last year. Their affiliation and field of interest is indicated:

Lucy Dos Passos, Occidental College. Horticultural taxonomy; plants of the Boston Public Garden.

Rukmani Herat, Occidental College. Vascular patterns of nodes and petioles.

Tissa Herat, Occidental College. The Theaceae and the Flora of Ceylon.

Syed M. A. Kazmi, Peshawar University, Pakistan. The Boraginaceae of Pakistan; basic botanical bibliography of Pakistan and adjacent areas.

Robert C. Kennedy, University of New Hampshire. Propagation of woody plants by seeds.

Madeleine Ly-Tio-Fane, Sugar Research Institute, Mauritius. Botanists and plant introduction via Mauritius.

Nancy M. Page, Stanford University. Plant propagation; landscape design.

Mario Sousa-Sanchez, University of Mexico. Graduate studies with a thesis on Lonchocarpus (Leguminosae).

Margaret H. Stone, Bailey Hortorium. Library and herbarium research.

The Friends of the Arnold Arboretum

The Friends of the Arnold Arboretum is an informal group of people who by annual or occasional gifts support our work. In addition to financial support, we receive from the Friends gifts of books and plants, or artifacts of botanical or horticultural value.

During the past year, largely through the efforts of Mr. Pride and Mrs. Pelkus, invitations to join the Friends were sent to the membership of groups with similar or compatible interests. We are pleased that the contributing membership is now over

A view in the low maintenance garden at the Case Estates.

1,100 persons, most of whom are from Massachusetts, with representatives from 34 other states and Canada.

The gifts of the Friends are used to support horticultural and other work with the living collections in Jamaica Plain and Weston. Gifts are tax deductible within the usual federal regulations. The Arboretum endowment has been built over the years through such gifts and it is these funds which support our every activity. A number of Friends wish their gifts to be accumulated as special gifts to be made during the centennial year 1972 at which time they will be announced.

Friends receive a free subscription to Arnoldia and are invited to participate in classes and to attend lectures at special rates. Six special events exclusively for the Friends were held during the past year: (1) a lecture followed by a tasting of Alsatian wines; (2) gift day when a collection of orchid plants were given to Friends many of whom later attended a Cattleya workshop; (3) preview visit to the exhibit of paintings of the plants of Tasmania by Margaret Stones; (4) gift day when surplus plants from the Arboretum were distributed; (5) "Evening with Friends" and (6) Lecture Series; "Meet the Staff" talks by Miss Powell and Messrs. Elias, Hebb, Long, Pride and Wyman. To show our appreciation to the Friends for their support we are continuing to develop our program for them and hope to create a more formal organization before 1972 — our centennial year.

Grants

A grant from the National Science Foundation to support the work of Dr. Carroll Wood on the Generic Flora of the Southeastern United States was renewed during the year. Dr. Lorin Nevling also received an NSF grant to work on the flora of Vera Cruz. Grants from the NSF were also in effect during the year to support the field work of Dr. Howard, and the works of Dr. DeWolf on taxonomy of tropical American and African figs.

Publications

The Journal of the Arnold Arboretum was begun in 1920 as a quarterly publication primarily to report the scientific studies of the staff and the students of the Arboretum. With the first issue in 1970 the Journal began its fifty-first volume and the Harvard Alumni Bulletin paid tribute to this half century by noting:

> "The Bulletin, having just reached its 71st birthday, wishes to congratulate another Harvard publication,

Mulch display beds at the Case Estates during renovation.

> the Journal of the Arnold Arboretum which is celebrating its 50th anniversary. Published quarterly, the Journal started as an outlet for the scientific work of the staff of the Arnold Arboretum. Now, only five editors later, it enjoys high reputation in the botanical world for the articles it contains, and for editorial excellence."

With the new volume the cover has been changed in color and is decorated with a drawing of the Golden Larch. Four issues appeared during the year with 33 articles by 36 authors and a total of 605 pages. Dr. Bernice G. Schubert is the editor.

Arnoldia

Arnoldia, another publication of the staff, also experienced changes during the year. First issued in several consecutive series beginning in 1911 as the Bulletin of Popular Information,

the title was changed in 1940 to Arnoldia. For 29 years Dr. Donald Wyman served as principal editor and each of the 12 issues during the year considered a single topic of horticultural interest. With his retirement, Dr. Wyman passed on the responsibility of Arnoldia to Miss Stephanne Sutton, who suggested a publication of different format which would contain several appropriate articles on a schedule six times a year. Mr. Christopher Reed redesigned the publication and the photographic covers are now familiar to readers. Each issue will contain approximately 32 pages and the price was increased to a realistic figure of $3.50. We extend our special thanks to Mr. Howard Allgaier of the Botanical Museum who has produced Arnoldia from handset type for many years. The new printer will be the Harvard University Printing Office.

The Index

The staff collaborated to prepare a cumulative index to the 29 volumes of Arnoldia edited by Dr. Wyman. We are indebted to Mrs. Robert Hebb of the Arboretum staff and Miss Sonia Adrouny, now a graduate student at the University of Massachusetts, for their hard work in preparing the entries.

Biography

Miss Stephanne Sutton completed the manuscript of her biography of Charles Sprague Sargent, the first director of the Arnold Arboretum. The book will be published by the Harvard University Press in November 1970. Miss Sutton resigned her present position at the end of the fiscal year to be free to write and travel. Her new corporation title is Honorary Research Fellow.

The Board of Overseers Committee to Visit the Arnold Arboretum

A part of the supervision that the administration of Harvard University offers the Arnold Arboretum is the Committee to Visit the Arnold Arboretum, created by the Board of Overseers. One alumni-elected member of the Board of Overseers is given the assignment of assessing the activities and functions of the Arnold Arboretum and its staff. That individual serves as chairman of a committee which visits the Arboretum in its several locations twice a year. During the past year a fall meeting was held in Jamaica Plain and at the Case Estates, and the spring meeting at Jamaica Plain and at Cambridge. Committee members representing horticulture and botany may be familiar in their occupations with commercial horticulture, botanical

Stachys grandiflora *as part of new planting in mulch display beds at the Case Estates.*

gardens, or publications. One member is usually a resident of the town of Weston, the location of the Case Estates; the chairman of the Boston Department of Parks and Recreation is an official member.

Members of the Visiting Committee have aided the Director many times in the past on special problems. The staff is particularly indebted this year to Mrs. Richard Pratt who served as local chairman for the annual meeting of the Garden Club of America held in Boston. The members who attended the meeting toured the Arnold Arboretum, and as souvenirs of their visit were given packets of seeds and copies of publications. Mrs. Pratt arranged for the local members of the Visiting Committee to aid as hostesses during the visit to the Arboretum. She also recruited members of the Garden Club of Chestnut Hill to help finance refreshments for the visiting group and to fill envelopes with seeds stratified in advance for ready germination.

The Visiting Committee during the academic year 1969–70 included:

George Putnam, *Chairman*, Boston, Massachusetts
George R. Clark, *Vice-Chairman*, Philadelphia, Pennsylvania
Mrs. George L. Batchelder, Jr., Beverly, Massachusetts
Mrs. Ralph Bradley, Canton, Massachusetts
Frederick D. Brown, Webster, Massachusetts
Mrs. Paul C. Cabot, Needham, Massachusetts
Joseph Curtis, Commissioner, Boston Parks and Recreation Department
Mrs. Dudley B. Dumaine, Weston, Massachusetts
William Flemer, III, Princeton, New Jersey
Mrs. Julian W. Hill, Wilmington, Delaware
Henry B. Hosmer, Boston, Massachusetts
Seth L. Kelsey, Greenville, Delaware
Russell E. Larson, University Park, Pennsylvania
Milford R. Lawrence, Falmouth, Massachusetts
Mrs. John E. Lockwood, Bedford, New York
Harold E. Moore, Jr., Ithaca, New York
R. Henry Norweb, Jr., Mentor, Ohio
Mrs. Richard W. Pratt, Chestnut Hill, Massachusetts
Mrs. Donald P. Ross, Montchanin, Delaware
Francis W. Sargent, Boston, Massachusetts
George Taylor, Kew, England
Mrs. Julian Underwood, South Dartmouth, Massachusetts
Mrs. G. Kennard Wakefield, Milton, Massachusetts
Nathaniel Whittier, Medfield, Massachusetts
Mrs. John G. Williams, Gladwyne, Pennsylvania

Bergenia cordifolia *as part of new planting in mulch display beds at the Case Estates.*

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RICHARD A. HOWARD, *Director*

Staff of the Arnold Arboretum · Spring 1970

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Middle row:
Dr. Richard A. Howard; Alfred J. Fordham; Harry Hill; Ralph Benotti; Arturs Ginters; Charles Mackey; Dr. Syed M. A. Kazmi; Dr. A. Linn Bogle; Dr. Gordon P. DeWolf, Jr.; Heman A. Howard; Mrs. Mildred Pelkus; Miss Virginia Savage; Mrs. Winnifred Hebb; Robert S. Hebb; Dr. Lorin I. Nevling; William E. Grime; Willie Casterlow; Vincent Antonovich; Ernest Abolins; Peter Ward; Angus MacNeil; Walter Polesky.

Back row:
Arturs Norietis; George H. Pride; Thomas M. Kinahan; Dr. Thomas S. Elias; Dr. Carroll E. Wood; Clarence Parker; Daniel Reuben; Joachim Hourihan; Michael Canoso; Scott Vonnegut; Dr. Paul Sorensen; Dr. Thomas G. Hartley; Dr. Norton G. Miller; Carl Joplin; William Schwabe; Robert G. Williams; Maurice Sheehan; Michael Gormley; Henry Goodell; Timothy O' Leary; Domingo Rivera.

Photo: Hutchins Photography, Inc.

Staff of the Arnold Arboretum

1969–1970

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Victor Ferenc Marx, M.Libr., *Librarian* * (Resigned Sept. 1969)
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Robert Gerow Williams, B.S., *Superintendent*
Carroll Emory Wood, Jr., Ph.D., *Curator*
Donald Wyman, Ph.D., *Horticulturist*

* Appointed jointly with the Gray Herbarium.

Notes from the Arnold Arboretum Plant Registrations

Every so often during the past 9 years new cultivars registered by the Arnold Arboretum have been published in *Arnoldia*. With the new format for *Arnoldia*, these will be published annually in the November issue along with the Director's Report.

Included in this issue are those cultivars which have been registered between January 1, 1969, and October 1, 1970. All correspondence concerned with more information, plants, or propagating material of these plants, should be directed to the various originators or introducers, not the Arnold Arboretum.

Abies concolor 'Gables Weeping'

This originated as a seedling in 1951 in the nursery of Joseph B. Gable, Stewartstown, Pa., and was introduced in 1966 by Mr. & Mrs. Donald Smith of the Watnong Nursery, Morris Plains, N. J. Mr. Smith writes, "To my knowledge this is the only truly dwarf weeping form of *Abies concolor*. At 18 years it is 16″ high and 20″ across."

Carissa grandiflora 'Seminole Queen'

A low, compact form of *Carissa grandiflora* introduced in 1954 by the Seminole Nurseries, 7800 Seminole Blvd., Seminole, Fla. In the words of Mr. Richard C. Johnson of Seminole Nurseries, it "thrives in all except wet and poorly drained soils. *C.* 'Seminole Queen' is distinguished by its glossy dark green foliage and has a medium-sized, round leaf. It is self-branching and has a dense, low-growing compact habit of growth." Hardy in Zone 10.

Carya ovata 'Holden'

This has been registered for the Holden Arboretum, Sperry Road, Mentor, Ohio, by Dr. Peter A. Hyypio of the L. H. Bailey Hortorium, Cornell University, Ithaca, N. Y. The original plant, which is well over 25 years old, was first noticed in 1966 growing at the corner of Main and Baldwin Sts., Hudson, Ohio.

In Dr. Hyypio's words, "The tree has an undivided stem from which rather slender lateral branches arise and grow upward at a rather wide angle. As the limbs lengthen they begin to arc and droop; at their tips almost all twigs curve upward. This unusual pendulous branching habit gives the tree a tall slender conical form which is attractive both in the winter and summer condition." Hardy in Zone 4.

Cercis canadensis 'Royal White'

This originated with the late Mr. Royal Oakes, Bluffs, Scott County, Ill. as a seedling from a native tree in Scott County, Ill. The age of the original plant is unknown, but it first flowered about 1940 and was selected before 1950. It was introduced in 1950 by the Louis Gerardi Nursery, R.F.D. 1, O'Fallon, Ill.

Prof. Joseph C. McDaniel of the University of Illinois at Urbana says the plant produces abundant white flowers opening somewhat earlier in the season and slightly larger than *C. canadensis alba.* The plant is more compact, matures earlier, and the leaves are wider-angled at the base of the blade. Plants are cross-fertile, but incompatible to their own pollen. Although fully hardy at Urbana, Ill., the northern limit is unknown.

Cercis canadensis 'Silver Cloud'

Mr. Theodore R. Klein, Yellow-Dell Nursery, Crestwood, Ky. selected this plant in 1964 from a row of seedling liners originally from Tennessee.

Mr. Klein writes, "The plant produces few flowers and is principally noteworthy for its decorative foliage. Most leaves on all branches are margined or splashed with silvery white variegation. Plants are less vigorous than typical *C. canadensis* and the branches are more slender. They seem to do best if planted in light shade and out of strong winds."

Cornus stolonifera 'Isanti'

This is an introduction from the Minnesota Landscape Arboretum, Box 132–1, Route 1, Chaska, Minn. which was first observed in 1963 as a sport on a plant growing at the Cedar Creek Natural History Area, East Bethel, Anoka Co., Minn.

Mr. Albert G. Johnson, Research Fellow, University of Minnesota describes the plant as having a dense, compact habit of growth. Branchlets are fine and produce a dense broomy shrub. The growth rate is about half that of normal *C. stolonifera.*

Chionanthus virginicus 'Floyd'

This originated as a chance seedling in the Sonnemann Experimental Garden, 605 N. 5th St., Vandalia, Ill., around 1945. It is named for the late W. Floyd Sonnemann by Prof. J. C. McDaniel, Department of Horticulture, University of Illinois at Urbana-Champaign, Urbana, Ill., who will introduce it in 1971–72. Prof. McDaniel writes, "The distinguishing feature is its more dense and upright growth habit. Compared with typical seedlings, this clone has more branching on new growth, branches emerge at an acute angle and grow straighter, producing a shrub taller than broad. It is staminate, with a few perfect flowers in its large panicles." Hardy in Zone 4.

Daphne burkwoodii 'Carol Mackie'

This sport of *Daphne burkwoodii* originated in the garden of Mrs. Carol Mackie, Far Hills, N. J., in 1962. The original plant is now in the possession of Mr. and Mrs. Donald P. Smith, Watnong Nursery, Morris Plains, N. J., who introduced it in 1968. Mr. Smith reports that the leaves are green with a clean rim of gold all the way around each leaf. A small plant of this is now in the nursery at the Arnold Arboretum and shows promise of being one of the most interesting new variegated plants we have seen here for some time. Hardy in Zone 5.

Albizia julibrissin '*Ernest Wilson.*'

Exochorda 'Carol Ann Bianco'

This plant originated in 1959 as the result of a cross between *Exochorda macrantha* 'The Bride' and *E. racemosa* made by Mr. Giovannina Bianco, 2220 Woodcrest Dr., Lynchburg, Va.

Mr. Bianco writes that the plant is bushier and has larger flowers than either of the parents. It is shorter than either of the parents, and blooms a week later than *E. racemosa*. Hardy in Zone 5.

Liriodendron tulipifera 'Ardis'

The original seed from which this plant grew was probably collected from a tree native in southern Illinois and germinated at a state forest nursery. The selection was made by Mr. and Mrs. W. F. Sonnemann, Sonnemann Experimental Garden, 605 N. 5th Street, Vandalia, Ill., in 1957. Prof. J. C. McDaniel, Div. of Ornamental Horticulture, University of Illinois, Urbana, Ill., has named the plant to honor Mrs. Sonnemann. Prof. McDaniel writes, "The original seedling tree and those budded from it are handsome miniatures of the species with ¼ to ⅓ the normal leaf diameter and tree height to date. Internode length is much reduced and color is normal. No flower buds have formed yet. It is hardy at Vandalia, Illinois and for the first winter at Urbana." In a letter dated March 10, 1970, Prof. McDaniel amends his original description by stating, "*L. tulipifera* 'Ardis' is not completely nonflowering, as previously suspected. The original tree this winter was discovered to have remnants of two fruits, from flowers borne in 1969."

Malus × *adstringens* 'Kelsey'

This cultivar originated at the Canadian Department of Agriculture, Research Station, P. O. Box 3001, Morden, Manitoba, Canada. The seed was taken from a plant (M#6011) which originated as a cross between *Malus* × *adstringens* 'Almey' and *M.* × *adstringens* #5212. The male parent was *M.* × *adstringens* #5908. It first flowered in 1966 and was introduced in 1970. Mr. W. A. Cumming, Head of the Ornamentals and Fruit Crops Section of the C.D.A. Research Station writes, "The flowers are semi-double with 10 to 16 petals. This is the only truly hardy double flowering crabapple which will survive in Zone 3. At Morden in Zone 3b double flowering crabapples including 'Dorothea', 'Katherine', *M. ioensis* 'Plena', and the recent Ottawa introductions are not hardy."

Malus × *adstringens* 'Rodney'

Approximately twenty years ago this tree originated at the nursery of Kelley and Kelley, Inc., Long Lake, Minn., as a seedling from *Malus* 'Hoppa'. The male parent is unknown. It was introduced by Mr. Rodney F. Kelley, who characterizes it as being an extremely vigorous grower and very hardy in Minnesota. The flowers are white, followed by dark red fruit which remain on the plant well into the winter. The thick glossy green leaves remain on the tree long after other trees are bare.

Malus × *adstringens* 'Sparkler'

This cultivar was selected in 1947 at the University of Minnesota Fruit Breeding Farm as a seedling from *Malus* 'Hoppa'. The male parent is unknown. The original plant first flowered in 1945 and is now 28 years old.

It was introduced commercially in 1969 and was first described in that year in the University of Minnesota Agricultural Experiment Station, Miscellaneous Report 84. Dr. Robert MacClain, Associate Professor, Department of Horticultural Science, University of Minnesota, St. Paul, Minn., reports that the plant reaches a height of 12–15 ft. and has a horizontal branching habit. The two-inch flowers are rose-pink and single. Fruits are dark red, ¼ – ½ inch in diameter, and the calyces are deciduous. Leaves are broadly ovate, acuminate, serrate, 1½–2 inches long, reddish in the spring and dark green later.

It is reported to be hardy in Zone 2 and prefers a well drained, loamy soil and exposure to full sun.

Malus 'American Beauty'

This first flowered in 1962 at Princeton Nurseries, P. O. Box 191, Princeton, N. J. and was selected in 1963 by Mr. William Flemer, III, of Princeton Nurseries. Seed was taken from *Malus* 'Katherine' and the male parent was *M.* 'Almey'. The plant was introduced in 1970 by Princeton Nurseries (Plant Patent #2821).

Mr. Flemer describes the plant as having an exceptionally vigorous habit of growth. It blooms annually with large (5 to 5.5 cm.) double flowers which are clear red (Munsell Chart 7.5 RP 4/11). Foliage is bronze red when young, bronze green at maturity. Hardy in Zone 4.

Malus 'Cameron'

This cultivar originated at the Central Experimental Farm of the Ottawa Research Station, Canada Department of Agricul-

ture, Ottawa, Ontario, Canada, in 1956. Seed was taken from *Malus* 'Arrow', and the male parent was *M.* 'Katherine'.

It will be introduced commercially in 1973 by the Canadian Ornamental Plant Foundation, c/o Ross & Robinson, 39 James St. S., Hamilton, Ontario. Dr. D. R. Sampson of the Ottawa Research Station describes the plant as having large (4.5 cm. across) double red flowers (7.5 RP 5/12). The leaves are lustrous bronze in the spring, turning to dark green in summer. Fruits are small (13.8 mm. diameter) and lustrous purple. It makes a tall-oval shaped specimen with moderate branch angles.

This was named in honor of Mr. D. F. Cameron, formerly the ornamental plant breeder for the Canada Department of Agriculture, at Ottawa, who bred 'Maybride', 'Prince Charming', and this cultivar.

Malus 'Donald Wyman'

As described in *Arnoldia*: Vol. 30, No. 3, p. 116, May 15, 1970, this tree was named in honor of Dr. Donald Wyman.

The original plant was first noticed as a spontaneous seedling on the Arboretum grounds prior to 1950. Flower buds are pink but they open to single, white flowers which are 4.5 cm. across. Under our conditions the tree flowers annually and has consistently produced a heavy crop of glossy, bright red fruits which average 1 cm. in diameter. The tree retains its fruit in good condition well into the winter months when the fruit of nearly every other crabapple in the collection has either dropped, been eaten by the birds, or has turned brown and unattractive. Probably hardier than Zone 4.

Malus 'Maybride'

This cultivar originated at the Central Experimental Farm of the Ottawa Research Station, Canada Department of Agriculture, Ottawa, Ontario, in 1956. Seed was taken from *Malus* 'Dorothea', and the male parent was *M.* 'Makamik'.

The large white flowers are 4.8 cm. across and have 17 to 18 petals. It blooms profusely every year at the same time as or a few days later than *M.* 'Makamik' and *M.* 'Almey'. The fruit is dull red to yellowish green, 18.7 mm. in diameter, and of little ornamental merit. Hardy in Zone 5a (C.D.A. Map).

Malus 'Pink Perfection'

This first flowered in 1960 at Princeton Nurseries, P. O. Box 191, Princeton, N. J., and was selected by Mr. William Flemer, III, of Princeton Nurseries. Seed was taken from *Malus* 'Kath-

Cephalanthus occidentalis pubescens.

erine' and the male parent was *M.* 'Almey'. The plant was introduced in 1970 by Princeton Nurseries (Plant Patent #2912).

Mr. Flemer describes the plant as having a vigorous oval habit of growth. Flowers are large (5 to 6 cm.), double pink (Mun-

sell Chart 10 RP 7.8), and have 15 to 16 petals. The foliage is green and resistant to Apple Scab. Hardy in Zone 4.

Malus 'Pink Charming'

This plant originated at the Central Experimental Farm of the Ottawa Research Station, Canada Department of Agriculture, Ottawa, Ontario in 1956. Seed was taken from *Malus* 'Makamik', and the male parent was *M.* 'Katherine'.

This is a late bloomer. Flowers are medium-sized (4 cm.), purplish red (7.5 RP 4/11) and double (12–14 petals). With age, the color fades from the center outward from orchid to white, while the margin remains deep purplish pink (5 RP 6/10). Flowering is profuse and annual.

The flowering season begins one week after *M.* 'Almey' and *M.* 'Makamik' and extends, at Ottawa, almost into the flowering season of *M. ioensis* 'Plena'.

The fruits which are seldom produced, are dark purple and average 13.1 mm. in diameter. The foliage is bronze and retains its good color during the summer and fall. It is resistant to Apple Scab. Hardy in Zone 5a (C.D.A. Map).

Correspondence concerning *M.* 'Cameron', *M.* 'Maybride', and *M.* 'Prince Charming' should be directed to Dr. D. R. Sampson of the Ottawa Research Station.

Malus 'Royal Ruby'

This cultivar originated fifteen years ago in the Simpson Orchard Co., Inc., 1504 Wheatland Rd., Vincennes, Ind. The seed is from *Malus* 'Van Eseltine' and the male parent is *M.* 'Almey'. It was first noted in flower in 1959 and introduced in 1969 by the Cole Nursery Co., Rt. 1, Circleville, Ohio. In describing this plant, Mr. William H. Collins of the Cole Nursery Co. says, "To our knowledge, this clone has the largest and reddest double flowers of any variety known to this organization. Flowers have been measured on young vigorous 2 and 3 year old plants up to 3 inches in diameter, average size is about 2 inches. Habit is upright. Foliage semi-glossy, scab-free, nearly fruitless but some ½ inch red fruit sets occasionally. Parentage denotes hardiness."

Malus 'Snowcloud'

This first flowered in 1963 at Princeton Nurseries, P. O. Box 191, Princeton, N. J., and was selected in 1964 by Mr. William Flemer, III, of Princeton Nurseries. Seed was taken from *Malus* 'Katherine' and the male plant was *M.* 'Almey'. The plant

was introduced in 1970 by Princeton Nurseries (Plant Patent #2913).

Mr. Flemer describes the plant as having a strong, vigorous, upright habit of growth, flowers large (6.5 to 7.5 cm.) and double (13 to 14 petals per flower). The color is white. Foliage is resistant to Apple Scab and fruit production is sparse. Hardy in Zone 4.

Nandina domestica 'Moyer Red'

First observed in 1952 at Moyer's Nursery, Winston, Ore., by the late C. E. Moyer, this cultivar was introduced commercially by Mr. Levi M. Gourley, Dillard Nursery, Dillard, Ore., in 1956.

In Mr. Gourley's words, "The red foliage is much more intense in color, retaining it more consistently through the season, and covering the bush more completely with red than the normal *N. domestica*. Also, the underfoliage is a deeper green and of more consistent quality than the type." Hardy in Zone 7.

Pinus flexilis 'Scratch Gravel'

This is a dense, upright form of *P. flexilis* which was found in 1963 by Mr. Clayton Berg, Box 845, Helena, Mont. The original plant is believed to be between 50 and 150 years old and is growing at 'Scratch Gravel', Silver City Rd., Lewis & Clark County, Mont.

In the words of Mr. Berg this is "a broadly upright form of unusual density and symmetry. Comparatively speaking it is a robust grower — at least in its present location." Hardy in Zone 2.

Pinus ponderosa 'Twodot Columnar'

The original plant was found in 1964 by Mr. Clayton Berg, Box 845, Helena, Mont., growing south of U.S. Rte. #12, Twodot, Montana. It is believed to be between 20 and 30 years old.

In Mr. Berg's words, "This is like any young *P. ponderosa* in the area except that it is narrower in stature and the side limbs show a definite tendency to more upright initial growth than is normal." Hardy in Zone 2.

Pinus banksiana 'Uncle Fogey'

This is an introduction from the Minnesota Landscape Arboretum, Box 132–1, Route 1, Chaska, Minn. and was discovered in 1960 at 6513–19th Ave. S., Richfield, Minn.

Mr. Albert G. Johnson, Research Fellow, University of Minnesota, describes the plant as having a prostrate habit of growth,

or being pendulous if grafted high. The leaves and cones are typical in size for *P. banksiana.* Although this would normally be propagated by grafting, it is reported that seedlings "come true" up to 95% of the time.

Tsuga canadensis 'Watnong Star'

This was found as a chance seedling in the woods of New Hampshire, by Mr. Robert Clark, Rochester Parks, Rochester, N. Y., in 1958. The original plant is now in the possession of Mr. and Mrs. Donald P. Smith, of the Watnong Nursery, Morris Plains, N. J. who introduced it in 1969. In Mr. Smith's words, "At 11 years this plant is a soft globe 16″ high and 20″ in diameter. The texture is tight, but not stiff. New growth is almost white at the tips, giving the effect of hundreds of small white stars." Originated in Zone 5.

ROBERT S. HEBB

Summary of weather data recorded at the Dana Greenhouses. August and September 1970.

	Precipitation	Average 8 a.m. Temp.
August	6.31	69
September	2.59	59.5

A view on Hemlock Hill.

ARNOLDIA *is a publication of the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts, U.S.A.*