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Front cover: *Amur cherry* (*Prunus maackii*). Photograph by N. Batkin.

Flowering Times In *Viburnum*

by MICHAEL DONOGHUE

That plants of different species flower at different times during the year is well known to everyone. But for many plants we have very little reliable data concerning flowering times, and even when we do have this information, we often know very little about what triggers flowering and what physiological changes are involved, let alone the evolutionary explanations for such timing differences.

Botanists are approaching these questions in a number of different ways. One approach is to record, over a number of years, the flowering times of all the plants in a given community (such as a tropical rain forest in Malaya (Medway, 1972) or a forest understory in New England (Lyon, 1922)) and to try to make sense of any patterns which emerge. Other botanists study variation in flowering periods within a single species and try to explain this in physiological, ecological, and evolutionary terms (Goodwin, 1941; Olmstead, 1944; Ray & Alexander, 1966). Another approach is to study flowering times in some broader taxonomic context, for example, by comparing the flowering times of the species within a genus. This approach has rarely been pursued very rigorously, although sometimes lists of flowering times are produced for seed manuals (e.g., Gill & Pogge, 1974) or in studies of wildlife food plants (e.g., Rollins, 1974). Plant sys-

Michael Donoghue is a graduate student in biology at Harvard University. He is writing his doctoral dissertation on the systematics of the genus Viburnum, especially the Mexican and Central American species.



photograph of *Viburnum rafinesquianum* taken in May 1903 by Alfred Rehder, who devoted considerable time to the study of viburnums, especially the Asian members of the genus. Though the size of *Viburnum* inflorescences varies considerably, most of them are constructed very much like those shown here. The photograph also shows the simple, opposite leaves characteristic of the genus.

tematists have long made a habit of noting the flowering periods of the plants they study, but unfortunately this information is rarely very precise. For example, we often read in monographs or in field guides that species A flowers in mid-spring, while its relative, species B, flowers in mid- to late spring. Because these records are for species throughout their geographical ranges, this information may obscure important differences in flowering times, particularly where two species happen to grow together, i.e., where they are sympatric.

An arboretum is an ideal place to begin a comparative study of the flowering times of woody plants, especially for those genera which are taxonomically well represented in the living collections. A comparative survey of flowering phenology conducted in one spot is certainly of interest to those who wish to plan their gardens and grounds so that plants are always in flower or who wish to have flowers of a similar kind over as long a period as possible. In addition, this kind of survey, when properly interpreted, can provide important insights into the biology of the plants concerned. On the basis of such studies alone we cannot hope to answer fully why related plant species differ in flowering times, but we may uncover patterns which suggest possible answers and discover problems which deserve further study.

The Arnold Arboretum has a long history of keeping records of flowering times. Professor J. G. Jack kept detailed records of blooming dates in the Boston area between 1887 and 1893. Later, Donald Wyman, horticulturist of the Arboretum for many years, listed the order of bloom of a wide variety of trees and shrubs in the Arboretum (1939a). These early lists were subsequently revised and expanded for various genera, among them *Viburnum*. Wyman (1937, 1945, 1959) placed 47 *Viburnum* taxa into flowering categories such as mid-May, late May, and early June. While his records are sufficient for most horticultural purposes, they are not very precise and in a few cases (e.g., *V. prunifolium*) seem to be inaccurate. Although he listed the order of bloom, he indicated nothing about the length of the flowering period or any overlap in flowering times.

During 1978 and 1979 I conducted a study of the different ways *Viburnum* plants grow from year to year once they become of flowering age. This required regularly visiting the Arnold Arboretum, especially during the spring and summer. In conjunction with this study I kept a record of the dates when plants of many *Viburnum* species were in flower. These observations reveal what seems to be a consistent order in which different species begin and end their flowering periods. But before discussing flowering times, we should first consider the structure of *Viburnum* flowers and inflorescences.

Flowers and Inflorescences

Viburnum is a genus of about 135 species. It is widely distributed in the Northern Hemisphere and extends into the Southern Hemisphere in the Andes of South America and in Malesia. *Viburnums* are



An especially large plant of *Viburnum dentatum* at the Arnold Arboretum. The dense, rounded shape is typical of old viburnums grown in the open. Note the very large number of inflorescences on this one plant. William H. Judd, standing next to the plant, was propagator at the Arnold Arboretum from 1916 to 1946. For many years he kept records of the onset of flowering in a variety of early blooming plants, including *V. farreri*. Photograph by R. W. Curtis, June 1922.

most abundant and diverse in eastern Asia, while eastern North America and the mountains of Mexico and Central America are also areas of high diversity. The genus is generally divided into nine sections. Alfred Rehder, who worked for many years at the Arnold Arboretum, is responsible for this subgeneric classification of *Viburnum* (1908, 1940). The sections differ principally in fruit and leaf characters but also in growth pattern. Egolf (1956) carried out an extensive program of controlled hybridizations in *Viburnum* and found that species within sections are commonly interfertile and produce viable seed, while crosses between species belonging to different sections yield very little seed.

The flowers of most *Viburnum* species are borne in rather complex inflorescences which are properly described as umbel-like, compound corymbs (Figure 1:a). These are often flat-topped and resemble the compound umbels of the Umbelliferae (the carrot family). In most species the inflorescence has a stalk, but some taxa produce sessile

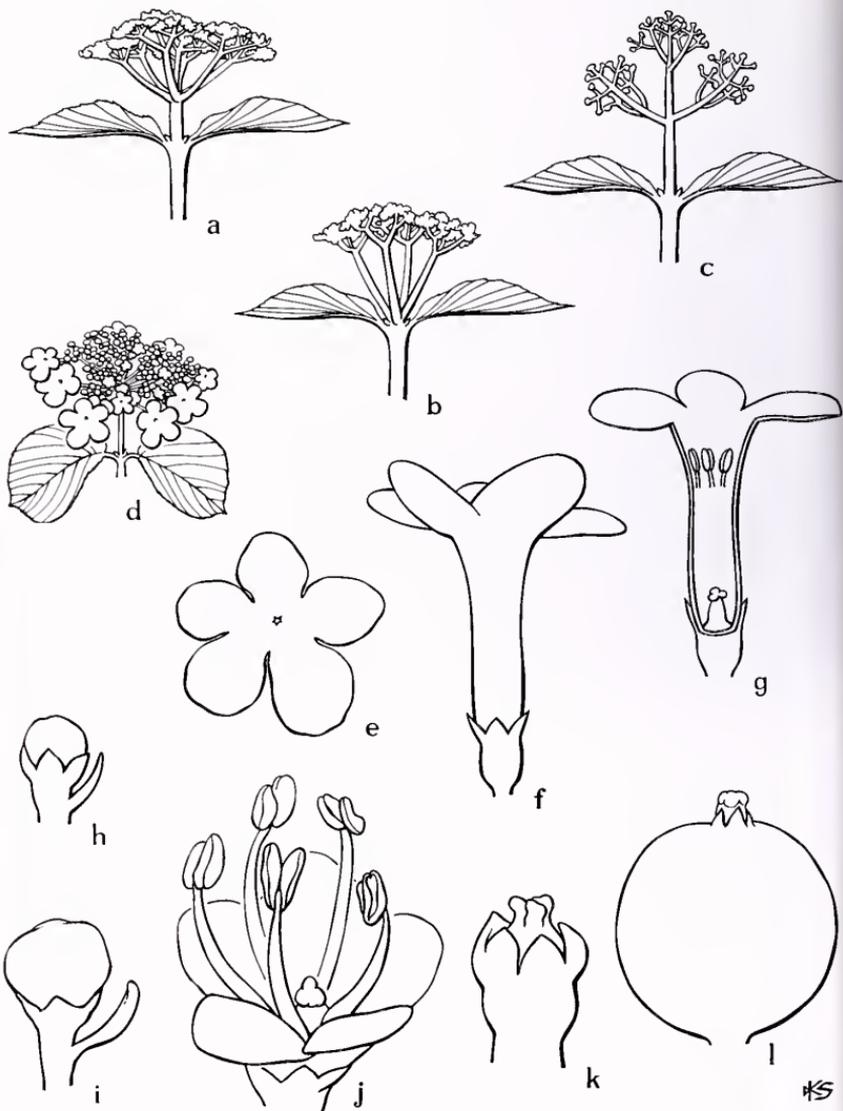


Figure 1. *Viburnum*. (a-d) Inflorescence types: (a) stalked umbel-like inflorescence with all its branches originating at one level; (b) stalkless umbel-like inflorescence; (c) paniculate inflorescence with its branches originating at different levels; (d) inflorescence with sterile marginal flowers. (e-g) Flower types: (e) close-up of a sterile marginal flower; (f) a tubular flower with its corolla tube much longer than its corolla lobes; (g) the inside of a tubular flower showing the attachment of the stamens to the corolla tube, the inferior ovary, and the short style. (h-l) Development of a flower from young bud through fruit: (h) very young flower bud; (i) old flower bud just prior to opening; (j) an open flower with a short corolla tube showing the five stamens which alternate with the five corolla lobes; (k) a flower from which the corolla and its attached stamens have fallen, leaving the sepals and the style; (l) the fruit (ripened ovary), which contains one seed.



Left: A picture of *Viburnum furcatum* taken in the winter. In this and some other species the vegetative buds and the well developed inflorescence "buds", such as the one shown, are not enclosed by bud scales. Plants with these so-called naked buds tend to flower earlier in the spring than those with bud scales. Right: Most viburnums have flowers very much like those of *Viburnum prunifolium* shown here. The five minute sepals are not visible in this picture, but note the five fused petals, the five stamens which alternate with the petals and shed their pollen inwardly, and the small style in the center of the flower. The flower buds also shown here would probably have opened within a day (see Figure 1:i,j). Photographs by M. Donoghue.

(stalk-less) inflorescences (in this study, *V. furcatum*, *V. lentago*, *V. prunifolium*, and *V. rufidulum* (Figure 1:b)). Some Asian species produce paniculate inflorescences with opposite branches (in this study, *V. farreri* and *V. sieboldii* (Figure 1:c)). The inflorescence is always terminal on a portion of stem, but it is sometimes borne on a short lateral shoot (in this study, *V. plicatum*) or sometimes on a shoot which dies back at the end of the season (in this study, *V. opulus* and *V. sargentii*). In some species the inflorescences overwinter in an exposed state as well-developed "buds" (photograph above). These are the taxa with naked buds (in this study, *V. × burkwoodii*, *V. carlesii*, *V. furcatum*, *V. lantana*, and *V. × rhytidophylloides*). In most species the next year's leaves and inflorescences overwinter enclosed by bud scales. In *V. cassinoides*, *V. lentago*, *V. plicatum*, *V. prunifolium*, and *V. rufidulum* one pair of bud scales is generally produced, while in the remaining species considered in this study, there are two (or rarely more) pairs of scales.

Plants of different species produce different numbers of flowers per inflorescence, from about 15 to over 500. The number of inflorescences per plant depends largely on the size of the plant, but there are often hundreds. This makes the flowering of viburnums quite spectacular and in part accounts for their horticultural importance.

The fertile flowers of nearly all viburnums are strikingly uniform in morphology, although they may differ slightly in size and hairiness. They are usually small (between 4 and 10 mm. across) and by themselves not very conspicuous. There are five persistent, small, green calyx lobes at the summit of the ovary. The corolla consists of five fused petals, i.e., it is sympetalous, and is white or cream-colored or rarely slightly pink. In most species the corolla tube is shallow (about 2 to 3 mm.) and the flowers are saucer-shaped or bell-shaped (Figure 1:j). In a few Asian species (in this study, *Viburnum carlesii* and *V. farreri*) the corolla is elongate and tubular and can be up to 15 mm. long. The five stamens are attached generally near the base of the corolla tube and are alternate with its lobes. The anthers are borne on slender filaments which usually project out of the throat of the corolla (Figure 1:j), but in those species with tubular corollas the anthers are borne within the tube near its opening (Figure 1:g). The anthers split open longitudinally and release the yellow-colored pollen. The pistil is constructed of three carpels, but only one large seed is developed in each fruit (see Wilkinson, 1948, for details of ovary construction and development). The ovary is inferior or nearly so, and the cone-shaped style is very short (usually about 1-1.5 mm. long (Figure 1:k)). The stigma, which is white in color in most species, but red in some, is usually slightly tri-lobed and fairly broad. When it is receptive to pollen it appears somewhat shiny. It seems that in most viburnums the pollen begins to be shed before the stigma is receptive, i.e., they are slightly protandrous, but this has never been experimentally confirmed.

In a few species (in this study, *Viburnum furcatum*, *V. opulus*, *V. plicatum*, and *V. sargentii*) sterile flowers are produced around the periphery of the inflorescence (Figure 1:d and photograph opposite). The corollas of these flowers are quite large and showy (to about 30 mm. across (Figure 1:e)). Occasionally one finds remnants of stamens and a style in the center of the flattened corolla. These showy marginal flowers are presumed to function in attracting insect pollinators, thereby increasing the number or the quality of the fruits that are produced, but this has never been tested. Cultivars of several species produce inflorescences with only sterile flowers. These so-called "snowball" forms occur in *V. opulus*, *V. plicatum*, *V. macrocephalum*, and *V. cordifolium* (Egolf, 1962).

Most viburnums seem to be pollinated effectively by a variety of insects. I have noted bees and wasps (Hymenoptera), flies (Diptera), butterflies and moths (Lepidoptera), and beetles (Coleoptera) visiting viburnums and presumably effecting at least some pollination.



Top: Large sterile flowers surround the numerous small, perfect flowers in these inflorescences of *Viburnum sargentii*. This condition occurs in five other *Viburnum* species in four different sections of the genus and may have evolved independently several times. Bottom: All of the flowers are enlarged and sterile in the inflorescences of the form of *Viburnum plicatum* shown here and known as the Japanese snowball. Snowball forms occur in three other species. Such plants cannot produce fruits and seeds and therefore must be propagated by cuttings. Photographs by M. Donoghue.

In addition Gould (1966) reported that ruby-throated hummingbirds occasionally visit the flowers of *Viburnum lantanoides* (the hobblebush, formerly known as *V. alnifolium*). The species with short corolla tubes often have a musky odor and probably are pollinated mostly by small bees and by flies. Species with long corolla tubes tend to have a strong, sweet odor, especially towards sundown, and may be visited most commonly by Lepidoptera, perhaps nocturnal moths. *Viburnums* produce very little nectar and only for a short time. Bees seem attracted to *Viburnum* flowers principally as a source of pollen.

Flowering Times

The timing of flowering varies considerably among *Viburnum* species. Some of the species that grow in tropical latitudes flower nearly continuously throughout the year and one can often find mature flowers and fruits at the same time on the same plant. *Viburnum sambucinum* in Malesia (Kern, 1951) and *V. hartwegii* in Mexico and Central America are examples. On the other hand, in some tropical species flowering is limited to a given season, although plants of this sort may go through two or more flowering flushes during this period. In the New World tropics many such species flower during the summer months, which is the wet season in most areas, but others flower during the drier winter months (e.g., *V. blandum* and *V. venustum* in Central America). Most *viburnums* of temperate regions have very restricted and well-defined flowering periods, mostly during the spring and early summer. Flowering in these species is highly synchronized on single plants, as well as between plants of the same species. Generally only one period of flowering (and consequently of fruiting) occurs per year.

Plants of *Viburnum* species from the Temperate Zone flower for approximately seven to twelve days. Inflorescences near the top of the plant often come into flower slightly before inflorescences lower on the plant, but generally there is a period during which flowers are open in nearly all the inflorescences at once. All the flowers in an inflorescence open usually within two to four days of each other. Because of the large number of flowers that open during this short period, the exact sequence of flower opening is very difficult to determine; however, sterile marginal flowers, if present, open usually one to four days before any of the perfect flowers.

Each flower begins its development in the spring as a compact green bud (Figure 1:h). As the bud expands, the corolla begins to turn white and becomes inflated (Figure 1:i). The flower opens (Figure 1:j) and then remains open until the corolla withers and falls off, usually within four or five days. The flowers do not close at night nor in bad weather as in some other plants. When the corolla falls, only the calyx lobes and the tiny style are left at the top of the

TABLE I: WEATHER STATION DATA RECORDED AT THE DANA GREENHOUSES

1978			1979				
	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Precipitation (inches)		Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Precipitation (inches)
March	45	24	3.21	March	49	33	2.83
April	54	36	1.93	April	57	37	4.44
May	69	46	5.25	May	70	52	4.12
June	81	55	0.40	June	81	54	0.96

ovary (Figure 1:k), which if fertilization has occurred, begins to enlarge and mature into a fruit (Figure 1:l).

Methods and Results

Viburnums from Asia, Europe, and North America are well represented in the Arnold Arboretum. Some 40 species and numerous varieties and cultivars, representing seven of the nine sections of the genus, are currently in cultivation in the living collections. The Arboretum thus provides a good spot to begin to investigate flowering behavior in Temperate Zone *viburnums*. The present study reports on 21 *Viburnum* taxa, including representatives of each of the seven sections present (Appendix). The plants I followed grow in or near the main *Viburnum* collection, which is located near the Centre Street entrance behind the Dana Greenhouses. All the plants are thus exposed to nearly the same temperature regime and receive the same amounts of sunlight and precipitation, although, to be sure, there are some micro-climatic differences. A summary of climatological data for the spring and early summer of 1978 and 1979, as recorded at the Dana Greenhouses, is presented in Table I.

The *Viburnum* collection was visited somewhat irregularly at intervals of about seven to twelve days throughout the spring and summer. On each visit I recorded the condition with respect to flowering for each plant and checked usually two or more plants of each taxon. The results are shown in Tables II and III. Since the observations were not continuous, some inferences about when a species began and ended its flowering period were necessary. If a plant were in bud on one visit, in full flower the next visit, and past flower on a third visit, it obviously began to flower between visits one and two and ended flowering between visits two and three, but the exact timing is not known. In tabulating flowering times I have made the assumption that plants flowered over ten consecutive days unless the observations actually indicated a longer time. Thus I marked the time

of full flowering and then marked five days on both sides of this. For some taxa an assumed flowering period of ten days was actually too long. If ten days were assumed in these cases, plants would have to have developed from the early bud stage to full flower in one or two days, while this development usually would take from three to five days. These special cases are indicated in Table III by an asterisk.

The tables of flowering times illustrate some interesting points. First, a glance at Table II shows that viburnums flower over a two- to three-month period, depending on the weather during a particular year. The first species begins flowering around mid-April and the last species ends by July. During this period different species flower at different times. The overall sequence of flowering in viburnums is almost identical in 1978 and 1979. Differences between these years are most notable among the species that flower earliest. For example, *Viburnum farreri* began flowering much earlier and its flowering period was longer in 1979 than in 1978. Mr. W. H. Judd, a former propagator at the Arnold Arboretum, kept records of the onset of flowering in a number of early flowering plants (Wyman, 1939b). He recorded considerable variation for *V. farreri* (then called *V. fragrans*) from January 14, 1932, through April 20, 1939. This variation clearly relates to differences in the weather, which is especially unpredictable during the early spring. As shown in Table I, the winter was milder and it was warmer earlier in the spring of 1979 than in 1978, and this appears to account for shifts in the onset of flowering. Flowering times of the early-flowering species were advanced by about a week in 1979, but species that flower later began flowering at about the same time in 1978 and 1979. While the exact dates of flowering fluctuate from year to year, the times that species flower relative to one another appear to fluctuate very little. Thus, presumably, the dates of flowering would change with locality, for example, between the southern and the northern United States, but the relative sequence of flowering probably would not change with locality very much. A species constancy resulting in a predictable sequence of flowering is clearly of interest to horticulturists.

The Biological Importance of Flowering Times

The observation that plants of a particular *Viburnum* species flower during nearly the same period every year suggests that there is a genetic basis for the timing of flowering, although a range of expressions is possible owing to environmental differences from year to year or in different localities. There also seem to be genetic differences within what are recognized as species, as illustrated by *V. dentatum*, within which var. *pubescens* and var. *scabrellum* tend to flower a week later than var. *dentatum*. Other evidence of variation within a taxon is provided by *V. × burkwoodii*, which had an extended flowering period in 1978 and a somewhat extended period in 1979. As Egolf (1962) points out, there are cultivars of *V. × burk-*

TABLE II: *Viburnum* FLOWERING TIMES

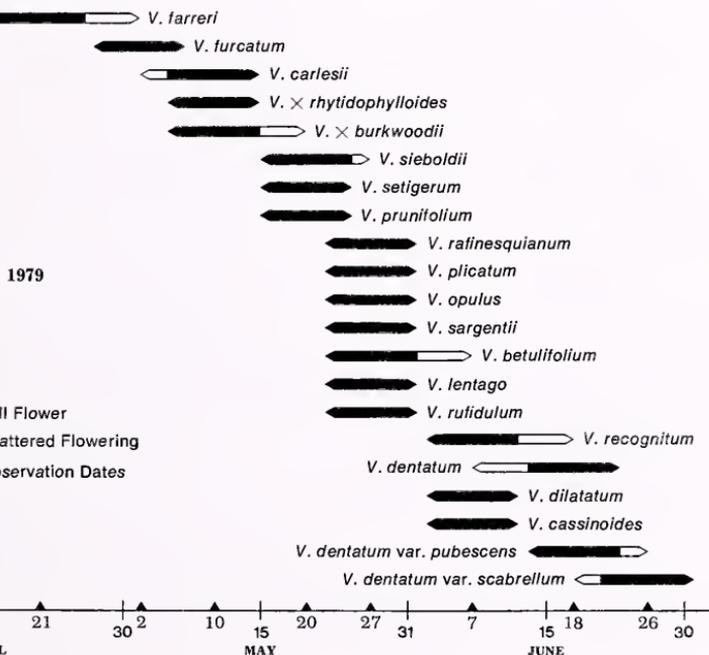
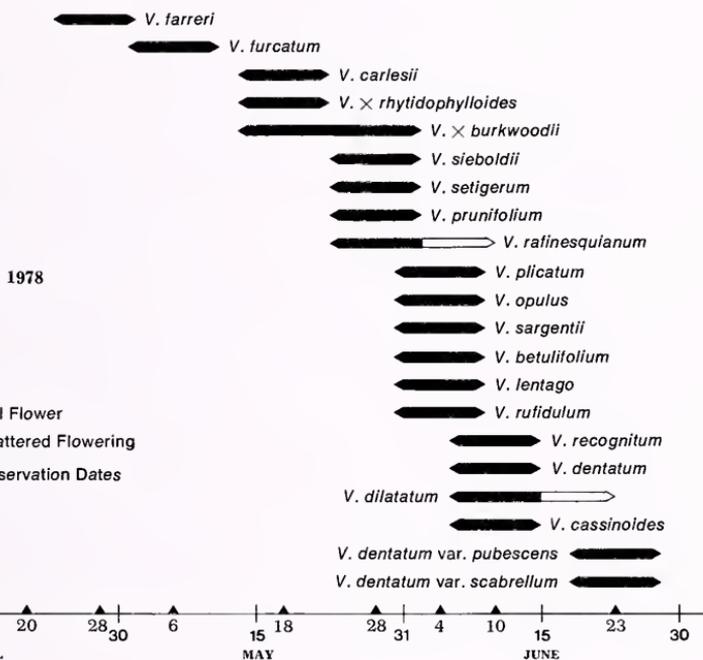
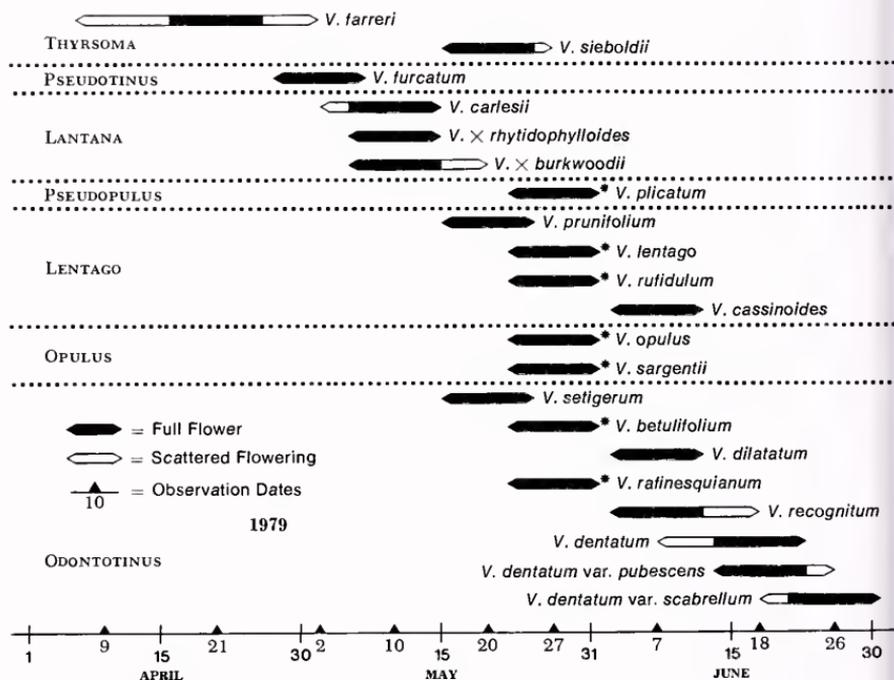
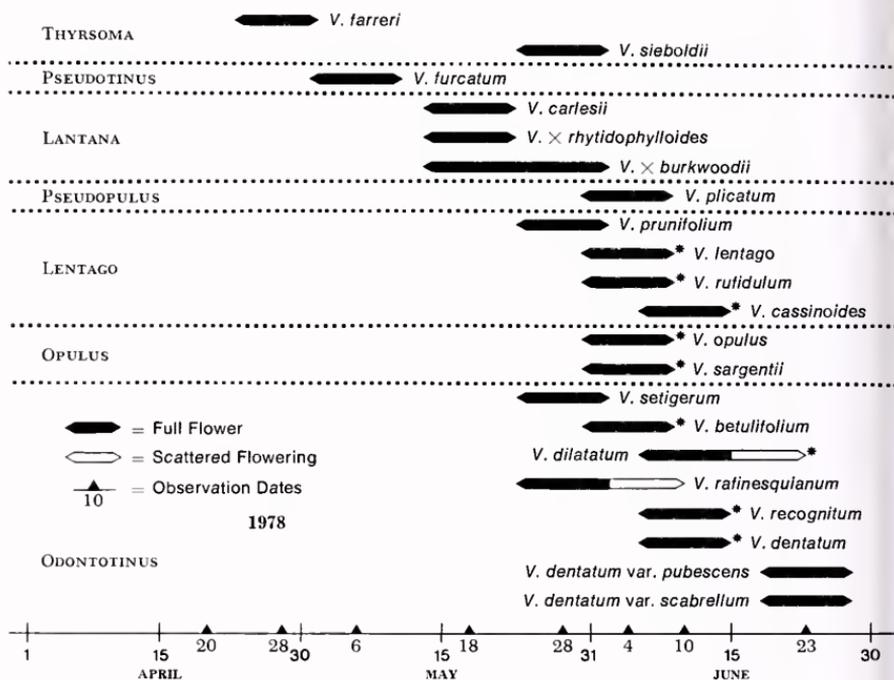


TABLE III: *Viburnum* FLOWERING TIMES BY SECTION

woodii ('Fulbrook' and 'Anne Russell') that differ markedly and consistently from one another in flowering times.

One question raised by these observations is how the differences in flowering times are mediated. In the viburnums considered here the initiation of inflorescences and flowers begins during the summer and continues through the early autumn. The inflorescences overwinter either as tiny primordia within a bud or in a relatively well-developed form in those species that have naked buds. The environmental cues that initiate flower production and those that trigger continued inflorescence and flower growth during the next spring are not known, but presumably a combination of factors is involved (for a discussion of the physiology of flowering see Bidwell, 1974). Temperature and available moisture seem to be the most important cues in early-flowering species. Consecutive warm days in the early spring are enough to swell the flower buds of *Viburnum farreri* and those species with naked buds. Unfortunately, this early growth often dies back when the weather turns cold again, and consequently flowering may be very spotty. As Egolf (1962) notes, "almost invariably the *V. fragrans* [*V. farreri*] flower clusters will be damaged by a freeze and the early blooms obliterated." It is possible that some day-length (or more accurately, dark-length) requirement may be involved in initiating spring growth in those species that flower later in the season.

Whatever the cues, different *Viburnum* species clearly respond differently to them. Why should this be so? To answer this question it is helpful to consider flowering times in a taxonomic context. In Table III, I have arranged the taxa according to the taxonomic sections of the genus to which they belong. There are several interesting patterns which emerge when this is done. As pointed out earlier, the sections differ in the number of bud scales produced and in the pattern of growth. Species with naked buds (sections LANTANA and PSEUDOTINUS) are invariably among the early flowering viburnums, while, with the conspicuous exception of *V. farreri*, all species with two pairs of bud scales flower during the latter half of the flowering season. Plants with naked buds begin their inflorescence development earlier and overwinter their inflorescences in a more fully developed state than plants with one or two pairs of bud scales. As a consequence they require less time to mature their flowers during the following season. In our area some species occasionally have a second period of flowering in the late summer or in the fall. Not surprisingly, these species are mostly those with naked buds, but the Asian *V. erosum* (section ODONTOTINUS), with two pairs of bud scales, seems to flower regularly again in the fall. McAtee, in his treatment of the North American viburnums (1956), has recorded many instances of sporadic fall flowering.

The exceptional *Viburnum farreri* develops an inflorescence within a bud with two pairs of bud scales. The inflorescence is produced on a very small, often leafless, stem. The development of the bud is not



Left: In this species of *Viburnum*, *V. farreri*, the flowers have tubular corollas with five spreading lobes. The stamens are not visible here because they are contained within the tube. This species and several others bear their flowers in paniculate rather than umbel-like inflorescences. Photograph by A. Bussewitz. Right: A photograph of *Viburnum farreri* taken by Oakes Ames on April 16, 1931. Plants of this species are the first viburnums to bloom in our area. The inflorescences are well developed in winter buds and expand rapidly following a warm spell in the early spring. The flowers open well before the leaves expand.

much arrested, and it may even begin to swell and open during the fall or during warm spells in the winter. When spring comes, the inflorescences are quite well developed, and the flowers mature while the plant is essentially leafless (photograph above). Although there is a marked correlation between growth pattern and flowering time, it is obvious that considerable variation is possible even within the constraints of a single pattern of growth (e.g., sections LENTAGO, ODONTOTINUS, and THYRSOMA), so other explanations for flowering time differences are needed.

One possible explanation is that flowering time differences originated while different *Viburnum* populations were growing in different regions, i.e., while they were allopatric. Allopatric divergence in flowering times could result from natural selection or from what is known as genetic drift.

Natural selection occurs when organisms with a particular heritable trait leave more offspring than organisms that lack the trait. This

process results in a larger percentage of organisms with the favored trait in succeeding generations. For example, imagine that a population of a particular *Viburnum* species is subjected to a new environment. Further suppose that there is some genetically determined variation in flowering time in this population. If in the new environment those plants that flowered somewhat earlier produced more offspring, then in succeeding generations we would notice that more of the plants in the population would flower earlier. Over a period of time, the result would be a shift in the flowering period in this population.

Genetic drift is the process whereby certain genes, and hence traits, are fixed in small populations due to chance alone. This could result in a shift in flowering time if, for example, all the plants that flower late in a particular population die, leaving only early flowering individuals.

If a shift in flowering time (either due to natural selection or genetic drift) were to occur in one of two populations growing in different areas and if at some later time the geographic ranges of these populations were to overlap, we would observe a flowering time difference between them. This difference might even prevent members of one population from interbreeding with members of the other population, i.e., they would be reproductively isolated.

A second explanation for the origin of flowering time differences is that divergence may have been the result of two (or more) similar species growing together in the same area. This could occur in several ways. Suppose that plants of two very closely related species happen to be growing together. Under these circumstances hybridization between plants of the different species might occur. If the hybrids were inviable or in some way less fit than either of the parental species, then any plants that did not hybridize would produce more viable seed and leave more offspring than those plants that did hybridize. As a result of this natural selection, any mechanism that would limit hybridization would become more common in succeeding generations. Hybridization would be limited, or impossible, if plants of the different species were to flower at different times. Therefore, given that there was genetically determined variation in flowering times in these populations, selection could result in a divergence in flowering times.

It is not necessary that two species be able to hybridize for there to be selection for a divergence in flowering times. Imagine two species that grow in the same area and have very similar flowers pollinated by the same kind of insect. If there were a limited number of pollinators in this environment and if plants of the two species flowered simultaneously, the plants would compete for the services of the pollinators. On the other hand, if the flowering times of the two species did not overlap, they could both more effectively utilize the pollinators and (all other things being equal) would set more

fruit and produce greater numbers of offspring. In this way natural selection might result in divergence in flowering times to minimize the competition for pollinators (see Robertson, 1924; Levin & Anderson, 1970; Mosquin, 1971; Heinrich, 1975; Frankie, 1975; and Stiles, 1978, for the development of this fascinating idea).

In the last two examples divergence was the result of two similar species growing together in the same area. As we have seen, under these circumstances natural selection could result in divergence (1) to prevent the production of hybrids and/or (2) to reduce competition between individuals of different species for some limited resource, such as pollinators. These phenomena are known as character displacement, a name which refers to the character differences between species which result when their geographic ranges overlap (see Grant, 1972, and Levin, 1978, for reviews of the history of this concept). It is very difficult to show that character displacement has occurred, and very few (if any) unequivocal cases have been documented. The problem is that all other possible explanations for divergence (for example, allopatric divergence) must be ruled out, and this is usually very difficult to do. In general, if we find that two species differ in flowering times or in some other way in the region where they are sympatric, but that they are the same in this regard where they do not grow together, then we can entertain the possibility that character displacement has occurred.

Now we can ask which of these explanations account for the flowering time differences we find in *Viburnum*. To answer this question we have to consider those instances where two or more *Viburnum* species grow together. Usually when different viburnums grow in the same region, they have different ecological preferences and so rarely grow side by side. But it is not too difficult to find several species growing close enough together that hybridization between them could occur. Often the viburnums involved are members of different sections of the genus and often they flower at different times. An example of this pattern in New England is provided by *V. lantanoides* (section PSEUDOTINUS, flowering in mid-May), *V. casinoides* (section LENTAGO, flowering in late May), and *V. acerifolium* (section ODONTOTINUS, flowering in mid-June). In this case and in others like it, it is very difficult to decide upon the cause of the flowering time differences. Timing differences may have resulted from divergence at some period when the species did not grow together or from character displacement to minimize competition for the same pollinators. As noted earlier, Egolf (1956) has shown that hybridizations between species in different sections are usually unsuccessful. Therefore, if the flowering time differences are the result of character displacement to limit hybridization, then it must have occurred in the distant past, before these species were genetically reproductively isolated, i.e., at a time when they could hybridize.

Sometimes species that belong to the same section can be found



The honey bee shown here is collecting pollen from the flowers of a plant of *Viburnum farreri* at the Arnold Arboretum. She packs moistened pollen into the pollen baskets on her hind legs for transport. Because of the length of the corolla tube in *V. farreri*, honey bees rarely reach the stigmas and are not effective pollinators. In the wild this and other species of *Viburnum* with tubular corollas may be visited by a wide variety of insects, but probably are mostly pollinated by moths and butterflies. Photograph by M. Donoghue.

growing close together. In such cases there generally are flowering time differences which effectively prevent hybridization between the species. In some of these cases differences in flowering times could have arisen by character displacement, perhaps to minimize the production of inferior hybrid plants. Possible examples of this are provided by species of the section LENTAGO. *Viburnum lentago* grows mostly in northern parts of eastern North America, while *V. rufidulum* grows mostly in the southeastern United States. The ranges of these species overlap a little in the central eastern United States. *Viburnum prunifolium* ranges through the central eastern states and frequently overlaps the ranges of both *V. lentago* and *V. rufidulum*.

As indicated in Table III, in both 1978 and 1979 *Viburnum prunifolium* flowered about a week before *V. lentago* and *V. rufidulum*. By the time the latter were in full flower *V. prunifolium* was completely past flowering. These species were recently studied by Rader (1976), who noted that "the flowering time of *V. prunifolium* was observed to be approximately two weeks earlier than *V. rufidulum*." She also noted that *V. lentago* flowered somewhat before *V. rufidulum*, an observation which my study does not corroborate.

It is possible to obtain hybrids between these species, and a few populations are known in which natural hybridization between species appears to be occurring (Brumbaugh & Guard, 1956; Rader, 1976). Rader even suggested that hybridization between *Viburnum lentago* and *V. rufidulum* may have given rise to *V. prunifolium*. But she also recognized that the "difference in flowering time poses a barrier to crossing, thereby reducing the incidence of successful hybrid populations." A fuller understanding of the cause(s) of these flowering time differences will require accurate observations of flowering times in the field, under natural conditions, throughout the ranges of these species. But the observations reported here provide the necessary groundwork upon which further studies can build.

The timing of flowering is affected by a variety of factors including the climate, plant architecture, pollinator availability, and the presence (or absence) of related or similar plants in the same environment. Sorting out the ultimate causes of flowering time differences is a very difficult task. Comparative studies of flowering times, both in the Arboretum and in the field, can help us to begin to understand the reasons for the differences in flowering times that are everywhere so apparent to us.

Acknowledgements

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Appendix

Viburnum Taxa Included in this Study of Flowering Times

<i>V. betulifolium</i> Batalin	<i>V. lentago</i> Linnaeus
<i>V.</i> × <i>burkwoodii</i> Burkwood (<i>V. carlesii</i> Hemsley × <i>V. utile</i> Hemsley)	<i>V. opulus</i> Linnaeus
<i>V. cassinoides</i> Linnaeus	<i>V. plicatum</i> Miquel
<i>V. dentatum</i> Linnaeus	<i>V. prunifolium</i> Linnaeus
<i>V. dentatum</i> var. <i>pubescens</i> Aiton	<i>V. rafinesquianum</i> Schultes
<i>V. dentatum</i> var. <i>scabrellum</i> Torrey & Gray	<i>V. recognitum</i> Fernald
<i>V. dilatatum</i> Thunberg	<i>V.</i> × <i>rhytidophylloides</i> Suringar (<i>V. rhytidophyllum</i> Hemsley × <i>V. lantana</i> Linnaeus)
<i>V. farreri</i> Stearn	<i>V. rufidulum</i> Rafinesque
<i>V. furcatum</i> Blume	<i>V. sargentii</i> Koehne
	<i>V. setigerum</i> Hance
	<i>V. sieboldii</i> Miquel

Viburnum Sections Included in this Study of Flowering Times

LANTANA Spach	OPULUS DeCandolle
LENTAGO DeCandolle	PSEUDOPULUS Dippel
ODONTOTINUS Rehder	PSEUDOTINUS Clarke
	THYRSOMA (Rafinesque) Rehder

Voucher specimens will be deposited in the herbarium of the Arnold Arboretum (Jamaica Plain).

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Itea: Summer Flowers and Autumn Color

by GARY L. KOLLER

The native shrub *Itea virginica* is adaptable to wet and poorly drained as well as drier soils and has a summer flowering period, richly colored autumn foliage, and showy pearl-like seed capsules. Despite its cultural and landscape assets, this plant is grown by few nurserymen and is virtually unknown to the American gardening public.

This strange and alluring plant is grown under common names including tassel-white, Virginia-willow, and Virginia sweetspire. The generic name *Itea* is the Greek word for willow and refers to the resemblance of the shrub's foliage to willow. The specific epithet *virginica* refers to the state of Virginia. Botanically the plant is the subject of some disagreement. Some taxonomists place it within the saxifrage family and others place it with the genus *Choristylis* in the segregate family, *Iteaceae*.

Itea virginica inhabits swamps, land around lakes, and borders of wooded streams. Its natural range spreads from the coastal plain of New Jersey southward to Florida, west to Louisiana and to East Texas, and again northward up the Mississippi valley into Illinois, Missouri, and Oklahoma. The species is native only to North America.

Virginia sweetspire grows six to ten feet tall and spreads an equal

Gary L. Koller is Supervisor of the Living Collections at the Arnold Arboretum. His article about Itea should be of particular interest to Friends of the Arnold Arboretum, who this year are receiving Itea virginica as a plant dividend.

or greater distance by means of underground stems. A great cluster of thin stems arise from the center of the plant. Twigs are wine-red on the sunny side of the plant and greenish on the shady side and on older branches. The deciduous leaves are simple, alternate, broadly elliptic to oblong, two to four inches long, and finely toothed. Summer color is a dull green.

The plant has two major attributes as an ornamental shrub, its flowering time and its foliage. At the Arnold Arboretum *Itea virginica* flowers in early July, a time when few trees and shrubs are in bloom and when much of the landscape is a monotonous green. The individual flowers are perfect and five-parted, pure white to pinkish white, and slightly fragrant. Flowers are grouped in nodding terminal racemes or axillary panicles, two to five inches long. The flowers are charming rather than spectacular: the plant needs to be placed in the landscape where it will be conspicuous when it flowers. According to a brief note in the March 7, 1908, issue of *The Gardeners' Chronicle*, *Itea virginica* "is particularly attractive to butterflies, especially the showy members of the genus *Vanessa*." The flowers gradually fade and mature into racemes of tan-brown, two-celled capsules. These capsules are extremely ornamental when viewed against the richly colored autumn foliage. The fruits survive after the leaves have fallen and persist into winter. The individual, small seeds are smooth, a lustrous dark brown, and ellipsoid. Dried clusters of seed capsules are eagerly sought out by flower arrangers.

Leaves are the second major landscape attribute of the Virginia sweetspire. In autumn the foliage changes from dull green to rich shades of reddish purple. As the change occurs, the colors blend from orange to vivid reddish purple. The foliage remains colorful for several weeks and so can be viewed both in the full glowing sun and on dull misty days, which enhance leaf color.

Itea virginica is easy to grow. It prefers a moist to wet soil rich in organic matter, but it does not tolerate standing, stagnant water. It will tolerate the drier, more infertile soils that occur in most home landscapes. The acidity of the soil seems to have little effect on the success and vigor of growth but ideally should be pH 5.0 to 7.0.

Exposure to light can vary from full sun to partial shade. However, in a site with full sun there should be adequate soil moisture or supplemental irrigation during periods of drought. Also, while the plant tolerates considerable shade, it will not flower as freely under shady conditions nor will it take on rich autumn tints. Shade will also cause the plant to stretch and become leggy.

Arboretum staff members Richard Weaver and Robert Nicholson have reported that Virginia sweetspire in the wild tends to be lanky and spindly. Maintenance pruning might be employed to keep the plant tight and compact. This can be accomplished by removing annually a portion of the old heavy stems directly at the soil line. This encourages new and vigorous growth.



The pendulous racemes of *Itea virginica* appear in mid-summer. As shown here, the flowers closest to the branch open first, and over a period of time the whole cluster comes into bloom. The individual flowers mature into tan-brown capsules. Even after the autumn leaves have fallen, the clusters of capsules remain attractive. Photograph by R. E. Weaver, Jr.

Itea virginica serves well as a specimen plant. It can be grouped or massed on banks where its heavy growth and stoloniferous habit help to hold and stabilize the soil. This plant may be a solution to the landscape problem of a shady site with poorly drained soil.

The Arnold Arboretum propagation staff has found that cuttings will root easily any time of year. Best results were obtained by dipping cuttings for five seconds in a solution of 8,000 ppm. of I.B.A. (indolbutyric acid) in 50% ethanol, inserting the cuttings in a medium of equal parts of peat and perlite, covering them with plastic, and misting. This plant should be a good classroom subject for beginners in propagation since rooting success is almost certain. The recommended method for home or classroom propagation is to take cuttings four to six inches long, dip the base of the cuttings in a rooting hormone, and place the cuttings in the peat and perlite mix, enclosing the pot and cuttings within a large plastic bag. This propagation unit can be placed in a brightly lit but not sunny window — a north window is ideal. *Itea virginica* also can be propagated by division and seeds.

We are growing an exciting exotic relative of *Itea virginica*, the Japanese *Itea japonica*. In 1955 Dr. John Creech, now Director of the National Arboretum, made his first plant collecting expedition to Japan for the United States Department of Agriculture. During this trip he visited the Hot Springs Utilization Station, Beppu, Kyushu, Japan, and collected six plants of an unnamed compact form of *Itea japonica*. These were assigned the USDA plant introduction number 226131, propagated, and distributed to a number of testing locations, including the Arnold Arboretum. Our plants, accessioned under the Arnold Arboretum number 144-74, were received in 1974. Today they are approximately two and one-half to three feet tall and are vigorous, stoloniferous plants.

At our request, Dr. Creech inspected the plants growing at the National Arboretum as of December 1979. He reports that they are growing well under a high canopy of trees. They are three to four feet tall and form a dense, broad, spreading mass with loose arching branches, reminiscent of *Leucothoë*. The young leaves are wine-red and persist into late autumn. The branches are greenish in color, probably due to the semi-shady conditions, and thin.

When I first arrived at the Arnold Arboretum, this compact form of *Itea* was a delightful discovery for me. Observations over subsequent summers confirmed that our plants bear their small white flowers in late June and early July. Our three-plant grouping is at the top of a stone wall in the dwarf plant garden below the Dana Greenhouses. It is growing in dry acid soil in full sun. The foliage is dark green in summer and wine-red to reddish purple for several weeks in the autumn. This group of plants suffered minor stem damage during the winter of 1978-79, but otherwise would appear to be hardy to our low of -6°F that season.

During the fall of 1976, the Arboretum distributed cuttings of our compact *Itea japonica* to Mr. James Cross of Environmentals, a nursery at Cutchogue, on Long Island, New York. He reports that he is growing this plant in containers and that it quickly grows to a full and handsome plant which he feels will have commercial appeal.

Some who know both *Itea virginica* and the compact form of *Itea japonica* feel that the Japanese plant is a better garden plant because of its size and vigor. Since the compact Japanese *Itea* does have a potential in the market, I believe it should receive a cultivar name to identify and distinguish the genotype. Therefore, with Dr. Creech's permission I propose *Itea japonica* 'Beppu' as the name for all plants originating from the National Arboretum's original introduction P.I. 226131. Its distinguishing characteristic is compactness, as compared with the normal species, which grows six to ten feet tall.

Itea japonica 'Beppu' should have wide appeal. It can be grown as a specimen plant. More importantly, landscape architects can use it in poorly drained soils, massed under trees, or grouped to stabilize banks and slopes. *Itea japonica* 'Beppu' is also useful for facing down borders and hedges of taller-growing material. It could also serve alone as a low but wide-spreading hedging material.

These two sweetspires are examples of many fine plants growing in arboreta across North America that are virtually unobtainable from commercial nurseries. The Arnold Arboretum has filled this void for many years by publicizing such plants in *Arnoldia* and by distributing little known plants to Friends of the Arnold Arboretum, to gardeners, and to the nursery trade. Therefore, we are pleased to announce that during April 1980 Friends of the Arnold Arboretum will be mailed a rooted cutting of *Itea virginica* for testing. This is our first biennial plant dividend featuring a native American plant. After the danger of frost has passed, these cuttings should be planted outdoors in a location protected against errant feet or misguided lawnmowers. During the fall of 1980, the plants should be well mulched with pine needles, hardwood bark, or wood chips and perhaps given protection from rodents.

All of the cuttings we are distributing were propagated from a plant collected by Mrs. Mary G. Henry, founder of the Henry Foundation for Botanical Research in Gladwyne, Pennsylvania. Mrs. Henry discovered the plant growing near Sharpsburg, Georgia, in November 1954 and selected it for its superior fall color and persistent autumn leaves. We are indebted to Ms. Josephine Henry of the Henry Foundation for sharing with us the original supply of stock cuttings to begin this distribution project.

People who are not members of the Friends of the Arnold Arboretum or who are members and wish to obtain additional plants of *Itea virginica* will find them available by mail order from Wayside Gardens, Hodges, South Carolina 29695 or Woodlanders, 1128 Colleton Avenue, Aiken, South Carolina 29001.



Departing from the usual high quality of illustrations in Curtis's Botanical Magazine, this illustration of Itea virginica (50(1823): t. 2409) is inaccurate in showing upright racemes and misleading in showing a trilobed leaf, an uncommon occurrence. Probably taken from a pressed herbarium specimen, this picture fails to depict the complete gracefulness and charm of the flowering plant.

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C. M. Hovey

This portrait of Charles Mason Hovey, executed by William Sharp, appears as the frontispiece to the first volume of The Fruits of America (1852). Charles was approximately 40 years old at the time of publication and was at the height of his career as a nurseryman, hybridizer, writer, and editor.

A Taste for Horticulture

by B. JUNE HUTCHINSON

The three decades from 1830–1860 showed greater progress in horticulture in America than in all the time before.

U. P. Hedrick, *A History of Horticulture in America to 1860*

In 1832 a young man with a passionate devotion to horticulture opened a nursery in Cambridge, Massachusetts, with his older brother. The young man's name was Charles Mason Hovey and his accomplishments in horticulture and his zeal in publishing the accomplishments of others made a singularly important contribution to the thirty years of progress in horticulture from 1830 to 1860. Indeed, Thomas Meehan, editorializing in *The Gardeners' Monthly and Horticulturist* in 1886, claimed that "horticulture on this continent is probably more indebted to [Charles Mason Hovey] than to any living man" (Meehan, 1886), a claim possibly as true now as it was in Thomas Meehan's day.

Views of Cambridge painted in 1809, portraying widely spaced houses around the Cambridge Common and distant views of farm-

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land (Emmet, 1978), show that Cambridge was still a rural village in 1810 when Charles Mason Hovey was born in his father's house on Brookline Street. The household already was a busy place for his mother, Sarah Stone Hovey, since Charles had five older siblings ranging from fifteen to three years of age (Daniel Hovey Association, 1913). A younger brother was born in 1813. Charles's father, Phineas Brown Hovey, conducted a grocery store on the western corner of Main and Brookline Streets, and bought, rented, and sold property elsewhere in Cambridge (Cambridge Historical Commission, Folder: The Hovey Tavern, Cambridgeport). He and Sarah owned pew twenty in the Cambridgeport Meeting House on Columbia Street and probably took Charles and his siblings there on Sundays.

Not a great deal is known about Charles's early years. He was sent to Cambridge Academy and graduated in 1824, when he was fourteen. There is no record that he had any further formal education. He apparently became interested in plants at a very early age, and the large areas of natural woods in Cambridge and the marshlands along the Charles River must have been a delight to him. A splendid watercolor executed between 1822 and 1828 is evidence that he sketched and painted very early. The watercolor shows Hovey Tavern¹ and the block of Massachusetts Avenue in Cambridge where the tavern stood; it remains the best pictorial documentation of that particular area of Cambridge (Cambridge Historical Commission, Folder: The Hovey Tavern, Cambridgeport).

According to one account, Charles began "when but fifteen years of age . . . gardening for pleasure [in] his father's ample garden" and at sixteen had gathered together a "goodly collection of Hyacinths, Tulips, Ranunculuses, and other bulbs and plants, and with borrowed tools built a small greenhouse" (Robinson, 1881). Charles had a strawberry collection at nineteen which he later said contained "all the fine sorts which were to be obtained" (Hovey, 1852), and two years later he was keeping vastly detailed sheets on pears, complete with sketches and information about their form, size, skin, color, flavor, core, and so on (Hovey, Notes on Apples, Peaches, etc.). His scholarly approach to horticulture is evident in an undated notebook in which he recorded, in a neat pen, the classifications of stem types, including the comment, "Linnaeus enumerates seven kinds of trunks, stems, or stalks of vegetables. These are necessary to be known for botanical distinctions though some are more important than others" (Hovey, Notes on Apples, Peaches, etc.). Charles's enthusiasm for plants motivated him not only to read and study, but to visit other horticulturists. Four years after the event, Charles described a visit he made in the fall of 1831, when he was twenty-one years old, to Landreth's old and respected Philadelphia nursery (Hovey, 1835).

¹ The inn was run from 1803 or 1804 until 1808 by Josiah Hovey, probably Charles's uncle.



The watercolor above, painted between 1822 and 1828 by Charles Mason Hovey, shows the Hovey Tavern and a portion of Massachusetts Avenue in Cambridgeport. To the right of the Hovey Tavern, across Douglass Street, is the store of N. Child, and the building beyond with hay scales in front is the soap factory of E. Davis. The large three-story building beside the soap factory was a two-family home occupied by Nathaniel Livermore, a soap manufacturer, and his son, John. Another of Nathaniel's sons, Isaac, married Eunice Hovey, Charles Mason Hovey's sister. All the buildings seen above were constructed soon after 1801. The tavern stood until June 12, 1828, when it burned. None of the other buildings exist today. Charles Mason Hovey's watercolor is in the collection of Nina Fletcher Little and is reproduced here by courtesy of the owner.

He may have made this visit to gather information (and plants) for the running of a nursery since the Hovey brothers opened their small nursery the following spring.

Charles was twenty-two and his older brother, Phineas,² twenty-nine when they began their nursery in 1832 on one acre of land in Cambridgeport. Charles already was seriously engaged in hybridiz-

² Phineas Brown Hovey, Jr., the oldest son of Phineas and Sarah Hovey, is listed as a horticulturist in the vital records of Cambridge and in the accounts of his death on May 3, 1885. Little is recorded of his personal life, and his outspoken, energetic younger brother clearly overshadowed him in the world of horticulture. Phineas married Mary L. Cook in 1828. He joined the Massachusetts Horticultural Society the year it was founded and remained an active member, serving on several committees. Charles Breck, speaking of Phineas at his death, said he had known him for forty years and found him an "honorable, upright gentleman with a noble kind heart" (Breck, 1885).

THE
AMERICAN
GARDENER'S MAGAZINE,
AND
REGISTER

OF
USEFUL DISCOVERIES AND IMPROVEMENTS IN HORTICULTURE
AND RURAL AFFAIRS.



CONDUCTED
BY C. M. HOVEY AND P. B. HOVEY, JR.

BOSTON:
PUBLISHED BY HOVEY & CO.....MERCHANTS ROW.
1835.

The American Gardener's Magazine, founded and edited by Charles Mason Hovey and his brother Phineas B. Hovey, was the first successful periodical in this country devoted to horticulture. Two years after the periodical was initiated, its name was changed to The Magazine of Horticulture and Charles Mason Hovey became the sole editor. The Magazine of Horticulture was discontinued in 1868.

ing strawberries, and that summer he prepared the plants from which he ultimately selected the seed for his famous 'Hovey's Seedling' (Hovey, 1852). In 1833³ Charles became a member of the Massachusetts Horticultural Society.

In 1834 Charles and Phineas opened Hovey and Company, a seed and agricultural warehouse at 79 and 81 Cornhill Street,⁴ Boston, which they ran in conjunction with their Cambridge nursery. It must have been an exciting and auspicious location for a new seed business: the meeting hall of the Massachusetts Horticultural Society was on the second floor of 81 Cornhill Street, immediately above the store.⁵ The winter of the store's founding was exceptionally severe in the Boston area, record cold and snow making life and travel difficult. Looking forward to spring, Charles and Phineas advertised a large selection of seeds, bulbs, dahlias, grape vines, and fruits, and an extensive list of books connected with gardening and botany.

The seed store was not Charles and Phineas's only new venture that winter. On January 1, 1835, the two brothers published Volume I, Number I, of *The American Gardener's Magazine*, the first periodical in the United States devoted to horticulture.⁶ The magazine was to be published monthly with forty pages an issue (the first issue and the second issue were slightly shorter and slightly longer, respectively) at the price of 25 cents per copy or \$3.00 per year. As Thomas Meehan later noted (Meehan, 1886), the name, design, and layout of the Hovey magazine were taken from *The Gardener's Magazine*, an English journal edited by J. C. Loudon. The title chosen by Charles and Phineas undoubtedly acknowledges their desire to emulate Loudon's magazine in more than appearance.⁷ At first both

³ Why Charles did not join in 1829, when the Society was founded, can only be guessed. The fact that he then was only nineteen years old may be a partial explanation. Among the sixteen men who tramped at mid-day through five and six feet of snow in the streets of Boston to institute a horticultural society for Massachusetts were such prominent local figures as John Lowell, General H. A. S. Dearborn, the nurserymen William Kenrick and J. Winship, and the famous Salem pomologist Robert Manning, figures in whose company a young man still living at home and as yet to make a mark on the world might well have felt out of place!

⁴ Cornhill Street was the name given in late 1833 or early 1834 to what earlier had been Market Street.

⁵ The Massachusetts Horticultural Society met at 81 Cornhill Street from February 1834 to late 1837, when it outgrew the space and moved to 25 Tremont Street.

⁶ When *The American Gardener's Magazine* began, there existed a handful of agricultural periodicals in America, which occasionally published articles on horticultural subjects.

⁷ The full title of the Hoveys' magazine was *The American Gardener's Magazine, and Register of Useful Discoveries and Improvements in Horticulture and Rural Affairs*. The full title of J. C. Loudon's magazine was *The Gardener's Magazine, and Register of Rural & Domestic Improve-*

Charles and Phineas were listed as "conductors" of *The American Gardener's Magazine*. With the third volume, the name of the journal was changed to *The Magazine of Horticulture*, and its title page carried only C. M. Hovey's name as editor.

The list of contributors to the new journal read like a "who's who of gardening". It represented all levels of horticulture from the professional gardeners and nurserymen to the knowledgeable amateur horticulturists and wealthy gentlemen farmers. Meehan wrote in 1886 that Charles Hovey "was fortunate in drawing about him an admirable line of correspondents who went into the support of the magazine with zeal and intelligence remarkable for the time . . . — names such as would make at once the fortune of any horticultural publication" (Meehan, 1886). How did a young man from Cambridgeport "draw about him" such an eminent group of contributors? The records do not say, but it is possible to speculate with some confidence. We know, for example, that Charles had traveled about the country at an early age and visited men in the plant world. He might have impressed them with his knowledge and enthusiasm; he certainly won friends among them. By the time *The American Gardener's Magazine* began, he was gaining a reputation as a professional nurseryman and hybridizer, and this surely gave him entree to other professionals. Finally, Phineas's circle of friends at the Massachusetts Horticultural Society clearly supported the new journal. Sixteen of the thirty-two contributors to *The American Gardener's Magazine* its first year were members or out-of-state corresponding members of the Massachusetts Horticultural Society. Four of the men who contributed the first year were among the sixteen who had trudged through the snow to the founding meeting of the Society.

A. J. Downing, the most famous name in landscape gardening in his day, a writer, nurseryman, and editor, contributed often to the new periodical. In 1837 *The American Gardener's Magazine* began with his "Notices on the State and Progress of Horticulture in the United States," an annual feature Charles Hovey took over the next year and continued to write, under similar titles, until 1868, the last year of the magazine. John Lewis Russell, Professor of Botany and Vegetable Physiology to the Massachusetts Horticultural Society, and Robert Manning, a foremost pomologist of the time, both were frequent contributors. Articles were received from Grant Thorburn of

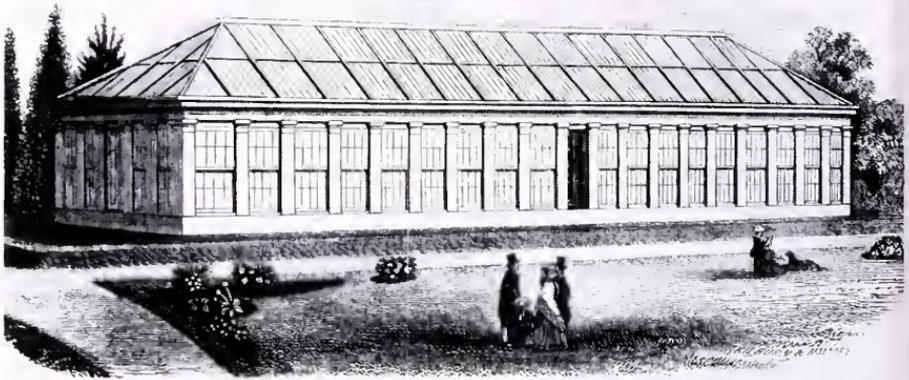
ment. Charles and Phineas did not mention Loudon in their "Introduction" to the first issue of *The American Gardener's Magazine*, but later in the issue they printed reviews of four articles in the May 1834 and July 1834 issues of *The Gardener's Magazine*.

L. H. Bailey also notes that *The American Gardener's Magazine* "was modeled after Loudon's 'Gardener's Magazine,' although its spirit was essentially American" (Bailey, 1935). Loudon's magazine, according to Geoffrey Taylor, was "the first Gardening magazine in England" (Taylor, 1952).

New York, the first seedsman of any consequence in America; William R. Prince, proprietor of one of the oldest and most extensive nurseries in the country at Flushing, New York; J. A. and William Kenrick, sons of the pioneer New England nurseryman John Kenrick; R. Buist, owner of an "exotic" nursery in Philadelphia; and M. Floy, Jr., owner of a New York nursery famous for its camellias. Practical, first-hand information was furnished by D. Haggerston, the first superintendent of Mount Auburn Cemetery in Cambridge and later the gardener to J. P. Cushing at Belmont Place, Watertown; J. W. Russell, gardener to J. Lemist, Roxbury, and superintendent at Mount Auburn after D. Haggerston; Peter McKenzie, Henry Pratt's gardener at the estate of Lemon Hill in Philadelphia; and Robert Murray, gardener at the Waltham residence of Theodore Lyman, Jr.

Among the affluent amateurs who supported the new magazine was John Lowell, a lawyer and political writer who after having amassed a fortune, retired to the Roxbury estate of Broomley Vale, "one of the oldest, finest places in Boston" (*Dictionary of American Biography*, 1930), intending to grow fruits and to farm scientifically. His greenhouse was the first in the area built on scientific principles. A founder of the Massachusetts Horticultural Society, he was sixty-six years old in 1835, but sent notes to the Hovey magazine before his death in 1840. Another local figure equally important in horticulture in 1835 was Marshall P. Wilder of Hawthorne Grove, Dorchester, a successful merchant and holder of several public offices. Marshal Wilder was an impressive fruit grower, specializing in pears, had an extensive camellia collection, and wielded considerable influence on horticulture in both the United States and England. He contributed a series of nine articles on camellias during the first ten years of the Hovey magazine. General Henry A. S. Dearborn, one of the founders and the first President of the Massachusetts Horticultural Society, communicated a number of letters from the naturalist Dr. Augustus Mitchell, and other notes of his own. In later issues of *The Magazine of Horticulture*, Henry Winthrop Sargent, Charles Sprague Sargent's distant cousin, contributed letters from travels in England, and articles on the wintering of evergreens at Wodenethe, his estate on the Hudson River.

The high caliber of articles in *The American Gardener's Magazine* and *The Magazine of Horticulture* certainly was an important element in the magazine's success. Another was Charles Hovey's diligence as editor. Charles kept abreast of horticulture; he read and reviewed new horticultural publications for his readers and occasionally offered a synoptic look at English and French journals. His contributions on topics such as plant hybridization were written from a vast store of personal knowledge. Thomas Meehan attributed Hovey's success as an editor to "the love of labor that he united with his intelligence" (Meehan, 1886). L. H. Bailey points up what is possibly the magazine's most valuable contribution: "It is a record of the bud-



CONSERVATORY OR CAMELLIA HOUSE OF MESSRS. HOVEY & CO.

The size and elegance of the greenhouse shown above, called the Camellia House, and the further facilities provided by three additional greenhouses attest to the prominence of the Hovey Nursery. The Camellia House lay at the end of a broad avenue one hundred and sixty feet from the street. C. H. B. Breck, a nurseryman, wrote in 1861 that he "visited the beautiful lawn in front of the greenhouses, around which are grouped specimens of rare shrubs and ornamental shade trees, of which [Hovey] has a magnificent collection, consisting of everything that is worth cultivating" (Breck, 1861). The Camellia House was nine feet high to the eaves and sixteen feet high in the center with a central walkway three and one-half feet wide. The finest varieties of climbing roses twined up columns on either side of the central walk and were a widely acclaimed feature of the greenhouse which contained the Hoveys' renowned collection of camellias.

ding stage of New World horticulture" (Bailey, 1935). Indeed, the magazine touched on almost every development in and affecting the horticultural world from 1835 until 1868, when it was discontinued. For example, the rise of landscape design in America can be traced from its merest mumuring — a William Sheridan respectfully informing the public in the March 1836 issue that he is available to lay out gardens, and a Mr. E. Sayers, lately employed by Dr. Hosack of New York, now in Boston, offering in the August 1837 issue to lay out gardens and pleasure grounds. In August 1837 C. M. Hovey reported a resolution in the House of Commons in England "that in all enclosure bills, a provision should be made for leaving an open space sufficient for the purposes of exercise and recreation" and editorialized his hope for a Congressional "act or resolve . . . authorizing the selectmen of towns or the corporations of cities to reserve open spaces for the exercise of the people." In an editorial in the January 1863 issue he laments that "cultivators have been called

from the garden to the battlefield, and the spade has been changed for the sword. Many energetic amateurs and nurserymen . . . have fallen in the cruel warfare which imperils our national existence."

At the close of the magazine in 1868, the editor, then fifty-eight years old, surveyed with satisfaction his successes during thirty-four years of publishing. He added that "with an enthusiasm unabated, and a zeal as earnest as ever, in everything connected with horticulture, we shall not retire from a field which has afforded us so much pleasure, but continue to labor."

With increased fame, the Hovey Nursery expanded. In 1840 Charles and Phineas purchased 40 acres of woodland on Cambridge Street in Cambridgeport. According to a later description, the land was cleared and "cut up into squares and avened with Pears and other trees, and extensive glass houses were erected" (Robinson, 1881). By 1848 four greenhouses were in use. R. B. Leuchars, author of the first book published in America on greenhouses, *A Practical Treatise on the Construction, Heating and Ventilation of Hot-Houses*, reported in February 1850 in *The Magazine of Horticulture* that the Hoveys "have just erected and completed one of the largest span-roofed houses in the country, being ninety-six feet long and thirty feet wide, chiefly for the growth of specimen plants, for which purpose it is well designed" (Leuchars, 1850). Leuchars was impressed by more than the greenhouse: "We hear a great deal about the *specimen grounds*, of nursery men, and . . . I have traveled some considerable distance to see them, both in this country and in England, but have found their existence only in catalogues and advertisements. I confess, therefore, I was not prepared for the *coup-d'oeil* which was here presented to me" (Leuchars, 1850). The specimen grounds had approximately two thousand dwarf fruit trees. The conservatory of the Hovey Nursery, called the Camellia House, was widely known not only for its beautiful construction "in the Grecian style" (Leuchars, 1850) and for its size — it was eighty-four feet long and twenty-two feet wide — but for the breath-taking Hovey camellia collection, set off by the best varieties of climbing roses twining up the inside columns (Hovey, 1854). The breadth of the nursery stock was staggering. There were nearly sixty thousand pear trees, and thousands of one-, two-, and three-year-old trees of each other fruit (Londoniensis, 1850). The nursery had a collection of twenty thousand geraniums, and the "best collection in the country of Japan lilies [*Lilium speciosum*]" (Hovey, 1848). In 1844 Charles visited England, Scotland, France, and Belgium, and brought back many ornamental trees and shrubs which he thought might be hardy in New England. He had imported plants from England and Europe for many years. The Hovey Nursery undoubtedly trained many young plantsmen. A notable instance is Jackson Thornton Dawson, who apprenticed himself at the nursery around 1856 and quickly earned the charge of the bouquet department. Eighteen years later this talented



Charles Mason Hovey began experimenting with the hybridization of strawberries in the summer of 1832. English varieties of strawberry were not vigorous enough to withstand the severe New England winters. With this in mind and convinced that he must look to his own garden for hardy varieties, Hovey began to raise plants from seed. Writing in 1837, he recorded that he considered five properties when he selected seedlings: hardiness and productiveness of the plants, and flavor, size, and color of the fruits. He added, "The chance of raising a very superior fruit may be considered as one to five hundred" (Hovey, 1837). In 1838 Hovey produced the famous 'Hovey's Seedling'. 'Hovey's Seedling' was the first good American strawberry and was widely grown until the close of the 19th century. The lithograph above is from *The Fruits of America* (1852).

NEW STRAWBERRY.

HOVEYS' SEEDLING.

This celebrated variety of the Strawberry, after the trial of another year (the eighth,) has still proved far superior to any kind ever yet seen in this country. Specimens of the fruit have been exhibited before the Massachusetts Horticultural Society, the present season, which were universally admired, and were pronounced, by all good judges, to be of extraordinary size and beauty. Upwards of *ten quarts* were exhibited at the meeting of the 26th June, many of the berries measuring from five to six inches in circumference. The following description of this variety is subjoined.

FRUIT, very large, round or slightly ovate, conical, and never coxcomb shaped, even in the very largest berries. **COLOR**, deep shining red, paler in the shade. **SEEDS**, inserted in a slight cavity. **FLESH**, scarlet, (paler in the largest berries,) and firm, abounding with an agreeable acid, and very high flavored juice, not surpassed by any other variety. **FOOT-STALKS** long, elevating the fruit from the ground, and every berry attaining a good size. **LEAVES** large, and rather light green. **VINES**, very vigorous, more so than any other kind, and as hardy as the old Virginia, or the Mulberry, standing the past five winters with scarcely the destruction of a single plant.

This variety has gained the premium of the Massachusetts Horticultural Society, for the last three years, although in competition with the best English varieties cultivated in this country.

The plants are now offered for sale, to be ready for delivery on the 1st of April, at the reduced price of \$2 per dozen plants. Orders will be executed in the order in which they are received. Orders from a distance addressed to us, enclosing the amount for the plants ordered, will be immediately attended to, and promptly forwarded to any part of the country.

. Orders immediately attended to and faithfully executed.

HOVEY & CO.,

AGRICULTURAL WAREHOUSE AND SEED-STORE,
7 Merchants Row... Boston.



Above: William Sharp, a pioneer in color lithography, produced the same hundred and ten colored lithographs which appeared in *The Fruits of America*. This portrait of the artist is the frontispiece to the second volume of *The Fruits of America* (1856).

Right: An advertisement for 'Hovey's Seedling' which was printed in *The Magazine of Horticulture* in January 1842.

young man would become the first propagator of the Arnold Arboretum.

Drawing on the great energy mentioned by many who knew him, Charles found time to continue his work in plant hybridization while attending to the responsibilities of the expanding nursery, the seed house, the traveling, reading, writing, and editing required for the journal, and the increasingly active role he was playing in the Massachusetts Horticultural Society. His early interest in strawberries led in 1838 to the introduction of 'Hovey's Seedling'. This berry was for many years *the* market and table strawberry. It won the Massachusetts Horticultural Society's annual premium for strawberries at least twelve times between 1838 and 1854.⁸ Charles's publication of his

⁸ According to the *Transactions of the Massachusetts Horticultural Society*, Charles Mason Hovey was awarded the premium for strawberries eight times between 1838 and 1850. In 1850 the *Transactions* began list-

breeding techniques in the July 1837 issue of *The Magazine of Horticulture*, together with the financial success of the seedling, undoubtedly encouraged other fruit breeders in this country. Charles introduced many pears, among them 'Dana's Hovey'. In 1855 he raised from seed the Hovey cherry. Charles Mason Hovey eventually became known as one of America's foremost authorities on fruit varieties. A packet of over 100 letters in the archives of the Massachusetts Horticultural Society attests to his reputation. Written largely in the years 1846 to 1853 and from Michigan, Pennsylvania, New York, all the New England states, and Canada, many of these letters sought help with some aspect of fruit culture. From 1852 to 1856 Charles Mason Hovey published the 24 numbers of the first two volumes of *Fruits of America*. Every number was handsomely printed, with four plates in color of fruit, stem, and leaves, an outline section of each fruit, and a drawing of each tree, the last made from a sketch by Charles Hovey. Only three numbers of the third volume were published.

Charles was interested in hybridizing trees and ornamental plants other than fruits. In 1860 he introduced *Thuja occidentalis* var. *hoveyi*, which he raised from seed. He did much to advance the culture of the camellia. He had begun hybridizing this plant in 1835, when he was 25 years old, and his cultivars 'C. H. Hovey', 'C. M. Hovey', and 'Mrs. Anne Marie Hovey' were important contributions (Hume, 1951); he won awards for all three, including a gold medal in 1854 from the Massachusetts Horticultural Society for 'C. M. Hovey' and a prestigious certificate in 1879 from the Royal Horticultural Society of London for the lovely white and blush pink 'Mrs. Anne Marie Hovey', named for his wife. Hovey also introduced cultivars of Indian azalea ('America' and 'Suzette'), speciosum lily ('Melpomene', 'Terpsichore', 'Thalia', 'Polyhymnia', and 'Clio'), geranium ('Cambridge Pet', 'Dolly Dutton', 'Commodore Nutt'), and the orchid cactus (*Epiphyllum*) 'C. M. Hovey'. In 1881 W. Robinson remarked of Charles Mason Hovey that "During his whole career the hybridisation of plants has been with him a favourite work" (Robinson, 1881).

Precise facts concerning Charles Mason Hovey's family life are scanty. In addition to launching his journal in 1835 and his other responsibilities, he somehow found time to call on Ann Maria Chaponil (sometimes spelled "Chapouil") of Cambridge, and on December 25, 1835, they were married. An entry in his horticultural note-

ing the variety for which the premium was awarded. The 'Hovey Seedling' won the premium in 1850, 1852, 1853, and 1854. Some of the other persons who won the premium for strawberries between 1838 and 1850 may have won it for a 'Hovey Seedling'. W. Robinson claimed that the Hovey Seedling won the Massachusetts Horticultural Society's premium twenty consecutive years (Robinson, 1881), and Thomas Meehan claimed that it won thirty consecutive years (Meehan, 1886).



The portrait of Charles Mason Hovey reproduced above was printed as the frontispiece to Volume 28 (1886) of *The Gardeners' Monthly and Horticulturist*. The engraving is based on a portrait of Hovey painted by Alonzo Hartwell of Boston in 1865, when Hovey was President of the Massachusetts Horticultural Society. The original painting is in the possession of the Massachusetts Horticultural Society.

book for that date indicates that Charles tended to business before the ceremony and records his finding the “*epacris* in full bloom” (most likely *Epacris grandiflora*, its rosy red and white blossoms especially appropriate for the Christmas season) and “*camellia fimbriata* in flower” (Hovey, *Horticultural Memoranda*). The subsequent gap in his horticultural notes suggests that he found his bride absorbing; the next entry is dated Monday, March 7. Possibly the Hoveys enjoyed an extended wedding trip, but business went on as usual, and no hint of such a trip appears in his writing.

Who Ann Maria was remains an intriguing question. The first volume of the *Vital Records of Cambridge* lists one Antoine Chaponil, born in Mayseac, France, on April 12, 1767. This likely was Ann Maria's father. The *Vital Records of Cambridge* also records Ann Maria's marriage to Charles, and the marriages of a Caroline and a Louise Chaponil, who probably were Ann Maria's sisters. A Lucy Chaponil Charpoil was buried on March 31, 1841, but whether or



In 1863 the Massachusetts Horticultural Society purchased the Montgomery House estate on Tremont Street as the location for a new hall. The hall, designed by Greley J. F. Bryant and built with Concord white granite, was constructed largely through the efforts and fund raising of Charles Mason Hovey, President of the Society from 1863 to 1866. The new building was dedicated on September 16, 1865, and was the headquarters of the Massachusetts Horticultural Society until 1900. The above photograph of the Horticultural Hall is reproduced from *History of the Massachusetts Horticultural Society, 1829-1878*. (Manning, 1880).

not she was Ann Maria's mother, possibly remarried, could not be established.

By 1843 Charles Mason and Ann Maria Hovey were living in Cambridge at 381 Broadway on the corner of Maple Street. The handsome colonial revival house was ornamented with an appropriate swag of flowers carved over the entrance. Although the house still stands on Broadway in Cambridge, it has been greatly altered over the years, and only the yet remaining ornamentation and detail hint at its former beauty. The location on Broadway and Maple Streets was convenient for Charles, since the nursery was nearby on Cambridge Street. Charles spent the remainder of his life in this house, and, indeed, the records tell us that he died there.

The *Vital Records of Cambridge* lists two children born to Ann Maria and Charles Mason, Susan in 1846 and Eulalie in 1857. Only two other references to Charles Mason Hovey's family were found. Writing in *The Gardeners' Monthly and Horticulturist* in December 1886, Thomas Meehan remarked that "During the past six or eight years, [Hovey] has suffered by the loss of wife, three daughters, daughter-in-law and four grandchildren; but the love of fruit and flower culture still affords him consolation" (Meehan, 1886). In 1892 Meehan reported that the Hovey "family have donated a large part of the library of their late father to the Horticultural Society of Massachusetts" (Meehan, 1892).

Charles Mason Hovey's work in horticulture apparently rewarded him handsomely. According to a credit report, by the mid-1860's he was "rich and growing richer all the time" (R. G. Dun and Company, Credit Ledgers), and in 1868 it is noted that he owned considerable real estate and was "doing a good business" (R. G. Dun and Company, Credit Ledgers).

Charles was very active in the Massachusetts Horticultural Society until his death. He served on virtually every committee and was President from 1863 to 1866. The records tell us that during his term of office membership increased from 500 to 1,000 and \$30,000 was raised. Largely as a result of his efforts, a building was erected on Tremont Street and dedicated in 1865. This building housed the Massachusetts Horticultural Society and its annual exhibitions from 1865 until 1900, after which year the Society moved to its present quarters on Massachusetts Avenue. Perhaps of greatest importance were the displays of constantly improved fruits and flowers which Hovey and Company exhibited at the Massachusetts Horticultural Society. Without question, these displays contributed enormously to a more sophisticated public taste for horticulture.

Charles Mason Hovey died in the evening on Thursday, September 1, 1887, of "an affection of the heart, inducing dropsical trouble" (*Cambridge Chronicle*, September 3, 1887). The *Cambridge Chronicle* stated that "although he was never a candidate for any local office, few names are more familiar to our citizens than his" (*Cambridge*

Chronicle, September 3, 1887). *The Cambridge Press* also printed his obituary and declared that he "was widely known not only in this country but in Europe" (*The Cambridge Press*, September 3, 1887). The funeral was held at his home at 2:30 p.m. on Sunday, September 4, 1887 (*The Cambridge Press*, September 3, 1887). Charles Mason Hovey was buried at Mount Auburn Cemetery, in Lot 4205 at the corner of Mound and Spruce. Phineas had been buried at the Mount Auburn Cemetery in 1885 in Lot 4554, Gerardia Path.

The *Transactions of the Massachusetts Horticultural Society* for 1887 record a memorial to C. M. Hovey. Describing Hovey as a man of "ceaseless activity, untiring energy, keen observation, retentive memory, boundless enthusiasm," and noting Hovey's contributions as a hybridizer, an editor, and an author, the memorial states that "it may be doubted whether any other man in this country has done so much to stimulate a love of horticulture in all its branches" (*Transactions of the Massachusetts Horticultural Society*, 1887). Among those who drafted the memorial notice was Robert Manning, son of the Salem pomologist who had been a frequent contributor to Hovey's magazine.

Horticulturist, hybridizer, nurseryman, writer, editor, and artist, Charles Mason Hovey is a singularly important figure in the history of American horticulture. Acknowledged and praised as such by his contemporaries, he has been all but forgotten by twentieth century historians, a fate undeserved by a man whose life has been characterized as "one continuous service . . . to horticulture" (Benson, 1929).

. . . Gardening is a pursuit to which we have ever been zealously devoted, and in which we have ever felt a deep interest. We hope our humble efforts, in our new avocation, will not be unavailing, in disseminating a taste for Horticulture . . .

Charles Mason Hovey, Introduction,
The American Gardener's Magazine,
Volume 1, Number 1, 1835

Acknowledgements

Assistance and suggestions for this paper came from many people, and materials from numerous institutions were used. The staff at both the Cambridge Public Library and the Massachusetts Historical Society were friendly and helpful. Charles Sullivan of the Cambridge Historical Commission made available fascinating archival material, as did Heather Miller of the Massachusetts Horticultural Society. Eleanor McPeck, instructor in the Radcliffe Seminars, Radcliffe College, gave encouragement and advice, and Sheila Geary always was able to come up with one more source from the splendid library of

the Arnold Arboretum. The photograph of the watercolor of the Hovey Tavern was graciously provided by Nina Fletcher Little, who owns the original.

Charles Mason Hovey is an intriguing figure, and many questions about him remain unanswered. Any additional information would be welcome and may be forwarded to the author through *Arnoldia*.

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Back cover: *Threadleaf false cypress* (*Chamaecyparis pisifera filifera*). Photograph by N. Batkin

Corrections: *The photographs on pages 345, 363, and 364 of the last issue of Arnoldia (November/December 1979) were taken by E. Gray. On page 366 of the last issue, the second title in the list of published writings of A. J. Fordham should be: Pieris floribunda and its propagation.*



ARNOLDIA

Arnold Arboretum
40, No. 2 Mar./Apr. 1980

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Front cover: J. Horace McFarland commissioned this photograph of Jackson Dawson in 1904 and donated it to the Arboretum in 1942. He and Jackson were close friends, sharing a great love of roses. Photograph by O. P. Beckley, September 13, 1904.



"Closely associated with the memory of Prof. Sargent is his lifetime associate Jackson Dawson, a very capable plant man with a very 'green thumb'. He always wore a 'biled shirt' — a starched bosom shirt and no collar. It was fresh every morning but it was rather amusing to see how little respect he had for its pristine whiteness. We would be looking at some special plants in the coldframe, which were being propagated, perhaps a plant from China. Taking the pot up to see what the species might be, the label would be obscured with moss or alga, which is removed by rubbing it across that lily white shirt" (Eldridge, letter, April 4, 1935)

Mr. Dawson, Plantsman

by SHEILA CONNOR GEARY and B. JUNE HUTCHINSON

There is a special magic experienced in growing plants, and Jackson Thornton Dawson not only was attuned to the magic, he was a master of it. William Trelease, who later became the first director of the Missouri Botanical Garden, met Jackson Dawson in 1884 and described him as "capable almost of resurrecting a dead stick and certainly of coaxing into vigorous growth a twig found in the pocket of a shooting jacket weeks after this had been laid aside" (Trelease, 1929).

Dawson started work at the Arnold Arboretum in 1873 as Charles Sprague Sargent's first staff member, and his career as propagator and superintendent spanned forty-three exciting years in the Arboretum's development. During these years he raised and distributed throughout the world 450,718 plants and 47,993 packets of seed and received in return from collectors, arboreta, and botanic gardens 174,200 plants and 27,729 packets of seed. Approximately 15-20% of the Arboretum's current living collections are the result of his labors.

Sheila Connor Geary, Assistant Librarian, has been at the Arnold Arboretum since 1970. She is a graduate of the Massachusetts College of Art. Having lived at 1090 Centre Street, Dawson's Arboretum home, she has long been interested in both Jackson Thornton Dawson and his family. B. June Hutchinson, a long-standing Friend of the Arnold Arboretum and an active volunteer since 1970, has been researching with Sheila Connor Geary the early history of the Arboretum.

Jackson Dawson was born in East Riding in Yorkshire, England, on October 5, 1841, and lived there for five years. After his father's death, Jackson and his mother, Elizabeth Thornton Dawson (1821-1870), came to New York City. Their voyage to America was a perilous one, lasting sixty-five stormy days. The seas were so turbulent that their small vessel, *The Garrick Trask*, was driven almost to the Gulf of Mexico. Memories of that journey stayed with Jackson, and a later opportunity to ride the Staten Island Ferry caused the small boy to plead with his mother not to take him on a boat again!

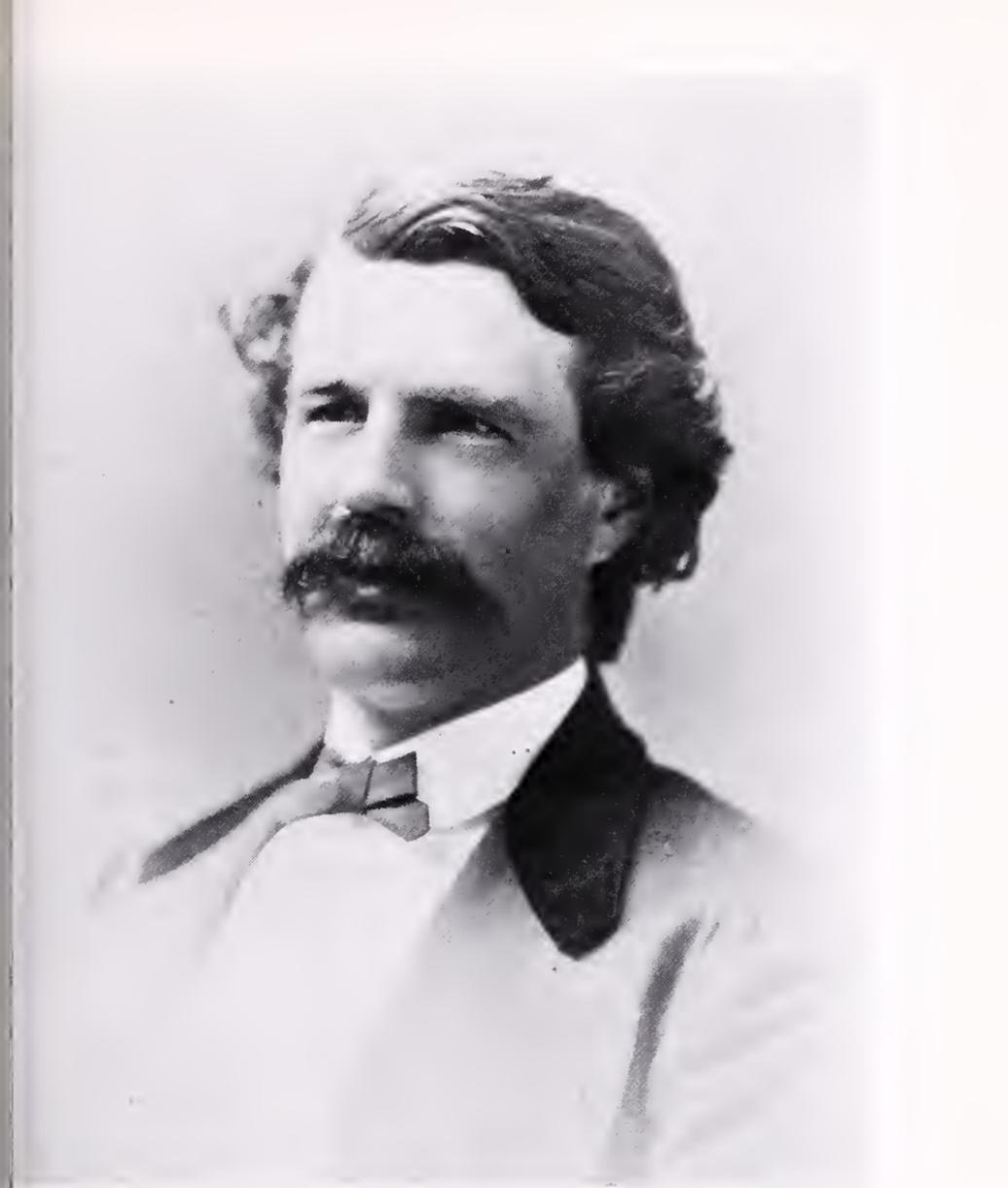
Elizabeth (Betsy) Dawson settled with her son on Cherry Street near the Brooklyn Bridge and earned a living by sewing elaborate tape measures for the fashionable tailors of New York. In 1849 a cholera epidemic broke out in New York City. In later years Jackson Dawson would describe the death carts which were driven through the city streets each day and the eerie call from the drivers to "bring out your dead". Fortunately the Dawsons survived the epidemic, but the horror of the experience was undoubtedly a factor in Betsy Dawson's decision to move to Massachusetts.

Betsy and Jackson went to live with her brother, George J. Thornton. He, his wife Elizabeth, and their three children lived in Andover, where George had a nursery and greenhouse. It was here at the age of eight that Jackson first began to work with plants. He stood on a soap box to reach the workbench and put in cuttings. He was a willing worker and apparently loved plants from a very early age. One family story relates how he hoarded his money and instead of spending it on a toy, purchased a basic text for botany students of the period, *Mrs. Lincoln's Botany* (Phelps, 1831 or 1833).

Jackson remained in Andover until he was a young man, attending school in the winter and working in his uncle's business in the spring and fall. When he was fifteen or sixteen years old, he was apprenticed to C. M. Hovey and Company, a noted nursery in Cambridgeport, Massachusetts.* Jackson was diligent, and family records depict a young man who spent long hours working and learning. He was a talented flower-arranger and was soon in charge of the bouquet department at the Hovey nursery. In the evenings he attended a business college, French's Commercial and Nautical Institute, located at 94 Tremont Street in downtown Boston. Established in 1848, the institute became known as French's Business College (1848-1901) and was one of the oldest commercial schools in the United States.

Family records also are clear as regards Dawson's personality. A picture of him as a youth reveals an exceedingly handsome face with merry eyes and dark hair. He was well-known for his endless fund of stories and jokes, which he told with great skill and wit. Dawson was fond of relating an early incident that reveals his storytelling ability. One evening, as Dawson and his friends waited for

* See "A Taste for Horticulture", *Arnoldia* 40(1):30-48.



Letty Blossom Johnson, in a biographical sketch of her grandfather, Jackson Dawson, recalled that he was a patient, loving man who always had time for the children of the family. "He was never too busy or too preoccupied that he wouldn't tell us some fascinating story about a little shrub or a big tree, or perhaps the seedlings or grafts he was at work on. And how he could tell a story! Weaving together the details of a plant's journey from some far corner of China or other distant locale to its present spot. His memory was prodigious and I believe he knew intimately every fact about every plant of the many thousands he had raised. He was so modest, it wasn't until decades later, I was to learn what an important part he himself, had played in raising these plants" (Blossom, 1957). Dawson's granddaughter also described his bushy mustache and twinkling eyes. Both are evident in this photograph of Dawson taken when he was thirty years old and working at the Bussey Institution. Photographer unknown.

the doors at the business school to open, he entertained his companions with an Irish joke. William Warren, an actor performing at the nearby Boston Museum, stopped to listen. When Dawson finished telling the story, Warren asked him, "Are you Irish, my son?" Mischievously, Dawson answered him with a sentence in Irish dialect but hastened to add, "No, thank heavens, I'm not." Warren offered to help Dawson with a stage career, but the young plantsman had already chosen his life's work. Warren was indeed a capable judge of Dawson's talents. One of the most popular 19th century comedians he appeared on the stage in Boston for approximately fifty years and was a member of the stock company at the Boston Museum on Tremont Street, where at that time curiosities as well as paintings were exhibited and theatrical performances presented.

Jackson Dawson's first public recognition in the plant world came in 1861 when he was twenty years old. Scotch heather labeled as "growing wild within twenty miles of Boston" was displayed that year in a July exhibition at the Massachusetts Horticultural Society. A card accompanying the exhibit identified the exhibitor as "a young gardener of Cambridge." Since heather had never been found growing wild on the American continent, the exhibit aroused considerable excitement, and the judges sent a letter to the exhibitor, requesting him to identify the location of the plant. No reply was forthcoming, with the result that the judges declared the incident a hoax. Later, Dawson came forward and explained to the judges that his employer originally had forbidden him to speak. On August 5 he led them to the farm of Charles H. Thwing in Tewksbury, Massachusetts, where heather was indeed growing. The Society awarded Dawson their gold medal and gave him a prize of ten dollars in gold. Since heather in fact is native only to parts of Europe, that growing in Farmer Thwing's land did appear there by accident; later accounts suggest that the heather may have grown from seed which had fallen from packing crates discarded near the site. Charles Mason Hovey suggested the heather may have been mixed in a shipment of pear trees that his nursery supplied to a farmer whose land was upstream from the site of the find. However, at the time everyone believed that Dawson's find was a native plant. Even the eminent Asa Gray, upon reviewing the facts, supported Dawson.

Dawson continued to work at the Hovey Nursery and to attend business school until August 1862, when he joined Company G of the Massachusetts 19th Volunteers to fight in the Civil War. He was shot in the battle of Fredericksburg on December 11, 1862. According to a family account, a hole in his jacket over his heart led his companions to believe him dead until they realized that Jackson was still breathing. The Confederate sharpshooter had aimed well, but the bullet had been stopped by the Bible that his mother had given him when they parted. He had instead fallen from

a second bullet and spent the next six months in a hospital in Washington, D.C., recuperating from a leg wound.

While recovering, Jackson was not idle. He served as a hospital orderly and helped with the floral decorations for a fund-raising fair sponsored by the Sanitary Commission. Established on June 9, 1861, and functioning until 1866, the Sanitary Commission provided medical care and supplies for the Union Army and was the forerunner of the American Red Cross. Frederick Law Olmsted, America's first landscape architect and the designer of the Arnold Arboretum, was Executive Secretary of the Sanitary Commission and played a major role in the effective functioning of this organization during the Civil War.

Jackson's ready wit won many friends for him during his army days, and family accounts suggest he also earned a reputation for being an excellent cook, frequently preparing meals for Company G. Jackson became an American citizen while he was in the Army and cast his first vote in a battlefield ballot box in the Presidential election of 1864. He did not forget his love of plants during the trying war years and collected and sent home to New England packets of seeds and rare plants from the southern states through which he travelled. It is likely that his two former employers, Thornton Brothers and Hovey Company, received his collections. At the end of his enlistment in 1864, Jackson returned to Boston and worked for a time for his old employer, the Hovey nursery.

In December 1866 Jackson married Mary (Minnie) McKenna in Andover, Massachusetts. Specific information about the life of Mary McKenna Dawson is meagre. She was born on Saint Patrick's Day, March 17, 1842, in New York City. Her family may have originated in County Kildare, Ireland, as this was the home of her younger brother, Terrance. By early 1868 Mary and Jackson were living in the gardener's cottage of the John Dove Estate in Andover where Jackson was working as gardener. Later photographs of the estate show greenhouses and suggest that the grounds were elaborate. Two sons were born in the gardener's cottage, William Francis on February 10, 1868, and George Walter on March 16, 1870.

In 1869, the first year of President Charles W. Eliot's administration at Harvard University, the Bussey Institution was organized. On March 8, 1871, Francis Parkman, historian and horticulturist, was appointed to the original faculty of the Bussey Institution as Professor of Horticulture. This was the first such position established at any American college or university and came thirty-six years after Benjamin Bussey created, in his will, trusts that would establish a School of Agriculture and Horticulture at Harvard.

Parkman resigned his position at the Bussey Institution at the end of the academic year due to failing health, but he did see the first enrollment of students in September 1871 and oversaw the planning and construction of the greenhouses, one of the first ranges construct-



The greenhouses and headhouse of the Bussey Institution. Jackson and Minnie Dawson and their seven children lived in the apartment over the headhouse from 1871 to 1886. Although Jackson Dawson was employed by the Bussey Institution only from 1871 to 1873, he continued to work at the Bussey greenhouses until the Arboretum constructed its own facility in 1886. During the time he worked in the Bussey greenhouses Dawson grew some plant material for Leopold and Rudolph Blaschka, the artists responsible for the Ware Collection of Glass Flowers at Harvard's Botanical Museum.

ed by Lord and Burnham. Equally important, in September or early October 1871, he hired Jackson Thornton Dawson as Head Gardener.* The Dawsons moved to Jamaica Plain and occupied an apartment over the headhouse of the greenhouses at the Bussey Institution. This was a living arrangement which however satisfactory to the occupants at the time, caused some concern in the minds of their grandchildren, who upon being told that "grandfather lived over the greenhouse," imagined a very precarious situation! A third son, Charles Jackson, was born promptly upon the Dawsons' arrival in Jamaica Plain on October 14, 1871. Over the fifteen years which Jackson and Minnie lived at the Bussey Institution, five additional children were born, James Frederick on January 13, 1873, Bessie Minnie on November 20, 1875 (Bessie lived only a brief time), Minnie

* For an interesting hypothesis concerning Parkman's influence on the selection of a Director for the Arnold Arboretum, see Walter Muir Whitehill, "Francis Parkman as Horticulturist", *Arnoldia* 33(3):169-183.

Motley on March 26, 1878, Laura Blanchard on January 29, 1881, and Henry Sargent on March 24, 1886. The Dawsons often named their children after relatives, but they also included names of family friends. Minnie Motley was named for her mother and the Motleys who were descendants of Benjamin Bussey and lived at Woodland Hill, the original Bussey Estate. Laura Blanchard was named after a prominent family in the area. Henry Sargent probably was named after Charles Sprague Sargent's cousin, Henry Winthrop Sargent.

The year following Dawson's arrival at the Bussey Institution, Charles Sprague Sargent was appointed Director of the Harvard Botanic Garden, a newly created position that included the administration of the Bussey Institution as Professor of Horticulture. In addition, on November 24, 1873, Sargent received his third and ultimate charge as Director of the Arnold Arboretum. Sargent held all three positions concurrently for several years; he was Director of the Garden until 1879 and a professor at the Bussey until 1877. Thirty-two years old when he assumed these responsibilities, Sargent was known for his determination, rather than for his scholastic ability; he had yet to publish a single scientific paper. But Sargent neither allowed an opportunity to pass nor overlooked the merits of any situation, and one of his first official acts as Director of the Arboretum was to hire Jackson Thornton Dawson. Although now officially an Arboretum employee, Dawson continued to work in the greenhouse of the Bussey Institution since the Arboretum did not have a propagation facility and, in fact, existed only as an official document and 120 acres of the Bussey Estate.

By 1874 Sargent estimated that Dawson had propagated "several thousand trees and shrubs" (Sargent, 1874). Mindful of the Arboretum's charge "to grow every tree and shrub capable of withstanding the climate of Massachusetts" and wishing to complement the plants raised from seed sent from all over the world, Sargent turned to the native woody flora of New England to expand the Arboretum's collections. Dawson described his role in this undertaking in an article in a Boston newspaper many years later: "In one year I collected 50,000 native shrubs to plant in the Arboretum. I also collected all the laurels and the yews" (Dawson, ca. 1911). As the Arboretum's first plant collector (Sargent made a collecting trip to California and Nevada in 1878), Dawson centered his collections around eastern Massachusetts. A horse and wagon would be rented, and he would set out for Lynn or Swampscott, Taunton or Plymouth. His records indicate that the North Shore was the location for many of his collections; his trips surely included a visit with his relatives in the area.

The Arnold Arboretum archives contain Dawson's early handwritten accession books. The earliest entry for plants collected by Dawson and still growing at the Arboretum is for several *Ilex verticillata* which he collected in 1872 in Reading, Massachusetts. These

plants are growing in the deciduous holly beds behind the *Aesculus* collection.

Dawson's workload increased as Sargent began to explore and combine his various administrative responsibilities. In 1875 he described his progress in combining activities at the Bussey greenhouses in two separate reports, one as Director of the Arnold Arboretum and one as Director of the Botanic Garden. In the report on the Arboretum he notes that "the Green-houses of the Bussey Institution having been placed at my disposal for uses of the Arboretum, they have been devoted to the raising of forest and ornamental trees and shrubs for future plantations . . . and 165 species have been added to the collection. Probably over 100,000 ligneous plants have been raised during the nine [preceeding] months" (Sargent, 1875b). And in the report on the Botanic Garden he notes that "the department of propagation of the Botanic Garden has been transferred to the Arboretum with excellent results in every way, materials for the botanical classes [held] during the winter, which were formerly raised at the Garden, are now either raised at the Bussey Institution or purchased" (Sargent, 1875a).

When Dawson was not engaged in propagating, raising, or collecting plants, he had the nursery areas to manage and the planting to supervise. Although Sargent always described the nursery plants as being in "excellent" and "flourishing" condition, it was evident that overcrowding had become a serious problem by 1876, and under Dawson's supervision the nurseries were expanded on a yearly basis.

Dawson collected another 2,500 specimens of New England plants during 1877, and as a partial solution to the problem of overcrowding, the policy was adopted that year to "select six of the best specimens of each species, and plant them in the nurseries" (Sargent, 1878). This policy freed excess plant material for the vigorous program of plant distribution accompanying the Arboretum's acquisition drive. To Dawson fell the responsibility of collecting and preparing the plants and packets of seed to be sent to arboreta, botanic gardens, nurseries, and individuals. It was through this interaction that his reputation as a skilled propagator and plantsman began to grow.

Frederick Law Olmsted had been working on a design for both a road system and an arrangement of plantings for the Arboretum since 1878, and when in December 1882 the negotiations between Harvard University and the City of Boston were finally concluded, the actual work of implementing his design began. Until construction of the road system was initiated in 1883, no permanent plantings, except for border plantations, had been attempted, but now plant material grown in the nurseries could be moved into the permanent collections. By 1885 Sargent was able to report that "Trees and shrubs to the number of 2,574 have been moved from the different nurseries into permanent boundary and other plantations" (Sargent, 1886).



1 construction in the Arboretum began in 1883, and the plant families in permanent systematic collection were sited as the road work progressed. Top: photograph, taken in October 1890, shows the area around Lily and Bussey Ponds. Bottom: Construction of the roadway at the Walter Street entrance, 1899. Photographs by the Boston Park Commission.

Sargent intended that native plant material be used along the roadways. By 1886 one third of the road system had been completed, and Dawson was able that year to collect and plant in permanent positions along the completed portions "62,000 shrubs from the woods in different parts of New England" (Sargent, 1887).

Sargent's only interest in the Bussey Institution was in its facilities and staff. His relationship with the Bussey could not have been improved by hiring Charles Edward Faxon in 1882 as his second Arboretum staff member. Faxon, like Dawson, was originally on the Bussey staff, having been an instructor at the Bussey since 1879. Now that the Arboretum was beginning to develop rapidly, the tension between the two institutions must have escalated even further. Although Dawson continued to carry on his work at the Bussey greenhouses long after Sargent's Arboretum office was moved to the nearby Sargent family estate, a description of a new greenhouse for the Arboretum appeared in Sargent's annual report of 1886. At the time Sargent characteristically referred to the new arrangement as an improvement.

A dwelling house, with an acre of ground adjoining the Centre Street entrance, has been taken on a long lease from the Trustees of the Adams Nervine Asylum. A small propagation house, better adapted to the reduced requirements of the Arboretum than the larger houses of the Bussey Institution which have been occupied for this purpose during several years, has been built at this point. The rest of the leased land will be used as a frame yard and nursery: the dwelling house will be occupied by the superintendent of the Arboretum (Sargent, 1887).

Jackson and Minnie Dawson moved in the summer of 1886 to the house at 1090 Centre Street, their home for the remainder of their lives. Plants soon were crowded into every available niche of the new greenhouse, which measured only 50 by 20 feet. "This workshop — this tiny greenhouse," wrote Ernest Henry Wilson, "is the cradle of the Arnold Arboretum, and Jackson Dawson is, and has been from the commencement, not only nurse but foster-father also" (Wilson 1916a).

Dawson's knowledge of plants was uncanny. Often working with material that would be brought into cultivation for the first time through his efforts, his successes were legendary. Charles Sargent doubted there could be any problem in propagation that Dawson could not overcome and considered no one superior to him in ability. In 1882 Dr. Emil Bretschneider, physician to the Russian Legation at Peking, sent to the Arboretum its first wild-collected seed of Asiatic plants. Bretschneider had also sent in 1879, 1880, and 1881 similar collections of north China plants to the Royal Botanic Gardens, Kew, the Museum d'Histoire Naturelle, Paris, and the Imperial Botanic



1090 Centre Street, the Dawsons' home and the site of the Arboretum's first greenhouse and nursery area, was leased from the Trustees of the Adams Nervine Asylum by the Arboretum in 1886. The property has a long history of ownership. A deed dated January 4, 1769, describes the original farm as "situated on both sides of the road leading from the Jamaica Plain Meeting House, so called, to Dedham". Later deeds recording divisions of the property are dated 1806, 1872, and 1877. In 1882 Annie May Glover conveyed her parcel, now containing 1090 Centre Street, to the Adams Nervine Asylum. Top: This photograph of 1090 Centre Street was taken by Jackson Dawson's son, William, around 1900 and shows on the doorstep one in the possession of brown collies that were Jackson's constant companions. Bottom: This photograph, taken in 1900 or earlier, shows the view from the second floor of the house looking toward the Bussey Institution. Photographer unknown.



An undated group photograph taken by William Dawson in the greenhouse at 1090 Centre Street. The envelope for the glass plate negative lists the members of the group, from left to right, as "Father, Wm. Dawkins, Charlie, Martin Daly, Harry and Gus Gilman." From archival records at the Arboretum, Martin Daly can be identified as Dawson's assistant. Gus Gilman, the man in uniform, was the member of the Boston Police Force permanently assigned to patrol the Arboretum. Dawson's grandchildren, Charles William Dawson and Frances Dawson White, recall that Patrolman Gilman was stationed at the Arboretum for many years and rigorously enforced the Park Department's rules, particularly the one that forbids the picking of flowers. Charlie is Charles Jackson Dawson, who by the time this picture was taken may have already established the family nursery business, Eastern Nurseries. Harry is Henry Sargent Dawson, the youngest of the Dawson children, who later took over the management of Eastern Nurseries. William Dawkins cannot be identified.

Gardens, St. Petersburg (Leningrad). The three institutions were successful in germinating most of the seeds received, but in England and France all attempts with the oaks failed. Dawson was able to propagate almost all of the seed including *Quercus dentata* and *Quercus variabilis*. On October 15, 1882, Bretschneider wrote to Sargent, "I am glad to hear that the acorns I sent you last autumn have germinated, and I accept your kind proposal to forward a few specimens of the young plants to Europe. I have several times sent acorns to Paris and London. They have never germinated" (Bretschneider, 1882). How pleased Sargent must have been to supply this material! The Bretschneider collection represented 91 different genera; Dawson was able to propagate all but 6, and 18 of the original Bretschneider plants (or propagants from the plants), including the two oaks, are still growing at the Arnold Arboretum.

Dawson delighted in his profession; he loved plants, and he loved to share his knowledge with the hundreds of plantsmen who came from all over the world to visit with him in his greenhouse or to

walk with him through the Arboretum. Ernest Henry Wilson and Jackson Dawson were both colleagues and friends. The one letter in the Arnold Arboretum archives written by Dawson is to Wilson in China. Wilson first met Dawson on a Sunday afternoon, April 8, 1899, seven years before he began his plant collecting for the Arboretum. "My first knock at the door of his home was answered by his hearty 'come right in.' . . . the few days I spent in the Arnold Arboretum in Jackson Dawson's company were more than ordinarily profitable to me. He, in that generous way of his, showed me all over the establishment and I was astonished and bewildered at what I saw, more especially at the size of the shrubs and trees raised from seeds, cuttings or grafts by the skilled craftsman who was my guide" (Sargent, *et. al.*, 1916). It would be impossible to reconstruct fully the conversations between Dawson and his visitors during their walks, but Wilson once described Dawson commenting on the different plants in the collections:

"This plant came from —, this was raised from seeds which came from Dakota or from the White Mountains, that from seeds collected by Bretschneider in China or by Sargent in Japan; this is a grafted plant, and that is from a cutting received from — in — . . ." (Wilson, 1916a).

Dawson shared his knowledge of plants in other ways, and anything calculated to further genuine interest in horticulture was sure to find ready support from him. He became a member of the Massachusetts Horticultural Society in 1872 and was actively interested in its work throughout his life, serving as a member of several committees and publishing papers in the Society's publications. By 1885 he was no longer "a young gardener of Cambridge", but an established plantsman able to speak with authority on the art of plant propagation. On March 7 of that year he lectured on the "Propagation of Trees and Shrubs from Seed". The lecture was published in the *Transactions of the Massachusetts Horticultural Society for the Year 1885* and was considered so valuable a paper that it was reprinted 39 years later in the *Year Book of the Massachusetts Horticultural Society* (Benson, 1929). In 1894 Dawson spoke at the Massachusetts Horticultural Society on budding and grafting; according to Albert Benson, "after the lecture many of his hearers gathered about him . . . the scene was a master with his disciples" (Benson, 1929). Dawson lectured again in 1909 on "The Different Methods of Propagation of Plants".

Dawson was one of the original 120 members of the Gardeners' and Florists' Club of Boston and was elected president of the club in 1893, six years after its founding. The object of the club, described in typical Victorian terms, was "to unite the individual interests in horticulture, that they may better lift up and carry forward all that tends to advance the interests of its members" (The Gardeners' and



This lovely photograph is another example of William Dawson's work. His comment on the negative envelope describes the photograph as "the first picture of the original Dawson rose". Jackson Dawson described his rose in 1911 in the magazine Count Life in America: "I obtained the Dawson rose in 1883 . . . It grew about nine feet high, spread fifteen or twenty feet, and was covered with thousands of flowers the early part of June" (Dawson, 1911).

lorists' Club of Boston, 1893). Dawson was also, for a number of years, a member of the Society of American Florists and served on the executive committee of the Society from 1895 through 1897. On September 6, 1911, the Horticultural Club of Boston held its first meeting. Jackson Dawson was one of the original 20 charter members. In a printed program for the 300th meeting of the Club on May 1, 1951, these early members were described as "the horticultural giants of their day . . . those whose names are written in capital letters in the annals of horticulture" (Bromfield, 1951).

In the early 1900's there was some controversy among committee members at the Massachusetts Horticultural Society concerning the awarding of cultivation prizes. The problem had troubled the prize committee before. Who was to be given the prize, the estate owner or the gardener? The decision was made to publish the names of both in the Society's *Transactions*. In 1909 George Robert White, a Boston philanthropist and an influential member of the Massachusetts Horticultural Society, gave the Society \$2,500, the interest from which each year was to be used to award a gold medal "to the man or woman, commercial firm or institution that has done the most during the year to advance the interest in Horticulture in its broadest sense" (Benson, 1929). In 1910, the first year the medal was awarded, it went by unanimous vote to Charles Sprague Sargent, estate owner, horticulturist, and Director of the Arnold Arboretum. The following year it was awarded to Jackson Thornton Dawson, gardener, plantsman, and Propagator of the Arnold Arboretum.

In addition to his work as a plant propagator, Dawson's hobby or avocation (he called it his by-play) was rose hybridization. He played an important part in the production of a new race of roses of American character, the ramblers, and between 1894 and 1909 won nine silver medals for his roses from the Massachusetts Horticultural Society.

Dawson described how he began to work with roses in the June 5, 1911, issue of *Country Life in America*, a popular periodical of the era. The issue was entitled the *Rose Lovers Number*. Charles Sprague Sargent was the consulting editor, and the two lead articles were written by Sargent and Dawson. The cover illustration was a watercolor of the Sargent rose, painted by George W. Dawson, Jackson's second son. Jackson Dawson noted that he "began hybridizing roses in the early eighties . . . with the white-flowered variety of [*Rosa*] multiflora. I made my first cross with multiflora and General Jacqueminot [a famous old hybrid rose introduced in 1852, dark crimson in color] . . . Of course I hoped to get double or semi-double roses, and I also wished to retain the hardiness and climbing habit of multiflora. At first I failed, but at last a break was made and all sorts of forms were secured. As usual, most of them were worthless" (Dawson, 1911). At a meeting of the Horticultural Club of Boston on February 4, 1914, Dawson revealed that it took three years

to get the first color break. Dawson worked primarily with three species roses introduced to America late in the 19th century, *Rosa multiflora* from Japan, *Rosa rugosa* from Japan, Korea, and eastern Siberia, and *Rosa wichuraiana*, another Japanese species. His first success was a tall hardy climber with bright rose-pink blooms appropriately named 'Dawson'. Other Dawson hybrids included 'Minnie Dawson', 'Daybreak', 'Arnoldiana', 'W. C. Egan', 'Crimson Rambler', 'Farquhar', 'Sargent', and 'Lady Duncan'. Jackson Dawson frequently named his roses, as he had his children, after friends.

Both Francis Parkman and Charles Sprague Sargent were rose fanciers and surely influenced Dawson. As early as 1874, entries in Parkman's garden diaries record conversations with Dawson about the proper method for handling rose cuttings and successful watering techniques. According to Walter Muir Whitehill, Parkman "is said to have had at one time over a thousand varieties" of roses in his garden near Jamaica Pond which, due to his arthritis, he often tended from a wheelchair (Whitehill, 1973). "One of my dreams" is how Sargent described his ambition to have an extensive collection of hybrid roses at the Arboretum. In a letter to J. H. McFarland, editor of *The American Rose Annual*, Sargent even suggested that some wealthy person might come forward and aid in establishing such a collection and thus "perpetuate his name in the world of horticulture for at least a thousand years" (McFarland, 1917).

Jackson and Minnie Dawson's children must have been a source of great pride to them. The wide range of talents and interests in their children's lives attest to a sensitive upbringing and to the influence of a father dedicated to propagating and hybridizing plants, an influence reinforced by uncles who were nurserymen and florists. Surrounded by plants at the Dove Estate, the Bussey Institution, and the Arboretum, it was natural the Dawson children would develop interests and choose careers that included plants and the landscape, careers not only in horticulture and the nursery trade, but in botany, landscape architecture, photography, and painting.

The oldest child, William, spent the summer of 1880 employed as an office boy by the Arboretum. He worked under the direction of John Robinson, who was in charge of the herbarium at Dwight House, a cottage on the grounds of Holm Lea, the Sargent family estate in Brookline. Dwight House held the herbarium, library, and Director's office until 1892, when Horatio Hollis Hunnewell donated funds for the construction of a building on the Arboretum grounds. Although William Dawson eventually chose engineering as a profession, a choice that branded him by the family as somewhat of a renegade, he had as an avocation the study of photography. His subject matter was often nature, particularly landscapes. Through the generosity of his family, the Arboretum has some of William's glass plate negatives. Several of his photographs appear in this article.

George, the Dawson's second child, attended the Massachusetts



Minnie, Harry (locks unshorn), and Laura Dawson photographed in the greenhouse by their oldest brother William about 1891. The greenhouse was small, and pictures were taken just inside the door with the subjects posed against the first bench. As adults, these three Dawson children each managed Eastern Nurseries.

Normal Art School, now the Massachusetts College of Art, and graduated in 1893. He continued his studies at the Pennsylvania Academy of Fine Arts and became an Instructor in Instrumental Drawing at the University of Pennsylvania in the fall of 1893. By 1911 he was Professor of Freehand Drawing and Watercolor, and in 1921 the University awarded him an honorary degree of Doctor of Fine Arts. Well known as a painter in watercolor of gardens, landscapes, and flowers, his knowledge of plants eventually led to his designing gardens and teaching landscape design.

Charles, the third son, attended classes at the Bussey Institution and worked there as a gardener in 1895. In 1901 he incorporated Eastern Nurseries, using 1090 Centre Street, the family home, as a business address. Originally some of the land at Centre Street was used as a nursery, but soon after the business became established, the plants were grown in Holliston, Massachusetts. On the cover of the nursery's first catalog, published in 1901, M. M. Dawson was listed as manager. Minnie Dawson remained manager of the business



Two of George Walter Dawson's paintings done while he was still a student at the Massachusetts Normal Art School. Both were painted in the Arboretum. The house in the top picture probably is 383 South Street. George was one of the founders of the Philadelphia Watercolor Club and was its president for twenty-five years. He designed gardens in Pennsylvania and Massachusetts. Charles Jackson Dawson and Frances Dawson White generously allowed us to photograph the original paintings



A portrait of the Dawson family taken on Labor Day weekend, 1901. First row, left to right: Jackson Thornton Dawson (1841-1916); Mary Elizabeth Dawson (on Jackson's lap), the daughter of William Francis and Julia Hoffman Dawson; Mary McKenna (Minnie) Dawson (1842-1902). Second row, left to right: Minnie Motley Dawson (1878-1922); Julia Hoffman Dawson, the wife of William Francis Dawson (1871-1954); Henry Sargent (Harry) Dawson (1886-1938); William Francis Dawson (1868-1939); Laura Blanchard Dawson (1881-1930). Third row, left to right: James Frederick (Fred) Dawson (1873-1941); Charles Jackson (Charlie) Dawson (1871-1902); George Walter (Walt) Dawson (1870-1938). Not included is Bessie Minnie Dawson, who died soon after her birth in 1875. Photograph by W. Dawson.

for many years. In the beginning she was assisted at times by Laura Dawson. Eventually, Henry Dawson and his wife Pauline joined them. Although Charles died in 1902, the nursery remained in the family until 1974. George designed a display garden adjacent to the nursery and lived there during the summer months, and Laura moved to a house at the nursery after the death of her father.

James, the fourth son, became a landscape architect. He studied landscape architecture at the Bussey Institution, receiving his degree with the Harvard class of 1896, and joined the office of Olmsted, Olmsted, and Eliot. He became an associate of the firm in 1906 and a full partner in 1922. After James's death, Frederick Law Olmsted, Jr., noted that "the design of public parks and park systems enlisted . . . much of [James's] effort and even more of his enthusiasm" (Olmsted, 1941). James is credited as principal designer of a great many projects of Olmsted, Olmsted, and Eliot, and the park systems he worked on included the Seattle and Spokane Park Systems in Washington, the Essex and Union County Parks in New Jersey, the Louis-

ville Parks in Kentucky, and Fort Tyron Park in New York. Among many other projects, he also designed the arboretum at the University of Washington in Seattle.

Both Minnie and Laura Dawson attended Girls' Latin School. Laura went on to Radcliffe College and immediately after graduating in 1903, became a resident instructor at Lowthrope, a school of landscape architecture for women. The school, located in Groton, Massachusetts, had been founded in 1901 by Mrs. Edward Gilchrist Low.* Laura considered teaching her most important accomplishment. She described Lowthrope as having "grown . . . from a trembling vision with one student, to a substantial professional school of first rank" (Dawson, 1928). This opinion was shared by Charles W. Eliot, who wrote in 1916 that "Lowthrope is the best place I know for training women to be landscape architects" (Cogswell, [undated]). In 1946 Lowthrope, along with some of its faculty, students, and equipment, was taken over by the Rhode Island School of Design.

Mary Dawson died in 1902, leaving Jackson with only Minnie and Laura at home. When Laura's sister, Minnie, married Harold Hill Blossom, a landscape architect who worked for a time with James Dawson at Olmsted, Olmsted, and Eliot and taught at the Lowthrope School, Laura assumed more responsibility for both the family business and the care of her father. Although only Laura and Jackson lived at 1090 Centre Street, it was the site of many family gatherings. The Arboretum archives contain an account of a Dawson Christmas written by William Judd, then newly employed by the Arnold Arboretum. The year was 1913, when Jackson was 72 and the Dawson children all long past childhood. However, the Christmas gathering was perhaps particularly festive since it also was an occasion to greet a new family member, Hazel Lease, James's new wife. Judd's diary describes the scene:

Then came my first Christmas away from England & it certainly felt strange, but still I found I possessed some good friends which certainly took the feeling away a good deal. Mr. Dawson was good enough to ask me to spend the day with him, which I gladly accepted. We enjoyed a capital New England Xmas dinner partaken of by about twenty persons at four o'clock. Several of his children & also Mr. & Mrs. Wilson were there. There was lots of good things to eat & drink, including turkey, "grape fruit," & champagne. The table looked very cheerful lit with candles, & the large logs blazing brightly on the open door fireplace, gave

* Mrs. Low is described in a Lowthrope pamphlet as "the great granddaughter of the founder of the Bussey Institute" (Cogswell, [undated]). Presumably she was a descendent of Benjamin Bussey.

it a wonderful appearance of Xmas. Almost all the candles were extinguished when the plum pudding was fired & everybody was happy. After dinner several more friends turned up & we spent a very enjoyable evening with music, etc. & moreover there were presents for everybody & the old gentleman gave me a nicely illustrated book on the "Wildflowers of N. America" by Mathews (Judd, 1912-1915).

According to custom, the newest member of the family was served the plum pudding first, and in order to insure good luck "the pudding must be aflame when she received it" (White, 1980). Francis White, Jackson's oldest grandchild, remembers her grandfather was quite liberal in his pouring to accomplish this feat.

The next major passage in William Judd's diary about Mr. Dawson was written almost three years later.

Today Aug. 5. 1916 Mr. Dawson was buried having died on Thursday Aug. 3. about 3 o'clock in the afternoon. His illness has lasted since last April, & he has done no work since that time. There was a large number of people at his funeral service today at St. Johns Episcopal Church, Jamaica Plain, at 12.30 pm. after which the body was buried at Andover. Mass. at Christ Church. In his death the world loses a very skillful & celebrated gardener & one who will be hardly replaced (Judd, 1915-1921).

On Wednesday, August 9, 1916, William Judd wrote in his diary:

Prof. Sargent came to see me & gave me to understand I was to succeed Mr. Dawson as propagator of the trees & shrubs for the Arnold Arboretum. . . . If I ever become so skillful a propagator as Mr. Dawson I shall feel more than satisfied with myself (Judd, 1915-1921).

After Jackson Dawson's death the Horticultural Club of Boston appointed a committee to plan a suitable memorial. The committee wanted the memorial to reach beyond the limits of the Club and published a subscription announcement that described their intentions and enlisted the support of "all who appreciated the man and his great work" (Roland, [undated]). The committee noted that it hoped to receive "small sums, particularly . . . since his friends are everywhere throughout this country and . . . everyone of them will want to contribute something" (Wilson, 1920). The Club raised three thousand dollars and placed the amount with the Trustees of the Massachusetts Horticultural Society. The interest was "to be used for prizes, lectures and medals, or, as the trustees may direct" ([Roland], 1924). In 1927 the Society established the Jackson Dawson Memorial Medal, awarded by vote of the Trustees "for skill in the science

and practice of hybridization and propagation of hardy woody plants" (Benson, 1929).

The tributes written in 1916 in memory of Jackson Dawson are filled with the fulsome praise that characterized the memorials of the period. He was described as "The Walt Whitman of Horticulture" ([*Horticulture*], 1916) and "One of the world's greatest gardeners" (*Boston Globe*, 1916). However, the theme that occurred most often was that Jackson Dawson was a man loved and respected for his personality as well as his ability, a man who left a living legacy of beautiful things to all.

Charles Sprague Sargent wrote in his annual report of 1917 a memorial to Dawson's work. "Dawson brought to the Arboretum industry, intelligence, imagination and entire devotion, and much of its success is due to his labors" (Sargent, 1918).

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Jackson Dawson had a most genial, straightforward temperament. His was a nature impressibly and perennially kindly. To his intimates he extended a strength and depth of friendship of profound intensity, and it begat like friendship in return. To know him was to love him, and to love him dearly. He was a good citizen, a most desirable neighbor, a priceless friend and the dearest father; a sturdy, upstanding, hole-souled man, every inch of him" (Mische [President of the American Association of Park Superintendents], 1916). Photographer unknown.

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The Bladdernuts

by RICHARD E. WEAVER, JR.

The month of May is the peak of bloom for woody plants in New England. The majority of azaleas, lilacs, magnolias, crabapples, and other favorite and familiar trees and shrubs bloom during the month, and they provide such a spectacular display that many other fine but less showy ornamental plants are often overlooked. A good example of these neglected ornamentals are the bladdernuts, the genus *Staphylea*. The seven to ten species are shrubs or small trees with white to pink, often fragrant flowers borne in drooping to pendent panicles in mid-May. The flowers of all the species are distinctly charming, but unlike those of crabapples or magnolias, must be viewed close at hand to be appreciated. The flowers are followed by curious papery, bladderlike fruits with very hard, nutlike seeds, which are ornamental through the summer and the fall, somewhat compensating for the lack of good autumn foliage color. All the species are woodland plants so they grow and flower well in full deciduous shade. They will succeed in any good, well-drained soil; they have no major insect pests; and the truly hardy species require minimal maintenance, looking their best with very occasional removal of the oldest stems. Admittedly, some of the species will re-

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The hybrid *Staphylea* × *coulombieri* usually bears both two-celled capsules as in *pinnata* and three-celled capsules as in *S. colchica*. Photograph by R. E. Weaver, Jr.



A young plant of *Staphylea pinnata* in the Arnold Arboretum. The conspicuous fruits, even while immature as in this photograph, are nearly as ornamental as the flowers. Photograph by R. E. Weaver, Jr.

main curiosities, cultivated in arboreta or botanic gardens for their botanical interest. But several are first-rate ornamentals and deserve to be cultivated more widely. Unfortunately, none of the species are readily available commercially at present. It is hoped this article will stimulate some interest among nurserymen, encouraging them at least to test the potential of these plants as ornamentals.

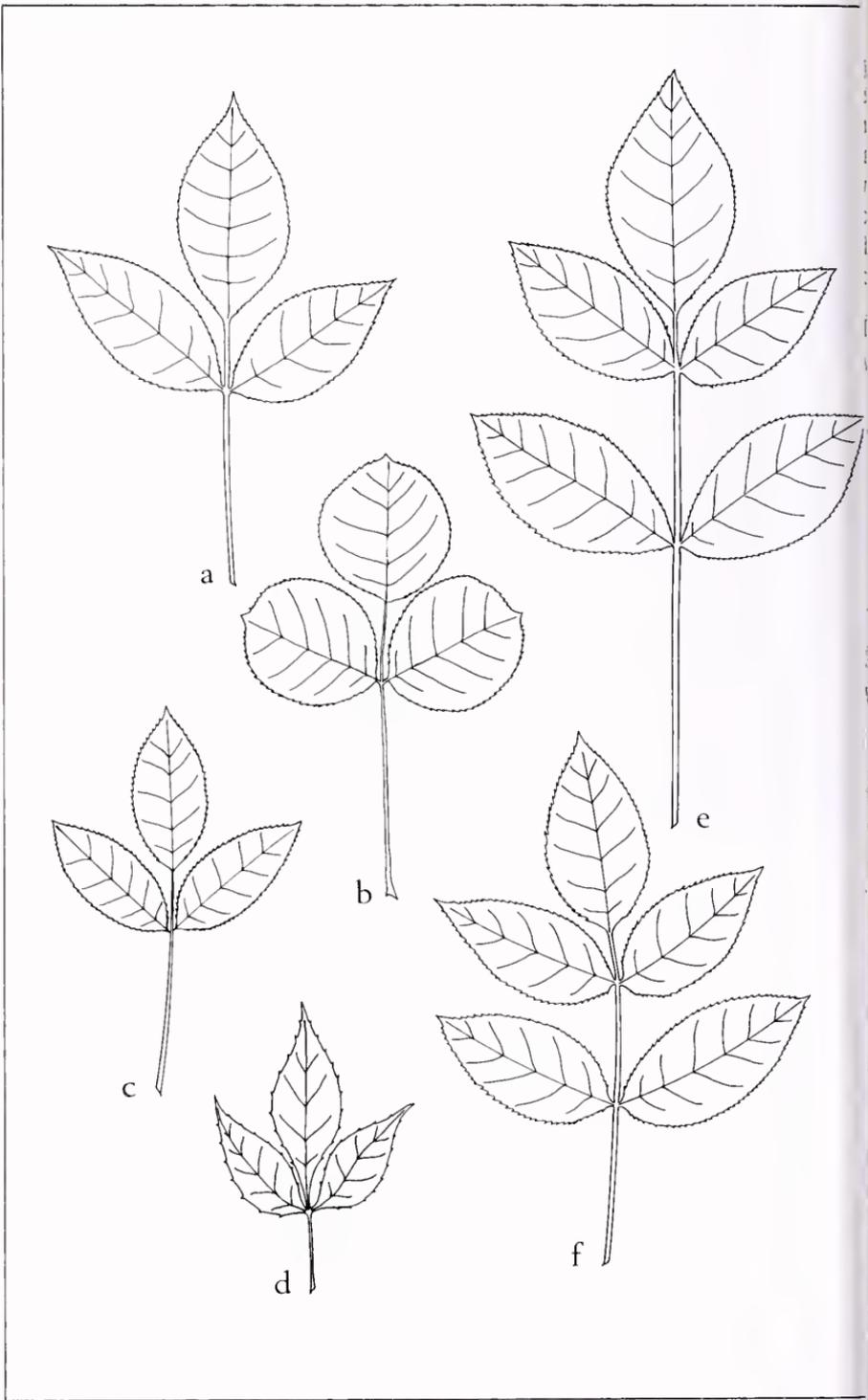
Staphylea is the type genus of the small family Staphyleaceae. The largest genus, *Turpinia*, is widely distributed through both the Old and New World tropics. Another genus, *Euscaphis*, with its single species *E. japonica* distributed in Japan, Korea, and China, is occasionally cultivated, but is not quite hardy at the Arnold Arboretum. *Staphylea* itself has a classic Arcto-Tertiary distribution. Plants with such a distribution pattern were once more or less continuously distributed across the entire North Temperate Zone. With time their ranges became restricted to several discrete and widely separated areas within that vast expanse: southeastern United States,



A flowering branch of *Staphylea pinnata*, showing the pendent inflorescence and the roundish, pearl-like flowers typical of this species. Photograph by R. E. Weaver, Jr.

western United States, eastern temperate Asia, the Himalaya Mountains, the Caucasus Mountains, and central Europe. At present one or two species of *Staphylea* are native in each of these areas.

The species of *Staphylea* are weakly to strongly stoloniferous shrubs with numerous arching, sparsely branched stems. In the wild they tend to be loose and unkempt, but in cultivation form attractive, vase-shaped shrubs. A few species occasionally grow to be small trees. The leaves are deciduous and opposite, as in the hardy members of the closely related maple family, and compound with finely serrate leaflets. The leaves of most species are trifoliolate, with three leaflets, but two species have pinnately compound leaves with five to seven leaflets at least on the non-flowering shoots. The flowers appear mostly with the leaves in more or less erect but usually drooping to pendent racemes or panicles. The flowers are perfect with five sepals, rarely fused at their bases and often nearly as long as the five free, white to pink petals; five stamens; and a two- to three-parted pistil



Leaves of the various *Staphylea* species. (a) *S. trifolia*; (b) *S. bolanderi*; (c) *holocarpa*; (d) *S. bumalda*; (e) *S. colchica*; (f) *S. pinnata*. Drawings by J. Hicl

with as many separate styles. The base of the superior ovary is surrounded by a fleshy, nectar-secreting disklike gland. The common name of the genus is derived from the unique fruits, which are actually papery, inflated, bladder-like, two- to three-celled capsules, with a few large, nutlike seeds with lustrous and extremely hard seed coats in each cell at maturity. The fruits develop rapidly after the flowers fade, and they persist into the fall or early winter, providing ornament for a long period of time.

Key to the Identification of the Cultivated Species of *Staphylea*

- A. Leaves with 3 leaflets.
 - B. Terminal leaflets and panicles usually sessile (stalkless); fruits 2-parted, flattened. 5. *S. bumalda*.
 - B. Terminal leaflets and panicles on long slender stalks; fruits 3-parted, inflated.
 - C. Panicles appearing before the leaves from lateral buds on year-old wood; fruits unlobed at apex. 4. *S. holocarpa*.
 - C. Panicles appearing with the leaves on short, lateral, leafy branchlets; fruits 3-lobed at apex.
 - D. Leaflets typically nearly round in outline; stamens conspicuously projecting beyond the petals. 2. *S. bolanderi*.
 - D. Leaflets typically oval in outline; stamens more or less enclosed by the petals.
 - E. Plants usually shrubby; flowers less than ½ inch long; fruits less than 1½ inches long at maturity. 1. *S. trifolia*.
 - E. Plants usually treelike; flowers about ½ inch long; fruits usually more than 2 inches long at maturity. 3. *S. emodii*.
- A. Leaves with 5–7 leaflets or with only 3 leaflets on the flowering shoots.
 - F. Panicles horizontal to slightly drooping; flowers with the fragrance of orange blossoms; sepals widely spreading, exposing the petals, which form a “tube” around the stamens; fruits more or less pear-shaped, longer than broad, becoming brittle and shedding their seeds while still attached to the plants.
 - G. Flowers pure white; leaves on flowering branchlets with 3 leaflets; fruits usually 3-parted. 6. *S. colchica*.
 - G. Flowers white, but the sepals tinged purple at their tips; leaves on flowering branchlets with 3–5 leaflets; fruits usually 2-parted. 7. *S. × coulombieri*.
 - F. Panicles pendent, hanging vertically; flowers with a faint spicy fragrance; sepals spreading only at their tips, more or less enclosing the petals; fruits more or less globular, about as long as broad, remaining soft and pliable and falling from the plants with the seeds still enclosed. 8. *S. pinnata*.

1. *Staphylea trifolia* Linnaeus

Our native bladdernut, *Staphylea trifolia*, is widely distributed in eastern North America from southern Canada to the northern Gulf states and eastward from the Mississippi Valley, but it has always been one of our lesser known native shrubs. There does not appear

to be any folklore associated with it, nor have references been located documenting its use by the American Indians. Finding it in the wild has always been exciting for me, perhaps because it often is an indicator of rich forests with an interesting and varied flora. It usually grows as an understory shrub, often forming dense colonies as a result of root suckering, but it occasionally grows to be treelike. The largest known individual, growing near Utica, Michigan, is thirty-six feet tall with a trunk circumference of nineteen inches. In cultivation it forms a graceful, vase-shaped shrub with numerous arching stems up to twelve to fifteen feet tall.

Like the majority of *Staphylea* species, *S. trifolia* has trifoliolate leaves. The three typically oval leaflets taper abruptly to a slender point, and their margins are finely and regularly serrate. They may be as much as four inches long when mature, and they are thinly covered on their undersides with fine hairs. The terminal leaflet is borne on a long, slender stalk, but the lateral leaflets are often nearly sessile (stalkless). The odorless flowers are borne in drooping panicles one to three inches long at the tips of short lateral branches and appear in mid-May at the Arnold Arboretum. The individual flowers are less than a half inch long. The white petals barely project beyond the sepals, and the effect is basically greenish. Also, since the flowers appear with the developing leaves and are partially obscured by them, *S. trifolia* is one of the least showy of the species in bloom. However, the three-parted, inflated fruits are borne profusely, and they persist on the plants well into the winter, longer than do those of most of the other species.

In 1918 a second eastern American species, *Staphylea brighamii*, was described from plants first noticed in a garden in Toledo, Ohio, but grown from locally collected stock. These plants differed from typical *S. trifolia* in a few technical characters, but also in having pink to maroon tinted fruits borne in profusion. Most taxonomists now agree that these differences are not of enough significance to consider *S. brighamii* a distinct species. However, selection of similar plants or of plants with particularly large flowers could produce better garden plants than those presently in cultivation.

A number of plant species native to the eastern United States including sweetgum (*Liquidambar styraciflua*), witch hazel (*Hamamelis virginiana*), partridgeberry (*Mitchella repens*), etc., have disjunct populations in the mountains of Mexico, separated from the main body of the species by 500 miles or more. These Mexican populations often differ from the eastern United States populations in a variety of characteristics and in many instances have been classified by some taxonomists as distinct varieties or even distinct species. *Staphylea pringlei* from the Sierra Madre of northern Mexico closely resembles *S. trifolia* except that its fruits are nearly round in outline rather than oval, its seeds larger, and its panicles of flowers usually longer and broader. These differences appear to be significant, but



A flowering branch of *Staphylea trifolia*. Although this species is normally quite floriferous, it is not showy because its flowers are mostly greenish and obscured by the leaves. Photograph by R. E. Weaver, Jr.

probably only enough to consider the Mexican plants a variety of *S. trifolia*. We have never attempted to grow the Mexican plants at the Arnold Arboretum, but considering the hardiness of *Pinus ayacahuite* (the Mexican white pine) from the same area (see *Arnoldia* 39(4):278-285), they might succeed here.

2. *Staphylea bolanderi* A. Gray

The Sierra bladdernut, *Staphylea bolanderi*, is an uncommon shrub or small tree to twenty feet tall that occurs sporadically along the western slope of California's Sierra Nevada at elevations between 2000 and 4000 feet. It is closely related to *S. trifolia* and is quite similar to that species in most respects. However, the leaflets of *S. bolanderi* are generally almost round rather than oval, and the stamens project conspicuously beyond the petals rather than being essentially enclosed by them. Like *S. trifolia*, *S. bolanderi* is rare in cultivation. We have tried the western species a number of times at

the Arnold Arboretum, but it has never survived for more than a few years even though Rehder lists it as being marginally hardy in Zone 5. In general, most other plants that grow within its native range are not hardy in New England.

3. *Staphylea emodii* Wallich

Staphylea emodii is distributed in the Himalayas of Pakistan, Nepal, and India at elevations between 7,000 and 10,000 feet. Although it was introduced into cultivation about 1890, it has never been commonly planted. It is very similar to *S. trifolia*, but it is larger in all respects: leaflets, flowers, fruits, and growth habit. Its common name in India means "snake stick." Several features may have given rise to the name: the bark is reported to be mottled, resembling a snake's skin; the straight branches are used for walking sticks and possibly for physically repelling snakes encountered in the field; and the odor of the cut branches reputedly is offensive to snakes, a single branch being sufficient, it is claimed, to keep a home free from them.

Rehder lists *Staphylea emodii* as being hardy to Zone 7. It has never survived out-of-doors at the Arnold Arboretum and to my knowledge is not cultivated in this country.

4. *Staphylea holocarpa* Hemsley

China is the home of several *Staphylea* species, the best known being *S. holocarpa*. This species was discovered by Augustine Henry in 1886, but it was not introduced into cultivation until E. H. Wilson sent seed to the Arnold Arboretum from western Hupeh in 1908. Wilson noted that it was very common on the margins of woods and thickets in western Hupeh and eastern Szechwan and that it was normally a large shrub, but occasionally grew to be a tree thirty feet tall with smooth gray bark. In unpublished notes he wrote that the plants are extremely floriferous and the flowers sweetly fragrant. The abundant nectar is much appreciated by sunbirds, the brilliantly colored Old World counterparts of hummingbirds. In the same notes Wilson commented that this species is one of the finest small trees he introduced from China. Yet the plant is extremely rare in cultivation in the United States.

Wilson recorded that the original plants at the Arnold Arboretum took several years to adjust to the New England climate and were slow to flower. The first flowering occurred in 1926 when the plants were seventeen years old. Few plants persisted for any length of time. The last remaining plant (actually a propagant from one of the original plants) was killed to the ground during the winter of 1933-1934. It recovered and was eventually moved when the *Staphylea* collection was consolidated in its present location across Conifer Path from the old dwarf conifers. The plant since has died, but our records do not say when or how. Therefore, except for some recently-germinated seedlings from various sources, we no longer have *S.*



N. Moxon & J. C. B.

Saphylea holocarpa from Curtis's Botanical Magazine (151(1925):t. 9074).
 floral details are shown in the inset drawings in the lower right. Inset 9 (upper
 ft) shows the distinctive capsule of the species with its unlobed apex. Permis-
 sion to reproduce this illustration granted by Curtis's Botanical Magazine and the
 entham-Moxon Trust.

holocarpa in our living collections. Fortunately, the seeds collected by Wilson in 1908 were widely distributed, and several plants grown from those seeds are still alive in the British Isles. Wilson noted that in 1929 the finest specimen was the one at Caerhays Castle in Cornwall, England, and that it was twenty-one feet tall at that time. According to our latest reports, the tree is still alive and magnificent and when last measured in 1966, was twenty-nine feet tall. We hope to procure propagating material from this plant as well as from other of the many original Wilson plants still growing at Caerhays Castle.

I have never seen a living specimen of *Staphylea holocarpa*, but illustrations and herbarium specimens show it to be indeed beautiful. Vegetatively, it is similar to *S. trifolia*, but its leaflets tend to be narrower. However, unlike all other members of the genus, the drooping panicles appear before the leaves from lateral buds on year-old growth. Since they are not obscured by the leaves, the flowers are shown to better advantage than are those of the other species. The panicles are from two to four inches long, and they are produced profusely. The individual flowers are about a half inch long and vary in color from white to pink. Wilson and Alfred Rehder described the pink-flowered plants as the variety *rosea*, but as Wilson later admitted in unpublished notes that the color variation is continuous from pure white through shades of pink, the recognition of a distinct pink-flowered variety is unwarranted.

The fruits of *Staphylea holocarpa* are unusual in that the tips of the three segments are united rather than free and spreading as in the other species. This character is not completely constant, but there are too few herbarium specimens available to assess the significance of this variation from a taxonomic standpoint.

Several other species, superficially similar to *Staphylea holocarpa*, have been described from China. However, as far as I know, they have never been in cultivation so they will not be treated here.

5. *Staphylea bumalda* de Candolle

Staphylea bumalda is the most distinctive of the trifoliolate species and in fact has been classified as the sole member of a separate genus *Bumalda*. It differs from all the other species of *Staphylea* in having a fruit which is flattened rather than inflated. In addition, the base of the terminal leaflet is drawn out into a long tapering point which ends where the lateral leaflets are attached. In all the other species the terminal leaflet is borne on a distinct stalk. The inflorescence of *S. bumalda* is also sessile (stalkless) with the lower-most branches originating in the axils of the subtending pair of leaves.

Native throughout Japan and into Korea and eastern China, *Staphylea bumalda* is a rather weedy plant in the wild. It is most common in thickets, cut-over forests, and other disturbed areas. As a cultivated plant, it is similar to the other species in habit, but is not completely hardy here at the Arnold Arboretum. Our plants experi-



Top: A flowering branch of *Staphylea bumalda*. This species is unusual in that even the flower stalks are white, as is evident in this photograph. Bottom: The samaras of *S. bumalda*, shown here from two different angles, are flattened rather than inflated as in the other members of the genus. Photographs by R. E. Waver, Jr.



An inflorescence of Staphylea colchica. The relatively large flowers, with a fragrance reminiscent of orange blossoms, help make this species one of the most attractive of the bladdernuts when in bloom. Photograph by R. E. Weaver, Jr.



The large, pear-shaped capsules of Staphylea colchica, with their long, slender tips are distinctive and conspicuous. Photograph by R. E. Weaver, Jr.

ence considerable dieback during most winters; as a result, they are a bit unkempt in the spring and require a good bit of annual pruning. The leaflets are seldom more than three inches long, and the foliage as a result is delicately textured. The individual flowers are slightly fragrant, pure white (including the sepals), and rather small, but they are borne in broad, more or less horizontal panicles while the leaves are not very well developed. Therefore a plant in good bloom is reasonably showy. However, the fruits are small and probably the least attractive in the genus.

6. *Staphylea colchica* Steven

Staphylea colchica has a limited distribution in forests at elevations to 4000 feet in the Caucasus Mountains of the southeastern U.S.S.R. and adjacent Iran. It is certainly among the most ornamental of the species although it occasionally suffers some winter dieback at the Arnold Arboretum. The $\frac{3}{4}$ inch long flowers are the largest

in the genus, and they have a fragrance strongly reminiscent of orange blossoms. At a glance, they also resemble the flowers of citrus in appearance: the white, widely spreading sepals (= petals in citrus) expose the erect white petals (= stamens in citrus). In *S. colchica* the column of petals surrounds the stamens. The flowers are borne in broadly pyramidal, horizontal to slightly drooping panicles, two to four inches long and about as broad.

The leaves on the flowering branchlets generally have only three leaflets, while those on the other branches have five. The mature leaflets are up to six inches long so the foliage is somewhat coarse in texture. The large, two to three inch long capsules are conspicuous during the summer and fall.

Most of the species of *Staphylea* have essentially no economic importance except as garden ornamentals. But the flower buds of *S. colchica* are fermented and eaten where the plant is native, and the oil extracted from the seeds, reportedly with the taste of pistachio nuts, is used as a purgative.

7. *Staphylea* × *coulombieri* André

From within a year after it was first described, the supposed hybrid between *Staphylea colchica* and *S. pinnata* has been the subject of much confusion. The hybrid was originally named *S.* × *coulombieri* by André in 1897 from a cultivated plant of unknown origin grown by a Mr. Coulombier in Vitry, France. A year later, a hybrid of supposedly the same parentage was described as "*Staphylea elegans*" by Zabel from a plant in a nursery in Flottbeck, Germany. Zabel was aware of the existence of the previously described hybrid, but he had not seen a specimen when he named "*S. elegans*". To add to the confusion, he later treated André's *S.* × *coulombieri* as a variety of *S. colchica* (retaining his "*S. elegans*" for the hybrid) and described "*S. elegans* var. *Hessei*", which is almost surely not a hybrid at all. So both the nomenclature and the identity of these plants are in a state of confusion. The whole situation needs further study, and the suggestions below are tentative.

The name *Staphylea* × *coulombieri* André is the correct name for all hybrids between *S. colchica* and *S. pinnata*. Study of plants in our living collections and herbarium specimens, including those from Zabel's herbarium, have led me to the following conclusions: the plants which have generally been known as "*S. elegans* Zabel" and "*S. colchica* var. *coulombieri* (André) Zabel" are referable to *S.* × *coulombieri* André; "*S. elegans* var. *Hessei* Zabel" is referable to *S. colchica*; and the status of "*S. colchica* var. *Kochiana* Medvedev" is uncertain.

Staphylea × *coulombieri* is distinctly intermediate between its parents; the characters that distinguish the plants are outlined in the key (page 81). It has the orange-blossom fragrance, capsules, and flower form of *S. colchica* and the purple-tipped sepals of *S. pinnata*.



Staphylea × *coulombieri*, the hybrid between *S. colchica* and *S. pinnata*, most resembles the former species in floral characteristics. The purple-tinged sepals, most obvious in the buds, distinguish the hybrid from *S. colchica*. Photograph by R. E. Weaver, Jr.

The inflorescences are intermediate between the loose, broadly pyramidal, more or less horizontal ones of *S. colchica* and the dense, slender, pendent ones of *S. pinnata*. Flower size is also intermediate. The leaves on the flowering branchlets have either three or five leaflets. To me, *S.* × *coulombieri* is not as attractive as *S. colchica*.

8. *Staphylea pinnata* Linnaeus

Staphylea pinnata is a plant of low elevation woodlands throughout much of central and southern Europe into Asia Minor, and it has long been naturalized in the British Isles. It has been in cultivation since the end of the sixteenth century, but it is now rarely seen in gardens. Yet it is an attractive plant in flower and fruit. The flowers have a faint, but distinct, spicy fragrance, and their purple-tipped sepals add a touch of color. The panicles are dense and tight and hang as if suspended by threads from the branches. The capsules are nearly always two-parted, and they are tinged with pink at maturity.



The roundish fruits of Staphylea pinnata fall without shedding their seeds. The holes near the tips, visible in this photograph, are far too small to allow the seeds to be released. Photograph by R. E. Weaver, Jr.

Unlike those of the other species, the capsules of *S. pinnata* do not become brittle and papery when ripe, but remain soft and pliable. They fall with the leaves without shedding their seeds; the seeds are not released until the capsules eventually decay. About the size of an average pea, the seeds are the largest in the genus. They have been used as rosary beads by Roman Catholics in countries where the plant is native.

As implied by the specific epithet *pinnata*, the leaves of this species are pinnately compound. It is the only *Staphylea* species in which the leaves on all the branches are consistently composed of five to seven leaflets. The plant is at the limit of its hardiness range at the Arnold Arboretum and suffers mild dieback in severe winters. Yet we have in our collections a fine old specimen twelve feet tall with a spread of eight feet.

Propagation

The bladdernuts are all easily propagated by division, preferably in the spring. The propagation files of the Arnold Arboretum show that the seeds germinate readily if subjected to warm stratification for five months, followed by cold stratification at 40°F for three months. Cuttings rooted most successfully when taken in late July, treated with 0.8% IBA, and placed under mist.

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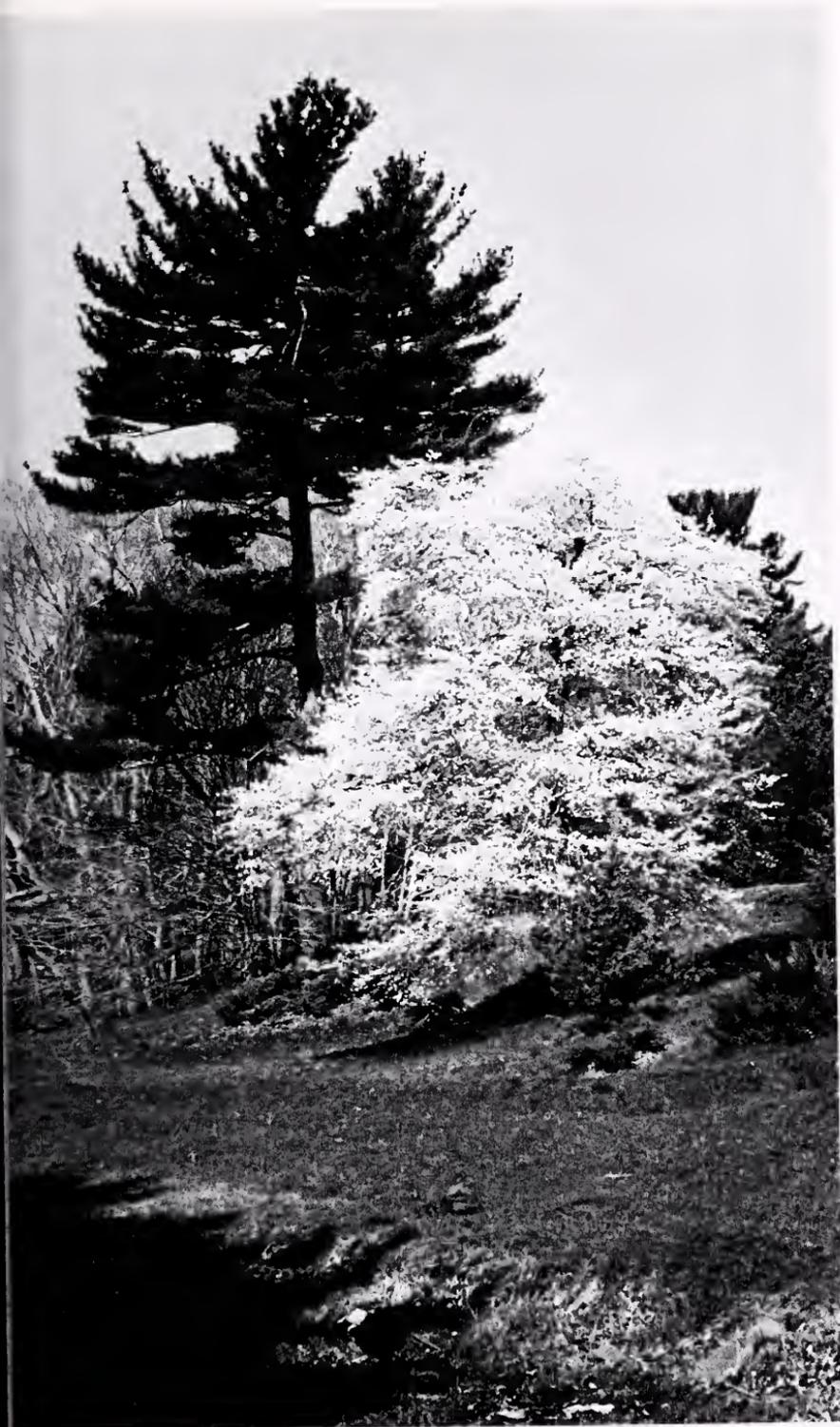
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Amelanchier arborea

This note is the first in a series featuring outstanding plants of the Arnold Arboretum, plants outstanding either for their rarity in cultivation or as specimens of singular beauty. We encourage our readers to visit the Arnold Arboretum to see and enjoy the plants featured.

The tree chosen to be the first in our series of outstanding plants is appropriate for several reasons: it is an exceptional specimen of its species; it is growing in a conspicuous location; it is one of the first showy trees to bloom in the Arnold Arboretum in the spring; and it is a personal favorite. The tree is the large specimen of *Amelanchier arborea* on the north side of Bussey Brook at the edge of the juniper collection. At thirty-six feet tall with a spread of thirty-eight feet and a trunk circumference of seventy-two inches, it is small in comparison with the seventy-six foot tall national champion in Standish, Michigan. But it is still a magnificent specimen. Growing in the open without competition from other trees, it has developed its full and graceful form. Because our records for the tree have been lost, its age and origin are unknown. But it was probably a spontaneous seedling as were many of the *Amelanchier arborea* now in the natural woodlands of the Arnold Arboretum. Judging from the size of other of our specimens of known age, it is at least a hundred years old. It may be part of the original vegetation on the property before the Arboretum was established.

Plants of the genus *Amelanchier* are known by a variety of com-





A flowering branch of *Amelanchier arborea*. The individual flowers resemble those of the closely related crabapples, but those of the shadbushes are smaller, with narrower petals. Photograph by R. E. Weaver, Jr.

mon names including shadbush, shadblow, juneberry, and serviceberry. The species *A. arborea* is usually referred to as "downy" because of the dense silvery-white hairs on the undersides of the expanding leaves. Most *Amelanchier* species are shrubby, but this one and *A. laevis* are distinctly treelike. (Although closely related, *A. laevis* and *A. arborea* are easily distinguished. The flowers of *A. laevis* appear at the same time as its coppery-red leaves whereas the flowers of *A. arborea* appear before its silvery-white leaves. *A. laevis* is in full bloom usually a week later than *A. arborea*.) All *Amelanchier* species are ornamental even when not in flower because of their small, red to purple, apple-like fruits in June, their brilliant orange autumn foliage, and their silvery gray bark with darker fissures. The flowers are often of short duration, particularly if the weather is hot or rainy, but this past spring our featured tree was in bloom from 15 April until 25 April.

Early next spring, when you are winter weary, come to the Arnold Arboretum just as it is coming to life. Few trees are flowering then to compete with the shadbushes. Pick a sunny morning, when our featured tree is seen to its best advantage, a mound of purest white against the blue sky, the green of the conifers, and the silver trunks of the beech grove behind.

RICHARD E. WEAVER, JR.

Right: The conspicuous reticulate (criss-cross) pattern of dark furrows in the basically smooth, silvery bark is an attribute which makes shadbushes ornamental at a seasons of the year. Photograph by R. E. Weaver, Jr. Below: One featured Amelanchier arborea photographed on April 30, 1950. The large oaks, which since they died, make it appear much smaller than it really is. Photographer unknown.



BOOKS RECEIVED

In February of this year we wrote to a selected list of publishers requesting that they send to Arnoldia newly published books on horticulture, forestry, botany, ecology, gardening, and closely related topics. As a service to our readers, the titles and publication information of the books sent to us will be published in a "Books Received" list. In the past Arnoldia has published reviews, often very brief, of individual titles. In the future we plan to publish lengthier, authoritative reviews that are topical and discuss not only recently published books, but established references and favorites. Two such reviews are now being prepared and will appear this year, one on field guides to wildflowers and the other on medicinal plant books. The staff of the Arnold Arboretum together with occasional outside reviewers should be able to provide useful and expert advice about a wide range of the current and past literature that may be of interest to readers of Arnoldia. But the large number of books published yearly make it impossible to review every title sent to us by publishers. The "Books Received" list serves some of the purposes of our earlier, shorter reviews while allowing us to implement our new review policy. It provides an overview of new titles; it assures publishers that books they send at least will be mentioned; and it enables us to give closer consideration to books as we receive them to decide which we might wish to review.

- Bicknell, Andrew. 1980. *Dr. Greenfingers' Rx for healthy, vigorous houseplants*. Crown Publishers, Inc., New York. 159pp. Cloth, \$12.95.
- Chapman, Arthur G., & Robert D. Wray. Second edition, 1979. *Christmas trees for pleasure and profit*. Rutgers University Press, New Brunswick, New Jersey. viii + 212pp. Cloth, \$10.95.
- Clegg, Peter, & Derry Watkins. 1978. *The complete greenhouse book*. Garden Way Publishing, Charlotte, Vermont. vii + 280pp. Second printing, 1979. Paper, \$9.95.
- Coxon, Margaret E., co-ordinator. 1978. *Gardening as therapy*. Technical Bulletin No. 5, The Botanical Garden, The University of British Columbia, Vancouver. iv + 32pp. Paper, \$4.25.
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Compiled by Jane Morss

Right: A photograph of E. H. Wilson taken in China around 1899, during Wilson's first collecting trip for the Veitch Nursery. Photograph by Teh Kee, Ichang. Back cover: "Father and [R. R. Rose] taken in the Greenhouse." Undated photograph by W. Dawson.



Next issue:

E. H. Wilson as a Botanist, Part I

Mapping the Collecting Localities of E. H. Wilson in China

Outstanding Plants of the Arnold Arboretum:

Prunus cyclamina



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Front cover: Pocket watch presented by James Veitch to E. H. Wilson upon completion of the first trip to China.

E. H. Wilson as a Botanist

by RICHARD A. HOWARD

Ernest Henry Wilson wished to go down in memory as "Chinese Wilson," and so it has been (Barron, 1913). His reputation today is certainly that of one of the most successful individuals to introduce horticulturally valuable plants from China to western gardens. Over 1,000 different plants were gathered by Wilson and introduced in England and America as seeds, bulbs, cuttings, or plants; these have since become established in the horticultural trade and in private or botanical gardens.

Wilson initially followed the collecting routes of several distinguished predecessors but then went on into new and unexplored territory, finding plants in flower, marking the specimens or the locality, and returning in the proper season for material that could be shipped to his western sponsors. Wilson made two collecting trips to China for the Veitch nurseries of England and two trips for the Arnold Arboretum. These were followed by a slightly less arduous

Richard A. Howard is Professor of Dendrology of the Arnold Arboretum staff. In 1978 he represented the Arnold Arboretum in the delegation of the Botanical Society of America that visited the People's Republic of China. After a reciprocal visit by a delegation of Chinese botanists, plans were made for the current Sino-American expedition on which Dr. Stephen Spongberg represents the Arnold Arboretum. Hopefully, this group or a future one can revisit some of the areas in which E. H. Wilson collected.



Davidia involucreta, the dove tree, was the object of Wilson's first trip to China. Wilson gathered 14,875 seeds of trees at Kuan Pao and sent them to the Veitch nursery. Wilson later wrote proudly of his "introduction of every seedling plant but one of this remarkable tree."

trip to Japan for cherries and azaleas already in cultivation, and a later trip to Formosa, the Liukiu Islands, the Bonin Islands, and Korea for conifers and general vegetation. Finally, Wilson made a special trip to Australia, New Zealand, India, Ceylon, and Africa to establish contacts for the Arnold Arboretum with gardens and botanists and to examine tropical gymnosperms. Following these adventures, Wilson served as Assistant Director of the Arnold Arboretum (1919–1927), and after the death of Charles Sprague Sargent, he was appointed Keeper of the Arnold Arboretum, a post he held until his tragic death in an automobile accident in 1930 (Plimpton, 1979, pp. 84–87).

Wilson's outstanding ability as a lecturer was equaled by his talent for writing about his trips and the plants he saw and introduced into cultivation. Less well known are Wilson's contributions as a botanist. For the Veitch firm, Wilson collected herbarium specimens to document his gatherings of seeds. On his later trips for the Arnold Arboretum, under specific directions from Sargent he made general collections of the flora in the areas he visited — in sufficient quantity to be distributed widely to other herbaria. Many of his collections have not fully been studied or identified to this day. When he had the opportunity to work over his herbarium specimens, Wilson contributed to the literature, at first with other authors and later under his signature alone. His scientific writings include floristic studies, papers on forestry and economic botany, and special treatments of such groups as rhododendrons, roses, hydrangeas, cherries, and especially the gymnosperms. Nevertheless, he is best known for his horticultural observations in several hundred articles and a dozen books.

We do not know if Wilson intended to write an autobiography. His last manuscript, "Wilson's Plants in Cultivation," is unpublished but is being considered for publication together with an updating of the nomenclature and with recent observations of the plants Wilson mentioned. The collection of Wilson's diaries and field books at the Arnold Arboretum is not complete, and not all the correspondence that probably exists has been assembled. Yet his life and his efforts seem worthy of a biographer. The following tribute comments on Wilson as a field botanist and adds to the published record some data on his itinerary, his collections, and his publications.

How It All Began: Wilson's First Trip (1899–1902)

It has often been written that a member of the Veitch firm saw Augustine Henry's specimen of *Davidia*, the dove tree, and sought a collector to contact Henry for its specific location and to return fruits to England for cultivation. Wilson himself (1905, p. 337) wrote that

"In time it chanced that the attention of Messrs. Veitch,¹ of Chelsea, became drawn to the mass of material Henry had collected. The result of this was that they applied to the Director of Kew to nominate a likely collector. I was the fortunate individual selected." On reading this article, James Herbert Veitch promptly wrote to Wilson:

You are, however, wrong on one little point, but I do not wish it publicly contradicted. It was not Henry's specimens which drew our attention to China. When I was in Japan in '91, '92, & '93 I was quite aware there was a very rich field, and so was Sargent, with whom I was with [sic] some time in Japan.

In fact, I wrote home here to my Chief [Harry James Veitch] to know whether I might not go (and I have the letters now) but my Chief very promptly sat on it, I did not go, and the matter dropped.

For years I had been pressing the matter, and though Henry's work gave a fillip to my wishes, the expedition was long determined on in my own mind, before Henry appeared on the scene. (J. H. Veitch, letter, February 6, 1905.)

In fact, Charles Maries had collected in China for the Veitch firm as early as 1879; he had discovered *Psilopeganum sinense* and had introduced the now well-known *Primula obconica*. James Herbert Veitch was on a collecting trip in Japan when Charles Sargent and

¹ In a recent article entitled "The House of Veitch" (*Int. Dendrol. Soc. Yearb.* 1972: 63-69. 1973), K. A. P. Fuller and J. M. Langdon stated that "the name of Veitch has held a very honoured place in the annals of horticulture over the past 150 years," and they published an abridged family tree showing the members of the family actively engaged in running the Veitch nurseries. The firm was started by John Veitch (1752-1839), who was aided by his son, James (1792-1863). James had three sons in the business, with James Veitch, Jr. (1815-1869) of the Chelsea branch being important to this story. James Veitch, Jr., also had three sons in the business, two of which are referred to in this article. John Gould Veitch (1839-1870), who collected in Japan and the Far East; and Harry James Veitch (1840-1924), who hired Wilson and wrote the letters that are quoted in this article. John Gould Veitch's son, James Herbert Veitch (1869-1907) — the nephew of Harry James Veitch — met Sargent in Japan. Thus, Harry James Veitch was the great-grandson of the founder, and his nephew James Herbert Veitch the great-great-grandson.

Harry James Veitch's letters to Wilson are usually on stationary with the printed address of Chelsea. Some of the letters are written personally by Harry James Veitch, while others are written by a secretary and signed with a short greeting by Harry James Veitch, but usually signed "James Veitch." Punctuation is commonly lacking in these letters and has been supplied as seemed appropriate to the meaning of the letter.

Wilson's plants were handled at the greenhouses in Chelsea and later planted out at the Coombe Wood Nurseries or the branch nursery at Langley.

party arrived, having crossed Asia and therefore part of China on the Trans-Siberian Railroad. Apparently, an expedition in China was discussed, and young Veitch wrote to his uncle — as did Sargent. Harry James Veitch replied to Sargent:

My nephew told me of his having been so fortunate as to fall in with you there and I am much obliged to you for your kindly expressions about him. . . . I trust he is now in Australia. His first consignment of seeds arrived last week and we are now looking forward anxiously to get further supplies. . . . As regards that portion of your letter which refers to his going to Central China after completing his present tour, he had also written to me previously on the subject and I have always been adverse to his undertaking such a journey; not because I should not like him to go but solely out of consideration as to what is best for him in connection with the business here. . . .

I do not say that my nephew can never go to Central China because he could manage this I dare say in the course of a year or two without difficulty in the same way as you from time to time take extended tours. . . .

I need not say that no one would hail with more delight than I should the introduction of some sterling hardy novelties and I should feel an especial pride were our firm to be the first to get them. It is not therefore from any desire to throw cold water on your proposals that I cannot fall in with them at once, but only because I am desirous of doing the best I can for all, in the circumstances in which we find ourselves — and I have written to you fully and quite candidly, that you may see I have given the matter serious consideration. You will I know treat all I say in strict confidence.

Reverting to your Japanese tour and the collections of seeds you have made, you will I feel sure excuse my asking you not to distribute anything which my nephew and you may believe to be new until we have had an opportunity of doing so. (H. J. Veitch, letter, January 10, 1893.)

Sargent did send seeds from his gatherings in Japan to Harry James Veitch and received another letter on the subject.

I trust my letter of Jan. 10 last with references to my nephew's future movements has reached you safely. I regret that he has again bothered you in the matter. It is a great pity that he is so impetuous. He seems quite to forget that there is another side to the question besides his travelling about. . . . I shall write to him very plainly about his troubling you and also his being so dissatisfied. (H. J. Veitch, letter, January 23, 1893.)

So Wilson was selected to make the trip and was well briefed by the Veitch firm as to his goals and methods. Regrettably, a written version of his instructions has not been located. Harry James Veitch later referred to Wilson's examination with him of Augustine Henry's specimens at Kew and of his suggestion that Wilson visit Sargent and the Arnold Arboretum *en route*. On March 30, 1899, just before Wilson's departure for America from Liverpool, James Gould Veitch wrote to Wilson:

Enclosed is . . . a copy of a letter my brother has received this morning from Professor Sargent of Harvard University. Read the letter carefully and ask any questions on any point therein, that may appeal to you. You will see that the professor suggests your going to the North first, and next year to the South.

Your instructions are of course to go to the South this year and then to the North and in spite of what the professor says, we think this plan preferable, and would prefer your following it. . . .

The professor is a very dogmatic and strong man but you must not let yourself be too impressed by what he says about collecting dried specimens. On this point however, we all know you will be careful, and understand what we want. . . .

P.S. Kindly acknowledge receipt of this. (J. G. Veitch, letter, March 30, 1899.)

Three contrasting statements have been written of Wilson's original visit to the Arnold Arboretum. Sutton (1970, p. 210) stated, "He had only five days in Boston and spent most of his time with Sargent at the Arboretum and at Holm Lea, where he was supposed to learn what he could about packing and shipping seeds for long trips from the Orient." Wilson (1926, p. 276) wrote, "My stay in Boston was limited to five days and nearly the whole time was devoted to looking over the Arnold Arboretum collections and I departed enriched in knowledge and with much sound advice on matters relating to the collecting and packaging of seeds from Prof. Sargent and from the late Mr. Jackson Dawson." Wilson also wrote, in another account (1927b, p. 614), "My first meeting with Sargent took place in the shadow of the large pig-nut hickory on Bussey road in the Arboretum [Sunday] April 23, 1899, when I was en route to China. After formal greetings he pulled out his watch and said, 'I am busy now, but at 10 o'clock next Thursday I shall be glad to see you. Good morning.' I voted him autocrat of the autocrats, but when our next interview took place I found him the kindest of the autocrats."

Wilson crossed America by train and sailed from San Francisco, arriving in Hong Kong on June 3, 1899. Setting out to find Henry

in southwestern China, Wilson sailed south to Haiphong in Indochina and traveled up the Red River to Laokai on the Chinese border, where he was delayed by officials because of reports of trouble in Yunnan. Sutton (1970, p. 212) stated, "During his eight weeks in Laokai he tried to busy himself with the vegetation, but it was jungle and no practical interest to him." Quite to the contrary, Wilson busied himself collecting. The first seed lots (1-67, plus scattered other numbers) went to Veitch and were from Laokai. Also from this location were the herbarium specimens 2765-2798, including the new species *Sterculia scandens* described from Wilson specimens by W. B. Hemsley as from Tonkin, and *Sonerila laeta* described by Otto Stapf as from China. Ultimately, Wilson was allowed to enter China, met Henry in Szemao, and traveled with him to Mengtze.

In Mengtze Wilson obtained propagating material of *Jasminum primulinum* (*J. mesnyi*), which he sent to Veitch. This was ultimately exhibited and, as Wilson noted in his field book, was awarded "my first F.C.C. [First Class Certificate]." Armed with the information Henry could supply him on the location of the dove tree (a hand-drawn, generalized map), Wilson returned to Hong Kong for Christmas and made arrangements for his passage from Shanghai up the Yangtze. He arrived in Ichang on February 24, 1900, to begin his real collecting in China. Wilson later (1926, p. 286) wrote, "Ichang, where I arrived on Feb. 24, 1900, was to be my headquarters for two years so I made plans accordingly. I purchased a native boat of good size in which to live and to serve as a base of supplies, and engaged some countrymen to assist me in collecting. The all-important arrangements completed, a series of short prospecting trips up country from Ichang were undertaken for the purpose of getting some acquaintance with the flora and for testing and training my men."

Wilson told in detail of his quest for *Davidia* in *Aristocrats of the Garden* (1917). When he reached the location given him by Henry, he found that the tree had been cut down and the wood used in the construction of a house. It was not until late May, 1900, that he found his first plant of *Davidia* in flower in the mountains south of Ichang; during the summer he was able to locate a total of eleven trees. Fortunately, they fruited well — his collection number 930, although undated in his field notes, is indicated to be from Kuan Pao, Fa Wan Ma Huang Po, with 14,875 seeds gathered. The records of the Veitch nurseries do not show this seed number, although Wilson stated that in the late spring of 1902 some 13,000 plants were raised at the Coombe Wood nursery. The germination pattern of the seeds of *Davidia*, now known as double dormancy, was seen at the time to be so unusual that W. B. Hemsley read a paper on the subject before the Linnean Society; this was later published (Hemsley, 1903). Wilson concluded his story of *Davidia* with the comment



Above: The west end of the city of Ichang in March, 1908, with native boats lined up in tiers. This was the point of departure for most of Wilson's major expeditions. Below: "The Harvard," Wilson's houseboat, at Kiating in western Szechuan, December 13, 1908. The boat captain and Wilson's assistant are on the roof; plant presses are lined up behind them. Photographs by E. H. Wilson.

(p. 295), "After sixteen years I have thought it of interest — and for history's sake desirable — to place on record the facts concerning the vicissitudes and difficulties which beset my path in the introduction of *every seedling plant but one* of this remarkable tree."

Little has been written by Wilson or others of the details of his first trip, and no diaries have been located. However, Wilson saved all his letters from members of the Veitch firm, and these are revealing of Wilson's personal and business relationships with Harry James Veitch.

Harry James Veitch took a paternal interest in Wilson, and his letters repeatedly contained homilies on Wilson's personal welfare. In his early letters Veitch warned Wilson of the loneliness he would feel and assured him that his friends and employers were thinking of him. "Keep up your courage and never lose heart — failure and disappointments in the very nature of things you must have — but always come up smiling and never allow yourself to believe things are bad — rely on it — they could always be worse" (H. J. Veitch, letter, December 11, 1899). "I am very glad to hear you are keeping well, take care of yourself and avoid whiskey (though I do not imagine you are fool enough to be weak in that point)" (H. J. Veitch, letter, February 26, 1901). After Wilson had some unexplained accident, Veitch wrote, "I beg you will take all reasonable precaution though never forgetting that 'nothing venture' means 'nothing have' whether it be in China or in the back street in Chelsea" (H. J. Veitch, letter, July 9, 1901).

Of Wilson's goals Veitch wrote, "It is especially the trees, shrubs and herbaceous plants of the mountain ranges around Ichang and those we saw together in the herbarium, Kew we are anxious to get hold of" (J. H. Veitch, letter, January 8, 1900), and "The real object of your three year trip lies before you i.e. to obtain during the next two summers and autumns plants, but more especially seeds of the flora in the mountain ranges around Ichang, keeping especially in view those you and I know from the Kew specimens are likely to be especially fine and of commercial value" (J. H. Veitch, letter, February 16, 1900).

Veitch asked Wilson, "Are you dressing as a Chinaman — I think it better — but on this point the opinions of Henry and Ford are worth more than mine" (J. H. Veitch, letter, February 16, 1900), and later, "Do you dress as a Chinaman? You have not mentioned it — Personally I believe in it — but by now you will know more about such matters than I do" (J. H. Veitch, letter, July 11, 1900). No letters are available to indicate how Wilson answered, if he did, and no photographs of this first trip show Wilson in costume. In photographs of his later trips, Wilson appears in a field jacket or a full suit with a western style hat, leather puttees with straps, and heavy shoes.



Above: A general view of the countryside to the south of Ichang, altitude 5,000 feet, January 21, 1909. Below: "Did fates ordain that I should live in Western China, I could ask for nothing better that to be domiciled in Sungpan," Wilson wrote of this walled city in northwestern Szechuan. A view north from the east gate, September 25, 1910. Photographs by E. H. Wilson.

News of the Boxer rebellion in the summer of 1900 must already have reached England, and Wilson evidently had written that he expected to encounter limitations to his activities, when James Harry Veitch wrote, "I do not know if this will ever reach you — as from what you say in your letter of the 23rd it is more than likely you will have had to leave Ichang even before the date on which I write. It is most unfortunate that it is one of those things for which we cannot in any shape or form blame ourselves — and if you have to come away I know it will be through no fault of yours. I fear, from the tone of your letter that the situation is serious — and hope you will at no time run any unnecessary risk" (J. H. Veitch, letter, October 9, 1900).

Wilson had been instructed to collect one or two specimens of each plant from which he obtained seeds. He occasionally enclosed a leaf or a flower in a letter, asking for an identification or an opinion. As the following extracts indicate, Veitch procrastinated: "If possible get dried specimens of anything of which you get seeds — just a specimen or two of each — it will help us to identify. This I probably mentioned before — and it should not be lost sight of" (J. H. Veitch, letter, January 8, 1900). "Send dried specimens — (as you have done) — where you can" (J. H. Veitch, letter, February 16, 1900). "Three large bundles of dried specimens have arrived and I am waiting for a quiet afternoon to carefully go through them — and shall particularly look out for the numbers you refer to in your letter of June 29" (J. H. Veitch, letter, September 5, 1900). "I see in your letter you draw attention particularly to several plants of which you have sent dried specimens — I will see particular attention is paid to these (J. H. Veitch, letter, April 19, 1901). "One case of dried specimens arrived. . . . As to whether I shall personally be able to go through the dried specimens I do not know — I shall certainly try — anyway I shall see all the leading things" (J. H. Veitch, letter, March 28, 1901). "You have sent a fine lot of dried specimens but I do not know when I shall get time to look through them" (J. H. Veitch, letter, April 19, 1901).

On July 10, 1901, Herman Spooner wrote to Wilson, introducing himself as a member of the Veitch organization. "During some spare time at Chelsea I commenced to look through your specimens, I have gone through some 15 to 20 bundles — they are in excellent condition, with the exception of some of the evergreens and conifers, the leaves of which in many cases have fallen — you were probably unable to poison them before drying. I was surprised at the number of species of Rubus, Acer and Rosaceous plants that there are, also at the brilliant colour of the Kerrias and Rhododendrons, one of the latter was of a distinct blue colour, if it is so in a fresh state it ought to be worth something." Shortly thereafter, Harry James Veitch wrote his man in the field, "I have also received a bundle of dried specimens, which so far I have not had time to look through, but

hope to be able to shortly. I notice you have difficulty with your Conifer specimens — I used to dip mine in some solutions — I forgot exactly what — which immediately destroyed life and the leaves kept on fairly well” (J. H. Veitch, letter, August 21, 1901). Finally, “I am now having all that great bundle of dried specimens you sent looked through. Hitherto I have had no one who could spare the time to do it. They seem in excellent order and I congratulate you on the success” (J. H. Veitch, letter, September 12, 1901). No lists of plants appear in Veitch’s letters, carefully saved by Wilson, and there were no identifications in the field books kept by the Veitch firm as Wilson’s material arrived. Apparently Wilson did not receive much direct help while in the field.

Wilson received a request for help from J. C. Willis, then Director of the botanical garden at Perideniya, Ceylon. He sent the letter to Veitch, apparently asking for instructions, and Veitch replied to Willis:

Our collector in China has sent us your letter dated 21st. September in which you ask him to get seeds for you.

It is of course clear to us you are unaware this man is in our employ, and is not permitted to gather anything for anyone but ourselves.

You can quite understand the great expense of a journey of this description and the impossibility of our man serving more than one master, though we hope we need hardly say how glad we should be to oblige you, if it were at all possible.

Should we be successful in raising plants of the genera you name to Wilson, we shall of course be glad, to give you specimens.

We trust you will understand no discourtesy is meant, and with the assurances of our best service always. . . . (J. H. Veitch, letter, January 23, 1901.)

Willis replied to Veitch and Sons, “I must apologize for having asked him to collect for me, but I was under the impressions that he was a resident, who collected for anyone that asked. If you can spare any plants of *Eucommia* or *Trapella*, I should be glad to receive them and exchange, and if we can be of service as a halfway house for anything that will not survive the whole journey from China please let me know” (Willis, letter, February 19, 1901). Wilson made a special journey in 1907 to collect *Eucommia* and attempted to obtain several bushels of the fruit as a potential source of the rubber-like latex. Wilson regretted in later years that he was unable to find the *Trapella*, although this rare plant had been collected by Henry near Ichang and subsequently by Frank Meyer. On August 21, 1901, Veitch wrote, “I enclose a letter from a Dr. Oliver, a botanist whom I should like to oblige — do what you can for him.” Although

Oliver's letter is not available, he may have been asking about *Trapella*, on which he had published earlier.

Wilson's enthusiasm was at times misdirected. He wrote to Veitch that he had found *Ginkgo* in the wild. Veitch replied, "I was very interested in what you said in your report about Conifers and also you said you saw *Ginkgo biloba* wild. Very few men have seen that — I was under the impression its actual habitat, although of course guessed at, was not actually known. Are you sure the trees you saw were not planted it may be 100–200 years ago — in these thickly populated countries it is difficult to know what has reached any spot by the hand of man or what reached there by the agency of nature" (J. H. Veitch, letter, July 9, 1901). Wilson did not comment further, as far as can be determined.

Veitch's supervision or control of Wilson's activities was also evident in a letter of February 26, 1901:

Now another little point — I notice in the last issue of the *Gardeners' Chronicle* which I now send you [February 23, 1901, p. 127], certain remarks of yours are published.

We do not permit our employees as a rule, to write for the public press, as you can imagine if they did it would very soon take up too much of their time.

I do not however wish to apply any of our ordinary rules to yourself, but would suggest until we meet, it would be better to leave this point in abeyance. This was a matter we did not discuss when you entered our service, and I think it may also be taken for granted any spasmodic articles may lessen the value of any possible publications undertaken in the future in a more complete form.

In the original agreement with the Veitch firm, Wilson apparently was to account for his expenses on a semiannual basis. Forgetting this, Veitch wrote in strong language asking for an account of Wilson's expenditures "every few months. It is more regular and business like" (J. H. Veitch, letter, February 16, 1900). Wilson promptly accounted for his expenses, but related his original instructions and his pique. Veitch humbly replied in appreciation and asked that "the matter shall be as though it had not been" (J. H. Veitch, letter, May 17, 1900). However, Veitch did not lack concern for costs. He usually mentioned several letters in advance that a payment would be sent on a certain date and frequently requested that Wilson keep costs down. "Do not forget that you are very keen and an enthusiast — and that enthusiasts are apt in their great keenness to sometimes lose sight of the financial side of questions" (J. R. Veitch, letter, February 26, 1901). "Do not forget efficiency usually means economy, but that does not mean save a penny when a shilling could be earned by spending it" (J. H. Veitch, letter, July 9, 1901). On April 19, 1901, James Veitch essentially presented an ultimatum: "When

you receive these funds the trip will have cost over £2,000 and I do not wish to spend more money. . . . If you feel that this amount will not enable you to stay til the middle of January 1903 and yet pay your expenses home, then you must do the best you can, and come away earlier."

Wilson brought his expedition to a close during the winter of 1902, intent on stopping in Paris to consult the herbarium. Veitch's letter of December 31, 1901, was directed to Wilson in Paris and stated: "I was yesterday at the Botanical building of the Natural History Museum [in Paris] and arranged for you to be expected. . . . Do not stay longer than necessary though you should take a day to see Paris — get a guide from the Hotel or you will see very little — he will perhaps want to take you around at night — which you can decline." Wilson returned to England in April, 1902. On his return, the Veitch firm presented him with a gold watch engraved inside the cover:

E. H. Wilson
from
James H. Veitch
1899-1902
Well done!

On June 7, 1902, Wilson married Ellen Ganderton. By the next January he was *en route* to China again to find *Meconopsis integrifolia*.

Wilson's Second Trip for Veitch (1903-1906)

Wilson left England in January, 1903, on his second expedition for the Veitch firm, and arrived in Shanghai on March 22. He found some of his former staff still available and quickly organized his expedition to find *Meconopsis integrifolia*, which grew at elevations higher than 11,000 feet. Two notebooks from this expedition are available, one a diary and the other a series of field notes on the plants Wilson saw. Clearly, he had worked over the specimens collected on his previous trip since he now referred to the plants by name, indicating those most recently taxonomically described. The details of his trip up the Yangtze River and into the mountains are published in Wilson's accounts of his expedition, and a series, "Leaves from my Chinese Notebook," ran for over a year in *The Gardeners' Chronicle*. He again purchased a boat, which he noted "is named and registered at the Customs the 'Ellena' after my wife. May it bring me luck in proportion as my dear one has" (Wilson, April 12, 1903). On June 7, 1903, he noted "the first anniversary of my wedding, what changes a year brings forth" (Wilson, 1903). (Wilson's marriage certificate is dated June 8, 1902.)

Wilson's search for the yellow-flowered *Meconopsis* was arduous but successful, and he wrote (1906, p. 101):



Above: Snow on the Ya-chia Range, and alpine meadows with dwarf junipers and rhododendrons. In this 13,000-foot pass near Tachien-lu, Wilson experienced hazardous weather. Below: The city of Tachien-lu (8,400 feet altitude), July 27, 1908. A village in this location had been demolished by a landslide a century earlier. Photographs by E. H. Wilson.

At 11,000 feet I came across the first plant of *Meconopsis integrifolia*. . . . I am not going to attempt to record the feelings which possessed me on first beholding the object of my quest to these wild regions. Messrs. Veitch despatched me on this second, and very costly, journey to the Tibetan border for the sole purpose of discovering and introducing this, the most gorgeous alpine plant extant. I had travelled some 13,000 miles in 5½ months and to be successful in attaining the first part of my mission in such a short time was a sufficient reward for all the difficulties and hardships experienced en route.

A year and a half later, Herman Spooner wrote to Wilson:

You will, I am sure, share our disappointment when you hear that *Meconopsis integrifolia* was first flowered by Messrs Bee and Co. alias Mr. Bully of Chester. We were astonished when we read the announcement in the *Gardeners' Chronicle*, as we thought we were the only people who possessed it. Fortunately, Mr. James [Veitch] visited Langley the day after the notice appeared in the *Gardeners' Chronicle* and discovered two small flowers on the plants there. He immediately wired to the *Chronicle* stating the fact and thus saved the situation. The following week from our material and Miss Smith's drawing the *Gardeners' Chronicle* published a very good figure, with some descriptive matter extracted from your letters, so I think we have fairly taken the wind out of Messrs' Bee's sails. (Spooner, letter, October 4, 1904.)

Wilson's letters from Veitch are very similar to those he received on the first trip. On behavior Veitch wrote:

You have a great chance and if you can manage to get hold of herbaceous seed — or of course — any seed — as you did on your last trip — you will do well — whatever position or work you ultimately undertake. . . . Take care of yourself and work — work is the only thing whether in England or China. (J. H. Veitch, letter, April 1, 1903.)

You have had a great chance — and have done well — Keep up your spirits and do equally well this time — and you will all your life be very glad of what you did in your youth — you have but one youth — and I doubt you ever have another such chance. . . . Work — and always work — it is the only thing — believe me — that man who through his whole life — does nothing but work — at the end of it has usually the least to regret — whether his work is what

yours is now — or some far less interesting. (J. H. Veitch, letter, October 5, 1903).

Both Veitch and Spooner wrote to Wilson of the success of the herbaceous seeds Wilson sent. They flowered quickly and provided good sales. However, Veitch confided:

I am really more fond of trees than any other plants — but you must not tell or whisper it for a business man ought not to have any likes and dislikes — and of course the great British Public does not buy trees — it has not the knowledge to select or the courage to wait for the results — and hence trees are “just trees” with no possibilities — but still after all they seem to be the finest type of plant. (J. H. Veitch, letter, October 5, 1903.)

Veitch was aware of the competition for new plants. “I see Vilmorin must have got quite a lot of plants — and there is no doubt we are only just in time — as far as can be judged missionaries must have sent him seed for many years now — though I doubt if he has any quantities” (J. H. Veitch, letter, January 5, 1904). When Wilson’s plants were described, many were attributed to cultivated specimens from Veitch and Sons, with the original locality given only as “China.” Veitch wrote: “I was annoyed at a paragraph the Journal of Horticulture recently printed about you — the editor said it came from a ‘friend at Kew’ — *do* be careful — once home it is quite different — but please ‘till then say but little” (J. H. Veitch, letter, January 27, 1901). Veitch had written previously on the subject of publications:

You will see in the Gardeners’ Chronicle dated July 25 your note about the boat service and the rapids which you found so difficult. I shall send *no* botanical or plant information — as I want to leave that for you on your return. Do not fritter away your information by writing scrappy information to injudicious friends, who, with the best of intentions in the world, send it on to the papers and thus forestall you. (J. H. Veitch, letter, July 24, 1903.)

I hope for your sake — you are making notes for the G.C. on your return — I shall have no objections to your doing this for your own sake and as a matter of business — though as to unexplored parts or information as to unvisited districts and any ideas you may have thereon, I think these should be at my disposal. What is past — and what you have learned in your two journeys you can dispose of *after* you return. (J. H. Veitch, letter, November 18, 1903.)

I hope you will have a good summer and autumn — I am sure you will do all you can — and I want you to make notes of what further district you think worth visiting — *for me alone* — in case I ever send you. (J. H. Veitch, letter, April 6, 1904.)

Nevertheless, Veitch was aware of the novelties being introduced by Wilson, and subsequently of the value of the herbarium specimens. He noted: "Papers on new plants are to appear by Nicholson and myself. . . . Nicholson is to read his paper on April 7 and we are to fill a centre table in the Hall with all your specimens — it will make a most interesting show." (J. H. Veitch, letter, February 16, 1903.) Regarding the herbarium specimens, Veitch wrote Wilson: "We have some lovely photographs of your dried specimens for the July issue of the *Journal of the R.H.S.* a copy of which I will send you" (J. H. Veitch, letter, February 16, 1903). "Last week we exhibited all your specimens at Drill Hall — they created considerable interest and an immense amount of jealousy. The ordinary person with Geraniums and Roses to exhibit, could not for the life of him see why the valuable space should be given up to dried specimens" (J. H. Veitch, letter, April 4, 1903). An article by James H. Veitch entitled "Recently Introduced Trees, Shrubs, etc., from Central China" appeared in the *Journal of the Royal Horticultural Society*. Forty-seven illustrations indicate the quality of the herbarium specimens Wilson had prepared, and the list suggests that 357 specimens were exhibited. A sheet from the Veitch firm now in the herbarium of the Arnold Arboretum is illustrated here; it indicates the quality and the beauty of Wilson's early collections.

Wilson's specimens apparently had been dispatched to and were being studied by the herbarium staff at Kew. Herman Spooner wrote to Wilson:

Professor Sargent has named your maples from the dried specimens, and I was out at Coombe Wood yesterday trying to name the living plants. I found it a rather difficult job as the young seedling plants are naturally more vigorous growers than the trees from which your specimens were taken and in consequence somewhat out of character. Sargent made three new species and a number of new varieties; one of the species is named *Wilsonii* (No. 303) but apparently it is not in cultivation at Coombe. In the next part of "Trees and Shrubs" Sargent proposes dealing with the Chinese maples and hopes to figure ten new species or species which have not been previously described (Spooner, letter, June 23, 1894).

It was, in fact, Alfred Rehder who named the species as described in "Trees and Shrubs."

Veitch again expressed his opinion on costs and expenses in many letters received by Wilson during his second expedition. "I am quite satisfied but try hard not to have to ask me for more money if it can be avoided" (J. H. Veitch, letter, November 18, 1903). "Twelve months after you get this I hope you will be with us — as soon as you have the result of the autumn of 1904 come right home — I know I can trust you not to leave till you have these — but stay not a moment longer" (J. H. Veitch, letter, December 2, 1903). However, two months earlier Veitch had written: "Today I wire you £100 and the January check will be for £300 — try and NOT *exceed* what we agreed on after this" (J. H. Veitch, letter, October 5, 1903). Shortly thereafter, Veitch asked a favor: "Instead of sending you £300 on Jan. 1 I will send £350, i.e., £50 from myself. . . . Buy me a few good pieces of lacquer, porcelain or bronze — not much silk — something quaint — but good — not much — but good" (J. H. Veitch, letter, November 18, 1903). Later he wrote: "I have no doubt I shall like the bronze etc., you have got for me, though of course buying for the taste of another is always a little difficult" (J. H. Veitch, letter, March 15, 1904).

The year was a difficult one for Wilson. "Food was scarce in Szechuan in 1904, and so labor was hard to get and harder to keep. Worst of all was the difficulty of feeding a group of 15 to 20 men for several days in the wilderness, wondering whether the next village would have enough food to sell and sufficient shelter" (Sutton, 1970, p. 221). On one trip Wilson ran out of supplies and had to retrace his tracks. The trips scheduled were arduous, and Wilson missed his wife and wondered about their future. No personal letters are available to provide their expressions on the subject. Veitch, however, wrote in relation to future employment:

I met Watson accidentally yesterday and do not think from what the director has said to me you need fear about a post in 1905 — we shall see you through. (J. H. Veitch, letter, November 18, 1903.)

You were very wise to write to Sir William [Thistleton-Dyer], and I know he much appreciated your letter — and sent it to Lord Landsdowne to read — next autumn I should write him again if I were you — it is always well to keep in touch with such gentlemen — everybody likes a little attention especially those beyond their first youth and in the so-called high places of the world — anyway Sir William has been very good to you and the firm. (J. H. Veitch, letter, December 2, 1903.)

I have written Kew to look out for something for you — there certainly will be. In fact, they say there may be a vacancy this summer in a colonial garden which may be suitable — and I would like you at Coombe anyway for a

time — though of course, if anything good came along, you should take it. (J. H. Veitch, letter, March 15, 1904.)

Sutton (1970, p. 221) commented: "Early in 1905 Wilson was ready to go home, having abundantly fulfilled the demands of his employers. He had shipped back 2000 numbers of seeds and plants and 5000 numbers of herbarium specimens, many of which eventually proved to be new species." The figures given, however, represent the total for both expeditions, for the second produced only 510 numbers of seed lots and 2,400 numbers of herbarium specimens.

When Wilson returned to England in March, he received a letter from Veitch: "I have bought for you a pin — a flower of *Meconopsis integrifolia* — the five great petals of gold — the numerous stamens forty-one diamonds — and I think it really looks like a *Meconopsis* and not a single Paeony or single Rose, which in jewelry it might easily have done — I hope you will like it" (J. H. Veitch, letter, March 18, 1905).

In January, 1906, Wilson accepted an appointment as a botanical assistant at the Imperial Institute in London, where he worked on collections from Hong Kong.

Wilson's Third Expedition (1906-1909) — the First for the Arnold Arboretum

"To all appearance, he [Wilson] was a man prepared to settle down to botanical research and retire forever from the field" (Sutton, 1970, p. 230). Charles Sprague Sargent, however, had been seeking a man to collect in China for the Arnold Arboretum, and after several failures with other candidates, he approached Wilson. Wilson was hesitant and wrote:

There are many difficulties in the way, difficulties which are well-nigh insuperable, but which you cannot be expected to appreciate in the way I do. Putting sentiment aside, I have to throw up a Government appointment which, if at present modest, has possibilities. Secondly, I have to leave behind my wife and child, and these have to be provided for. Thirdly, there is the possibility of the pitcher going too often to the well. There are other things of might which have to be considered, and the possibilities of obtaining suitable employment on my return do not appear to me to be brighter in the future than in the past. (Wilson, letter, October 3, 1906.)

Sargent had been persuasive in earlier letters, but he also made some questionable statements about Wilson's career: "The trip is worth making alone for the seeds of fine conifers you have discovered, and you are likely to remain practically unknown unless you revisit China. . . . If you had been in China for two years more your

service would be very valuable to the Arboretum either from a cultural point of view or from working up your Chinese material" (Sargent, letter, July 16, 1906). Wilson was certainly aware of the financial success Veitch and Sons were enjoying from his introductions, as well as of the scientific contributions made by his herbarium specimens. Therefore he could easily assume that he had made his mark. Nevertheless, in a letter dated September 14, 1906, he accepted Sargent's proposal, and he arrived in Boston shortly before Christmas. On December 27, 1906, a formal contract was signed by E. H. Wilson and "President, Fellows of Harvard College by Charles S. Sargent." The first paragraph read,

Wilson agrees to go to China at once and for two full winter and summer seasons, or until about Dec. 1, 1908, to collect there for the College botanical specimens, seeds, information about plants, photographs, etc. All of the same including photographic plates or films, obtained by Wilson are to belong to the College immediately on coming into Wilson's possession, and are to be sent to the College by Wilson as often as practicable. Wilson agrees that during the period above mentioned he will devote all his time and his best energy and skill to the purposes above stated and will engage in no other occupation.

A salary was agreed upon with semiannual payments, and in case of his death before the term was completed, payment would be made for the current full year. An additional clause covered the period after the contract ended from December 1, 1908, until April 1, 1909.

The following day (December 28, 1906) Sargent wrote a detailed letter of his expectations, which shows both Wilson's task ahead and Sargent's botanical wisdom. It is reproduced in full:

My dear Mr. Wilson:

I shall try in these notes to set down some of the subjects that we have been discussing in regard to your journey to China.

The object of this journey is to increase the knowledge of the woody plants of the Empire and to introduce into cultivation as many of them as is practicable. It is therefore desirable to cover as much territory as possible rather than to attempt to gather large quantities of specimens or seeds of any particular plant, and although we have generally decided on the territory that you will visit, it is desirable as far as it is practicable for you to do so to cover new regions not previously visited by you.

For herbarium specimens we have decided that it would be well to undertake to dry six sets of all woody plants, and in order to show the distribution of species it is further de-

sirable to dry specimens of the same species when this occurs in distinctly different regions. In the case of species appear variable it is desirable to make a number of specimens showing as far as possible the extent of such variation. It is intended, of course, in such cases that these supplementary specimens should be made only or chiefly for the Arboretum and need not be included in your other sets.

With regard to herbaceous plants it is desirable to make specimens of any plant of which you gather seeds, or of herbaceous plants which appear to you to be new or to present special interest either from a scientific or horticultural point of view.

It is desirable to collect ferns for Dr. Christ to supplement your collections that have already been studied by him. All orchids should be collected for Mr. Ames, and where these present no difficulty in drying it would be a good plan to make a dozen specimens of each for purposes of exchange.

As far as practicable seeds of all woody plants should be collected with the exception, of course, of such very common things as *Ailanthus glandulosa*, *Kerria*, *Rhodotypos*, and other species known to you to be in common cultivation. If it is possible to obtain so many, it would be a good plan to have enough seeds to raise four or five hundred plants of all species likely to prove hardy in our northern states. This, however, would not apply to oaks, chestnuts and walnuts, as these seeds require packing in earth and it would be too laborious and expensive to send them in large quantities. Three or four dozen sound acorns, chestnuts or walnuts would probably be all that we could expect to get. *Magnolia* and *Euonymus* seeds also travel badly and they probably should be sent either in earth or damp moss.

In regard to seeds of plants like broad-leaved evergreens (with the exception of *Rhododendrons*) that cannot be expected to thrive in our climate, a much smaller number of seeds will be sufficient, my idea being to raise these plants here and then distribute them to gardens in southern Europe or the most temperate parts of Great Britain.

In collecting seeds it must be borne in mind that the position of the individual from which the seeds are gathered has a great influence on the hardiness of the offspring and that it is therefore important, in cases of species of wide distribution, to gather the seeds from the individuals growing as far north as possible or at the highest altitudes. This I consider a matter of utmost importance. I believe

it will prove more satisfactory to send seeds by mail unless you find that you have so many to send packed in earth that it would be more economical to send a case by freight. Seeds should be gathered of all Irises and Peonies, unless it is better to send roots of these by mail. It is also desirable to gather seeds of any showy bulbous plants other than Lilies, and of alpine and other herbaceous plants of real horticultural interest provided they have not already been introduced into cultivation, with the understanding, of course, that the introduction of herbaceous plants is secondary to the introduction of woody plants.

In case seeds cannot be obtained, grafts or cuttings should be sent instead. It will probably be necessary to send the grafts of Elms as it is not easy to obtain the seed. We can manage the grafts of nearly all the deciduous-leaved trees and shrubs that you are likely to meet with but not evergreens. I do not think it would be worth while to undertake to send a large number of grafts of each species, and probably three dozen of each would be sufficient. Cuttings of all Poplars and Willows should be sent.

Of Lily bulbs packed separately but sent with the Farquhar's bulbs, I should like to have one hundred and fifty of each of the Chinese Lilies for some of the subscribers here. If I hear from Miss Willmott that she also wants Lily bulbs, they had best be sent to her direct. I shall write you later on this subject.

Notes. It was desirable that the herbarium specimens should be accompanied by descriptive notes covering the points that are not shown by the specimens themselves. For example, the date when the specimen was gathered, the locality and altitude; in the case of trees, the average height, trunk diameter, habit, etc.; color of the flowers and fruit, the color of the anthers of *Crataegus*, economic uses of the plant if any, general character of the bark, value of the wood if this is used commercially, etc.; in the case of shrubs, their size, habit, etc. It may be well to state that our definition here of a tree is a plant that grows up with a single stem from the ground without regard to its size or height, and that of a shrub a plant that grows up with two or more stems from the ground without regard to its height, so that a shrub may be often much larger than a tree.

I think you agree with me that it is important to devise some system of numbering specimens and seeds by which the seeds can be correctly and quickly referred to the numbers of the herbarium specimens. Probably the plan we have discussed of giving each genus temporarily, at least, a separate series of numbers will prove effective. If this is

done, I should suppose it would be possible to give the herbarium specimen and the seed the same number, and later when the sets are made up for distribution the plants can have a new series of numbers independent of the seed numbers which would be for our convenience only.

It is desirable to photograph as many trees as possible, provided the tree photograph can be named. Some system of numbering referring to the herbarium specimens would therefore be needed for the photographs in the case of trees which you do not know. Photographs of flowers like Magnolias, Rhododendrons, etc., made life size if possible, are of very great value, and so are the photographs of the fruiting branches of *Picea*, *Tsuga* and *Abies*. Photographs on a large scale of the bark of trees are extremely valuable and should be made showing the character of the country inhabited by different trees. It would be well, too, if time permits, to take views of villages and other striking and interesting objects as the world knows little of the appearance of central and western China.

Conifers. I shall be glad to have you collect all conifers with both flowers and fruit if it is practicable for you to do so. We should also be glad to get the seeds of all of them, and in the case of genera like *Pinus*, *Picea*, *Thuja* and *Larix* to obtain at least one hundred cones detached from the branches gathered from different trees in order to show as far as possible any variations. In the case of *Cunninghamia* which, raised from seed gathered near the coast, is not hardy in this climate, seed from higher elevations in the interior should be sent. Of course what I have said about the importance of gathering seed from northern and elevated stations applies with equal or greater force to conifers.

I should be glad to get for our museum specimens of walnuts that you may meet with in the markets, as well as the fruits of other trees like chestnuts, etc., sold in Chinese markets. It would also be interesting if you could gather information about the trees and shrubs cultivated by the Chinese in their gardens or for economic purposes. The value of such notes would be increased if you could supply specimens of such plants.

I understand that it is not possible to longer [*sic*] find *Azaleas* cultivated in the Shanghai gardens. If there is a chance of doing so, however, it might be interesting to see them and perhaps secure plants of anything that may seem desirable to you. Shanghai, too, is the place of *Populus tomentosa*, of which we are desirous to obtain flowers.

Bamboo. If it is feasible to do so, it might be well to try the experiment of sending small pieces of rooted plants by

mail, of any of the small-growing mountain Bamboos that might prove hardy in this climate.

Books. I should be glad to have you pick up for our library books on Chinese botany.

Yours very truly,

C. S. Sargent

Sargent financed the third Wilson expedition by soliciting gifts from the Friends of the Arnold Arboretum, one of \$7,000, fourteen each of \$1,000, and numerous other smaller donations. Three donors from England contributed, but significantly no gift was received from the Veitch firm. Sargent apparently approached the firm, and Harry Veitch replied: "Thank you also very much for what you told me about Wilson's trip to China for you. I felt sure always that you would take care that anything he sent you, provided we already had received the same from him, should not interfere with our stock. . . . I appreciate fully your kindness in offering to tell Wilson to collect anything for us of which we are in special need" (J. H. Veitch, letter, July 1, 1907). Specifically, Wilson was to secure orchids for Oakes Ames; ferns for Hermann Christ of Switzerland; and lily bulbs for the Farquhar nurseries of Boston and for Miss Ellen Willmott of England, as well as some to be used as gifts for the supporters of the trip.

Field cooperation on this trip was planned with representatives of the U.S. Department of Agriculture and the Museum of Comparative Zoology of Harvard. The trip was far different in its goals and cooperative efforts from the business adventures undertaken for the Veitch firm. In the cooperative efforts planned with the U.S. Department of Agriculture, Wilson was to obtain seeds and propagating material of economically important plants for David Fairchild, while the Department's Frank Meyer was to gather herbarium specimens and cones of conifers especially for Wilson and Sargent in the Wu t'ai Mountains, where he was to make a spring trip for flowering specimens and a fall trip for the seeds.

Wilson arrived in Shanghai in February of 1907 and briefed Meyer on procedures. As he described these instructions in a letter to Sargent, they were a remarkable copy of those he had received himself. Meyer was to collect six sets of specimens of everything in this unknown flora, giving preference to ligneous plants, ferns, and terrestrial orchids (Wilson, letter, February 16, 1907). From Sargent's point of view, Meyer failed miserably in his mission, while Fairchild made repeated direct requests to Wilson. The situation caused Sargent to comment: "It was never understood that you were to do a great deal for the Department, and certainly it was not contemplated that while you were in the field you were to be bothered by answering their inquiries. . . . I should judge that you have already done more for the Department than the Department is likely to do for the Arboretum" (Sargent, letter, December 5, 1907).

Before Wilson had left Boston he knew he was to have the administrative responsibility for — and often the company of — Walter Zappey, who went sent by the Harvard Museum of Comparative Zoology to acquire bird skins and animal pelts. In a publication describing the results of the expedition, Samuel Henshaw later wrote:

The collections described in the following pages were made in the Chinese provinces of Hupeh and Szechwan during the years 1907 and 1908. With hardly an exception they represent the work of Mr. Walter R. Zappey while he was attached to the expedition sent out by the Arnold Arboretum under the direction of Mr. E. H. Wilson, the well-known botanical collector. . . . Mr. John E. Thayer, recognizing the need of zoological work in lower China, secured the consent of Prof. C. S. Sargent, the Director of the Arnold Arboretum, for a trained collector to accompany Mr. Wilson, and most generously provided the necessary financial support. . . . The results of Mr. Thayer's liberality and Mr. Zappey's zeal would have been very much less, however, had they not been supplemented by the tact and administrative ability of Mr. Wilson. . . . Mr. Wilson's earlier work in China was of distinct advantage for the success of the Arboretum Expedition. It had shown that he possessed the trustworthiness characteristic of his race, and the natural and ever present suspiciousness of the natives towards aliens engaged in a line of work the object of which is not wholly clear, was happily avoided from the beginning. It should be recognized that all of Mr. Wilson's time and energy were required for his botanical work and that every additional task he assumed, even though willingly and successfully, was nevertheless a burden. (Henshaw, 1912.)

Wilson had to keep separate accounts for the "John E. Thayer expedition" for Harvard. He handled baggage and repacked packages too large or too heavy. He arranged for support personnel, took care of customs formalities, and finally packed and shipped all the zoological specimens, notifying Sargent of their departure. In succeeding months Wilson repeatedly asked if they had arrived and inquired why he had not heard from Thayer. Finally Sargent wrote: "If Mr. Thayer has not written to you about Zappey's consignment, he is most enthusiastic over Zappey's work and perfectly delighted with Zappey's results, and especially the way in which his collections were packed. Apparently they have reached Boston in perfect condition and appear to contain many new specimens" (Sargent, letter, December, 1908). Although they traveled separately a great deal of the time, Zappey was Wilson's charge from February, 1907, until Zappey's departure from China in March, 1909.

Wilson was less successful with some of the shipments of bulbs



Walter Zappey (right), his assistant, and his dog, with a bag of seven Reeve's pheasants shot at Chang-yang Hsien in January 1909. Wilson made all of the arrangements for Zappey to collect for the Harvard Museum of Comparative Zoology on the "John E. Thayer Expedition." Photograph by E. H. Wilson.

to the Farquhar nurseries. Although he had collected, packed, and shipped bulbs on the Veitch expeditions, literally thousands of bulbs, each carefully wrapped in mud, rotted *en route* on this trip. Wilson was deeply chagrined at the failure of the first shipment and vowed to replace the consignment. With other seeds and plants Wilson was highly successful. Jackson Dawson, propagator at the Arnold Arboretum, was kept busy handling the significant introductions of Wilson's third trip. Sargent kept much of the herbaceous material for his own estate or shared it with botanists at Kew or with the Veitch firm.

Wilson held in storage the herbarium collections he made in 1907, gathered more in 1908, and shipped all at once in 1909. His collecting localities during this period are included in a separate listing later in this paper.

During the summer of 1908, while Wilson was still in China, Sargent made a trip to Europe to discuss with Harry Veitch the prospects for a new expedition. Veitch thought candidates would be more numerous in Europe. After a refusal from George Forrest, they chose William Purdom, once of the Veitch firm and then at Kew. After a

quick briefing Purdom was sent to China to meet Wilson, who was preparing to depart. Apparently Purdom's appointment was news to Wilson, for he wrote to Sargent:

You may be quite sure that anything I can do for Mr. Veitch and yourself in the way of helping your new man will be done. My last attempt in such matters [i.e., in the case of Mr. Meyer] was not altogether a success, but nothing daunted I am willing to try again since you wish it. It is well, professor, you did not tempt me with the offer to remain another season, for in spite of what I said in '06, I fear I should have succumbed to such an offer providing the political outlook in China seemed favorable. This would have completely broken up my wife, and for her sake, therefore, I am very glad the temptation did not come my way. But I am human and I confess to a slight feeling of chagrin at being passed over so completely in favour of another and without a word of warning. It can be interpreted to reflect unfavourably on the work I have accomplished during the past two years. I merely mention this: I do not say I think it thus intended. I am no longer a "cheap" man and I can quite understand that Mr. Veitch would hesitate to pay the salary you yourself did not think exorbitant. It is probably foolish of me to expose myself thus, but perfect frankness has characterized our association thus far and I think you know me too well to attribute this to a churlish or jealous spirit. With kind regards and best wishes for the success of your new venture. (Wilson, letter, March 9, 1909.)

Wilson packed his materials in Ichang, shipped them from Shanghai, and on April 25, 1909, was in Peking to return via Siberia. He stopped in Moscow and St. Petersburg (Leningrad) to examine herbarium specimens, particularly those of gymnosperms. In the greenhouse nurseries in St. Petersburg, he discovered seedlings grown from his Chinese collection of 1907, seeds of which Sargent had sent to Russia. In the herbarium of the botanical garden in Berlin, Wilson wished to study the collections of von Rosthorne and to acquire duplicates for the Arnold Arboretum. However, he learned that these collections were only on loan, and that the staff of the Berlin herbarium had first choice of duplicates or fragments, so no material would be available. This may explain a critical statement he wrote to Sargent:

In Berlin I saw the most flagrant examples of species mongering that have ever come under my notice. . . . At this moment I will content myself with one example. You will remember that Diels described a new *Liquidambar* from

Rosthorne's collection. Having been practically all over Rosthorne's ground and failed to discover anything answering the description, I had grown skeptical and determined to see the type when in Berlin. I did. The species is founded on *two leaves only* and these leaves are those of a *palmately veined species of Acer*. Can anyone defend the founding of a new species on two leaves alone? Greed and greed alone is responsible. (Wilson, letter, May 22, 1909.)

This was *Liquidambar rosthornii* Diels, which was not considered in Sargent's *Plantae Wilsonianae* by Rehder and Wilson in spite of Wilson's observations, and which was placed in the synonymy of *Acer sinense* Pax by Handel-Mazetti in 1933.

After a stop in Paris, Wilson reached London on May 17. He met with Ellen Willmott and visited Coombe Wood to see the plants grown from his earlier collections. Since his photographic plates had been sent to London, he worked with Wallis at Kew in the development of the plates and the identification of the pictures.

His herbarium collections, however, went directly to Boston, where Sargent apparently realized the task ahead in organizing and identifying the material. Although Wilson's contract had expired, Sargent offered him temporary employment to work up the material "after a short vacation." "When this work on the herbarium is done, possibly some arrangement for other work connected with the Arboretum can be found or perhaps you will care to undertake another journey" (Sargent, letter, May 24, 1909). Wilson was not pleased with the salary offered and "when he asked Sargent for a higher salary to cover his herbarium work Sargent replied that any increases would only generate ill feelings among Arboretum staff members who worked for less. Dissatisfied though he was, Wilson had no better alternatives, so in September he packed his wife and daughter and sailed for the United States to settle down in the herbarium for a while" (Sutton, 1970, p. 245).

Wilson's Fourth Expedition (1910-1911)

Although a goal of the third expedition was the collection of seeds and propagating material of conifers, the season proved disastrous. As Wilson observed, first Meyer let them down and then: "I am sorely afraid the fates intend to treat me severely this year in the matter of conifers" (Wilson, letter, October 11, 1908). In Boston Wilson arranged his herbarium specimens and apparently found himself ill-prepared to do much of the taxonomic and nomenclatural work Sargent had in mind for the publication *Plantae Wilsonianae*. In the original prospectus the work was to be in six parts comprising three volumes. As completed, it proved to be nine parts in three volumes totaling 1931 pages. The work was dominated by Alfred Rehder.

Little is known of the conversations and arrangements that led to



Ernest Henry Wilson with his wife (Ellen Ganderton) and daughter (Muriel Primrose) photographed during a visit to Japan.

the fourth expedition. Wilson and his family had arrived in Boston in September, 1909, and Wilson departed for China in March, 1910. The objective was to try again for seeds of gymnosperms. Taking the train across Europe to Moscow and from there to Peking, Wilson arrived in Ichang on June 1, 1910. Again he was able to assemble "as much of his old men as he required" and left from Chengtu on June 4. Wilson said:

My object was to enter Szechuan by way of northwestern Hupeh and then strike due west to Chengtu, the capital of the province. Much of this proposed route was absolute terra-incognita, and no one had before attempted this journey in its entirety. The distance is about seven hundred miles, but in rough mountainous country mere mileage is no criterion. In all it took about eight weeks of steady travel to cover the distance. (Wilson, 1912, p. 160).

From Chengtu Wilson made a round trip to Sungpan. He collected a few herbarium specimens, reported his "camera was very busy," and arranged for the gathering of fruits of *Eucommia*. Three day's travel outside of Chengtu, Wilson's party was caught in an avalanche of sliding rock. Although Wilson escaped from his sedan chair, which was carried over the precipice, he was hit on the leg and suffered a compound fracture.

He wrote to Sargent of the accident: "Fortunately as far as the expedition is concerned my plans have been so laid that whilst handicapping us, the accident cannot involve the expedition in entire failure" (Wilson, letter, September 10, 1910). He added the personal postscript: "P.S. My wife of course knows nothing of the accident, nor will she for several weeks to come, for I shall not write her about it until I am on a fair way to recovery. Please take every precaution to prevent the news from getting into the hands of the press or its friends at yours [*sic*] or across the water" (Wilson, *op. cit.*).

He received medical care from Dr. and Mrs. W. Henry Davidson of the Friends' Mission in Chengtu, and from a Dr. Mouillac, the French army surgeon in charge of the École de Médecine and the Roman Catholic Hospital in Chengtu. Because of the delay caused by the long passage from the scene of the accident, Wilson's leg became infected and nearly had to be amputated. Twelve weeks elapsed before he could hobble about on crutches with a shortened and painful limb. Sargent expressed his sympathy in a letter of October 25, 1910, and Wilson wrote in reply:

While in bed I knew my men would do what they could, although hardly as much as if I was around. An abundant seed season and possibly a grain of sympathy have worked in our favor with most gratifying results. In mere quantity the amount of seed despatched is equal to any former sea-



Above: Dr. and Mrs. Davidson and their house in the Friends Mission compound, Chengtu, where Wilson recuperated from his broken leg. Photograph taken December 20, 1910. Below: Wilson wrote the caption "My Chinese collectors, all faithful and true" for this photograph. The group, assembled in Ichang on February 15, 1911, had continued to collect while Wilson was recovering from his accident. Photographs by E. H. Wilson.

son. On counting, I find some four hundred packages have been despatched by post. At Ichang I expect to find a certain amount more. (Wilson, letter, December 4, 1910.)

While incapacitated, Wilson received a letter offering him the post of Assistant Superintendent (under Tutchter) of the Botanic Garden at Hong Kong. He replied:

Had the offer presented itself at the time of old Ford's retirement, I should have accepted it joyously. But seven years alter the aspect of affairs. In the first place I am bound by written agreement to remain with Harvard until April 1 next and to return there. There is also a more or less tacit understanding that I remain with them until all the collections are distributed. I have also the offer from Harvard of a permanent post of rather better value than the Hong Kong post, though it is doubtful if I shall accept even this. I have an almost overwhelming desire to settle down at Kew and take up certain work having direct connection with that which I have done in China. (Wilson, letter, November 16, 1910.)

Documentation for his contract and offer of a permanent post have not been located in the Harvard Archives.

Wilson collected only 462 numbers during this trip, but specimens dated after his accident, from locations far from Chengtu, indicate that his team worked during his recuperation. Wilson's last letter was written in Ichang on February 16, 1911, and he arrived back in Boston in March, 1911, almost a year to the day after his departure. His subsequent medical treatment and his mental and physical adjustment to work in an herbarium are not well documented.

Wilson's Collecting Localities

The following chronology of Wilson's travels in China is based on dated herbarium specimens and photographs, and on the entries available from his diaries and field books. Specific dates, when known, follow the month in parentheses (when Wilson appears to have been in two widely separated places on the same date, one collection was probably made by one of his collectors). The spellings of place names are those used by Wilson.¹ The smaller localities, in italics, are not mapped (in the paper following this by Clausen and Hu). Where possible, additional information about the localities is given. The following list of Chinese terms and their English equivalents should be helpful in interpreting the localities.

¹ Because there was not yet a standard system for romanization of Chinese, it is likely that Wilson had to create his own spellings of localities too small to be on any map. He was not consistent, but I feel that it is important to use his spellings for each particular collection.

<i>chiao</i>	bridge
<i>chou, chow, fu,</i> or <i>ting</i>	town, administrative center
<i>ho</i>	small river
<i>hsien</i>	township or seat of a township
<i>kiang</i>	river
<i>kou</i>	mouth of a river, ravine
<i>ling</i>	range of mountains
<i>shan</i>	hill or mountain

FIRST VEITCH EXPEDITION, 1899-1902

1899

April (23). Arrived in Boston.

June (3). Hong Kong.

August. Yunnan: Laokai.

September. Yunnan: Mengtsze; Szemao.

December (25). Hong Kong.

1900

February (24). Western Hupeh: Ichang.

March. Western Hupeh: Ichang; Nanto.

April. Western Hupeh: Ichang; Nanto; Patung; Chang-yang Hsien.

May. Western Hupeh: Chang-yang; *Chienshi Hsien*; Ichang; Nanto.Western Szechuan: *Ching ting Shan*.June. Western Hupeh: *Chien-si Hsien*; *Pao-kang Hsien*; Patung.

Szechuan: Wa-shan Mountain.

July. Western Hupeh: *Chienshi*.August. Eastern Szechuan: *Wulan*.

October. Western Hupeh: Chang-yang Hsien; Ichang.

December. Western Hupeh: Ichang.

1901

March. Kui (possibly Kui-chou in Eastern Szechuan).

April. Western Hupeh: Chang-yang Hsien; *Pao-kang*; Patung.

May. Western Hupeh: Patung Hsien.

June. Eastern Szechuan: Kui-chou.

Western Szechuan: Chang-yang; Fang Hsien; *Pao-kang Hsien*.July. Western Hupeh: Fang Hsien; *Pao-kang*; Patung.August. Western Hupeh: *Pao-kang Hsien*.

September. Western Hupeh: Chang-yang Hsien.

Undated (1900-1901)

An An Miao
Western Cheping
Fu Wan
Hsi Sha Ho
Hsing Shan
Kuan Pao
La Mo

Lalang
Linong
Lu Lung Po
Lung Kuan
Ma Huang Po
Mu Lung Po
Manhao

Papien River
Ping Shan Kai
Pu Lachi
Sze kou tze
Ti Mo Shan
Tu Wan
Yunnan
Yuenchiang

1902

April. Returned to England.

SECOND VEITCH EXPEDITION, 1903-1905

1903

- March (22). Hong Kong; Shanghai.
 April (25). Western Hupeh: Ichang.
 May. Szechuan: Chungking; *Fu-chau*; Kiating-fu; *Mu-tung*; *Shih Kai Tu*.
 June. Western Szechuan: Kiating-Fu (June 19); Tachien-lu; Wa-shan.
 July. Western Szechuan: *Fulin*; Kiating; Mt. Omei; Tachien-lu; Tung Valley; Wa-shan; *Yin-Kou*.
 August-September. Western Szechuan: Kiating (August 10-September 23).
 October. Western Szechuan: Kiating; Mt. Omei.
 November. Western Szechuan: Kiating.
 December. Western Hupeh: Ichang.

1904

- March (15). Western Hupeh: Ichang.
 April (24). Western Hupeh: Ichang.
 Western Szechuan: Sui Fu.
 May. Western Szechuan: Kiating; Mt. Omei; Tachien-lu; *Ta-hsiang-ling*; Tung Valley; Wa-shan.
 June. Western Szechuan: Mt. Omei; Mupin; Tachien-lu.
 July. Western Szechuan: Kiating; Mt. Omei; Tachien-lu; Tung Valley.
 August. Western Szechuan: Kiating; Sungpan.
 September. Western Szechuan: Chengtu; Min Valley; Sungpan.
 October. Western Szechuan: Mupin; Tachien-lu.
 November. Western Szechuan: Kiating.
 December. Western Szechuan: Kiating (December 8); Chung-king (December 14).

1905

- March. Returned to England.

FIRST ARNOLD ARBORETUM EXPEDITION, 1907-1909

JOHN E. THAYER EXPEDITION TO CHINA FOR THE MUSEUM OF
 COMPARATIVE ZOOLOGY, 1907-1909

1907

- February. Arrived in Shanghai (February 2); Ichang (February 26)
 March. Western Hupeh: Hsing-shan Hsien; Ichang.
 April. Western Hupeh: Chang yang Hsien; Hsing-shan Hsien; Ichang; Patung Hsien.
 May. Western Hupeh: *Changlo-Hsien*; Fang Hsien; Hsing-shan Hsien; Ichang.
 June. Western Hupeh: Changyang Hsien; Fang Hsien; Hsing-shan Hsien; Ichang; Patung Hsien; *Ta-wan* ("big turn").
 Kiangsi: Kuling.
 July. Kiangsi: Kuling.
 Western Hupeh: *Chang-lo Hsien*; Hsing-shan Hsien; *Ta-wan*.
 August. Kiangsi: Kui-Kiang; Kuling.
 Western Hupeh: Fang Hsien; Hsing-shan Hsien; Ichang.
 September. Western Hupeh: Fang Hsien; Hsing-shan Hsien.
 October. Western Hupeh: Fang Hsien; Hsing-shan Hsien; Ichang.
 November. Western Hupeh: Changyang Hsien; Fang Hsien; Ichang; Pa-tung Hsien.
 December. Western Hupeh: Changyang Hsien; Hsing-shan Hsien; Ichang.

1908

- January. Western Hupeh: Hsing-shan Hsien; Ichang; Shasi.
 February. Western Hupeh; Ichang.

- March. Western Hupeh: Ichang; *Ichang Gorge*; Patung City.
Szechuan: *Hsin-lung Rapids*; Yangtze River (may be near Kui-Fu);
Kui-Fu City; *Te-t'an* (village); *Windbox Gorge*; *Wushan Gorge*; Yün
Yang City.
- April. Western Szechuan: Feng-tu Hsien; Sui-Fu; Wan Hsien (city).
- May. Western Szechuan: Chengtu; *Chengtu Plain*; Chien-wei Hsien;
Ching-chi Hsien; Chiu-Ting Shan; Hanchou; Hsin-Hsin Hsien;
Kiating Fu; Mao-chou; *Mao-chou Plain*; Mien-chu Hsien; *Min Valley*;
Shih-Fang Hsien; Tachien-lu; Ta Hsing-ling (range of mountains,
possibly near Tachien-lu); Wa-ssu; *Wei-chow* (possibly Mei-chou);
Wên Chuan Hsien.
- June. Western Szechuan: Chengtu; *Hsao-chin Ho* (probably Hsiao-chin
Ho); Hsin Wên ping; Hsuan Kou; *Kuan chai* (between Monkong Ting
and Pan-lan-shan Pass); Kuan-Hsien; Mongong Ting; Mupin (region
northwest of Tachien-lu); *Niu-tou-shan* (mountain east of Pan-lan-
shan); Pan-lan-shan (mountain pass); Pi Hsien; Romi Chango;
Tachien-lu (Kang-ting); Ta-Chin Ho (upper Tung River); *Tsung-lu*
possibly Tungolo, west of Tachien-lu); *Wokji* (village; also the name
of a region north of Mongkong Ting).
- July. Western Szechuan: *Cheto-shan* (mountain range west of Tachien-
lu); Mupin; Tachien-lu; Ta-p'ao-shan (Pan-lan-shan); Tung River
Valley; Wa-shan (mountain); Wassu Kou (probably a ravine near
Wa-ssu); West Romichango.
- August. Western Szechuan: Chengtu City; Chengtu Fu; Ching Chi Hsien;
Fei-yüeh-ling; *Hua-ling-ping*; Kiung-chou; Kuan Hsien; *Leng Che*
(village); Luting-Chiao; Nitou (possibly Nui-tou shan near Pan-lan-
shan); Shuangliu; Tartar City, Chengtu (inner city of Chengtu);
Wa-shan (mountain); Ya-chou Fu (Ya an); *Yung-yang Hsien*.
- September. Western Szechuan: Ching Chi Hsien; *Hungya Hsien* (hamlet
south of Ya-chou Fu); Kiating Fu; *Malie* (near Wa-shan); Mt. Wa-
Wu; Omei Hsien; *Tatien Chieh* (hamlet); *Tung River Valley*; Wa-
shan (mountain).
- October. Western Szechuan: *Chengtu Plain*; Chiu Ting shan, Mien-chu
Hsien; Hsin-Hsin Hsien; Kiating; Mupin; Tachien-lu; Tung River
Valley; Ya-chi Fu (probably Ya-chou Fu).
- November. Western Szechuan: Chengtu City; Chiu-Ting shan, Tu Men;
Kiating Fu; *Min River Valley*; Mupin; Pan-lan-shan; Tachien-lu; Tung
River Valley; Wa-shan (mountain); Wassu.
- December. Western Szechuan: Chiang Ching Hsien; Kiating Fu; Lu-chou;
Min River; Na-Chi Hsien (probably Nan-chi); Sui Fu; Yachou Fu;
Ya River.

1909

- January. Szechuan: Chungking; *Shih-pao-chai*; Wan Hsien; *Wushan
Gorge*; Yunyang.
Western Hupeh: A-tung Hsien (probably Pa-tung Hsien); Hsing-shan
Hsien; Ichang; *Ichang Gorge*; Nan t'o; *Mitsang Gorge*; *Chin Tan
Village*; Patung Hsien; Putze (hamlet); *Shan-Yuh-Tung Glen* (near
Ichang, among the Yangtze gorges).
- February. Western Hupeh: Changyang Hsien; Ichang.
- March. Han-Kow; Ichang Fu; Shanghai;
- April. Hong Kong; left China at the end of April.

SECOND ARNOLD ARBORETUM EXPEDITION, 1910-1911

1910

April. To China via Trans-Siberian Railway.

Western Hupeh: Ichang.

May. Western Hupeh: Ichang; *Sun-yu-tung Glen*.June. Western Hupeh: Fang Hsien; Hsiang-Tan; Hsing-shan Hsien; Ichang; *Kuo-Hu-ping*; *Lumeng Ho*, Patung Hsien; *Sha-kao-che*; *Shakou-pieu* (hamlet); *Sun-yu-tung Glen*; *Yangtze gorges* (near Ichang) Eastern Szechuan; *Tan-chia-Teng* (village); Taning Hsien.July. Eastern Szechuan: Kai Hsien; Shato-tzu (market town); *Wan-to-tsau*; *Wên-tang-ching*; Yünyang Hsien.North-central Szechuan: Chint'ang Hsien; *Chung-chiang Hsien*; *Hwai-pai-lu* (small market village); *Nan-ching Kuan*; Pa-chou; *Paoning Fu*; *Tai-lu-che* (market village); *Tung-chuan Fu*; *Tung-Hsiang Hsien*; *Yenting Hsien*; *Yi-lung Hsien*.

Western Szechuan: Chengtu Fu.

August. Western Szechuan: An Hsien; Chengtu; Han-chou; Kuan-Hsien; *Kung-ching ch'ang*; Lungan Fu; Mao-chou; Mienchu Hsien; *Min River Valley*; *Shi-chuan Hsien*; Sin-tu Hsien (Hsin-tu Hsien); Sungpan; Sungpan Ting (Sungpan); Tachien-lu.September. Western Szechuan: Kiating; Kuan Hsien; Mao-chou; *Ping-long-shih* (near Mount Wa-wu); Sungpan; Sungpan Ting (Wilson's accident); Tachien-lu; Wen-ch'uan Hsien; *Yen-Meng*.

Western Hupeh: Fang Hsien.

November. Western Szechuan: Wa-ssu.

December. Western Szechuan: Chengtu; Mt. Omei.

1911

February. Western Hupeh: Ichang; Hankow; Kin-ling (port); Shasi.

March. Hankow; Kuikiang; Shanghai.

Arrived in Boston.

(To be continued in *Arnoldia*, July/Aug., 1980)

Mapping the Collecting Localities of E. H. Wilson in China

by KRISTIN S. CLAUSEN and SHIU-YING HU

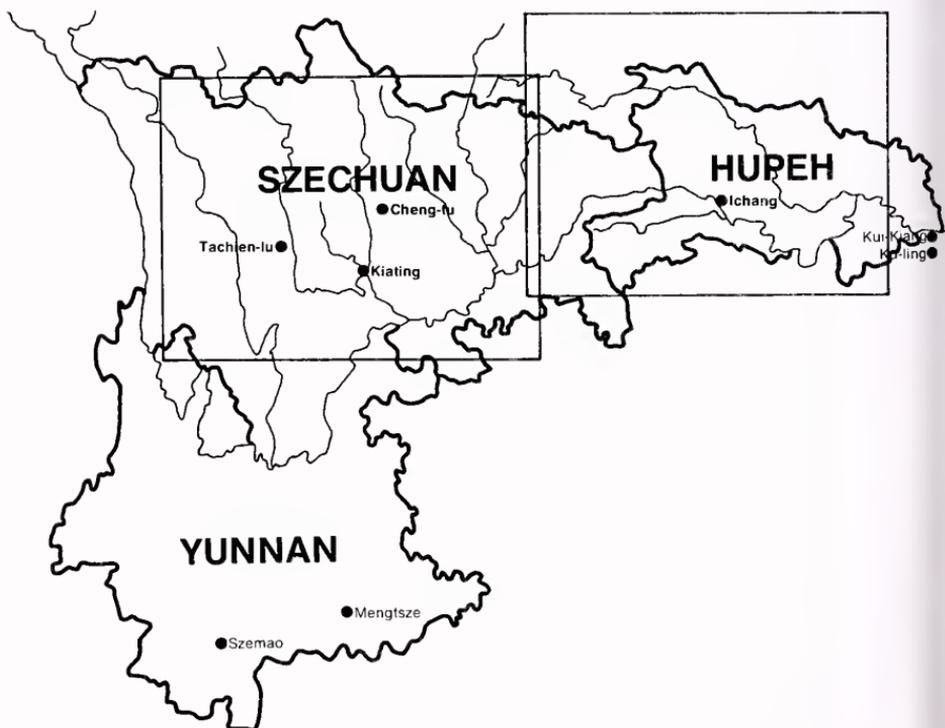
Ernest Henry Wilson traveled in China on four separate trips between 1899 and 1911 to collect seeds, propagating material, and specimens of the rich temperate flora of Hupeh and Szechuan. His first two trips were made while he was in the employ of the English nursery firm of James Veitch and Sons. He then was sent on two collecting trips by the Arnold Arboretum.

The sources of information used to ascertain Wilson's collecting localities are as follows: photographs taken during the two Arnold Arboretum trips to China by Wilson, and his field notebooks, trip journals, and numerical lists of specimens and seeds. When Wilson traveled in China, he was working in virtually unmapped territory and had to rely on the rudimentary maps of missionaries and Western merchants. Because there was not yet a standard system for romanization of Chinese, it is likely that he had to create his own

Kristin Clausen has been working with Dr. Richard Howard this year as a research assistant in botany for the Arnold Arboretum. She has a B.S. in botany from the University of Wisconsin and plans to be a graduate student this fall in the Department of Ecology and Evolution, State University of New York at Stony Brook. Shiu-ying Hu, botanist, has worked for the Arnold Arboretum for 27 years, specializing in the flora of China. She has worked as an associate professor at West China Union University, Chengtu, Szechuan (E. H. Wilson's headquarters in China) and has traveled through most of the area shown on these maps.



Map 1. China and neighboring countries. Provinces where Wilson collected plants are shaded. Note the western border of Szechuan during Wilson's time (broken line) and the course of the Yangtze River (dotted line). Boxed area indicates area included in Map 2.



Map 2. The major rivers of Hupeh and Szechuan. Collecting localities in Yunnan from the first Wilson expedition to China for Veitch and Sons and two localities in Kiangsi province at the eastern border of Hupeh. Boxed areas indicate Maps 3 and 5, and 4 and 6.

spellings in order to record the place names of hamlets and villages too small to be on any map. This is corroborated by inconsistencies in Wilson's spellings throughout his notes, lists, and books from the China trips.

During the early period of British and American involvement with China, the Post Office system of transliteration was used in mapping. In 1942 it began to be replaced by the Wade-Giles system. In order to prepare the maps for this paper, it was necessary to change Wilson's spellings to those of the Wade-Giles system in order to tap into this geographic literature. More recently, the People's Republic of China has adopted the Pinyin system of transliteration. This system is now being used by *The New York Times* and The National Geographic Society.

We are using Wilson's spellings on the maps because we feel that these will be the most helpful to researchers trying to identify localities for his specimens. In addition, we have prepared a list that gives the Wade-Giles and Pinyin equivalents for each of these spellings. In order to ease the problem of using maps with different systems of transliteration, the latitude and longitude of each locality are given.

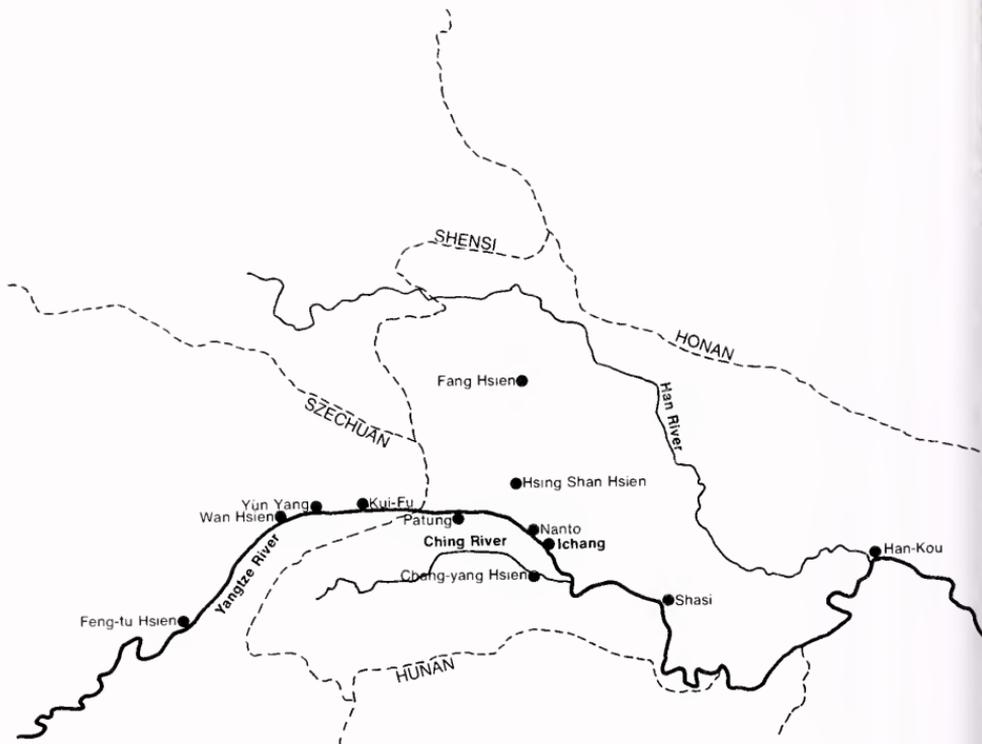
In Wilson's time, China was divided into three levels of administrative units: provinces, districts, and "hsien" (townships). Since then, there have been many changes, two of which have directly affected the mapping of Wilson's localities: changes in names of major cities, and the extension of the western boundary of Szechuan. An example of the first case is the major Tibetan border trading city of Tachien-lu, which Wilson used as a base on his collecting trips. Today it is known as K'ang-ting. Such changes are indicated in our list by parentheses around the current name in the Wade-Giles and Pinyin columns. In some cases where both names are still in current usage, both are retained. Szechuan's western boundary during Wilson's trips is indicated by the line on Map 1. The territory to the west was called Eastern Tibet by Western explorers of the period and includes towns now well within the heart of Szechuan.

A *hsien* may refer to a township as well as to the township seat. We have taken all Wilson *hsien* designations to refer to townships. However, because of the small scale of our maps we have designated only the seat. A given "hsien" locality should be interpreted as "in the vicinity of" the town of the same name on the maps.

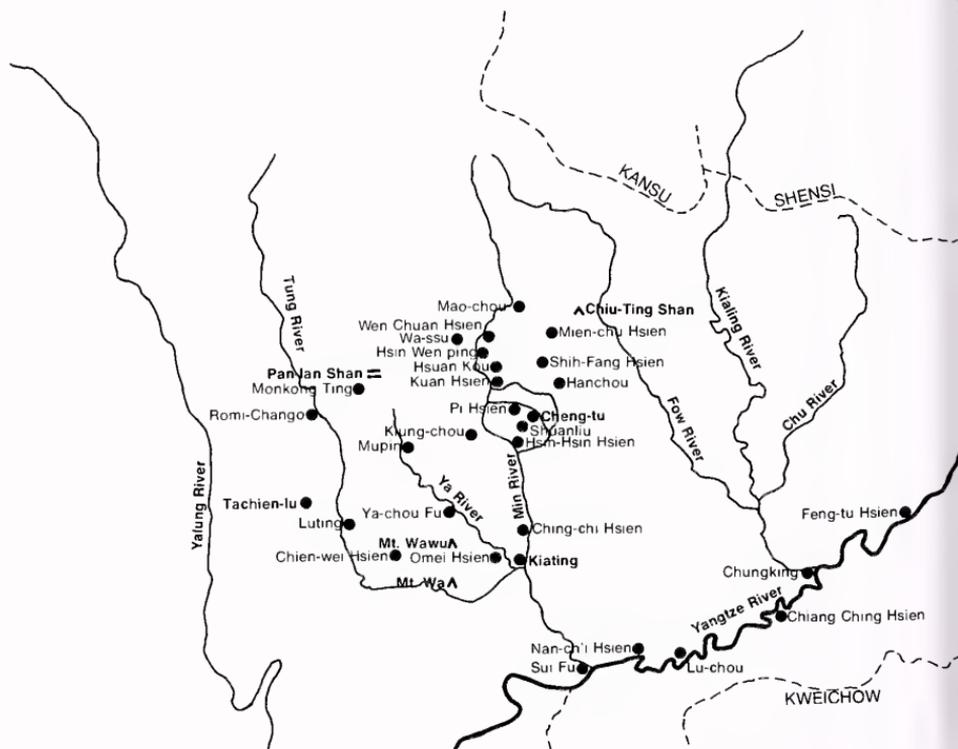
We have included those localities at the "hsien" level or above. Many villages and hamlets that are listed as collecting localities are simply not to be found on maps of the scale accessible to most researchers. In the few cases where we have included these smaller localities, our source was the map at the end of Wilson's book, *China Mother of Gardens*.

Acknowledgments

We would like to thank Laurie B. Feine and Dr. Bernice Schubert for their critical review of the manuscript.



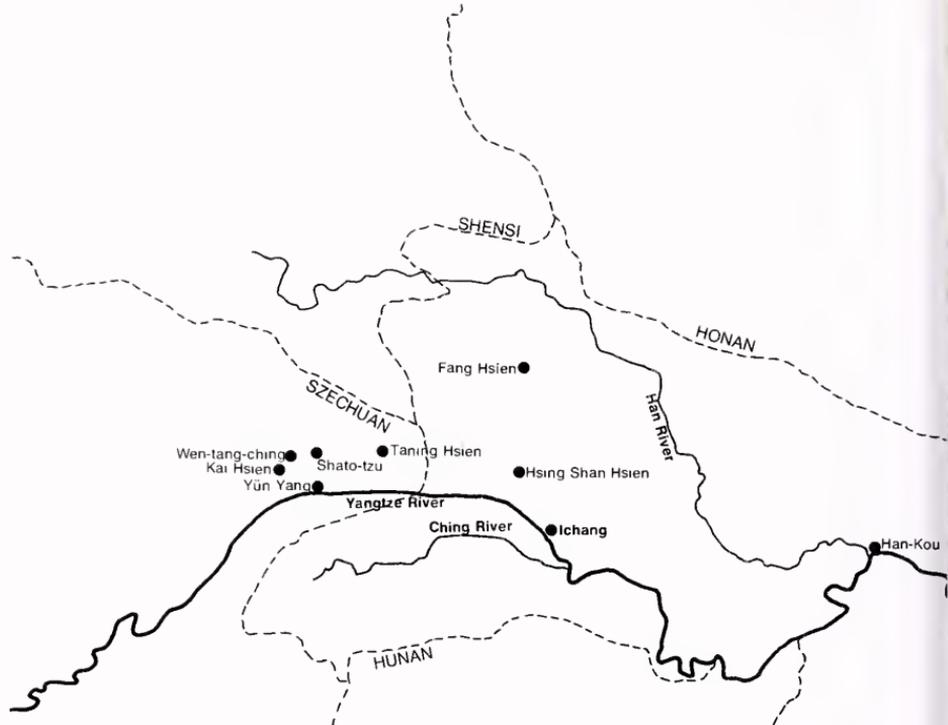
Map 3. Arnold Arboretum expedition to China, 1906-1909: collecting localities in western Hupeh and eastern Szechuan.



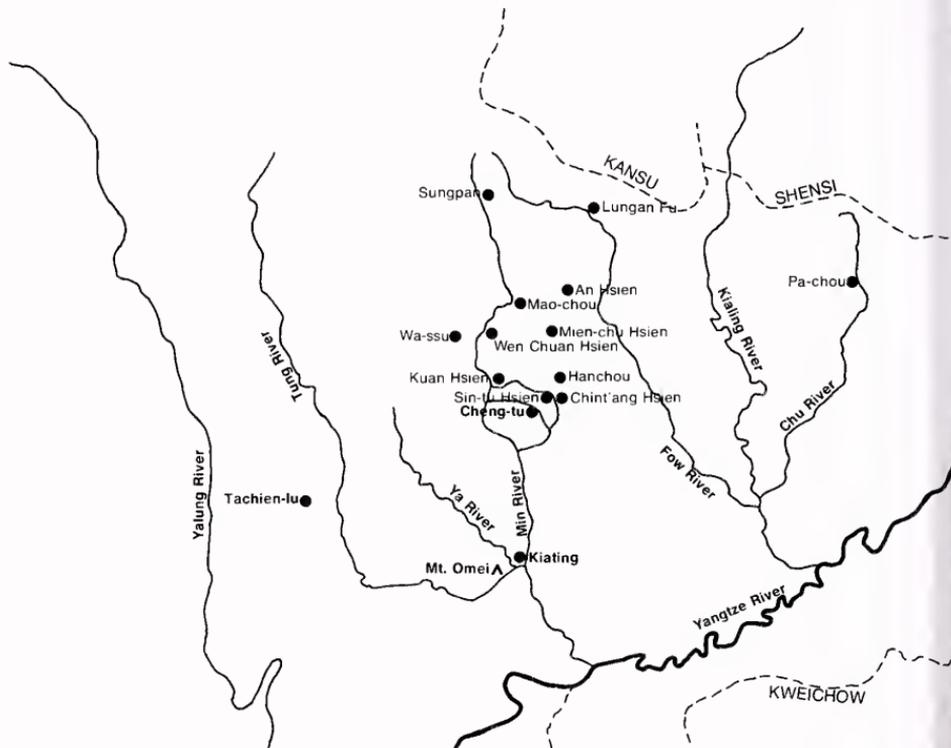
Map 4. Arnold Arboretum expedition to China, 1906-1909: collecting localities in western Szechuan.

Mapped Wilson Localities

<i>Wilson spelling</i>	<i>Wade-Giles system</i>	<i>Pinyin system</i>	<i>Latitude and longitude</i>	
HUPEH				
Chang-yang Hsien	Ch'ang-yang Hsien	Chang-yang	30°30'N	111°14'E
Fang Hsien	—	Fang-xian	32°06'N	110°50'E
Han-Kow	Han-k'ou	Han-kou	30°30'N	114°16'E
Hsing Shan Hsien	—	Xing Shan	31°12'N	110°50'E
Ichang	I-chang	I-chang	30°44'N	111°22'E
Kin-ling	Chiang-ling	Jiang-ling	30°40'N	112°12'E
Nanto	Nan-t'ou	Nan-tou	30°45'N	111°22'E
Pao-kang Hsien	—	Bao-kang	31°58'N	111°20'E
Patung	Pa-tung	Ba-tong	31°N	110°28'E
Shasi	Sha-shih	Sha-shi	30°20'N	112°12'E
KIANGSI				
Hong Kong	—	Xiang-gang	22°45'N	114°10'E
Kui-Kiang	Chiu-chiang	Jiu-jiang	29°40'N	116°02'E
Ku-ling	— (Lu-shan)	Gu-ling (Lushan)	29°30'N	116°02'E
Shanghai	Shang-hai	Shanghai	31°20'N	121°30'E
SZECHUAN				
An Hsien	—	An-xian	31°42'N	104°28'E
Chengt'u	Ch'eng-tu	Cheng-du	30°45'N	104°02'E
Cheto-shan	Chê-tuo Shan	Zhe-tuo shan	30°31'N	101°45'E
Chiang Ching Hsien	Chiang-Chin	Jiang-jin	29°12'N	106°25'E
Chien-wei Hsien	—	Jian-wei	29°10'N	102°55'E
Ching-chi Hsien	Ch'ing-shen	Qing-shen	29°50'N	103°50'E
Chint'ang Hsien	Chin-t'ang	Jin-tang	30°55'N	104°20'E
Chiu-Ting Shan	—	Jiu-ding Shan	31°30'N	104°30'E
Chungking	Chung-ch'ing	Chong-qing	29°35'N	106°35'E
Feng-tu Hsien	Fêng-tu	Feng-du	30°N	107°50'E
Hanchou	(Kuang-han)	(Guang-han)	31°N	104°25'E
Hsao chin Ho	Hsiao-chin-ch'uan	Xiao-jin-chuan	31°10'N	102°20'E
Hsin-Hsin Hsien	Hsin-ching	Xin-jing	30°28'N	103°47'E
Hsin Wên ping	Hsing-Wên Ping	Xing-wen Ping	31°10'N	103°30'E
Hsuan Kou	Hsuan-k'ou	Xuan-kou	31°15'N	103°20'E
Hungya Hsien	Hung-ya	Hung-ya	29°50'N	103°20'E
Kai Hsien	K'ai Hsien	Kai-xian	31°12'N	108°30'E
Kiating	Chia-ting	Jia-ding	29°30'N	103°38'E
	(Lo-shan Hsien)	(Lou-shan)		
Kuing-chou	Ch'ung-lai	Chong-lai	30°30'N	103°25'E
Kuan Hsien	—	Guan-xian	31°N	103°32'E
Kui-chou } Kui-Fu City }	K'uei-chou (Fêng-chieh)	Kui-zhou (Feng-jie)	31°05'N	109°30'E
Lu-chou	—	Lu-zhou	28°55'N	105°25'E
Lungan Fu	P'ing-wu	Ping-wu	32°28'N	104°32'E
Luting Chiao	Lu-ting Chiao	Lu-ding Chiao	29°55'N	102°20'E
Mao-chou	Mao-hsien	Mao-xian	31°48'N	103°55'E
Mien-chu Hsien	Mien-chü	Mian-ju	31°28'N	104°20'E
Min Valley	—	—	31–32°N	103°31'E
Monkong Ting	Mou-kung	Mou-gong	31°N	102°23'E
Mt. Omei	—	—	29°30'N	103°20'E
Mupin	(Pao-hsing)	(Bao-xing)	30°10'N	102°56'E
Na-Chi Hsien	Nan-ch'i	Nan-chi	28°55'N	104°58'E
Niu-tou-shan	Niu-t'ou Shan	Niu-tuo Shan	31°30'N	103°10'E
Omei Hsien	O-mei	—	29°33'N	103°30'E



Map 5. Arnold Arboretum expedition to China, 1910-1911: collecting localities in western Hupeh and eastern Szechuan.



Map 6. Arnold Arboretum expedition to China, 1910-1911: collecting localities in western Szechuan.

<i>Wilson spelling</i>	<i>Wade-Giles system</i>	<i>Pinyin system</i>	<i>Latitude and longitude</i>	
Pa-chou	—	Ba-chong	31°50'N	106°50'E
Pan-lan-shan	Pan-lan Shan	Ba-lang shan	31°10'N	102°50'E
Pi Hsien	P'i-hsien	Pi-xian	30°58'N	103°50'E
Romi-Chango	(Tan-pa)	(Danba)	30°42'N	101°58'E
Shato-tau	Sha-t'ou szu	—	31°25'N	108°45'E
Shih-Fang Hsien	—	Shi-fang	31°10'N	104°10'E
Shuanliu	Shuang-liu	Shuang-liu	30°35'N	103°58'E
Sin-tu Hsien	Hsin-tu	Xin-din	30°50'N	104°10'E
Sui Fu	Hsü-fu (I-ping)	(I-bing)	28°48'N	104°32'E
Sungpan	Sung-p'an	Sung-pan	32°40'N	103°35'E
Tachien-lu	Ta-chien-lu (K'ang-ting)	(Kang-ding)	30°02'N	102°E
Ta-Chin Ho	Ta-chin-ch'u'an	Ta-jin-chuan	31°32'N	101°55'E
Taning Hsien	—	—	31°25'N	109°30'E
Tung valley	T'ung	—	29-32°N	102°E
Wan Hsien	—	Wan-xian	30°50'N	108°28'E
Wa-shan	—	—	29°20'N	103°E
Wa-ssu	Wa-ssu	Wa-si	31°28'N	103°28'E
Wen Chuan Hsien	Wen-chuan	Wen-chuan	31°30'N	103°30'E
Ya-chou Fu	Ya-an	—	30°N	103°E
Ya River	—	—	30°N	103°E
Yün Yang city	Yün-yang	Yun-yang	30°58'N	108°56'E
YUNNAN				
Laokai	Lao-K'ai	Lao-kai	22°30'N	104°E
Mengtsze	Mêng-tzu	Meng-au	23°12'N	103°25'E
Szema	Ssu-mao	Si-mao	22°45'N	101°08'E

Prunus cyclamina

In the Boston area winter's long grip eases with the onset of longer and warmer days in early April. Spring bursts forth with colorful flowers from such bulbous plants as winter aconites and snow drops, to be followed some weeks later by an abundance of color from flowering trees. One of the first trees to put forth blossoms is the rare and little-known cyclamen cherry (*Prunus cyclamina*). Early season visitors to the Arboretum cannot miss the spectacle of our large cyclamen cherry even though it is tucked away in a little-visited corner behind the hickory trees near the Centre Street Gate. Complemented by the soft yellow of the corylopsis flowers nearby, the cyclamen cherry stands out among its neighbors that, still leafless, retain the brown and gray hues of the winter landscape.

In response to moderating climatic conditions, *Prunus cyclamina* quickly takes on a rose-pink blush as the flower buds swell. Flowers of this cherry open a short time ahead of those of *P. sargentii* in early to mid-April, and they still remain when the petals of the Sargent cherry (*P. sargentii*) are only speckles of pink in the greening grass.

Blossoms 3 to 6 cm. wide, of the softest pink, are borne on a stalk 1 cm. long. At full anthesis the sepals are strongly reflexed. The five individual petals are narrowly ovate in shape with a deep cleft or notch at the tip. According to notes on this species by Collingwood Ingram (1948), one of Europe's foremost authorities on the genus *Prunus*, floral color varies in richness and intensity from seedling to



Flower color of the cyclamen cherry varies from pale to rose pink, dependent on genetic variation, from plant to plant. Note the deep cleft on the outer tip of each petal.



This specimen of Prunus cyclamina (AA 11262-2), with a height of 30 feet and a spread of 40 feet, becomes a floral focal point because of its early-season performance and abundance of bloom.

seedling, with some forms being even more richly colored than *P. sargentii*. He also stated that the tree begins flowering at an early age and flowers freely and dependably thereafter. Our plants at the Arnold Arboretum flower heavily each year, and I have not observed the blossoms to be harmed by frost. However, high wind or heavy rain quickly causes the flowers to shatter, thus ruining the display. As the petals mature and fall away, the young leaves emerge glossy and bronze-red, blending visually with the dull reddish purple of the persistent floral cup and combining to extend a muted but attractive color show for a week or more. As the foliage expands, it quickly changes to the dark green tone of summer. Autumn color is unspectacular and cannot match the rich orange to purple hues of *P. sargentii*.

After flowering, the small cherries develop quickly and eventually attain the size and shape of a pea. They ripen to a dull purple-red in late June or early July. The tasty fruits are very attractive to birds, but because they are small, with meager pulp, they have little value for human consumption.

Native to Hupeh, Szechuan, and Sikang provinces of the People's Republic of China, this plant seems to have been discovered in 1889-

90 by A. E. Pratt, who collected it near Tachienlu, Sikang Province, in China, but his specimens were long misidentified. "*Prunus cyclamina* was first described by Koehne in 1912 from material which E. H. Wilson had collected under his no. 9 on his first expedition for the Arnold Arboretum in 1907. Wilson found the species near Changyang Hsien, Hupeh growing in woodland at altitudes of 3300-4300 ft. and it was introduced into cultivation by means of seeds he collected" (Sealy, 1959).

Two mature specimens of *Prunus cyclamina* exist at the Arnold Arboretum. One (AA 706-31-B) is located between the pond and the Forest Hills Gate. It was propagated from seed in 1931, and at 49 years of age is it 25 feet tall with a spread of 30 feet. Three large stems and three smaller ones arise from a point about one foot above soil level. The tree displays several large pruning wounds — evidence that it has lost large branches in the past.

The second plant (AA 11262-2), propagated from seed collected from an earlier accession at the Arboretum, grows among the collections of *Carya*, *Ilex crenata*, and *Buxus* near the Centre Street wall. At 51 years of age, it is 30 feet tall with a spread of 40 feet. Branching begins at four feet above the ground, with seven major branches spreading outward and upward from this point. Average new-season growth is 10-14 inches long, with some branches showing vigorous growth of 24 inches. This second specimen is the plant featured in this article.

The tree develops heavy branches that arise with strong crotch angles, and the branches are spaced far enough apart to give a bold visual character to the tree. The branching habit of *Prunus cyclamina* is a bit more open and slightly more wide-spreading than that of *P. sargentii*.

The branches are clad in bark that is a dull dark purple-brown on the older stems; the smoothness of the bark is interrupted by rough, horizontal bands and short lenticels. Bark on young branches is a dull reddish brown with short lenticels.

Although the cyclamen cherry has been cultivated at the Arnold Arboretum for approximately 72 years, it is virtually unknown in North America. This author believes that the species may possess the same degree of toughness exhibited by *Prunus sargentii* and *P. × yedoensis*, for despite the fact that our cherry collection has declined due to nematodes, viruses, and black knot, these plants appear to be healthy, vigorous, and extremely floriferous.

Cyclamen cherry blooms at the same time as — and can be used to create landscape scenes with — *Corylopsis* species, *Rhododendron* 'PJM', *Forsythia × intermedia* cultivars, *Cornus mas*, *C. officinalis*, *Viburnum farreri*, *V. × bodnantense*, *Magnolia stellata*, and bulbous plants including *Scilla sibirica* and *Adonis amurensis*.

The plants can be propagated by sowing the seeds after three months of cold stratification at 40°F to insure optimum germination.

Grafting has been accomplished successfully using *Prunus avium* as a rootstock and making the graft as close to the soil level as possible.

Cuttings have been rooted at the Arnold Arboretum. Although specific details are incomplete, we do have the following data compiled by Steve Silberstein, a horticultural trainee during the summer of 1978. He took 50 cuttings on June 17, 1978, divided them into five treatment groups of ten cuttings each, and placed them in equal parts of perlite and sand, under mist. On August 8, 1978, prior to Steve's departure, the cuttings were lifted and inspected. At that time he found that the control cuttings, as well as those treated with five-second quick dips in a solution of 5,000 and 10,000 ppm. of I.B.A. (indolbutyric acid) in 50% ethanol alcohol, had formed heavy callus tissue but had no roots evident. Quick dips in a solution of 5,000 and 10,000 ppm. of N.A.A. (naphthalene acetic acid) in 50% ethanol alcohol resulted in a high mortality of the cuttings. Vegetative propagation of this species needs continued testing and review.

Hardiness ranges for the species have not been adequately explored due to limited availability and trial. It is fully hardy to -10°F (-20°C) and perhaps lower, but it needs further testing to determine the limits of its cold hardiness and heat tolerance. A check of the *Master Inventory of Botanical Taxa* published in microfiche form by the Plant Science Data Center lists only two other institutions that are growing this plant. They are the Morton Arboretum in Lisle, Illinois, and the U.S. National Arboretum in Washington, D.C. At present we know of no commercial sources in North America.

In order to promote testing, the Arnold Arboretum is willing to supply dormant scion wood to interested nurseries and individuals. Scion wood in quantities of 10 scions per request will be available in January and February, 1981.¹ Before receiving this material, you should have rootstocks of *Prunus avium* on hand and forced for grafting by early January, 1981.

GARY L. KOLLER

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¹ A charge of \$16.00 per package of 10 scions will be made to help defray the costs of handling and postage.



A stout trunk, strong branch angles, and vigor of growth indicate that the cyclamen cherry may be robust enough to be useful in urban landscapes. Note the bands of lenticels that encircle the trunk and stems.

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pg. 67, caption (photo): *For* Minnie, Harry (locks unshorn), and Laura Dawson *read* Laura, Harry (locks unshorn) and Minnie Dawson

pg. 70: *For* Lowthorpe School *read* Lowthorpe School

Right: *Meconopsis integrifolia*, the yellow-flowered Chinese poppy, was the goal of Wilson's second expedition. Photo taken by J. F. Rock in the Minshan Range near Koangkei shan, June, 1925.

Back cover: The tie pin representing *Meconopsis integrifolia* presented to E. H. Wilson by the Veitch firm after the second expedition to China. The petals are gold, and there are forty diamonds for stamens.

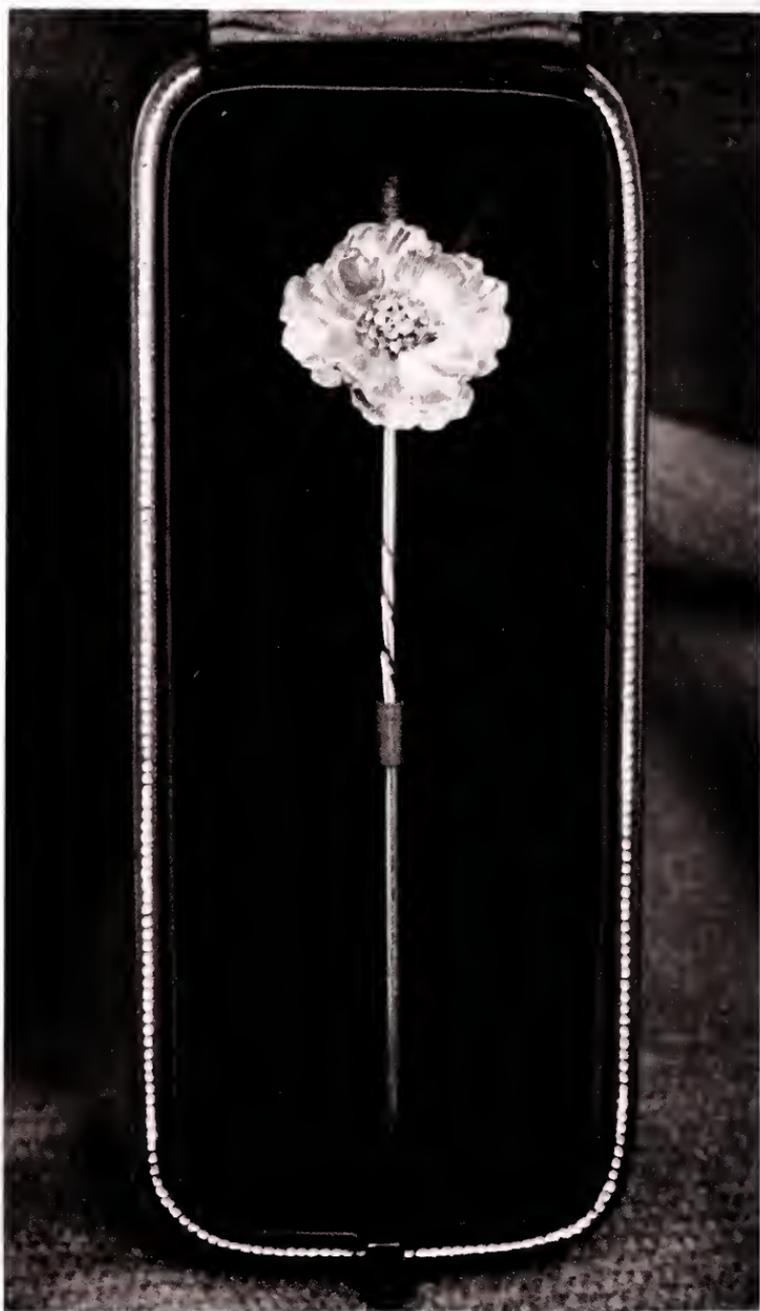


Next issue:

E. H. Wilson as a Botanist, Part II

Outstanding Plants of the Arnold Arboretum:

Quercus × *Sargentii*



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ARNOLDIA

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RICHARD E. WEAVER, JR., Editor BARBARA O. EPSTEIN, Circulation Manager

Our thanks to Elizabeth Schmidt who edited the manuscript, and
Carl Lobig who acted as managing editor for this issue.

On the front cover: Bamboo suspension bridge in the mountains of Shih-chuan Hsien, Western Sechuan (alt. 2700 feet). Taken 12 August 1910, this is a fine example of E. H. Wilson's glass plate photography.

E. H. Wilson as a Botanist*

by RICHARD A. HOWARD

Wilson after 1911

Although Wilson referred to a "written agreement with Harvard until April 1, 1911," "a tacit understanding that I remain with them until all the collections are distributed," and "the offer from Harvard of a permanent post" (Wilson, letter, November 12, 1910), none of these can be confirmed in the available records. Sutton (1970, p. 249) stated that "Sargent felt conscience-bound to provide for him professionally when he limped back from China." Wilson did need further medical treatment both in England and in Boston, and the abrupt return required much physical and psychological adjustment. "The Wilson family tried to adapt to the United States while living in a modest apartment in Jamaica Plain near the Arboretum. Wilson could not make up his mind about the United States [and never did become a citizen]; Ellen Wilson, for her part, liked neither America nor Americans. Wilson soon became accustomed to the new environment and began to enjoy the benefits of his reputation" (Sutton, 1970, p. 250). He was in popular demand as a speaker with his "stereopticon illustrations," and Sargent, recognizing the value of the publicity for the Arnold Arboretum, encouraged him to

* Continued from Volume 40, p. 138.



Ernest Henry Wilson standing on the steps of the Administration Building of the Arnold Arboretum, Jamaica Plain, Massachusetts.

write popular articles and to give lectures. Wilson did contribute to the study of his collections, but it is obvious that Alfred Rehder dominated the work, handling nomenclatural problems and especially the German literature with greater interest and facility than did Wilson. Wilson wrote numerous popular articles based on his explorations of China and also calling upon his experiences at Kew and subsequently at the Arnold Arboretum. The *Bulletin of Popular Information* issued by the Arboretum beginning in May, 1911, contained unsigned articles until Sargent's death in 1927. The information in many of the notes is probably attributable to Wilson, and the phrases are often repeated in Wilson's later, signed articles. Former staff members recall that Wilson dictated to a secretary as he rode or walked around the grounds, and such material was published in the *Bulletin*.

Both Wilson and Sargent had field knowledge of Japan, its flora, and the plants under cultivation there. In 1914 an arduous field trip was still out of the question, but Wilson did accept Sargent's plan for a special trip to Japan to study the plants under cultivation. Sargent had less difficulty soliciting funds for this trip because of Wilson's reputation, and Wilson was permitted to take his wife and daughter along. Wilson's field books reveal trips primarily along railroad routes, and they are dominated by entries from various botanical gardens and by records of cultivated plants. Two of his publications for the Arnold Arboretum, *The Cherries of Japan* (1916) and *The Conifers and Taxads of Japan* (1916), resulted from his observations on this trip. When World War I broke out, Sargent was in England. He cut short his planned trip and returned to Boston, where he wrote to Wilson, suggesting that he abandon the original plans for traveling to adjacent islands and return home soon. Wilson arrived in Boston in April, 1915. Sutton (1970, pp. 256, 257) reported Wilson's frustration, resentment, and bitterness over his isolation and his inability to enlist or serve in the war effort in a useful way:

Wilson's patriotism ran deep and frustration blurred his judgment. Before the war Rehder and Wilson had been close friends. Now, although the professional dialogue continued amiably, Wilson — under pressure from his wife — discontinued their social relations. . . . Rehder, a scholarly, gentle person, was apolitical, and it was some time before either he or Mrs. Rehder understood why the Wilsons mistrusted them.

Rehder may have been "apolitical," but he was strongly pro-German throughout his career. Sargent clearly had a personnel problem: "Sargent became conscious of Wilson's irritability and restlessness, and these influenced his decision to send Wilson on a new collecting expedition even though the fighting was still in progress" (Sutton,

1970, p. 257). In January, 1917, Wilson left again for Asia and the Bonin Islands before spending six months in Korea in 1917. In 1918 he collected in Formosa for four months and then returned to Korea via Japan. He returned to Formosa in the late fall of 1918. Apparently his leg no longer bothered him, for the schedule he kept was arduous. He collected over 3,000 numbers in remote places and exposed over 600 photographic plates, primarily on the flora of Japan. It was during this trip that he assembled from nursery sources the collection of Kurume azaleas that became known as the "Wilson Fifty." Those plants not hardy in the Boston area were kept by Sargent at Holm Lea and by the Ames family in North Easton. They were forced for exhibition at the spring flower shows of the Massachusetts Horticultural Society and other organizations; during nearly fifty years of exhibitions, they won prizes on each occasion.

Wilson's exact title at the Arboretum during this period is not recorded, although in one article he refers to himself as "Dendrologist, Arnold Arboretum." In 1916 he received an honorary Master of Arts degree from Harvard, and in 1919 he was appointed Assistant Director of the Arnold Arboretum, without limit of time. In this capacity he made one more trip to the Pacific area. This lasted from July of 1920 until September of 1922, during which time Wilson visited Australia, New Zealand, Tasmania, India, Ceylon, Kenya, Rhodesia, and South Africa. He took few photographs on these trips — in fact, he had commercial photographs sent back to the Arboretum. He sought specific conifers for study, but his collection numbers for this period are incomplete, overlapping, and confused, and many specimens are without numbers. No introductions of seeds or living plants were made, as far as can be determined. The trip has often been described as a "public relations effort" to permit Wilson to be introduced to the staff of various tropical botanical gardens. A series of reports from each area visited was published in the *Garden Magazine* (1923-24) under the title of "Travel Tales of a Plant Collector," and the subject matter became chapters in his two-volume work *Plant Hunting* (1927a).

Sargent died in 1927. The University filled the gap by appointing Professor Oakes Ames as Supervisor of the Arnold Arboretum and chairman of a standing committee on the University's botanical collections. The title of Director of the Arboretum was abandoned, and Wilson was given the new title "Keeper of the Arboretum." Only after Wilson's death was the title of "Director" re-established for the Arnold Arboretum.

Wilson died October 15, 1930, in an automobile accident near Worcester, Massachusetts, while returning from a trip to Montreal. The accident was blamed in part on the weakness of his leg so badly injured in China.



Above: *Oo-ryong-too*, on *Dagelet Island*, off the northeastern coast of Korea (June 1, 1917). Below: *The Bonin island of Hah-jima*, from *Naga-hama* with *Muko-jima* on the horizon. Wilson collected in this area on April 27, 1917. Photographs by E. H. Wilson.

Wilson's Collecting Localities in Asia, 1914-1919

1914

- February. Japan: Tokyo (3).² Undated: Kagoshima; Shitogo; Yakushima.
- March. Japan: Kinishima (9); Kagoshima (17); Nagasaki (18); Tokyo (20). Undated: Kai; Kamo; Kusakabe; Muji; Sakurajima; Sano; Shigotomi; Togo; Yoshino.
- April. Japan: Tokyo (15); Kyoto (26); Tokyo (30). Undated: Hachioji; Gotemba; Hakoue; Hatogaya; Joshino; Kasuga-yama; Koganei; Kyoto; Meguro; Miyanoshita; Nara; Ongata; Totsuka-mura.
- May. Japan: Kamakura (11); Fuji (14); Nikko Mts. (23); Chuzenji (31). Undated: Enoshima; Kasukae; Kanazawa; Sanjohara; Subashiri; Tatebayashi; Urami Falls.
- June. Japan: Chuzenji (5); Tokyo (6); Mitsumina, Mt. Chichibu (9); Mt. Ontake (15); Mt. Fuji (20); mountains near Yumoto (28). Undated: Kofu; Nantai-san; Rokugome; Yoshida.
- July. Japan: Nikko, Matsushima (2); Matsushima to Noboribetsu (6); Hakkeda and Yama to Tokyo (10); Asama (18); Adzuma (22); Morioka to Hakodate (22); Osisna (27); Yezo Fuji (30); Kutchan to Sapporo (31). Undated: Furo-zan, Lake Onuma; Mt. Moiwa; Mt. Teine; Wadamura.
- August. Japan: Sapporo to Otaru (1); Otaru to Saghalien (2); Saghalien (9); Otaru to Sapporo (10); Kushiro (15); Abashiri (17); Rubeshibe (20); Oketo (25); Sapporo (26); Hakodate (30). Undated: Bihoro; Kamizaima; Kushino; Odomari; Sakaihama; Yachigashira.
- September. Japan: Hakodate to Karinzawa (2); Tokyo (6); Lake Suwa (17); Yatsugadake (22); Tokyo (24); Mt. Hazachine (30). Undated: Ashitoriya; Lake Towada; Nakabusa-onsen.
- October. Japan: Aomari (3); Hakkoda (5); Lake Towada (8); Odate (9); coolee trip to Chokai-san (9); Adzuma Mts. (11); Yumoto (20); Lake Chuzenji (29); Tokyo (30); Nagoga (31). Undated: Jimba; Konseitoge; Kurosawa; Nikko; Onsenga-take; Mt. Ontake; Sanjo-hara.
- November. Japan: Mt. Ontake (5); Gotemba (6); Mt. Fuji (9); Tokyo (10); Kobe (16); Shikoku and return to Kobe (23); Osaka (25); Miyajima (29); Kobe (30). Undated: Higashi-kawa; Lake Yamanaka; Nagoya; Nishinogawa; Shigaro-yama; Sugi.
- December. Japan: Kaga-san (3); Nara (7); Kyoto (10); Tokyo 11, 24); Yokohama (29); Tokyo (31).

1915

- January. Japan: Yokohama (2).
Arrival in San Francisco (22), Boston (29).

1917

- January. Started trip to Asia.
- February. Liukiu Islands.
- March. Liukiu Islands. Oshima: Atami; Idzu; Naze. Okinawa: Genku Mt., Naha. Karama group: Aharen Island; Aka Island. Unplaced: Kanaguru; Katema; Yaeyama Island; Yakuji Island; Yonebara.
- April. Japan: Boshu Peninsula (10). Undated: Hojo; Michizaki; Sakai. Bonin Islands: Haha-jima (23); Muko-jima (28). Undated: Okumura; Sekimonzan.

² The day(s) of the month, where known, are indicated in parentheses after the locality.

- May. Bonin Islands: Ani-jima (3); Chichijima (3); Hachijo-jima (6).
Korea: Ajio Station, Yamagutachi ken (17); Seoul, prov. Keiki (21);
Nam-san prov. Keiki (23), Ka-zan, near Suigen, prov. Keiki (24);
Hoko, prov. Kesho (29), Dagelet Island (30). Undated: Sango.
- June. Korea: Dagelet Island (1-5); Taiyudo, prov. N. Heian (15-30).
Undated: Dodo; Pukchin, prov. Heian; Takkori, prov. Heian; Maban,
prov. N. Heian.
- July. Korea: Koryo, near Keijo, prov. Keiki (6); Keijyo (13); Shinguiban
on Yalu River, prov. N. Heian (15).
Manchuria: Darien (19); Port Arthur (20); Murden (22).
Korea: Shingishu, Mt. Hakuba, prov. N. Heian (24). Undated:
Chiao-lan.
- August. Korea: Sempo, prov. S. Kankyo (1); Chemulopo, prov. Keiki (7);
Fu-nei (14); Sha-yunei, prov. N. Kankyo (15); Mogan, prov. N.
Kankyo (16); Jyosohyo, prov. N. Kankyo (17); Enshamen, prov. N.
Kankyo (18); Yujyo (19); Sohyo (20); Engan (23); Setsurei (Snow
Mt.), prov. N. Kankyo (25); Tumen-Yalu, prov. N. Kankyo (29-31).
Undated: Kankyo Ho; Hokudo.
- September. Korea: Tumen-Yalu, prov. N. Kankyo (1, 2); Keizanchu (4-
12); Chochiin to Shinkari, prov. S. Kankyo (14); Laoling (17); Eiko
(18-23). Undated: Kanin; Koshukoyu; Nanchatongu; Rynsan, Shan-
shui, Sinkabachin, Shinyu, Shobo; Yeiko River.
- October. Korea: Gensan to Onseri, prov. S. Kankyo (5); Kongo-san, prov.
Kogen (8-16). Undated: Bambutsusu; Fukendo; Jizo; Kyurynan;
Miroku-ho; Reifun san.
- November. Korea: Quelpaert Island (2-6); Chiri-san, prov. S. Keisho (13-
17). Undated: Hallai-san; Keijyo, prov. Keiki; Saishu; Seikiho.
- December. Korea: Tanjyo-gan, prov. N. Chusei (9). Undated: Baiho-men;
Baiho-rei.

1918

- January. Japan.
Formosa (22).
- February. Formosa: Takao, prov. Tainan (20); Bamshoruo (21); Anping
23); Kagi, prov. Kagi (24). Undated: Arisan; Funkiko, Hso-gei-han;
Keitao; Shakorio.
- March. Formosa: Mt. Noko, prov. Nanto (2); Horisha (9); Lake Can-
dideus (10); Taihoku, prov. Taihoku (17-27); Chosokei (30); Urai
(30). Undated: Housha; Jukirin; Keelung; Koken; Mt. Kiraishiu; Mt.
Taihei; Musha; Naisweizan; Nama; Parisha; Sekitei; Shirin; Sokei;
Sozan; Tahken; Tentana.
- April. Formosa: Chosokei, prov. Taihoku (1). Undated: Keelung; Zuihu.
- May. Japan: Nishi-kirihima (4); Osaka (8); Yamamoto, Ikedo (8); Ha-
komo, Gotemba (11). Undated: Nishi-kirishima; Yokkaichi.
- June. Japan: Fuji-san (12); Subushiri (12); Onada (17).
Korea: Keijyo, prov. Keiki (22); Kongo-san, prov. Kogen (30).
- July. Korea: Diamond Mts., prov. Kogen (2); Miroku-ho, prov. Kogen (6);
NW. Korea, prov. N. Heian (28-31); Ping-yang, prov. S. Heian (29).
Undated: Chinnampo, Choanji; Heiko; Hichecanbo Peak; Hyokunji;
Kishi; Kokai; Makaen-an; Mt. Miraku; Mochuri; Shinchindo.
- August. Korea: NW Korea, prov. N. Heian (1-8); Keiki-on, prov. Keiki
(20); Unsan distr., prov. N. Heian (29-31). Undated: Kanghura
Island; Keijyo; Pukchin.

- September. Korea: Unsan distr., prov. N. Heian (1-5); Kongo-san, prov. Kogen (11-17). Undated: return to Japan and to Formosa.
- October. Formosa: Sekitei, prov. Taihoku (10); Sozan (11); Arisan, prov. Kagi (16-31). Undated: Funkiku; Keitao; Mt. Morrison; Mungetsu; Rinkiho; Rinnai.
- November. Formosa: Ketao, prov. Nanto (1); Boryo to Kuraru, prov. Koshun (14); Pinan (17-20); Karenko, prov. Karenko (22-26). Undated: Gukutsu; Nanwo; Shin-chow; Tsihan-roku.
- December. Formosa: Horisha, Lake Candideus (3-7); Island of Tanshima, Japan Sea (23).

1919

- January. Japan: Tokyo (29).
- February. Japan. Undated: Goto; Yamashiro.
- March. Arrival in Boston (17).

Wilson's Itinerary for 1920-1922

1920

- July. Started trip via England.
- August. England; Scotland.
- September. Australia.
- October. Australia: Perth (21).
- November. Australia: Albany (6); Goolgardia to Widgremooltha (22).
- December. Australia. Undated: Adelaide, Narara, Sydney.

1921

- January. Australia: Mossvale (4).
Arrival in New Zealand (27).
- February. New Zealand.
- March. New Zealand.
Tasmania: Hobart (17).
- April. Tasmania.
Australia: Melbourne (22).
- May. Australia.
- June. Australia.
- July. Departure for Singapore, Penang, Rangoon.
India: Calcutta (19).
- August. "India" (Pakistan): Rawalpindi (14); Srinagar, Kashmir (15);
Delhi (23). Undated: Dehra Dun.
- September. India: Darjeeling (19); Shillong (24). Undated: Coonoor.
- October. India: Calcutta to Madras (1).
Ceylon: arrival (6). Undated: Colombo; Manaar; Peradeniya;
Ragalla.
- November. India: Bombay (4).
Kenya: undated.

1922

- January. Kenya.
- February. South Africa.
- April. Departure from Cape Town (7).
- May. Arrival in London (31).

June. England: Dawyck (9); London (19).

July. France: Paris (5); Les Barres (17).

England: Wisley (21); Hillier Nursery (28); Cambridge (28).

August. England: Kew (11); departure from Liverpool (15).

Wilson in the Field

Wilson left little information about his method of operation in the field. What can be gathered from occasional comments in his writings and diaries does not give a complete picture of what was needed to live and travel as he did during the eleven years from 1900 through 1910. In *Plant Hunting* (1927a, Vol. 1, p. xxv) he stated the necessary qualifications:

Like any other vocation, plant hunting calls for certain qualifications on the part of those who essay the task. First and foremost it is a work of youth, for it takes a heavy toll of strength and endurance, patience and enthusiasm. A sound constitution and an eminently sane mind are fundamental requisites. An optimistic temperament and abundance of tact are essential in dealing with the difficulties and delays incident upon travel and the idiosyncracies of native peoples. The more knowledge the hunter has of plants already in cultivation, of gardening, and of botany, the greater the chance of success. Some business acumen, ability to mingle freely and pleasantly with all sorts and conditions of men are added qualifications of no mean order. But above all else tact and a sound physique are needed in the rough and tumble of plant hunting.

In his first published article, in *The Field, The Country Gentleman's Newspaper* (CVI: 109, 1905), Wilson recommended western China for the sportsman: "Leaving aside the cost of outfit, which should be procured in England or America, £500 would amply cover a sportsman's expenses for one year in the country. This sum would include first class fare from London to Shanghai and return. The journey could even be done for £400 if strict economy were enforced; on the other hand many pounds could easily be expended."

Wilson's first major report of his travels was entitled *A Naturalist in Western China, with Vasculum, Camera, and Gun, Being Some Account of Eleven Years' Travel, Exploration, and Observation in the More Remote Parts of the Flowery Kingdom* (1913). The vasculum, adopted from his early training in Europe, is a metal case carried over the shoulder and opened by a cover hinged on the long side. Plant specimens are carried in it all day without being crushed; in the evening they are sorted and dried in plant presses. Wilson's photographic equipment will be mentioned later. The gun, according to available photographs, apparently was never more powerful than a double-barreled shotgun, "12 bore" as he described it. It was used



*The type tree of *Ormosia hosiei* Hemsley & Wilson, near Chengtu City, November 11, 1908. The species was named in honor of Alexander Hosie, of the Consular Service, who aided Wilson in shipping his collections. A sedan chair of the type Wilson used is in the lower left corner. Photograph by E. H. Wilson.*

for acquiring birds “for the pot” or, on one trip, for skins and pelts. Zappey, who accompanied Wilson in 1908–9, carried a rifle suitable for downing larger animals. Wilson’s party commonly had soldiers along, and there is some indication that their guns were used for hunting.

One chapter in *A Naturalist in Western China* is devoted to the subject “Methods of Travel: Roads and Accommodation.” On page 22 of Volume 1, he stated, “In the regions with which we deal there is nothing in the nature of wheeled vehicular traffic save only the rude wheel-barrow in use on the Chengtu plain. There are no mule caravans and scarcely a riding pony is to be found. For overland travel there is the native sedan-chair and one’s own legs; for river travel the native boat.” The sedan-chair is mentioned frequently: “I travelled mostly on foot but had with me a light sedan chair made of rattan and my Boy or principal servant was similarly favored. A sedan chair is an outward and visible sign of respectability without which no traveller is properly equipped. In those days it was of far more importance than a passport, for it inspired confidence and insured the respect of the people. Whether one rode in it or walked was immaterial; the important thing was its presence” (Wilson,

1927a, Vol. 2, p. 148). Wilson was riding in his sedan chair in 1910 when the landslide occurred and he suffered a compound fracture of his leg. He fortunately left the chair before it was carried over the cliff. Wilson once wrote (1913, Vol. 1, p. 198) that although he slept in a hut of spruce boughs, "my boy preferred to pass the night in his chair." Four coolies of Wilson's entourage were engaged to carry the botanist and his "Boy" in the sedan chairs.

"One should have with him an outfit comprising bed, bedding, victuals, cooking paraphernalia and insect powder" (Wilson, 1929, p. 19). On several trips Wilson made his headquarters at Ichang and purchased a boat to be used as a residence. On the second Veitch expedition he had a boat named "Ellena" after his wife; on the two trips for the Arnold Arboretum, the boat was named "The Harvard." Ichang was a fairly busy commercial port, with customs officials and missionaries in residence. The two small rooms that made up the accommodations on the boat were confining, especially when plants were being worked up or stored. He found warehouses to store his collections, and he enjoyed the hospitality of many of the residents who spoke English. His indebtedness for their friendship is indicated by the number of species dedicated in compliment to them. "While travelling overland in China it is not possible to use tents and one has perforce to make use of such accommodations as the country affords. The Chinese do not understand tents, and it is unwise to try innovations in a land where people are unduly inquisitive" (Wilson, 1929, p. 19). The local accommodations, invariably called "hostels" by Wilson, were occasionally "fair" or "pleasant," but more often than not unpleasant, dirty, "ridden with hungry tormenting fleas," leaky, muddy, smelly, noisy, and sometimes "undescribable." At Wang-tung-tiao "we found lodgings for the night. . . . The inn is beautifully situated in a grove of bamboo and cypress, but is poor and abominably stinking. Really, it is a pity that such a vile house should defile such a charming spot" (Wilson, 1913, Vol. 1, p. 81). At Lao-tang-fane the single room had "a long row of 'bunks' built along one side, with benches for the accommodation of loads on the other. . . . Skins of serow and budorcas served as mattress on the bunks or settees" (Wilson, 1913, Vol. 1, p. 132). At Shihcu'uan Hsien he was "glad to escape from the malodorous, vermin infested inn" (Wilson, 1913, Vol. 1, p. 120). At Hsin-chia-pa the inns were unacceptable to Wilson, and a high-handed solution was described: "We happened on a decent farmhouse, which we commandeered. The owner being away, his wife was at first sorely afraid, but in a couple of hours her confidence was gained and all was well. . . . We parted excellent friends with our hostess at Hsin-chia-pa, a trifling present and 400 cash (5 pence) made her extremely happy; her thanks were both genuine and profuse" (Wilson, 1913, Vol. 1, p. 89).

Wilson's "bed" and "bedding" are never explained. Presumably, a folding camp cot was used, for he referred to his bed having been



The hostel of San-Chia-Tsze, altitude 12,500 feet, one mile below the summit of Hsnek-Shan Pass. Wilson makes a rare appearance in the extreme right of this photograph taken August 23, 1910.

brought in late by a coolie. He carried "oil sheets," which were used to cover native beds or to protect Wilson from the leaking roofs at night.

In spite of his comment on tents, Wilson apparently did "camp out" on occasion. At Tatién-lu,

We selected a convenient spot nearby on which to pitch a tent for ourselves. Whilst I acted as family doctor my companion and the two men in good health attempted to fix up the tent outside. . . . Meanwhile rain, hail and sleet descended in torrents. After a half-hour's struggle, the rain and wind conquered, and the task of rigging the tent outside had to be abandoned. There being no possible place to sleep inside, free from rain, the only thing left was to fix the tent inside the house, the floor of which, owing to the absence of part of the roof, being already a quagmire. At length it was put up somehow, our beds were arranged beneath it, and oil-sheets placed over the top, as the thin cloth did not pretend to be waterproof. . . . (Wilson, 1906, p. 100.)

Wilson's party was often large; one of his photographs showed 24 people. He generally depended on local inns or hostels to supply meals and accommodations, and he rarely wrote of food or food sup-

plies. The expeditions from a base such as Ichang, Tatién-lu, or Sungpan were generally of two or three weeks' duration. One 1904 expedition to Sungpan took 52 days. On a trip to Shenei in 1907, the party ran out of supplies and had to double back. At Yu-yu-tien "travellers furnish their own food supplies, since nothing is obtainable at the hostel except, perhaps, some green vegetables in minute quantities" (Wilson, 1913, Vol. 1, p. 178). Wilson employed a cook, but I have not encountered in his notebooks any description of either his meals or his tastes in food. Farrington (in Wilson, 1931, p. 26) commented, "He told once of his difficulties in getting accustomed to Chinese food, especially certain chickens which have black bones. He had a fondness for birds' nest pudding, and he said that eggs which had been kept for two years in Chinese fashion were none too bad." He wrote of the taste of pheasant and of ships' biscuits and tea for breakfast.

Of all the locales Wilson visited, he appears to have been enthusiastic about only one. Of Sungpan he wrote (1913, Vol. 1, p. 144),

Did Fates ordain that I should live in Western China I could ask for nothing better than to be domiciled in Sungpan. Though the altitude is considerable the climate is perfect, mild at all times, with, as a general rule, clear skies in Tibetan-blue. During the summer one can always sleep under a blanket, in winter a fire and extra clothing are all that is necessary. Excellent beef, mutton, milk and butter are always obtainable at very cheap rates. The wheaten flour makes a very fair bread, and in season there is a variety of game. Good vegetables are produced such as Irish potatoes, peas, cabbages, turnips, and carrots, and such fruits as peaches, pears, plums, apricots, apples, and wild raspberries. Nowhere else in interior China can an Occidental fare better than in Sungpan Ting.

James Veitch asked Wilson in an early letter if he wore Chinese clothes. Photographs of him in the field always show him in western dress: occasionally he is shown with a field-type jacket, otherwise in a seemingly heavy suit including a vest. He wore a hat, leather puttees fixed with leather straps, and heavy shoes; he once referred to the fruits of *Heteropogon* as capable of penetrating the tongue of a "shooting boot."

Veitch wrote that field glasses were being sent to him in 1900. Wilson recorded the distances he traveled and indicated that 20 miles was an average day's trip. In his field books he recorded distances in *lis*, a Chinese unit of measure equal to one third of a mile. He carried a pedometer (among his mementos, still set for a 35-inch stride). He had two compasses, as well as an altimeter made by Negretti and Zambra that he referred to as an "aneroid" when he gave altitudes

at various locations. Once Wilson cited a thermometer reading of 36°F, suggesting that he had a thermometer. Presumably he had axes or saws, for he reported felling large trees to obtain cones and removing slabs of bark from larger trees.

In letters to Veitch and to Sargent, he often reported on his health. An illness of 22 days in 1907 he attributed to a bout of malaria. On another occasion he suffered from "ague, brought on by a chill." He also wrote, "The magistrate sent me word that he was suffering from pains in the stomach and vomiting, and would be grateful for some medicine to relieve his suffering. I sent him some Epsom-salts and an opiate. . . . A traveller gets many such requests for medicine, and I have generally found quinine, Epsom-salts and opium pills most useful cures, for which the people were always grateful" (Wilson, 1913, Vol. 1, p. 192). He also noted that he "acted as family doctor" to his men who suffered frostbite and snow blindness on a trip from Tchien-lu (1906, p. 101). Although he published notes on Chinese medicinal plants, he made only one personal reference: "The dried rhizome of *Coptis chinensis* is an all-round medicine and particularly valued as a stomachic. . . . Personally I can testify that it makes an excellent and appetizing bitters" (Wilson, 1929, p. 319).

Wilson appears to have kept a great many notebooks in the field. His diaries are available for parts of all of his trips except the first one for Veitch. They are not complete and rarely fill an entire notebook, suggesting that he frequently started a new book for a new trip. The entries in his diaries are in pencil, while most of his plant records are in ink; his writing is difficult to read. He kept a separate record book for seed collections for Veitch, but for the Arnold Arboretum seeds, specimens, and photographic records are frequently combined in one ledger. Wilson also referred in letters to his "book of records of photographs," but this has not been found. A few of his separate books of financial records are available. On most trips accounts were not kept in detail, but on some occasions he was explicit as to items for his "Boy," coolies' wages, expenses for his collectors, and one record of a Christmas gift.

Wilson's task was to collect seeds and botanical specimens. Nothing is known of his equipment for these purposes while he was employed by Veitch. At times Wilson collected in a vasculum, transferring the specimens to a press to be dried. On June 28, 1907, he wrote to Sargent, "I worked with nine presses and a thousand driers and I can assure you changing specimens every night meant work." Earlier (1906, p. 27) he had written, "My collections grew apace and it took all hands three hours changing papers." No photographs have been located showing how Wilson dried specimens. He used wire-frame presses that he made himself, or had made in China. The end frames were secured with chains and tightened by readjustment to a hook on the opposite frame. Wilson used thin blotters without ventilators; the paper containing the specimens must have been acquired

in Shanghai. On February 15, 1919, Sargent wrote to Wilson that Purdom "is not taking any paper for drying specimens with him as you didn't and as I understand there is no difficulty in getting such material in China." Dr. Shiu-ying Hu told me that, as a student in the Natural History Museum in West China Union University, Chengto, Szechuan, she used the press frames, blotters, and drying paper Wilson had left behind. Dr. Hu recalled that the type of paper Wilson used was not then available in that region of China, and she felt that he must have brought it with him. When Wilson's specimens were dry, the packages were wrapped in oiled paper for storage and shipment.

Wilson also preserved fleshy fruits in "Chinese spirits" and returned some of this material to the United States. There is no indication where he obtained the bottles or spirits, or how this material was sealed.

One often gets the impression that Wilson was a loner and did not have company beyond members of his staff. Although he did not speak or read Chinese, as far as can be determined, he said that an interpreter was not necessary if there was a good "boy or principal servant." On each of his trips, he acquired a dog for company, and although the breed cannot be determined from the photographs available, one was referred to as a "spaniel." None of the dogs was identified by a name. Wilson (1913, Vol. 1, p. 249) referred to the need to carry them across narrow bridges or up ladders when ascending Mt. Wa. Wilson had field companions who can be identified only by the dedication of new species to them: Dr. William Kirk, "a keen lover of nature and the collector's companion on many rambles" (*Meliosma kirkii*); Rev. J. Moyes, of Tatién-lu, "companionship on one long and interesting journey in Eastern Tibet" (*Rosa moyesii*); Mr. W. C. Haines-Watson, "my friend and travelling companion" (*Rhododendron watsonii*); Mr. G. Houlston, "my companion on many a delightful ramble in the Ichang neighborhood" (*Rhododendron houlstonii*); and of course W. R. Zappey, the zoologist who was associated with Wilson during his 1907-09 trip (*Prunus zappeyana*). No specimens are recorded as joint collections, and none of his Chinese collectors are acknowledged on the field labels.

Wilson's publications rarely revealed his feelings concerning his nomadic life. Veitch had warned him that he would be lonely and that he must keep up his spirits by hard work. Of a trip to the Chen-to Pass (14,500 feet) on June 19, 1904, Wilson did write (1906, p. 101), "We crossed the Chen-to Pass in a blizzard of snow and sleet. I shall never forget that day. It was the hardest, roughest and most exhausting one I experienced during the while of my five years wandering China. . . . As I look back on that day I marvel that we were not all frozen to death. As it was, several of the party were badly frost-bitten and 11 suffered from snow blindness. It was many weeks ere we fully recovered from the effect of the passage."



The vegetation at 2,000 feet altitude on Quelpaert Island, Korea, showing Quercus glauca and Q. glandulifera. Dr. N. Nakai, who accompanied Wilson, is seated on the boulders in the foreground. Photograph taken November 2, 1917, by E. H. Wilson.

Sargent's letters to Wilson were less frequent than Veitch's had been but usually concerned matters more related to the expeditions. For example, "I suppose by this time you are in the field and I hope that you are enjoying yourself. Write when opportunity offers, although do not let writing interfere with the real work unless you have something it is necessary to say" (Sargent, letter, April 18, 1907). Wilson did inform Sargent of each trip when it was planned and again when it was completed. His trips of 1908 were to new and difficult country. He reported the trip to Mt. Omei and Mt. Wa as having been profitable, "but owing largely to bad weather, desperately hard and uncomfortable. I never want to hear of, much less see that region again" (Wilson, letter, October 11, 1908). In a letter written on September 3, 1910, only days before the accident that broke his leg, Wilson wrote, "I am certainly getting very tired of the wandering life and long for the end to come. I seem never to have done anything else than wander, wander — through China."

Wilson as a Photographer

In an early letter (December 11, 1899) James Veitch wrote to Wilson, "The camera I have not sent as I feel sure you will do better in Hong Kong; have a quick look around and buy one — preferably an American. I also do not think you should use plates — films are much handier and give most excellent results and the roll can be changed in broad daylight. I have used such and find that though not the best for highest art photographs for all general purposes they are suitable." On July 9, 1901, he wrote again: "I am sorry to hear about your camera, you are indeed unlucky. I was more fortunate and only had my Kodak go wrong once." *Gardeners' Chronicle* (37: 337, 382, 383, 1905) published several photographs to go with Wilson's article "Leaves from My Chinese Note-book," which reported on his 1903 trip. Similar to prints from Wilson's later trips, these photographs are marked "Gardchron" and "W. J. Welch, Sc." but are not credited to Wilson. If they were taken by Wilson, they would be the film negatives taken on the first of the Veitch expeditions. Wilson later (1913, Vol. 1, p. 129) wrote, "My first journey over this highway was, as mentioned before, in 1904. At that time I had no camera.

Sargent, however, wanted a good photographic record of the plants that Wilson saw and introduced, as well as of the countryside and the vegetation. In a special issue of *Arnoldia* commemorating the 100th anniversary of Wilson's birth, Peter J. Chvany (1976) reproduced many of Wilson's photographs and related how even Miss Willmott encouraged Wilson to acquire a camera and take pictures. Wilson had a Sanderson whole-plate field camera, with bellows and a stout wooden support tripod custom made, and he carried it in three heavy boxes. On the trips for the Arnold Arboretum, he also took along a roll-film camera on which he took some personal pictures. Sargent wrote to Wilson, "I hope you won't forget the photo-



*the hamlet of Ping-ling-shih in western Szechuan, 3,150 feet altitude, with Mount
a-wu in the background. Photograph by E. H. Wilson. September 8, 1908.*

graph business which seems to me important, as we ought to get from this expedition all possible information about the Chinese flora" (Sargent, letter, October 11, 1906). On April 21, 1907, Wilson wrote Sargent, "I took fifty Kodak photos of different subjects and these have been forwarded to England to be dealt with by Ingalls"; on August 13 Sargent replied, "I did see some of the proofs of your photographs. These seemed to me to be promising although, as you have already heard, some change in exposure will have to be made."

By the middle of 1908, Wilson had mastered the camera. He wrote,

Photography formed an important part of the journey just completed. With the large camera I took twenty dozen plates. I have had two dozen of these developed and the results were most gratifying. Whilst the bulk of the photos are of trees and other floral subjects, a fair sprinkling showing scenery are included, enough to give an idea of the general appearance and configuration of the country.

The Kodak continues unsatisfactory. A consignment of films ordered from England to be sent via parcel post have got lost somewhere. As the few remaining old films are apparently useless I shall have to leave the Kodak behind on future trips. However the larger camera is working well and I have heaps of plates and the need for the Kodak is small. (Wilson, letter, August 27, 1908.)

Chvany (1976) describes well the effort Wilson made in the field despite the uncertainty of the results. As Wilson (1913, Vol. 1, p. 197) stated, "Photography in the forest is no mere pastime. It took over an hour on three occasions clearing away brushwood and branches so as to admit of a clear view of the trunk of the subject. I secured a dozen photographs, which entailed a hard day's work." In February Wilson reported,

On the last trip I secured 11 dozen photos with the big camera, practically all of them showing winter aspect.

Today with the full plate camera I have taken 57 dozen plates. I hope to manage three dozen more and thus complete 6 gross. As I wrote you before, from experiments made from time to time there is good reason to believe, failing accidents, that these photos will turn out well. The trick before me now is to get them home safely. (Wilson, letter, February 2, 1909.)

While Wilson was preparing to leave China, he wrote Sargent from Ichang,

I have this day shipped to E. J. Wallis of Kew, three cases each containing 20 dozen undeveloped plates. These 60 doz. photos represent the work of two seasons with the

large camera. A correct record of every plate has been kept and I anticipate no difficulty in correctly naming every photo. Trees largely predominate but scenery and objects of interest generally have not been forgotten. I have instructed Wallis not to commence developing until I arrive home, which will be soon after the arrival of the cases. If these plates reach Wallis in the condition they should, and all is as I anticipate, I think you will appreciate the unique collection of photos which in themselves should form not the least important result of the expedition. I have worked pretty hard at this photography business, and if anything goes wrong with these plates I vow I will never attempt to handle another camera. So soon as I know how the plates are turning out in Wallis' hands I will write you for instruction. (Wilson, letter, March 8, 1909.)

Wilson worked with Wallis and saw to it that the plates were developed individually. In June, 1909, he sent prints to Sargent, even though his records of the subjects had not yet reached England. His enthusiasm grew as more were developed, and apparently Sargent, too, was pleased. Wilson wrote in July,

Acting on the suggestion contained in [your letter] of July 13th, I yesterday called on the Director of Kew with very happy results. I took along a couple of dozen photos and made known your wishes. Colonel Prain said, "Certainly Kew would like a set, but what would the price be?" This I answered was a matter for arrangements between your good selves, but I presumed it would be about the ordinary market rate. On looking through the photos the director was highly complimentary in his remarks and told me to inform you "that Kew would be glad to acquire a set at any cost." . . . From the enthusiastic remarks of Col. Prain and Dr. Stapf it seems probable that the more important continental herbaria would purchase sets of these photographs. Personally I think it reasonable to suppose that the different herbariums receiving sets of our dried plants will be glad of the opportunity to acquire a set of photographs which will so materially increase the value of the herbarium specimens themselves. . . .

The whole of the photos are now developed and nearly all are "spotted" and numbered with "running numbers" in sequence. In all there are exactly sixty dozen (720) negatives. Of these 80% are purely botanical, practically all trees with a few shrubs, herbs or forest-scenes. Of the remaining 20% about half are birds and mammals and should be of much value to Mr. Thayer and others with similar in-

terests. The other half are general, i.e., scenes, architecture, porcelain and bronzes, and a few figures illustrating phallic worship. With the exception of about half a dozen of personal interest only, there is not a photo but what some scientific institution or another should be glad of. (Wilson, letter, July 2, 1909.)

In looking at Wilson's photographs of a "bag of pheasants after a day's shoot" (in Chvany, 1976, p. 81), or of more than fifty ducks hung on a bamboo boat, or of a large number of dead animals, one must keep in mind that these were taken when Zappey was along collecting for the Museum of Comparative Zoology. The day's hunt was probably not for the pot but for science. Zappey brought back 3135 birds, skins of 370 mammals, and specimens of various reptiles and fishes, which since have been distributed to many museums as specimens for scientific study. Wilson appears to have kept the photographic record of the collections. Several chapters and many plates in *A Naturalist in Western China* are devoted to the zoological collections.

By November of 1909, the first of Wilson's excellent photographs had been used in a publication. W. J. Bean, in writing "Garden Notes on New Trees and Shrubs" (*Kew Bull.* 1909: 351-357. 1909), reproduced two photos with the acknowledgment, "By kind permission of Prof. Sargent, Arnold Arboretum, photographs of *Tapiscia* [*sinensis* Oliv.] and *Tetracentron* [*sinensis* Oliv.] taken by Wilson in China are reproduced on the accompanying plates."

Although Wallis made additional prints from the glass plates, we have no idea how the final sets were prepared. An announcement on the inside back cover of *Plantae Wilsonianae* (Sargent, 1913, Vol. 1, part 3) offered 850 photographs 8.5" × 6.5" for \$425, or \$.50 each.

His confidence renewed by the success of his photographic efforts, Wilson offered to expose the remaining plates on plants at Kew and at Coombe Wood. Wilson also took many striking photographs during his 1914 trip to Japan, and a smaller number on his later trips to the Liukiu Islands, Australia, and Africa, but apparently none in India or Ceylon.

Wilson's Publications

James Veitch did not encourage Wilson to submit notes for publication during his field work; in fact, he warned him against the practice. However, Veitch bragged in print about the expedition and the plants being introduced and often quoted Wilson's comments and observations. Wilson's first writing appears as an abstract from a letter to Veitch (*Gard. Chron.* 34: 50, 1903). He then had travel articles in the *Gardeners' Chronicle* for 1905; these extended a full year. Off the topic of plants, he wrote "Western China: A Field for the Sportsman," which appeared in *The Field, The Country Gentleman's*



A massive *Ginkgo biloba*, 50 feet x 30 feet, growing in the garden of the Zanpu-kuji Temple Azabu, Tokyo. The tree is extinct in the wild, but has been preserved in temple gardens such as this. Photograph by E. H. Wilson, 1914.

Newspaper, describing and recommending the ideal hunting localities and the game that could be procured as trophies.

A set of the dried specimens collected by Wilson on the trips for Veitch was presented to Kew. W. B. Hemsley and Wilson (1906, p. 147) noted, "It was hoped that eventually the whole collection would be systematically dealt with. Before, however, this undertaking could be complete, Mr. Wilson had to take up duties that rendered it impossible for him at present to continue his share of the work." This was the project that later became *Plantae Wilsonianae* under Sargent's editorship.

With Hemsley, Wilson published an article on "Some New Chinese Plants" in 1906 and one entitled "Chinese *Rhododendron*: Determinations and Descriptions of New Species" in 1910. In the latter the authors stated (p. 101), "Towards the end of 1906 and just previous to his departure on a third mission to China, Mr. E. H. Wilson devoted a considerable amount of time to the determination of the magnificent dried collections of *Rhododendrons* made on his two previous journeys, while Mr. W. B. Hemsley afforded him as much assistance as it was possible to give in unofficial hours." In these works Wilson supplied the field observations, while the Latin descriptions were initialed by Hemsley.

Wilson then made two trips for Sargent and in 1911, hampered

by his injured leg, turned to writing both horticultural notes and botanical descriptions. Sutton (1970, p. 249) commented,

Sargent encouraged him to return and work over his herbarium with a view to publishing an account of his collections. Wilson as a collector was one thing, as a taxonomist he turned out to be quite another. For him the intellectual adventure of painstaking research with dried specimens and books could neither replace nor equal the thrill of finding living plants in the open field. Moreover it had been a long time since he had done any serious work in classification. The project evolved into a six-year task, resulting in the volumes called *Plantae Wilsonianae*, a treatment of the ligneous species Wilson collected in China. Sargent acted as editor, and other people, Alfred Rehder in particular, collaborated in the effort. Even a casual glance through *Plantae Wilsonianae* reveals that Rehder did a great share of the work, and that Wilson's contribution was correspondingly small. Rehder wrote 44 articles to Wilson's twelve and they did 47 more together. Evidently Wilson was quite willing to let Rehder assume the burden of preparing the nomenclature.

It was during these same six years that Wilson continued his contributions to the *Gardeners' Chronicle*, began to submit articles to *Horticulture* and to *Garden Magazine*, and published *The Vegetation of Western China* (1912), the two volumes of *A Naturalist in Western China* (1913), and *Aristocrats of the Garden* (1917). In addition, he wrote many articles on such topics as the cherries of Japan, the conifers and taxads of Japan, and the history and botanical relationships of the modern rose. Wilson's horticulture articles number at least 263 and are grouped in Rehder's (1930) account of Wilson's life (for example, "30 shorter articles contributed to vol. xix-xxxii, 1914-1921"). Many of these have been indexed for the Torrey Card Index, but others should be sought if a biography of Wilson is ever attempted.

Many of Wilson's books are collections of articles and essays published in slightly different form elsewhere. His observations combined his knowledge of the plants in the field with the experiences of Veitch and Sons and the Arnold Arboretum in propagating and growing the plants. His scientific writings covered many facets as well. The early interest of Maxwell T. Masters, who had contributed treatments of the gymnosperms for Forbes and Hemsley's enumeration of Chinese plants in Wilson's collections, may have increased his attention to this special group of woody plants. Sargent was particularly interested in the conifers and gave special instructions to Wilson to collect specimens, extra cones, and seeds. Wilson's first trip for the Arnold Arboretum was to accumulate such material. Wilson wrote

to Sargent of his success and failure regarding the conifers in 1906: "If Mr. G. R. Shaw ever intends to deal with the Chinese pines he had better finish off the Mexican ones within the next two years. Since he has studied this genus so closely I should be grateful if he would give me some hints as to what are the important points to note. At present I observe the general appearance of the tree and the nature of the cones, leaves, buds and bark. Are there other points of specific value that should be noted?" (Wilson, letter, April 19, 1907). The notes that Shaw sent, as mentioned in a letter to Sargent, are not available (Wilson, letter, July 21, 1907). Shaw included some information on the pines of China in his monograph *The Genus Pinus*, published in 1914. Subsequently, Wilson wrote *The Conifers and Taxads of Japan* (1916). In the paper "Taxads and Conifers of Yunnan," Wilson (1926, p. 37) commented, "During the years 1922-23 Mr. J. F. Rock collecting in Yunnan under the auspices of the National Geographic Society made a large collection of Taxads and Conifers he met with. A set of these was presented to the herbarium of the Arnold Arboretum. Naming this collection has afforded an opportunity to identify other material in this herbarium collected in Yunnan and enables me to present a review of the Taxaceae and Pinaceae of the whole province." In 1928 Wilson did the same for the groups in Rock's collection from northwestern China and northeastern Tibet. In fact, Wilson made special studies of *Juniperus procera* in Kenya, and *Podocarpus* and *Widdringtonia* in South Africa, and later on gymnosperms of New Caledonia. Wilson was asked by Sargent to collect particular gymnosperm material for two American specialists, J. M. Coulter and E. C. Jeffrey, and he supplied seeds, specimens, and wood.

It is of interest to note that Wilson learned of root nodules on the conifers in New Zealand. He stated in *Plant Hunting* (1927a, Vol. 1, p. 231), "My attention was directed to the presence of tubercles on the roots of Taxads and Conifers by Capt. L. MacIntosh Ellis, the director of forests. Later I found that their presence was known to others but the significance does not appear to have been grasped by anyone but the director of forests and no investigation of this phenomenon had been attempted." Wilson said the tubercles were analogous to those on the roots of leguminous plants, and he thought that they might be the controlling factors in the rate of growth of taxads and conifers in New Zealand, and in the success or failure of these plants when placed in ordinary garden soil. Wilson's extensive observations have been overlooked in recent publications on mycotrophy in plants.

Early in his career Wilson wrote a few short papers on economic plants, and he devoted special chapters to the subject in his books on China. The extensive collection of photographs taken in Japan of the damage done to the vegetation by adjacent fumaroles and volcanic vents suggested that he might have had articles on the subject

in mind. Likewise, he kept extensive notes on fluviatile shrubs; these were never incorporated in his writings. He wrote on forestry and forestry practices and on the relationships of the vegetation of eastern Asia to that of eastern North America — especially after he found a new plant, *Symphoricarpos sinensis*, the first representative of that American genus in Asia.

Wilson wrote floristic descriptions of areas he visited in China, and these were incorporated in many of his books. The Bonin Islands were largely unknown to the Western world when he visited them, and Wilson's 1919 account, "The Bonin Islands and Their Ligneous Vegetation," is still regarded as an excellent treatment. He wrote of the Island of Formosa (1922, 1930) and of its flora and authored a phytogeographic sketch of the ligneous flora of Korea (1920); both accounts have been reproduced for special studies by governmental departments during the last two decades. During his visit to Korea in 1917, Wilson was apparently asked to give a lecture on the vegetation to the local branch of the Royal Asiatic Society. The lecture was published in the transactions of the Society (1918) and also led to one of the first listings of common and scientific names (in the three parts of "Arboretum Coreense," prepared by Mark N. Trollope, Bishop in Korea). Trollope (in Wilson, 1918, appendix) wrote,

As I listened to Professor Wilson's lecture, it seemed to me that some such step as is here taken was necessary to bring home to us who live in Chosen the interesting facts which he had to teach us. . . . The course I took was the simple one of collecting twigs and branches of all the common trees and shrubs I came across, affixing to them labels with the vernacular names given to them by Choseans and then asking Professor Wilson to identify them and supply their proper botanical equivalents. . . .

In an obituary of E. H. Wilson published in the *Journal of the Arnold Arboretum* in 1930, Alfred Rehder supplied a bibliography of Wilson's writings. Two articles related to ragweed or hay fever plant especially in the Gaspé Peninsula were listed as "not yet published." No further reference has been found to them, and no manuscripts are known.

The following articles were unknown at the time or were omitted in error:

- 1905. Wanderings in China. *Jour. Roy. Hort. Soc.* 28: 656-662.
- 1906. Chinese rhubarb. *Chemist & Druggist* 69: 371, 373.
- 1906. Some new Chinese plants (with W. B. Hemsley). *Bull. Misc. Inf. Kew* 5: 147-163.
- 1907. A new Chinese rhododendron (with W. B. Hemsley). *Ibid.* 1907: 244-246.
- 1907. T'Ang-shen (*Codonopsis tangshen* Oliv.). *Kew Bull.* 1907: 9.

1908. The Chinese flora. *Jour. Roy. Hort. Soc.* 33: 395-400.
 1910. Plant collecting in the heart of China. *Trans. Mass. Hort. Soc.* 1910: 13-24.
 1911. *Potentilla veitchii* Wilson. *Gard. Chron.* III. 50: 102.
 1912. My fourth expedition to China. *Trans. Mass. Hort. Soc.* 1912: 159-169.
 1916. Flowers and gardens of Japan. *Ibid.* 1916: 17-24.
 1919. Citizens of Tokyo — save your cherry trees. *Sakura* 1(2): 4-6.
 1931. If I were to make a garden. iv + 295 pp. Stratford Co., Boston.

The final item was edited from Wilson's manuscript after his death in 1930 and was published with a foreword by Richardson Wright, a tribute appraising Wilson's work by Edward I. Farrington, and "Vale — In memoriam," by Edward Loomis Davenport Seymour.

Wilson's Dedications

Wilson's first book, *A Naturalist in Western China*, he dedicated to his wife. The revised version, *China, Mother of Gardens*, he dedicated "to my alma mater, the Royal Botanic Gardens, Kew." *Aristocrats of the Garden* he inscribed, "To Garden Clubs, the most potent forces in garden-making in America, with homage and respect"; and *Plant Hunting*, "To those of every race and creed who have labored in distant lands to make our gardens beautiful."

Five new genera were based on Wilson collections. Hemsley named one *Sinowilsonia*. Hemsley and Wilson created the genus *Hosiea*, by implication named for Alexander Hosie of H. B. M. Consular Service; Hosie was also commemorated in *Ormosia hosiei* with the notation "to whom we are indebted for much information respecting Chinese economic products." Rehder and Wilson named *Sargentodoxa* for Charles S. Sargent, and *Fortunearia* for Robert Fortune, a collector of Chinese plants between 1843 and 1861.

The majority of the new species collected by Wilson were described and named by Hemsley and Wilson, or by Rehder and Wilson publishing either jointly or individually. The sponsors of Wilson's expeditions are well recognized in the large number of plants named for Veitch and Sons (e.g., *Mahonia veitchiorum*), Miss Willmott (*Lilium willmottiae*), Sara Choate Sears ("artist, lover and successful cultivator of flowers"; *Rhododendron searsiae*), Mary Shreve Ames ("a generous friend of the Arnold Arboretum and of its Chinese explorations"; *Rhododendron amesiae*), the Thayer family, of Lancaster, Massachusetts ("prominent in horticulture and generous in its support of the explorations in China undertaken by the Arnold Arboretum"; *Rhododendron thayerianum*), General Stephen Minot Weld ("former president of the Massachusetts Horticultural Society and a generous supporter of Wilson's expeditions to China"; *Rhododendron weldianum*), the Hunnewell family ("for two generations of

the Massachusetts family have devoted themselves to the cultivation of these plants in their gardens at Wellesley . . ."; *Rhododendron hunnewellianum*), and many others. Mrs. Charles S. Sargent was commemorated with *Lilium sargentiae*, while *Rhododendron wilsonae*, "one of the most beautiful and distinct of Chinese Rhododendrons" he "named in compliment to my wife." *Rosa murielae* was "named for my daughter Muriel."

His field companions were not forgotten (Dr. William Kirk — *Meliosma kirkii*; Rev. J. Moyes of Tatieu-lu — *Rosa moyesii*; W. C. Haines-Watson — *Rhododendron watsonii*; G. Houlston — *Rhododendron houlstonii*), nor were his aides in other lands (Mr. J. C. Williams, of Caerhays Castle, Cornwall, "the first amateur to appreciate the horticultural value of Rhododendrons of western China; in his garden the best collection of these new introductions is now to be found" — *Rhododendron williamsianum*; Mrs. W. J. Tutcher, of Hong Kong, "to whose husband I am indebted for assistance and kind hospitality during my several visits to the island" — *Rhododendron tutcheriae*; W. B. Hemsley, who helped to identify much of Wilson's early material — *Rhododendron hemsleyanum*; and Mr. H. Spooner, "who very largely assisted in making up my collections into sets for disposal to different herbaria" — *Rhododendron spooneri*).

A singular dedication was made to Mr. Y. C. Wong, of Ichang, "a cultured Chinese gentleman, who rendered me signal services during the whole of my stay in China" (*Rhododendron wongii*). Missionaries who helped Wilson were commemorated: Rev. Henry Openshaw, of Szechuan (*Rhododendron openshawianum*); Mrs. Shelton, wife of Dr. Shelton, missionary at Tachien-lu (*Rhododendron sheltonae*); and Rev. B. Ririe, of Kiating (*Rhododendron ririei*). *Rhododendron wiltonii* was "named in compliment to Mr. E. C. Wilton of H.B.M.'s Chinese Consular Service, in 1900 Acting Consul at Ichang, as a mark of appreciation of numerous kind offices during that troublesome year." The most heartfelt dedications must be *Rhododendron davidsonianum* and *Photinia davidsoniae*, for Dr. and Mrs. W. Henry Davidson, "in grateful recognition of the important services which he rendered to me after my serious accident in the early autumn of 1910." Camillo Schneider named *Berberis mouillacana* "at the request of Mr. Wilson . . . for Dr. Mouillac, a distinguished French Army Surgeon, at one time in charge of the École de Médecine & R.C. Hospital, Chengtu, in appreciation of valued services rendered to him during the autumn of 1910" (Sargent, 1913, Vol. 1, p. 371).

The Numbers on Wilson's Specimens

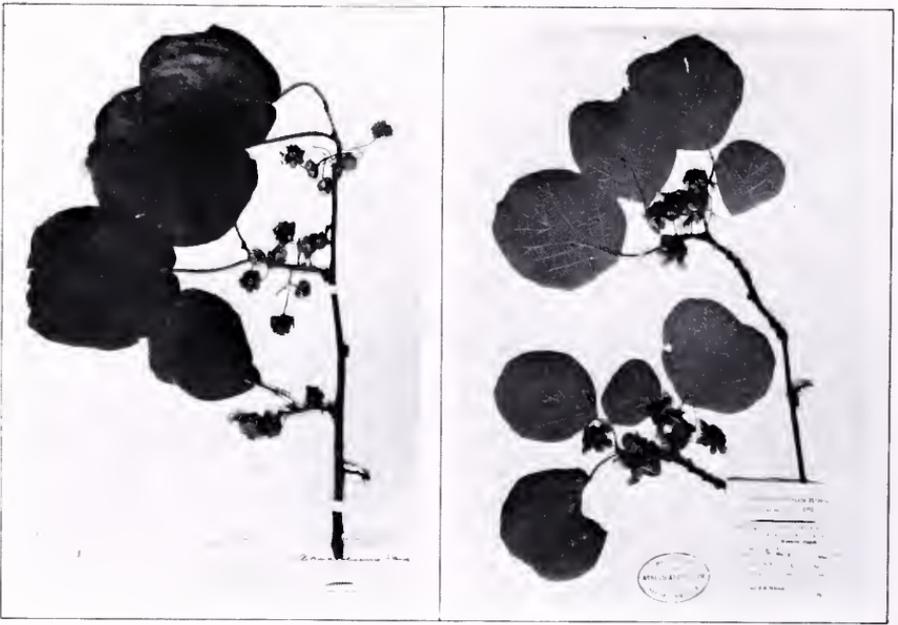
The instructions Wilson received from the Veitch firm for the 1899-1902 and the 1903-05 trips have not been located. Veitch at first did not put emphasis on the preparation of voucher specimens, and he certainly did not encourage collection of the general flora. However Wilson's specimens proved to be of high quality, and Veitch displayed

them with pride at an exhibition in London (Veitch, 1903a). At the Arnold Arboretum, there are no field books of Wilson's first expedition and only a diary account in two small notebooks of the second trip. Apparently Wilson sent in his letters lists of seeds, plants, or cuttings dispatched to the Veitch firm; when the lists were received, a record was entered into a ledger. Wilson dispatched herbarium specimens to the Veitch firm at different times, and these were also recorded — although in a separate listing. Two copies of these records from the Veitch firm are in the library of the Arnold Arboretum. The numerical lists of herbarium specimens occasionally have cross references to the seed lists (e.g., "seeds") or to specific numbers (e.g., 517) in the seed lists. Although the lists are in numerical order, there are no dates given and the field localities are not in a logical sequence. The books suggest that the Veitch firm placed no importance on dates or exact areas of collection. As has been pointed out, many of the plants described from specimens grown from Wilson's seeds have only general localities such as "China," "Western China," or "Szechuan," without number or date.

When preparing herbarium specimens in the field, Wilson jotted some brief notes on small slips of paper, one or rarely two inches square, sometimes giving a date and/or place. These have been attached to some of the mounted herbarium specimens distributed by the Veitch firm. Similar slips (but not always with comparable data), in Wilson's handwriting, are on sheets in the Arnold Arboretum herbarium acquired in exchange from the Department of Parks and Forestry in Hong Kong. It appears that Wilson was not consistent in his notations.

For his trips for the Arnold Arboretum, Wilson received instructions from Sargent. As indicated in the letter of December 28, 1906, reproduced earlier in this paper, Sargent asked Wilson "to undertake to dry six sets of all woody plants, . . . to make specimens of any plant of which you gather seeds, or of herbaceous plants which appear to you to be new or to present special interest either from a scientific or horticultural point of view." For the numbering system, however, Sargent's instructions were not clear:

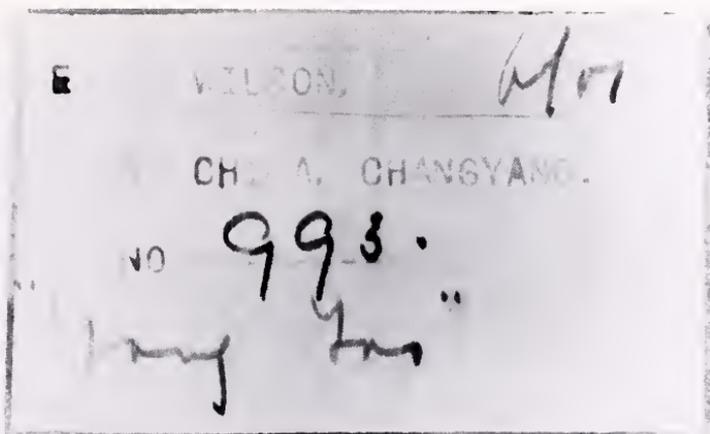
I think you agree with me that it is important to devise some system of numbering specimens and seeds by which the seeds can be correctly and quickly referred to the numbers of the herbarium specimens. Probably the plan we have discussed of giving each genus temporarily, at least, a separate series of numbers will prove effective. If this is done, I should suppose it would be possible to give the herbarium specimen and the seed the same number, and later when the sets are made up for distribution the plants can have a new series of numbers independent of the seed numbers which would be for our convenience only. . . . It



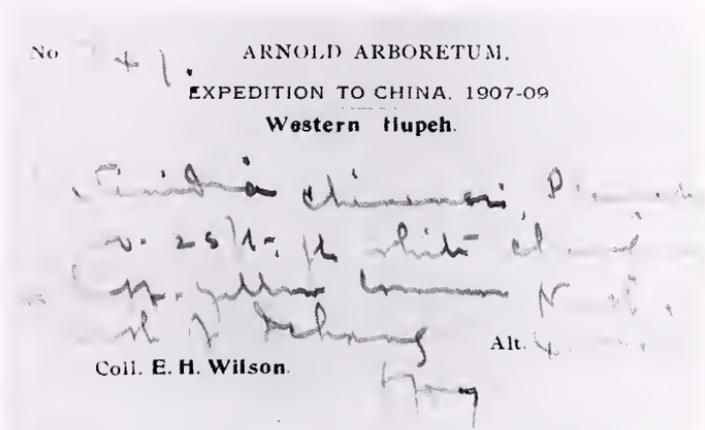
Left: *Herbarium specimen of Actinidia chinensis, the kiwi fruit collected by E. H. Wilson in 1901. A comparable specimen was in the display prepared by the Veitch firm for the Royal Horticultural Society Show. Right: A specimen of Actinidia chinensis collected by Wilson in 1907 for the Arnold Arboretum.*

is desirable to photograph as many trees as possible, provided the tree photographs can be named. Some system of numbering referring to the herbarium specimens would be therefore needed for the photograph in case of trees which you do not know (Sargent, *op. cit.*).

Wilson began his numbering sequence anew for the Arnold Arboretum, and three ledgers preserved in the Arnold Arboretum library are important in assembling data on Wilson collections. One record book, AA #39526, is a numerical list (1-1474), representing the 1907-09 trip; on the flyleaf it bears in Wilson's own hand, "E. H. Wilson, % British Consul, Ichang, China." Identifications are given in Wilson's hand and are incomplete (generally to family or genus, rarely to species). No dates are given although localities are commonly grouped. There are references to some herbs collected for Miss Willmott and to other plants collected for the "Agric. Dept.," Messrs. Farquhar, and Veitch, with a few for "prof. Sarg." The sequence of the plants entered in this ledger suggests that at first general collecting was done, with the specimens numbered and pressed in random order. At about number 1000 Wilson seems to have changed his system. Collections after this point apparently were grouped by genera before numbers were assigned (thus, for example, numbers 1400 to 1435 are mostly species of *Salix* from nonadjacent areas). Why this change in system took place is not revealed in any of



The label prepared for the specimens collected by Wilson for the Veitch firm. Very little information was given on the label and additional data is often in Wilson's field books.



A comparable label for specimens collected for the Arnold Arboretum in 1907, contained a greater amount of information.

Wilson's or Sargent's letters. Possible answers are that Wilson accumulated specimens from several trips and numbered them at one time, or perhaps that his collectors arrived from different areas and their collections were sorted to genus, numbered, and entered in the records.

The second portion of this ledger contains numbers 4000 to 4464, representing the 1910 trip, and duplicates the published *Field Notes* (Wilson, 1911). There are frequent notations in these entries that plants are being sent, and the numbers do not represent herbarium specimens.

A second ledger in the Arnold Arboretum library (AA #39525) has the primary entries in Wilson's hand but does not seem to have been carried in the field. The numbers run from 1 to 3817. Entries

1 to 1474 are as in AA #39526; however, the descriptive details often vary in order and amount. The numbers above 1475 are generally grouped by family or genus. The listing is annotated in a variety of hands, with the complete scientific name, the authority, and an occasional reference to the place of publication.

This ledger does not contain the numbers between 3817 and 4000; the second portion also repeats the names published in *Field Notes*, numbers 4000 to 4462, but with identifications entered for the majority. There is an initial column designated as "no. of sets," with numbers 1 to 11 apparently indicating the number of duplicates. Where no number appears in this column, the collection may have been a unicate or, since the material is often not completely identified, propagating material sent to the Arnold Arboretum. Throughout this ledger there are some scattered references to photographs. The 1910 trip represented by the second half of the ledger ended abruptly for Wilson when his leg was broken and he was incapacitated for twelve weeks. He did record in a letter that his men continued to work in his absence, and there are collections numbered from 4463 to 4744, mostly all identified, and grouped by genus or family but from a variety of locations.

A third ledger in the Arnold Arboretum library (AA #39611) is entitled "Numerical lists of seeds [Nos. 1 to 1474, 4000 to 4462] collected on his Arnold Arboretum expeditions to eastern Asia 1907-1908, 1910, which were planted in the arboretum nurseries." Although the numerical sequence is complete, not all numbers have entries. Wilson's seeds were sent to Sargent at irregular intervals and were distributed by Sargent, probably by number and with incomplete identification, before the associated herbarium specimens were shipped to Boston at the end of Wilson's expedition. Wilson's seeds, when grown at the Arboretum and planted out as living specimens, may also carry new serial accession numbers; the field numbers and accession numbers are cross-referenced in the Arnold Arboretum. Today plants grown from seed and sent to Kew or Edinburgh (and possibly to other places) often carry only the Wilson seed number and may lack details as to origin. It would be possible, but not at all an easy task, to associate Wilson's seed numbers with herbarium vouchers, work out the details of location, and obtain the original field data for the plants that he introduced. Other columns in this ledger indicate that the seeds or seedlings were plants in several different locations at the Arboretum: greenhouse and frames, Dawson nursery, Curtis nursery, overlook nursery, Peter's Hill nursery, the shrub collection, and the Arboretum collection. For the 1910 collection an additional column is designated "Prof. Sargent," and the entries include herbaceous plants that apparently were grown only at Holm Lea.

During the trips to China for Veitch and for the Arnold Arboretum, Wilson attempted to collect the same plant in flower and in fruit. In



EX HERB. HORT. BOT. REG. KEW.

COLL. E. H. WILSON,

(FOR JAMES VEITCH & SONS).

WESTERN CHINA.

No. 3370

Handwritten notes: "2-34", "13", and other illegible scribbles.

Handwritten notes: "2'5", "The...", "...", "..."

E. H. WILSON
COLLECTOR
Arnold Arboretum
Expedition
To Bonin
1917

8368
MAY 3 1917



E. H. WILSON
COLLECTOR
Arnold Arboretum
Expedition
To Korea.
1917

E. H. WILSON
COLLECTOR
ARNOLD ARBORETUM
TO JAPAN
1914

Above: The isotype specimen of *Rhus wilsoni* Hemsley. Wilson's original field "ticket" is 2 inches square. The printed labels of the Veitch firm did not give specific locations and rarely had sufficient space for an annotation. Below: The printed tags with strings that Wilson attached directly to the specimens collected in later expeditions for the Arnold Arboretum. A date stamp and a numbering stamp appear to have been carried in the field. The small rectangular tag was attached by Wilson to a specimen collected in Kenya in 1921.

Plant Hunting (1927, Vol. 1, p. xxvi) he noted, "The plant hunter having found his plant must abide the proper season for securing ripe seeds, roots or small plants, or failing these, wood for cuttings or scions. His quest may be found in blossom in spring or summer when it must be marked down for another visit in the autumn. Often several visits are necessary before the actual season of harvest is determined." Wilson indicated in his letters that often a specific plant might be marked, and that either he or a collector returned to the plant and presumably collected herbarium specimens in fruit, as well as the seeds and fruits. Thus, many of Wilson's herbarium collections bearing a single number will reveal on data slips dates of May and September or July and October of the same or even different years. If the collector returned to the marked plant, the flowers and fruits may represent the same plant. However, the frequency with which Wilson's collection numbers have subsequently been superscripted (e.g., "a," "b," "c"), or have been cited "in part" or "fruit only" in *Plantae Wilsonianae* and other publications, indicates either that the collector did not locate the original tree, or that if he did, he did not confine his collecting to one plant, and a mixed collection has resulted. Furthermore, there is evidence that some of Wilson's numbers cited "in part" and those with superscripts are deliberately mixed numbers collected from widely separated locations. For example, in the case of *Acer Henryi* Pax, "No. 424, in part" has been given to specimens taken in "Fang Hsien," "Changyang Hsien," "Patung Hsien," "north and south of Ichang," and "Hsing-shan Hsien" (Sargent, 1911, Vol. 1, p. 97). These collecting localities in western Hupeh cover an area of roughly 120 square kilometers. The reason for this unorthodox assignment of numbers is unclear.

The seed or propagating material sent back to the Veitch firm was grown, and the plants were often exhibited. Such living material is the basis for the botanical descriptions of many species cited as "Wilson," without number, date, or locality. A few names that we have been able to check in the Kew herbarium were not represented by any specimens attributed to either Veitch or Wilson.

During his first two trips, Wilson sent dried collections to Veitch at intervals. Wilson wanted the identifications reported to him, but James Veitch often wrote that he had not yet had time to work over the material. Eventually Herman Spooner of the Veitch firm may have been given the task of identifying the collections. A letter that Spooner sent to Wilson commented on the fact that he could not associate the living specimens at the Coombe Wood nursery with the names placed on the herbarium sheets. Wilson dedicated *Rhododendron spooneri* to Mr. H. Spooner, "who very largely assisted in making up my collections into sets for disposal to different herbaria."

Hemsley and Wilson (1906, p. 147) reported, "The first set of this collection [1899-1902 and 1903-05 trips] was very generously presented to the Herbarium at Kew by Messrs Veitch." Earlier, however,

M. T. Masters (1903, p. 267) had written, "The following enumeration comprises the names of the Coniferae collected in various parts of southwestern and central China by Mr. E. H. Wilson, on behalf of Messrs James Veitch and Sons. Seeds of most of the species were gathered, and the seedling plants are in cultivation in Messrs Veitch's nurseries. Mr. Wilson's specimens are excellent. . . ." Concerning *Picia ajanensis* Fischer, Masters (1903, p. 269) commented, "Mr. Wilson collected numerous cones of this species so that the hesitation expressed as to the identity of the specimens collected by Dr. Henry and Abbé David need no longer be felt." Five of Wilson's seed collections, when grown to flowering condition, were illustrated in *Curtis's Botanical Magazine* for 1903. In the same year Henry (p. 100) stated, "I only had the opportunity of seeing part of Mr. Wilson's dried specimens — the lot collected by him in his first year at Ichang." Between 1906 and 1908 a large number of species were described by the Kew staff and others in the series "Decades Kewensis, Plantarum novarum in Herbario Horti Regii Conservatarum," which appeared regularly in the *Kew Bulletin*.

Some of Wilson's earliest gatherings at Laokai, which he made while he was en route to see Henry, were spores of ferns. There is no conclusive evidence that herbarium specimens were gathered; however, when plants developed from the spores, these were sent to H. Christ in Switzerland for identification. This association with Christ was continued during Wilson's trips for the Arnold Arboretum.

Following his trips for Sargent, Wilson was employed to work over the collections. Sets of specimens were selected and mounted, and labels were prepared. Wilson wrote in detail of the materials assembled on his third trip. The collections of 1907 had been in storage in Ichang, and those of 1908 were added to them. Wilson hired a boat in addition to "The Harvard" for the descent of the river to the coast and divided his collections between them. He wrote,

I have this day shipped home the herbarium material collected during the two seasons the expedition has been in China. It is contained in twelve cases measuring 8½ tones [sic]. I have no accurate idea of the numbers of specimens but I think it must be the largest as it certainly is the finest and most complete collection I have got together. It probably contains some two thousand five hundred species in some twenty thousand sheets. With rare exceptions each species is replete with flowers and fruits, the specimens of barks of practically every tree have been preserved and I think you will find this collection of barks of interest and value. Collecting these barks has increased the work considerably but I believe it to have been time well spent.

In the cases of all plants with "fleshy" fruits and also with many having capsular fruits, a small packet of seed bearing the seed number is attached to its proper specimen. By

this means after the material is properly sorted you will be able to name every plant you have growing from the seeds sent without waiting for these plants to flower. [Sargent had written Wilson that not all seeds had been planted. Some seeds were retained for a second try or an emergency situation, or to enable later determination.]

With the exception of *Pinus* and *Larix* we have had ill luck in regard to seeds of conifers, but the herbarium material of this group and more especially of *Pinus* itself you will find exceptionally good and complete. In many cases I have been able to secure a hundred cones in addition to those on the specimens themselves. This per your letter of general instructions.

One specimen of every species bears a rough field ticket giving the necessary information not derivable from the specimen itself. More than this pressure of work has rendered impossible. The sorting, labelling and making into "sets" of this herbarium will be a big and I fear difficult task. It would be well not to have the cases unpacked until you have men ready to start on the task of making up the sets. The conifers should be carefully set aside in the general sorting and dealt with either first or last. The packages of cones should be set aside and on *no* account must one of these packages be opened until the conifers have been arranged in "sets." The clue to the ticket in and/or on the packages of cones is to be found on the label of the corresponding specimens themselves. If by any chance the cones should get mixed I fear no earthly power can set them straight.

I much regret that want of time prevented the arranging of this herbarium material in such a manner that it could be as easily dealt with by anyone as by the person who collected it. (Wilson, letter, March 6, 1909.)

Later, Wilson wrote "Cases J.E.T. No. 14 contain two small boxes each marked Arnold Arboretum. These small boxes contain succulent fruits or various plants and certain coniferous material all preserved in Chinese spirit. Mr. Thayer will hand these over to you after taking possession of his own material enclosed in the same larger case" (Wilson, letter, March 26, 1909). When the sets of specimens were made, several collections of the same number were mounted and retained by the Arnold Arboretum. Thus, flowering, fruiting, or sterile specimens, juvenile foliage, aberrant growth forms, bark, or wood may all represent the same plant under one number, although the dates may be different. Some of the labels were written completely by Wilson, and each label carries slightly different details — as though it had been written for the particular mounted



1 2 3 4 5 6 7 8 9 10 11 12 13 14

719 ARNOLO ARBORLUM
 EXPEDITION TO EASTERN ASIA 1913
 Formosa.
 E. H. Wilson 1914
 1/11/1916

HERBARIUM
 ARNOLO ARBORLUM

herbarium specimen of *Taiwania*, collected by Wilson in Formosa, represents an adventitious shoot from an exposed root. Wilson also gathered specimens of cones, vegetative but sterile branches, pieces of the bark, and wood from this tree. The label contains data entered on three different occasions.

specimen before him. In other cases, another person wrote the basic label, repeating the same data on each, and Wilson added only the determination. We retain no record in the Arboretum files indicating where sets were sent. It has been our experience, however, that other institutions did not receive multiple specimens of a single number and may, in fact, have only the flowering or the fruiting collection. Where these represent a mixed collection, the annotation or identification may be in error. To the present, not all of Wilson's plants have been identified, and material is found in the "indet" covers at the family or genus level without complete determinations. No complete numerical list is available for his collections.

It must also be kept in mind that Wilson employed a number of Chinese who collected for him; Wilson may have assigned his number to their material. It appears to be these collections that most frequently lack data on location, date, or characteristics. The fact that Wilson appeared to be in widely separated places on the same date may be due to his unacknowledged "collectors." An itinerary of his field travel can not be compiled from the serial collecting numbers, and it is dangerous to draw conclusions on possible associations of plants with adjacent numbers as being components of one floristic zone. Moreover, in the early field notes derived from the Veitch records, Wilson noted that he obtained some seeds and specimens from Henry on their initial meeting. These now bear Wilson numbers. Later, on leaving China in 1909, Wilson wrote to Sargent that he had acquired herbarium specimens from Fokien from S. T. Dunn (Superintendent, Botany and Forestry Department, Hong Kong, 1903-1910), and later a collection was made by a Chinese collector "and is unfortunately without labels. However we must consider ourselves fortunate in getting them at all" (Wilson, letter, April 12, 1909). The Dunn specimens are not known to me, but several "Ningpo" collections have been encountered — a few with Wilson's name and a few credited to MacGregor.

Wilson traveled to Japan between December 24, 1913, and February 29, 1915, and obtained living material, seeds, and herbarium specimens. These as well as photographs are recorded in two field books (AA #39527, #39528), with numbers starting at 6001 and ending with 7888. The Wilson serial numbers between 4744 and 6000 apparently were not used. For this trip and the following one Wilson used round or square tags printed or stamped with his name and number and attached to the specimen with a string.

A trip to Japan, the Liukiu and Bonin islands, Korea, and Formosa occupied Wilson in 1919, and his collections are represented by field books (AA numbers #39529, #39530, #39531, #39532, and #39533). Collections are numbered consecutively; again, however, they may be grouped by genus and thus can not be used to determine a chronological itinerary. Serial numbers 9634 to 9736 were inadvertently used twice for collections from Korea and Formosa.

In 1920 Wilson began a trip that included Australia, Tasmania, New Zealand, India, Ceylon, and East, Central, and South Africa. Only a few of Wilson's notebooks and diaries are available for these trips, and they are without serial accession numbers. One field book for Australia is in part a diary and itinerary and in part a numerical list of collections numbered from 1 to 507. A second book for this trip has lists numbered from 520 to 717 and a separate signature of small sheets with numbers from 700 to 799, indicating a repetition of numbers 700 to 717 within Wilson's Australian collections. Wilson did collect some specimens in Tasmania and New Zealand, but all of these are without collectors' numbers in the herbarium of the Arnold Arboretum. There is no evidence that Wilson collected specimens in India or Ceylon, although a partial diary account of that trip has been preserved. While in East and Central Africa, Wilson recorded his search for *Juniperus procera* in *Plant Hunting* (1927a). Various herbarium specimens from Kenya have been located, several bearing numbers 21 and 138 and others without numbers, suggesting that Wilson had still another numerical series for this trip. For South Africa, two lists of identifications have been preserved; these were made by Marloth of Wilson's South African plants and include numbers between 80 and 430 with many gaps. Wilson may well have had a different series of numbers for each country he visited.

In the third volume of *Plantae Wilsonianae* (Sargent, 1917, pp. 463-511), Rehder and Wilson published a list of "Numbers and names of specimens collected during the two Arnold Arboretum expeditions." A footnote indicates "this is a complete enumeration of all the numbers referring to woody plants; numbers omitted refer to herbaceous plants. For the numbers and names of Ferns see H. Christ, *Filices Wilsonianae* [in *Bot. Gaz.* 51: 345-359. 1911]." Under "other collections cited," Rehder and Wilson gave numerical lists of identifications for Wilson's Arnold Arboretum expedition to Japan, numbers 6029 to 7868; his Veitch expeditions to China, numbers 1 to 5186; and his Veitch expedition, seed numbers 98 to 1930. In the text Rehder and Wilson referred to the Arnold Arboretum collections as "Wilson No. _____," "Wilson Veitch Expedition No. _____," or "Veitch Exped. Seed # _____" (or "Seed No. _____").

Wilson's collection of plants as cited in the literature of 1903-1910 are those of the Veitch expeditions, although that may or may not be indicated. In the literature after Wilson's 1907-09 trip for the Arnold Arboretum, it is often impossible to tell which set of Wilson's numbers was used without consulting the herbarium in which the specimen may be deposited.

Rehder and Wilson and the other contributors to *Plantae Wilsonianae* may have designated "type" or "co-type" for new species. The holotype designation was not then in use, and three, four, or more sheets in the Arnold Arboretum herbarium may be marked as "type" in either Wilson's or Rehder's hand. In a modern treatment of any

species based on Wilson's plants, the designation of a single specimen as a lectotype is required. In a few cases the situation is further complicated when a living plant associated with the original collection is involved. In the case of *Salix rehderiana* Schneider, the "type" is designated as the pistillate plant, collected April 24, 1912, and grown from cuttings of *Wilson 1403*. A sterile specimen of *1403* collected in November, 1908, is indicated as a "co-type"; a staminate specimen of the same number collected April 13, 1910, is also marked "co-type."

In the future it seems desirable to use a parenthetical designation after a Wilson collection — for example, *Wilson 123* (Veitch Exped.), *Wilson 123* (Veitch seed), *Wilson 123* (AA expedition), *Wilson 123* (E. Africa), *Wilson 123* (Australia), or possibly other, similar combinations.

Wilson's Field Numbers in Summary

- 1-1310. Seeds collected for Veitch, 1899-1901. China.
- 1-2800. Specimens collected for Veitch, 1899-1901. China.
- 1400-1910. Seeds collected for Veitch, 1903-1905. China.
- 3000-5420. Specimens collected for Veitch, 1903-1905. China.
- 1-3817. Collections for the Arnold Arboretum, 1907-1909. China.
- 4000-4744. Collections for the Arnold Arboretum, 1910. China.
- 6001-7888. Collections for the Arnold Arboretum, 1914-1915. Japan.
- 8000-8415. Collections for the Arnold Arboretum, 1917. Liukiu Islands.
- 8416-9736. Collections for the Arnold Arboretum, 1917. Bonin Islands and Korea.
- 9634-11268. Collections for the Arnold Arboretum, 1918. Formosa, Japan, and Korea.
- 1-507, 520-717, 700-799. Collections for the Arnold Arboretum, 1920. Australia.
- 21-138. Collections for the Arnold Arboretum, 1921. Kenya.
- 80-430. Collections for the Arnold Arboretum, 1921-1922. South Africa.

Acknowledgments

The Veitch letters and many of the Wilson manuscripts mentioned were presented to the Arnold Arboretum by the late Dr. and Mrs. George Slate (Murial Primrose Wilson Slate). Recently, their daughter, Mrs. John R. Abbott (née Barbara Slate), has generously donated to the Arnold Arboretum copies of Wilson's articles, clippings, manuscripts, and mementos that have been useful in compiling this article. To all of these members of E. H. Wilson's family I am grateful. I am especially indebted to Kristin Clausen for her help in the herbarium and library searches required to clarify Wilson's itinerary, and for the maps of his collecting localities.

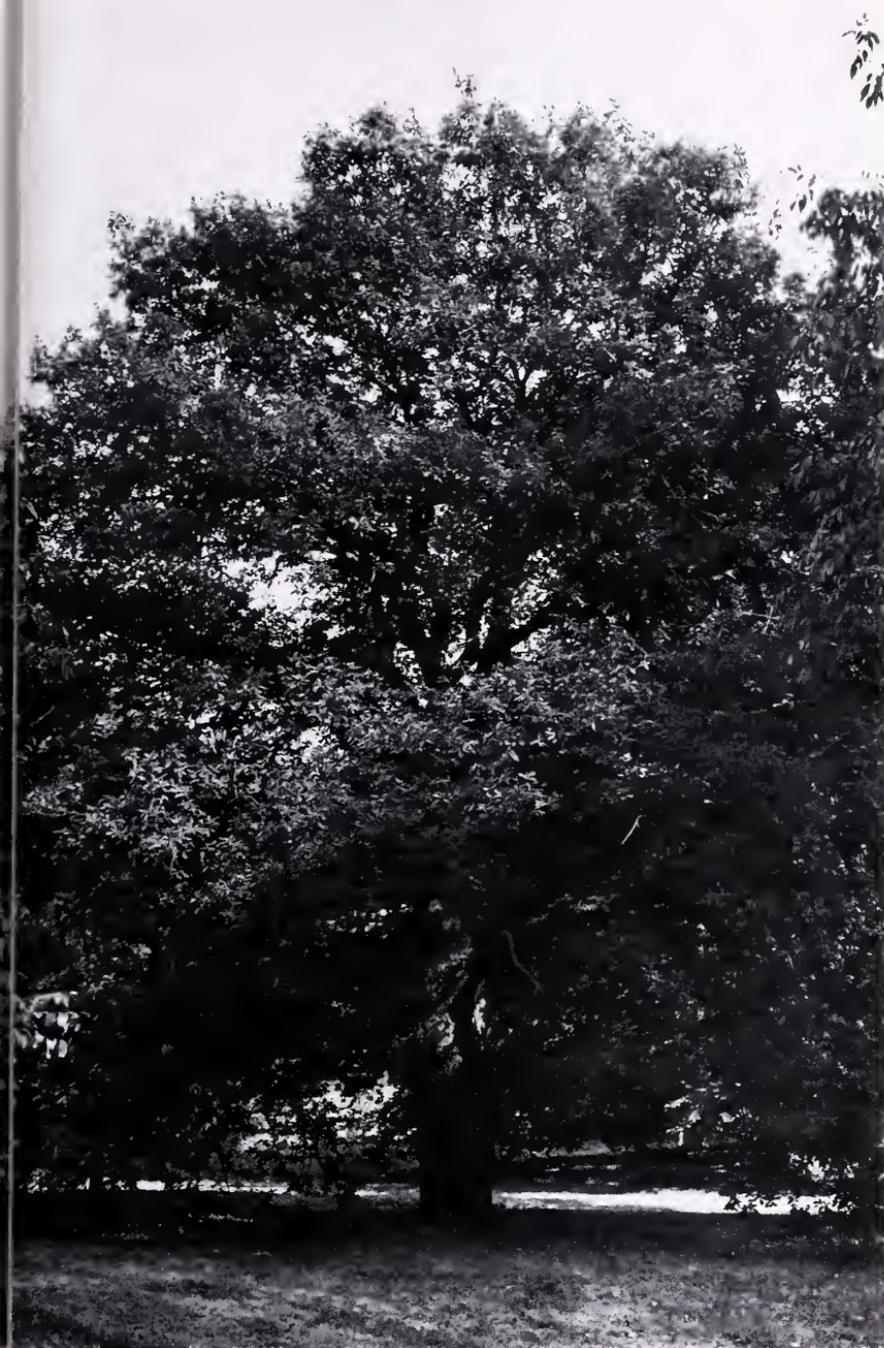
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Quercus X sargentii

On the eastern slope of Bussey Hill, between the ash collection and the site of Benjamin Bussey's mansion, are three of the finest specimens of European beech in the Arnold Arboretum collections. Right in their midst is an equally stately tree, *Quercus* X *sargentii*, the Sargent oak. Its most striking feature is its growth habit: it has a short, straight trunk and heavy, oddly curved branches forming a broad crown that sweeps to the ground. Five feet from the ground, the dark, thick trunk is nearly eleven feet in circumference; toward the base it narrows, giving it a hominoid aspect. Its deep bark fissures are contorted by many large, swollen scars of branches long since lost. Fifty-four feet tall and with a 60-foot spread, it brings to mind fairytale illustrations of haunted or animate trees.

This plant of *Quercus* X *sargentii* is one of three still living in the Arnold Arboretum; only a few others are known. The Sargent oak is a hybrid between *Q. prinus* L. (also known as *Q. montana* Willd.), the chestnut oak, and *Q. robur* L., the English oak. Both are members of subgenus *Lepidobalanus*, the white oak group. The chestnut oak, one of 27 oaks native to eastern North America, has a limited distribution. Its typical habitat is on dry, rocky slopes and ridges, where it succeeds better than other oaks. Trees of this species were formerly valued for the high tannin content of their bark. The English oak is one of the two oaks native to Great Britain, where it has long been used and valued. Its natural range extends through most of



Quercus × *Sargentii* is a hybrid combining the vigor of the American chestnut oak with the grand habit of the English oak. It was first discovered at Holm Lea, Charles S. Sargent's estate in Brookline, Massachusetts. Photograph by C. Lobig.

Europe to North Africa and western Asia. Introduced to North America before 1575, it has occasionally spread to roadsides and edges of woods near where it has been planted.

When compared to species oaks, which are abundant in the deciduous forests of eastern North America, hybrids are rare, although studies indicate widespread genetic compatibility among the species within each of the two subgenera. When hybrids do occur, they are often fertile. Ecological isolation keeps the genetically compatible oaks from crossing more frequently. When spontaneous hybrids are found, they are usually in marginal, intermediate, or disturbed habitats. Although deliberate crosses between oak species have seldom been made, approximately 50 hybrids from the United States have been described and named. Their hybridity must usually be inferred from the intermediate characteristics of foliage and fruit and from the presence and relative abundance of the supposed parent species in the vicinity. Many hybrid oaks have been brought into cultivation in botanical gardens and arboreta, but they are hardly ever grown outside of such collections.

Although the hybrid originated before 1830, *Quercus* \times *sargentii* was not formally described and named until 1915, when Alfred Rehder published an account of it in the German periodical *Mitteilungen der Deutschen Dendrologischen Gesellschaft*. Rehder distinguished *Q.* \times *sargentii* by its vigorous growth and by its foliage and fruit that show some of the characteristics of each of the parent species. The leaves of the hybrid have auriculate bases like those of *Q. robur*, but have margins with five to eight pairs of deeply crenate teeth rather than the three to five pairs of lobes of *Q. robur* or the ten to fifteen pairs of shallow teeth of *Q. prinus*. Leaf color and size are intermediate between those of the parent species. The acorn stalk of the hybrid is less than three cm. in length; in the chestnut oak it is similar, while in the English oak it can be as long as eight cm. The dark-colored bark and branching habit of the Sargent oak resemble those of the English oak, while its vigor at the Arnold Arboretum is indicative of its chestnut oak parentage.

Our featured tree is one of five plants accessioned under number 5883. All were grown from seeds collected on October 6, 1877, from a tree at Holm Lea, Charles Sprague Sargent's estate in Brookline, Massachusetts. The parent tree at Holm Lea was planted by Thomas Lee, who lived and gardened on a 20-acre parcel that was later purchased by Charles Sprague Sargent's father, Ignatius. In 1844, in the second edition of his *Treatise on the Theory and Practise of Landscape Gardening*, Andrew Jackson Downing described Lee as a man "enthusiastically fond of botany, and gardening," who had an outstanding collection of rhododendrons, kalmias, other shrubs, and trees. Downing noted a 40-foot English oak near Lee's entrance gate that had been planted only 14 years before his visit there. The Sargents acquired this tree when they obtained Lee's land. During the



The handsome, dark green foliage of the Sargent oak displays shape, size, and texture intermediate between its parent species. The relatively short acorn stalk is one indication of its chestnut oak parentage, while the auriculate leaf bases are a feature of the English oak. Photograph by C. Lobig.

ears when he managed Holm Lea, Charles noticed that the tree was especially robust and that its foliage differed from that of other English oaks. After Sargent became director, seeds from this tree, as well as from many others on his estate, were planted at the Arnold Arboretum. As the trees matured, they retained their intermediate characteristics, prompting Alfred Rehder to name them *Quercus* × *sargentii*.

During a recent visit to the site in Brookline, the parent tree was located. It is 93 feet tall, with a crown-spread of 94 feet and a trunk circumference of 14.5 feet. At over 150 years of age, it is showing signs of decline. Near it are two other large, declining trees that may also be Sargent oaks, although their fruit has not yet been examined to determine this. We do not know where Thomas Lee obtained his plants but can guess that they grew from acorns of an English oak that was planted near a native stand of chestnut oak.

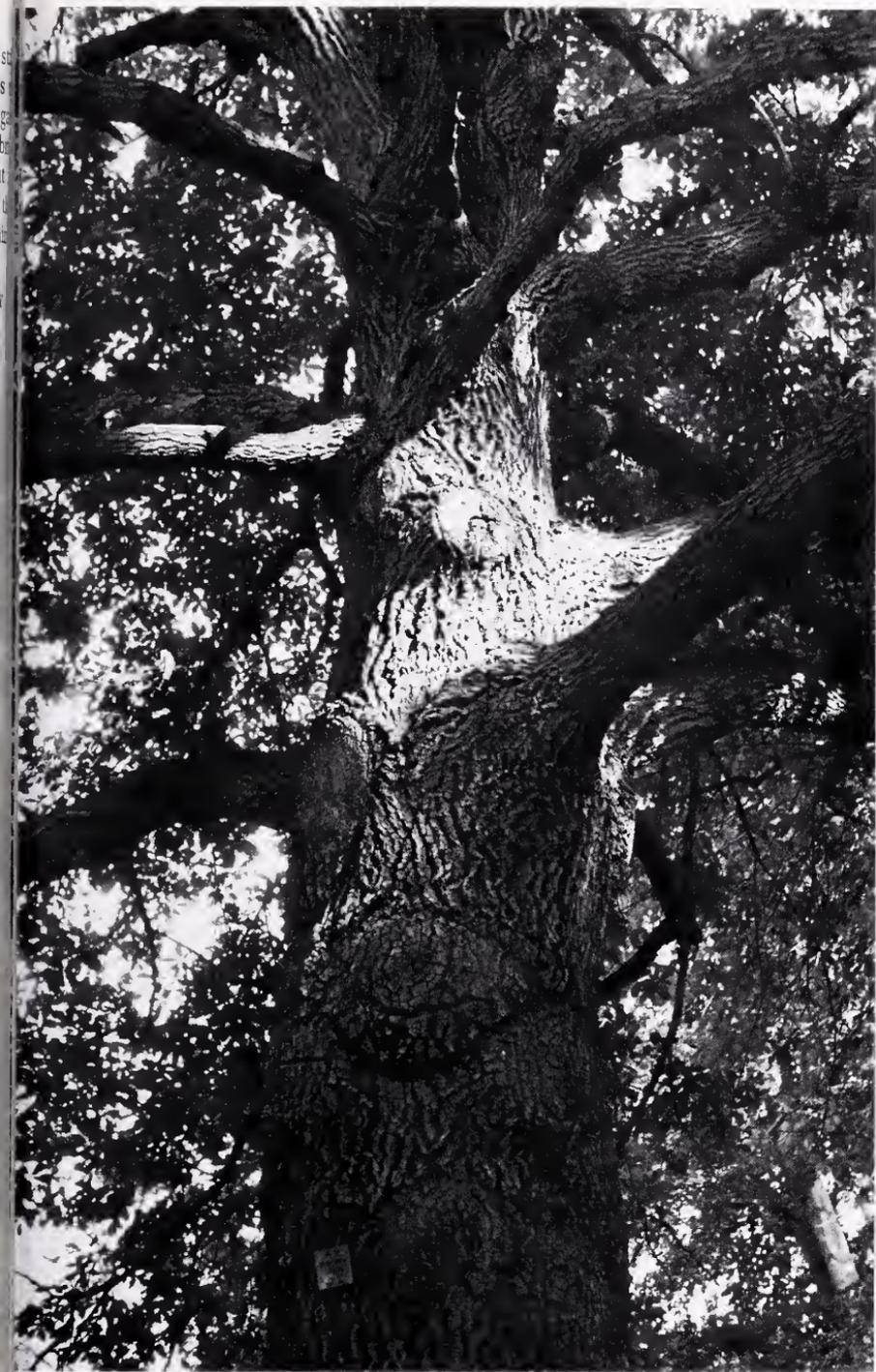
There is one specimen of *Quercus* × *sargentii* in the collections of the Morton Arboretum in Lisle, Illinois. It is a grafted plant, started in 1947 from vegetative progeny of an Arnold Arboretum tree. Ray Schulenberg, Curator of Plant Collections, at the Morton Arboretum, reports that their tree has a 32-inch trunk circumference and is 25 feet in height, with a 24-foot crown diameter. At one-third the age of our trees, their tree is now nearly one-half the size. As far as we know, the tree at the Morton Arboretum is the only other Sargent oak in cultivation.

Our featured tree is the most picturesque of the Sargent oaks still living at the Arboretum. Its history reminds us of the influences of Charles Sprague Sargent and of nineteenth-century landscape gardening style on the Arnold Arboretum's development. Its hybrid origin tells us something about the biology of trees. Although it is located near the beeches and thus invites comparison with them, the Sargent oak certainly holds its own as an outstanding and charming tree.

IDA HAY

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One of the pleasing qualities of the Sargent oak is the way the branch scars contour the deeply fissured bark. Photograph by C. Lobig.

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Above right: *Tsuga canadensis f. pendula*, Sargent's weeping hemlock, growing in Fairmount Park, Philadelphia, Pennsylvania. Photograph by A. Rehder, July 19, 1898. Below right: *Thirty-year-old specimen of Tsuga canadensis f. pendula*, observed in Germantown, Pennsylvania. Photograph by A. B. Stout, May 20, 1938.

Back cover: E. H. Wilson's favorite introduction, *Lilium regale*, flowering in the Farquhar nursery in Roslindale, Massachusetts, (1920).



Next Issue :

Sargent's Weeping Hemlock Reconsidered
Outstanding Plants of the Arnold Arboretum :
Pseudolarix amabilis



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Front cover: Female cones amidst the whorled foliage of *Pseudolarix amabilis*.
Photograph by G. Koller.

Sargent's Weeping Hemlock Reconsidered

by PETER DEL TREDICI

The Sargent weeping hemlock (*Tsuga canadensis* f. *pendula*) is a tree that inspires amazement and wonder in anyone who is fortunate enough to see it. Mature specimens can be twelve to sixteen feet high and twice as broad. The pendulous foliage cascades down to the ground giving the plant a fluidity that more upright trees lack. Not only is this variety of hemlock the most beautiful of the hundreds of known hemlock forms, but it also has the most colorful history, involving many of the horticultural giants of the late nineteenth century. Tradition has it that four weeping hemlocks were found near the town of Beacon, New York around 1860 and that from these all future generations of Sargent's hemlock were propagated. Then in 1939 Mr. A. B. Stout, writing in the *Journal of the New York Botanical Garden* (Vol. 40; 153-66) announced the discovery of a fifth weeping hemlock of the Sargent type growing in the wild about nine miles east of the town of Beacon. In the same article, Stout gives a thorough discussion of the pre-1939 history of weeping hemlocks and makes the first attempt to analyze their habit of growth.

Since 1939, very little original work has been done on the weeping hemlock. This article is intended to bring the literature up to date.

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The Weeping Hemlock Spruce (*Abies canadensis pendula*). Engraved for *THE GARDEN* from a photograph sent by S. B. Parsons, Flushing, Long Island, U. S. A.

Figure 1. *The first known illustration of *Tsuga canadensis f. pendula*, from *The Garden*, October 22, 1887. The high, narrow crown clearly suggests that staking played an important role in the development of this specimen.*

DISCOVERY

The history of the Sargent weeping hemlock (*Tsuga canadensis f. pendula*) has always been shrouded in confusion, due partly to the lack of precise information regarding the date, location and appearance of the original wild seedlings, and partly to the numerous mis-statements that seem to flow directly from one horticultural author to the next without ever being critically examined. The only way to resolve the confusion and conflicts that have arisen in the weeping hemlock literature is to go back to the original sources — the writings of the people who were directly connected with the original seedlings when they were found — to see what they had to say.

The first mention of weeping hemlocks was formerly thought to be in the October 9, 1875 edition of the British periodical *The Garden*. Unfortunately, this reference says nothing about the trees except that they existed in 1875. I have discovered another much more useful statement, also from 1875, that constitutes the first description of *Tsuga canadensis f. pendula*. It comes from Mr. Henry Winthrop Sargent (the person for whom the tree is named and who first introduced the plant into horticulture) in the supplement to the 1875 (Ninth) edition of *A Treatise on the Theory and Practice of Landscape Gardening*, by A. J. Downing. The Appendix to the Ninth Edition is fourteen pages long and contains no less than five references to the weeping hemlock, the most important of which is on page 581:

Abies canadensis pendula, or *Sargenti*, as sometimes called, is a very interesting and distinct variety of Hemlock. It is as pendulous as a Weeping Cherry, perfectly hardy, and admirably adapted for small places, though as yet very rare, Messrs. Parsons, of Flushing, alone having plants for sale. It is a sport of our native Hemlock, found in the Fishkill Mountains.

The most important item in this reference pertains to the location of seedlings for it shows that as early as 1875 the exact location of the original plants was not precisely known. The term "Fishkill Mountains" covers a rather broad geographical area. According to P. H. Smith, on page 174 of his *General History of Dutchess County*, published in 1877, "the Fishkill Mountains, extending along the southern border [of Dutchess County], are high, rocky and precipitous." In a map included in the book, the "Fishkill Range Mts." are shown to follow the southern boundry of Dutchess County from the east shore of the Hudson River to the Village of Hortontown. At this point, they turn away from the county line and move in a northeasterly direction up to the town of Dover Plains, where they end. They run a total distance of about thirty miles, and Mount Beacon, on the Hudson River, at 1685 feet, is their highest point. The broader geographical term "Hudson Highlands" includes the Fishkill Mountains, as well as mountains on the west bank of the Hudson, in Orange County.

The second reference to the original seedlings comes twenty-two years later from H. W. Sargent's cousin, Professor C. S. Sargent of the Arnold Arboretum, writing in Volume 10 of *Garden and Forest*:

There are a number of abnormal forms of *Tsuga canadensis* in gardens. The most distinct of them was found about forty years ago on the Fishkill Mountains, in New York, and was first cultivated and made known by Mr. H. W. Sargent. This plant, which is now usually called in gardens, Sargent's Hemlock, is a bush about three feet high with short pendant branches and branchlets, forming a remarkably dense, compact flat-topped mass of foliage. Several of these plants were originally found together and transplanted, and the largest of them which I have seen is on the Howland estate, in Matteawan, New York, and is now about twenty five feet across. This variety has been propagated by grafting the branches on the ordinary Hemlock, but in a few years, the grafted plants form an erect stem and lose the dense low habit which is the charm of the original seedlings. [pp. 490-91]

This statement is particularly important because it makes a distinction between the appearance of the original seedlings and the appearance of the subsequent grafted propagations. It is also impor-

tant because it puts the date of discovery of the seedlings at "about" 1857 (1897 minus 40 years). This figure should only be taken as a rough estimate, however, because one year later in Volume 12 of *Silva of North America* (1898) Professor Sargent states that the seedlings were found ". . . about thirty years ago . . ." a figure that puts the discovery date at "about" 1868. The best one can do with these two conflicting statements is to say that the seedlings were found some time between 1857 and 1868.¹

The next reference to the original seedlings comes twenty-three years later from Sargent's colleague at the Arnold Arboretum, E. H. Wilson. Writing in *The Garden Magazine* (September 1920), Wilson was the first person to credit General Joseph Howland with the discovery of the wild seedlings and the first to mention that one of them was growing at Professor Sargent's estate in Brookline, Massachusetts.

In 1923, Murray Hornibrook in his book *Dwarf and Slow-Growing Conifers*, contributed what I would consider to be the last original reference to the Fishkill seedling:

Bean [W. J. Bean, *Trees and Shrubs Hardy in the British Isles*, 1914] separates these two varieties [the taller, upright *pendula* and the more compact *Sargentii*], but Professor Sargent informs me that the nurseryman's stock has all been produced from grafts from the four original plants found near the summit of Fishkill Mountain (near Beacon City, on the Hudson River) by General Joseph Howland about 1870. The finder grew one in his own garden at Matteawan, N.Y., gave the second to Mr. Henry Winthrop Sargent, of Fishkill;² the third to Mr. H. H. Hunnewell, of Wellesley, Mass.; and the fourth to Professor C. S. Sargent of Brookline, Mass. The second and third are dead, but the first and fourth have made very fine specimens. Grafted plants in general cultivation vary considerably, some being dwarfer and more compact than others. The best form makes a very compact hemispherical mass of pendulous branches. [pp. 185-86]

¹ In the 1898 *Silva* article, Sargent also says that the seedlings grow to be "two to three feet in height and twenty feet across." This is noteworthy, given the fact that in 1897 he said that the largest seedling was twenty-five feet across. This discrepancy, coupled with the discrepancy in dates, suggests that the "Silva" passage, while copyrighted 1898, was actually written before the 1897 article.

² A source of constant confusion in the literature on Sargent's weeping hemlock has to do with the use of the word Fishkill. H. W. Sargent lived in Fishkill-on-Hudson. General Howland lived in Matteawan. These two towns were side by side. In 1913, they merged to become the present town of Beacon. The present town of Fishkill is about 5 miles north of Beacon and has nothing to do with the original seedlings.

This statement of Hornibrook's was paraphrased in an article that appeared in the February 23, 1924 issue of *The Garden*. Mysteriously, the article is usually considered anonymous, but, in fact, it is clearly signed by E. H. Wilson. The fact that Sargent was alive when these two statements, by close associates appeared, makes it likely that they are reliable. However, the fact that they also contain the same obvious error (the phrase, ". . . near the summit of Fishkill Mountain . . .") must make one wary of the possibility of other misstatements, especially when one considers that Hornibrook was giving a second-hand report forty-eight years after H. W. Sargent initially announced the discovery of the plants.

The Fishkill Seedlings In 1980

The *Howland Hemlock*, at Beacon, New York, is in good health and looks much as it did in 1939. The normal hemlock that was shading it in 1939, is still there and has completely killed one side of it. Since 1939, the tree has put on about 2 feet in height and about 1 foot in breadth. Figure 2 shows the tree, and in Table 1, I have put together all available data on its growth.

The *H. W. Sargent* and *Hunnewell Hemlocks* are still as dead as they were when Hornibrook announced it in 1923. It is interesting to note that this first mention of their death is also the first and only mention of their existence. C. S. Sargent makes no mention of a *Tsuga canadensis* f. *pendula* in his article about H. W. Sargent's estate, Wodenethe, written for *Garden and Forest* (1897a). This is a noteworthy omission since he says specifically that:

Of the hundreds or perhaps thousands of conifers planted by Mr. Sargent during the years of his greatest activity, when he ransacked every nursery in Europe for species and abnormal forms, those which we have mentioned are now the only ones which are conspicuous for their size and healthy condition. [p. 449]

As for the Hunnewell tree, H. H. Hunnewell himself makes no specific mention of a *Tsuga canadensis* f. *pendula* in any of his various writings about his Pinetum at Wellesley (*Life, Letters and Diary of Horatio Hollis Hunnewell*, 1906). However, a "Sargenti" is shown on a map, drawn in 1895, that is included in Vol. 3. This same tree is still standing in 1980, an impressive, multi-stemmed specimen about sixteen feet tall. (fig. 3) While it is possible that this tree might be one of the original seedlings, there are no references to support this contention, and Hornibrook's 1923 statement clearly says that it is not. For lack of evidence to the contrary, then, it must be assumed that both the H. W. Sargent and the Hunnewell seedlings died prior to 1900.

The *C. S. Sargent Hemlock*, at Brookline, Massachusetts, has put on only 6 inches of height growth since 1939 but nearly 6 feet of



Figure 2. *The Howland Hemlock at Beacon, New York. The tree is about 13 feet high and 36½ feet across at its widest point. The trunk system is multi-stemmed. Photograph by A. Kelley.*

horizontal growth. The tree is quite healthy and promises to live on indefinitely. In 1962, Alfred J. Fordham gave this plant the cultivar name 'Brookline'. Table 1 gives a history of its growth, and figure 4 shows the tree as it appeared in 1900, figure 5 shows the tree as it appears in 1980, and figure 6 shows the remarkable trunk system of this tree, illustrating, from the underside, the total horizontality of the tree.

The 'Horton'

In his 1939 article, Stout announced the discovery of a very old, wild-growing, weeping hemlock growing about nine miles from Beacon, New York, which he chose to call the 'Horton'. As far as I know, this first mention of the tree is also the only mention of it. When Mr. Augustus Kelley of Little Compton, Rhode Island, told me that the 'Horton' hemlock was still alive and well in 1980, I resolved immediately to go and see it for myself. It turned out to be a beautiful specimen of a tree, perched on a hillside overlooking what is now known as the Taconic State Parkway to the west and the village of Hortontown to the east. This location puts the 'Horton' squarely in the center of the "Fishkill Range Mountains" as described by Smith in 1877. The 'Horton' is completely healthy and is located on the property of Mr. Joob Veldhuis (fig. 7). Currently, Mr. Veldhuis is using the tree as a kind of storage shed, a use to which it is admirably, if ignobly, suited. The pendent branches totally conceal no less than half a cord of wood, a hundred-gallon oil tank, a ladder, a



Figure 3. *The trunk of Tsuga canadensis f. pendula, growing at the Hunnewell Pinetum, Wellesley, Mass. The tree is most likely not one of the original seedlings. Photograph by P. Del Tredici.*

wheelbarrow, numerous packages of shingles and innumerable other artifacts of country life. The tree stands 18 feet, 3 inches tall, and describes a circle on the ground 31 feet across (all measurements were taken from the downhill side of the trunk). The trunk is $24\frac{1}{2}$ inches in diameter at a height of $4\frac{1}{2}$ feet. The lowest branch is at 5 feet and the main branches, which make up the framework of the tree, start about 8 feet up the trunk. In this upper framework, there is considerable self-grafting, where branches have touched one another. In 1939, Stout described the trunk as quite angular, and not fully erect. Forty years of stem thickening has eliminated much of that angularity (fig. 8). Except for the increase in the size of the tree, it seems to be identical to the way it was when Stout discovered it. In Table 1, I have summarized the changes the tree has undergone.

Having seen the 'Horton', I was not satisfied with vague speculation about its age or origin, so with the help of Mr. Jack Karnig, chief forester at the Harvard Black Rock Forest at Cornwall, New York, I took a small core sample from the lowest branch of the tree (at 5 feet). While this core could not give me the total age of the tree, it gave me the age of the tree when it was 5 feet tall. Counting the annual rings under a $25\times$ power dissecting microscope revealed that the branch at 5 feet was 119 years old. The rings were extremely small showing an average width of 0.5mm. By subtracting 119 years from 1979, I came up with 1860 as the date at which the Horton was at least 5 feet tall. Given that the Fishkill seedlings could have been



Figure 4. *The C. S. Sargent Hemlock at Brookline, Mass. as it appeared in 1900. Photo by A. Rehder from the Archives of the Arnold Arboretum. Using the length of the needles for scale (currently the tree has needles that average 1.5 cm in length), the tree measured about 3½ feet by 9 feet.*

found any time between 1857 and 1868, the date of 1860 becomes significant because it makes it likely that the 'Horton' is a wild tree and not an early propagation of the Fishkill plants. As to just how old the 'Horton' might be is hard to say. A core sample taken from a branch at 6 feet showed 115 rings, meaning that it took four years for the tree to grow one foot. Working backwards, this meant it would have taken the 'Horton' twenty years to grow 5 feet, putting the total age of the tree at 139 years. The age of the tree may be calculated in a different way, using Stout's finding that seedlings of *pendula* increased in height a bit less than 2 inches per year over a period of 23 years. Using this figure, it would have taken the 'Horton' about 30 years to reach 5 feet, putting the age of the tree at 149 years.

Regardless of whether one accepts either of these projected figures, the known age of the tree at 5 feet is sufficient to make the 'Horton' at least as old, if not older, than the Fishkill seedlings. The fact that the 'Horton' is growing "on the Fishkill Mountains" makes it possible that it might be the parent of the Fishkill seedlings found by General Howland. This seems a rather unlikely relationship, however, given their closeness in age. More likely is the suggestion that the 'Horton' is a sibling of the Fishkill seedlings, a fifth seedling, that was either not discovered or was too big to move. It is also possible that there was a time when there were many more weeping hemlocks in the area, but only the 'Horton' and the Fishkill seedlings survived.

Regardless of which hypothesis one prefers, the close geographical proximity of the 'Horton' and the Fishkill seedlings makes it likely that they are somehow related to one another.

When I visited the 'Horton' in February of 1980, the tree was covered with cones which were full of sound seed. I collected as many of these as I could, along with numerous cuttings. These seeds and cuttings are now being grown at the Arnold Arboretum for further study. It will be particularly interesting to see if the cuttings grow up to have the same erect single stem that the 'Horton' does, and if the seedlings will be weepers, as they are in the case of other specimens of *pendula* that have produced cones (Jenkins, 1935; Stout, 1939).

NORMAL HEMLOCK vs. "WEEPING"

Normal Hemlock Growth

Tsuga canadensis f. *pendula* is a mutant form of *Tsuga canadensis*. In order to understand the nature of the *pendula* mutation, it is crucial first to understand the nature of the normal hemlock tree. Fowells, in *Silvics of Trees of North America* (1965) summarizes the pertinent literature on the growth and development of hemlock, and Mergen, writing in the journal, *Forest Science* (1958), gives an excellent and very precise description of the growth of the terminal shoot of hemlock. I shall make further reference to Mergen's article below.

At the beginning of the growing season, the shoot tips of all branches droop down, giving the tree a graceful, feathery appearance (figure 9). As the season progresses, these drooping shoot tips slowly turn upward to become nearly erect, giving the tree an ascending rather than a drooping appearance. In New England, the terminal shoot tips of all the branches are usually horizontal or subhorizontal in July. By November, the terminals erect themselves to a nearly vertical position (figure 10). In the words of Mergen:

The straightening process was effected mostly by a bending close to the base of the current year's growth which caused the leader to turn upwards. This bending was accompanied by a stiffening of the cells. As the growing season progressed, this point of stiffening progressed up to the stem.
[p. 102]

Associated with the erection of the leader, according to Mergen, is the formation of compression wood along the underside of the terminal. Compression wood is of general occurrence in conifers, and is readily visible to the unaided eye by virtue of its deep red color. With hemlocks, the only tool needed to see compression wood is a razor blade, which is used to make smooth cross sections of the twigs.

In pines and other straight growing conifers, small amounts of compression wood always occur on the lower side of lateral branches



The C. S. Sargent Hemlock at Brookline, Mass., as it appeared in 1980. Figure 5 (above): The tree is 7½ feet tall and 32½ feet wide. The children shown in the picture were playing under the tree, which they called "The Fort." Figure 6 (below): A view of the trunk system. The large, ribbon-shaped branch on the left is 14 inches by 5 inches in cross section. Photographs by P. Del Tredici.



Figure 7. *The Horton Hemlock, at Hortontown, New York. The tree measures 18 feet 3 inches in height and 31 feet across. Photograph by P. Del Tredici.*

and are considered to be responsible for maintaining the branches in their horizontal position against the pull of gravity. Compression wood is found more sparingly in erect parts of the tree. It is most conspicuously formed when the leader in an erect growing conifer is destroyed and a lateral branch must change direction to replace it (Sinnott, 1952; Westing, 1965). In this instance, large amounts of additional compression wood are formed along the underside of the branch, forcing it upward.

In most conifers, compression wood functions to maintain the laterals at a specific angle. Should a tree need to change the angle at which a branch is carried, e.g., to compensate for damage, this is accomplished by increasing the amount of compression wood. In hemlock, the use of extensive amounts of compression wood to change branch angles (rather than just maintain them) is not limited to extraordinary circumstances as it is in other conifers. Instead, it is part of the normal ontogeny of the plant, functioning to erect the leader on a yearly cycle.

The growth of the hemlock tree can be summarized as follows. In the spring, as the buds break, new growth comes out plagiotropically (this is the botanical term for the horizontal position). After these terminal shoots have been growing for a month or two, second order branches start to grow out several inches below the shoot tip in the axils of newly formed needles (figure 11).³ The fact that the terminal shoot is in a horizontal position when these lateral branches grow out results in a greater measure of equality between the terminal and its laterals than would be the case if the terminal were vertical (Mergen, 1958). While in the plagiotropic state, there is no absolute terminal shoot, rather there is a complex of shoots, all produced during the same season, any of which has the potential to become the new leader. In late fall and early winter, this whole shoot complex is erected to an orthotropic (vertical) position. At this point, the terminal shoot reasserts its dominance and suppresses the subtending laterals.

In young, vigorous hemlocks, raised in a nursery, the stem is usually a monopodium built up by the activity of a single terminal meristem that each year erects itself into the orthotropic position upon completion of its active growth. Only when there is some damage to the terminal shoot itself is a lateral shifted into the terminal position. In forest-grown hemlocks, this basic pattern is somewhat modified. Growth is less vigorous, and the secondary erection of the leader may take more than one year to complete. In addition, laterals become dominant not only when the terminal is damaged, but also when

³ The habit of developing lateral branches without a period of dormancy is called syllepsis. The buds from which sylleptic branches grow are characterized by a lack of bud scales which over-wintered buds always possess.



Figure 8. The trunk and branches of the Horton Hemlock. At 4½ feet, the trunk diameter is 24½ inches. Photograph by P. Del Tredici.

the terminal loses its vigor for no apparent reason. In wild trees at the Harvard Forest, in Petersham, Massachusetts, dominance shifted from a weak, undamaged terminal to a subtending lateral on an average of once every four years (Hibbs, 1980).

This habit of growth has important implications for the hemlock tree, which can be described best by one word — flexibility. Mergen puts it this way:

If, during the growing period, the terminal growing point of hemlock trees is damaged by an insect, or by mechanical means, hardly any amount of growth is lost, but a new growing point is formed immediately without leaving a noticeable bend in the leader. If the entire leader is cut off toward the latter part of the summer, one of the side branches, which is closest to the leader, assumes dominance at once and leaves little trace of damage. As a matter of fact, it is very difficult at times to select the terminal leader during the growing season, and there appears to be a flexible, or a loose, pattern of apical dominance during the early part of the growing period. [p. 107]

In contrast, the native white pine (*Pinus strobus*) has a rigid system of apical control. One look at its crown, ravaged white pine weevil and blister rust fungus, is enough to make clear what a great advantage the “flexible” system of apical dominance can be. Indeed, the well known ability of hemlock to withstand prolonged periods of sup-



Figure 9. A specimen tree of *Tsuga canadensis* growing at the H. H. Hunnewell Estate at Wellesley, Mass. The tree is 51 feet tall. Photograph by P. Del Tredici.

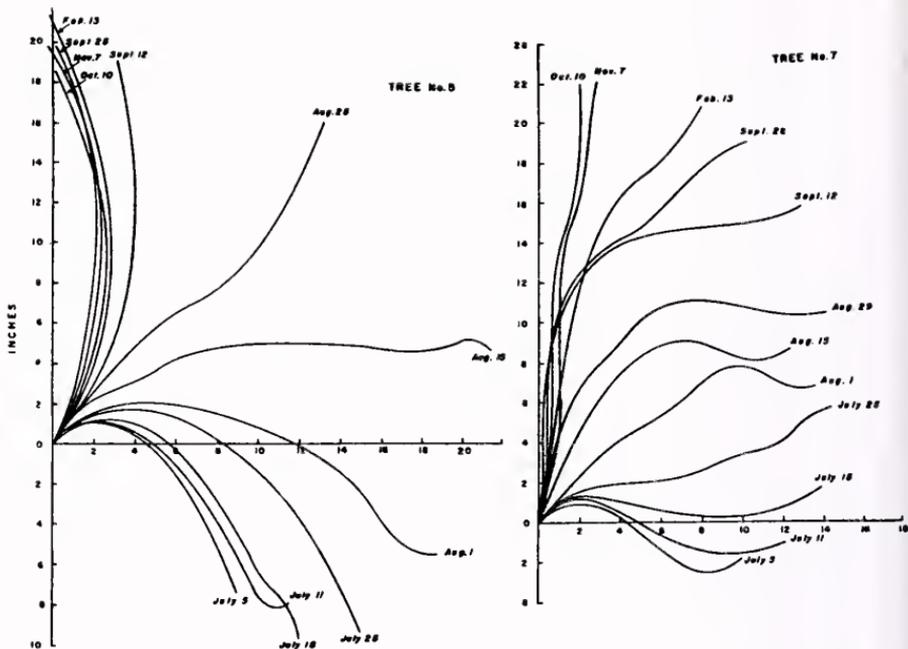


Figure 10. Graphic presentation of the course of the straightening of the leaders in two normal hemlocks. Reprinted with permission from Forest Science 4(2):103.

pression by hardwoods and pines (Fowells, 1965) is partly due to the flexibility of its growth pattern (Hibbs, 1980).

“Weeping” or Pendula Growth

A. B. Stout, as other authors before him, recognized two distinct forms of *Tsuga canadensis* f. *pendula*: (1) The *shrub* form, characterized by a low spreading habit and numerous stems arising near ground level, which have more of a horizontal orientation than vertical; and (2) the *standard* form, characterized by a single stem with a nearly vertical orientation. In general, plants of the standard type are more umbrella-like in their appearance and more pendulous than plants of the shrub type. Unfortunately, for those who like neat categories, there exist many specimens of *pendula* that conform neither to the shrub nor the standard type. They are intermediate between the two in terms of the angle at which their stems grow and their degree of pendulousness. In studying *pendula*-type hemlocks, it is important to recognize that there is a continuum of forms and not just two extremes. In the remainder of this section, I will address myself to those features of growth that are common to all specimens of *pendula*, saving until last the discussion of stem formation and orientation.

Tsuga canadensis f. *pendula* differs from the normal hemlock tree in one overwhelmingly important respect — it lacks the ability to erect a leader after the initial horizontal stage of growth is completed.

Pendula, therefore, is a plagiotropic plant in which growth occurs in a horizontal rather than a vertical direction. At least, this is so in theory. In reality, absolute plagiotropy is never achieved. The main branches always tend to grow at a small upward angle and the trees slowly increase in height. In the normal tree, the erection of the leader is the basic organizing principle. In *pendula*, this organizing principle is lacking.

In *pendula*, the lack of the ability to throw up a leader is the primary mutation from which the other features follow as a natural consequence. The plagiotropic terminals remain plagiotropic only for as long as they can resist the pull of gravity. Once they start to become pendulous, one of the laterals behind the terminal grows out during the following season, to continue growth in the plagiotropic direction. Sometimes, the lateral may overtop its own terminal and sometimes it will grow out at an angle unrelated to the terminal. In the process of overtopping the terminal, the lateral erects itself partially. Unlike the situation in the normal hemlock, however, this secondary erection never involves more than the very base of the shoot (two or three inches at the most). Without the benefit of secondary erection, the shoot tip itself succumbs to the pull of gravity and becomes pendulous, giving the plants their characteristic weeping appearance. It is interesting to compare these pendulous hemlocks with prostrate hemlocks (such as *Tsuga canadensis* 'Cole') which fail to erect any portion of their stem and consequently increase extremely slowly in height.

Once a terminal is overtopped, the main axis of growth is shifted away from it to the overtopping lateral, resulting in a stem that grows up at an angle slightly greater than the horizontal. Unlike the vertical stem of the normal tree, which is built up by utilizing the entire terminal shoot, the plagiotropic stem of *pendula* is built up by utilizing only the proximal portion of the terminal. Sometimes these plagiotropic stems go off in a fairly straight line in one direction and sometimes they grow back upon themselves and form a circle by self-grafting. It is nearly impossible to generalize about the growth of these stems, other than to say that they can grow in any direction and at any angle. Stout found considerable variation in the height of *pendula* seedlings after 23 years of growth. Among the five plants he grew, the smallest one was three feet tall, the largest about four feet. Such variation suggests that there are genetic differences in the amount of tissue that different individuals erect in the process of overtopping. Interestingly, all of the seedlings were multi-stemmed.

In hand sections of terminals of *pendula*, using a razor blade, I usually found small amounts of red-colored compression wood along the underside of the branches, but never as much as can be found in the normal hemlock tree. In general, the actively growing shoot tips of *pendula* show differing amounts of resistance to gravity as well as differing amounts of compression wood, but there seems to be no

relationship between them. The vertically flattened, ribbon-shaped stem seen in many older specimens of *pendula* (fig. 6) are a sign of eccentric radial growth, indicative of the presence of large amounts of compression wood. This extra thickening is an engineering necessity that allows the branch (which is essentially a cantilever) to carry the load that develops as a result of having to grow plagiotropically.

As a final consequence of the lack of ability to erect a leader, there is no hierarchy among the branches and hence no regulation of tree form from above. All buds are free to grow out without relation to any of the other branches. If *pendula* is allowed to grow freely, it will always describe a perfect circle of vegetation on the ground. This symmetry is not just a random occurrence, it is a reflection of the total equality and equivalence of all the plagiotropic branches.

In summary, *pendula* is plagiotropic at all stages of its life. The normal hemlock tree, on the other hand, is plagiotropic only during the period of its active growth. During the winter, it becomes orthotropic. Thus, within the same species, we have two totally opposite growth forms. Such extreme intraspecific variation is not common in trees (Hallé, 1978).⁴

Stem formation. The continuum of forms that exist from the multi-stemmed shrub forms to the single-stemmed standard forms has caused some horticulturists to speculate that there are at least two forms of *pendula*. Whether or not these forms merit separate varietal rank is dependent upon whether or not it can be established that there are genetic differences between the two types. In order to answer this question, it is necessary first to go back to the original literature on the subject. The earliest reference concerning propagation of *pendula* is from the Parsons and Son's catalogue of 1879 (Jenkins, 1933a):

Abies canadensis pendula sargentii, Sargent's weeping hemlock, the most graceful and delicately beautiful evergreen known. When the leader is trained to a stake, it can be carried to any reasonable height, each tier of branches drooping gracefully to the ground, like an evergreen fountain. It was first sent out from Flushing, having been received from H. W. Sargent, of Fishkill-on-Hudson.

⁴ In the normal hemlock tree, the trunk is an orthotropic monopodium, as are all the continuously arranged lateral branches. Growth is rhythmic, as indicated by the presence of bud scales. Flowering does not interfere with this monopodial growth in so far as the male flowers are borne laterally, and the female flowers, while borne terminally, are found only on lateral branches. According to the system described by Hallé, et al. (1978), *Tsuga canadensis* (L.) Carr. would seem to belong to either Rauh's or Attim's Model. However, the fact that the terminal goes through a plagiotropic stage argues against either classification. As far as I can tell, the hemlock does not fit any of their models precisely.

Figure 11. The upright, dormant terminal shoot complex of a normal hemlock, photographed in April, 1980. The white arrow indicates the starting point of the 1979 season's growth and the black arrow indicates its end point (the total growth is 38 cm.). Note the abundant sylleptic branches. Photograph by P. Del Tredici.



So here it is plainly stated by the people who supplied all of the propagations of the original plants that they were staked to achieve a greater pendulous effect. In a statement dating from 1887 (*The Garden* 32: 363), Samuel Parsons is quoted as saying that attempts were made to graft *pendula* "upon high stocks" but he also says that he considers the results unsatisfactory. He illustrates this article with what is considered to be the first picture of a weeping hemlock (fig. 1). This early propagation clearly shows the standard form. The fact that the crown is high yet narrow suggests that staking was involved in producing this tree.

Beissner, writing with Jäger, in "Die Ziergehölze der Gärten und Parkanlagen" (1884), echoes these statements of Parsons in his description of *Tsuga canadensis* f. *pendula*:

Tsuga canadensis (Carr.) — *pendula*, mit hängenden Aesten, durch Aufbinden der Spitze als Stamm zu erziehen über Felsen oder Abhänge als Busch frei hängend. [p. 445]

Tsuga canadensis (Carr.) — *pendula*, with hanging (drooping) branches, may be trained as a stem by tying up the leader, or may be grown as a shrub hanging over slopes or rocks.

This statement is particularly important in that it comes from the man

who is the author of the name *Tsuga canadensis* f. *pendula* (Rehder, 1949).

A second factor that may contribute to the development of a single erect trunk in *pendula* was suggested by C. S. Sargent in (1897b):

This variety (*pendula*) has been propagated by grafting the branches on the ordinary Hemlock, but in a few years the grafted plants form an erect stem and lose the dense low habit which is the charm of the original seedlings. [p. 491]

This statement is of interest first, because it states that none of the original seedlings were of the standard form and second, because it suggests that the understock may be influencing the growth of the scion by making it more vigorous. A wealth of information exists which clearly shows the effects of various types of rootstocks on apple and pear tree stature and on their branching angle. It seems plausible that there should be some sort of similar root stock effect in hemlock. Given that there exist many grafted plants which do not have the standard form, it is unlikely that it is the sole cause of vertical stem formation, but that there should be some effect cannot be denied. In talking to nursery people who work with *pendula*, grafting is always accompanied by staking because the weight of the weeping foliage would break the graft union without a stake (see Jenkins, 1939). The combination of grafting and staking offer a plausible explanation of the standard form, especially when taken in conjunction with Sargent's hypothesis that the understock makes the scion more vigorous.

It is a well known fact among hemlock enthusiasts that a staked weeper (such as a *Tsuga canadensis* 'Cole') grows much faster and taller than one simply allowed to grow without interference. Why this is so, from a physiological point of view, is not clear but it shows that the artificial imposition of a leader upon a normally leaderless plant completely changes the whole habit and rate of growth of the plant. Artificially creating a leader in *pendula* eliminates one of the traits that defines it, namely, the total equality of all the branches. Mergen (1958) has shown that staking the drooping terminal in a normal hemlock changes the angle at which subtending laterals are carried, making them more like laterals and less like the potential terminals they would be if unstaked. Given the fact that staking alters the terminal-lateral relationship in the normal tree, one does not have to think very hard about the implications of staking a *pendula*.

It is possible that environmental factors, such as shade, also play a part in vertical stem development. As I see it, trees show a greater tendency to slough off lower branches under shaded conditions than they do under conditions of full sun. By eliminating the lower branches, the tree is automatically favoring height growth over horizontal growth. It is a case of stem formation by default. Human

activities, such as piling trash under the all-concealing tree, would also cause the premature loss of horizontal branches, and also favor single-stem development.

The mechanism that would cause the stem of a weeping hemlock to become vertical is not known exactly. It appears likely, however, that the large amount of compression wood that is found on the lower surface of the horizontal branches, which allows them to bear heavy loads, can have the added effect of actually pushing them into a position that is more upright than the one they had when they were formed. This process would be analogous to the way in which the upper portion of the trunk of a leaning hemlock can be brought back to the vertical position by compression wood formation (Westing, 1965, p. 449) or to the way in which lateral branches are shifted to a more vertical position following decapitation of the leader (Münch, 1938). The fact that *pendula* is a leaderless plant makes the analogy with a leaning or decapitated tree, both leaderless plants, particularly appropriate.

The only real difference between the shrub and the standard forms of *pendula* is the formation of a single erect stem. Other than this, their growth habits are identical. All available evidence indicates that a combination of horticultural and/or environmental forces are responsible for erect-stemmed specimens of *pendula*. Nevertheless, the fact that there is a small amount of secondary stem erection involved in laterals over-topping terminals, leaves room for the possibility that some of the standard forms may indeed be able to erect larger portions of their stems than shrub forms, and that they are able to combine these segments into a fully erect main stem. Experiments are now being conducted at the Arnold Arboretum in which cuttings of standard trees have been rooted to see if they develop the standard form without any horticultural treatment. I hope they will provide an answer to the question of the genetic basis of vertical stem formation in Sargent's weeping hemlock.

Acknowledgements

Many people have been helpful in preparing this article. Foremost among them is Mr. Augustus Kelley, who first interested me in weeping hemlocks. Thanks also go to Mr. Spencer Barnett, historian of the city of Beacon, N.Y., Mr. Jack Karnig of the Harvard Black Rock Forest, Cornwall-on-Hudson, N.Y., Mr. Spencer Klaw, Mr. Ed Mezitt of Weston Nurseries, Hopkinton, Mass. and to Professor M. H. Zimmermann of the Harvard Forest, Petersham, Mass. Finally thanks go to members of the Arnold Arboretum staff and to my wife, Susan, for suffering through my obsession with hemlocks.

Table 1. A summation of the growth of certain individuals of *Tsuga canadensis* f. *pendula*, from 1860 to the present.

Year Measured (by whom)	'Sargent' Hemlock	'Howland' Hemlock	'Horton' Hemlock	Arnold Arboretum 1514-2 ^a
1860			5'h ^b	
1897 (C. S. Sargent)		3'h 25'w		
1900	3½'h 9'w			
1913				6'h ^c
1924 (E. H. Wilson)	6'h 23'w			
1933 (C. F. Jenkins)	6'h 24'w	10½'h 33'w		
1939 (A. B. Stout)	7'h 27'w	11'h 35'w	16'h	10'h ^d 28'w
1953 (A. A. Records)				12'h 30'w
1962 (A. J. Fordham)	7'h 28'w			14'h 34'w
1980 (P. Del Tredici)	7½'h 32½'w	13'h 36½'w	18'3" h 31'h	12'9" h ^e 21'w

(a) A plant grafted in 1881 from a grafted plant received from Parson's Nursery in 1880;

(b) Estimate based upon ring counts from a limb cored in 1980 (see text);

(c) Estimate based upon ring counts from a limb removed in 1980;

(d) Jenkins, 1939;

(e) The tree lost a major branch around 1970.

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Pseudolarix amabilis

People are often surprised to learn that a few conifers, rather than being evergreen, lose their foliage in the winter. In fact, I am told that when the larch trees (*Larix* sp.) on the Harvard campus begin their autumn leaf drop there is a flurry of concerned telephone calls inquiring after the health of the trees and what can be done to stop the defoliation.

While the deciduous species of *Larix*, *Metasequoia* and *Taxodium* are known to many, few people know or grow the rare Chinese tree known as golden larch (*Pseudolarix amabilis*). This common name describes the fall foliage color of bright golden-yellow which begins with the first crisp frost and ends when the last needle is carried away by the autumn winds. It is difficult to describe the autumn color adequately for while the golden shade is rich in itself the color saturation is intensified on clear days when the sun, as a result of its low arc in the autumn sky, produces mellow light conditions. It is because of its suffused autumn colors that the Chinese call it either *Kin-ye-sung* "golden-leaved pine" or *chin-lo-sung*, "golden deciduous pine."

Our grove of six golden larch trees growing along either side of Bussey Brook near the Walter Street gate is worthy of attention, not only in fall. In spring, the warm days stimulate new growth. Emerging leaves are a soft yellowish-green and the small, yellow, male cones are produced in dense clusters at the ends of short, spurlike branches. During the summer, leaf color is a pale emerald green which gradually gives way to golden autumn hues. Color change in the needles



A superb group of one young and five mature specimens of Pseudolarix grows along either side of Bussey Brook near the Walter Street gate to the Arboretum. Having trees of different genotype and provenance allows adequate pollination by wind and results in an abundant seed crop every other year. Photograph by G. Koller.

begins at the outer tip and progresses inward briefly giving the effect of a green eye surrounded by gold.

During alternate years its large crop of female cones is extremely ornamental as the individual cones have thick cone scales which are arranged in such a manner as to resemble artichokes. In the immature state they are a pale green and as they ripen, in mid-October, they become a light tan. As the cones dry the scales loosen from the central axis so that the whole structure falls apart. Two seeds adhere to each cone scale and as the cones shatter the seeds are dispersed by the wind.

In the winter the tree presents an elegant silhouette for the trunk is straight and tapers gradually to the tip. The branches are widely spaced, thin in diameter and basically spread from the tree in a horizontal or slightly upthrust angle. Mature lower branches are clear of growth near the trunk with smaller branches and foliage presenting themselves on the outer one-third to one-half of the branch. The outermost branch tips are horizontal or slightly upturned. The upper crown is densely branched, with more upright branches, so that old trees have a flattened top which gently blends with a graceful curve into the more sparsely spaced side branches.

During the summer the foliage density is thin and as a result directly beneath the tree one can find spots of sun shining on the lawn. Grass grows directly up to the trunk and there is no evidence in any of our plants of surface or shallow rooting. Spacing to create landscape effect is often critical to the visual and spatial quality of a mature grove. Our grove of trees is planted on 30-35 foot centers which allows the plants adequate space to develop a full canopy without crowding, while enabling the outer branches of individual trees to touch, providing, in effect, a continuous ceiling. Beneath mature trees with their open canopy one could establish perennial plantings of ground covers, herbaceous plants or taller woody species such as azaleas, *Leucothoe*, *Skimmia* or low growing hollies. Landscape architects who seek plants with an open airy crown at maturity should consider using the golden larch.

Bark on the trunk and major stems of mature specimens is distinctive as it is broken into a series of irregular plates separated by deep ridges with color varying from gray brown to reddish brown. Young stems and branches are smooth and gray brown.

I have observed a great variation in growth rates for this plant. While some twenty year old plants are little more than 6-8 feet tall and have a sickly yellow green summer color, others grow robustly, and at the same age are 18-25 feet tall with emerald green foliage. Of those plants which were languishing most were growing on soil with a high lime content or on limestone seams of rock. Notes in the English literature appear to confirm that they are lime intolerant. However, this needs to be more substantially documented by controlled growth experiments.

Right: The leaves are arranged in a whorled pattern at the end of a short spurlike branch. Below: Cones are abundant every other year and are generally grouped or clustered along the upper surface of the branch. Cones ripen in the autumn of their first year. Photographs by G. Koller.





Cones which resemble artichokes in appearance change from light green to tan as they ripen in mid-October. At full maturity the cone becomes deciduous and the whole structure shatters, scattering cone scales, with two adherent seeds, in the wind. Photographs by G. Koller.

At the Arnold Arboretum we have access to plants of different ages from which to derive observations on growth rates. In mid-February 1980 seeds were germinated at the Dana Greenhouses. Individual seedlings were transplanted from a crowded seed pan into individual 3 inch pots and by 1 October averaged 4-7 inches tall. Eighteen-year-old plants, well established in our permanent plantings, exhibit 16-22 inches of new growth on terminal and lateral branches. An examination of several mature trees 90-120 years old produced evidence of 4-8 inches of new season growth. Growth observations of several seedling batches presently at the Arboretum is deceiving as one batch was partially eaten by rabbits and in another progressive transplanting and crowding resulted in an exaggerated lack of vigor.

In order to document sources, age, and growth rate I took the following measurements from plants existing in our permanent collections on 1 October, 1980:

1. Accession Number 3656: acquired as plants of an undetermined size from Veitch and Sons Nursery in Chelsea, England in May, 1891
 - Plant A — approximately 40 feet tall, 42 feet wide with a d.b.h. of 2 feet. New season growth was 4-8 inches long.
 - Plant B — approximately 45 feet tall, 42 feet wide with a d.b.h. of 2 feet. New season growth was 4-6 inches long.

2. Accession Number 16779: acquired as seed from H. H. Hunnewell, Wellesley, Massachusetts on January 29th, 1896.
 Plant A — approximately 40 feet tall, 45 feet wide with a d.b.h. of 1 foot 9 inches. New season growth was 4-6 inches long.
 Plant B — approximately 42 feet tall by 55 feet wide with a d.b.h. of 2 feet 4 inches. New season growth was 4-6 inches long.
3. Accession number 10764: acquired as a plant of undetermined size from W. H. Hunnewell, Wellesley, Mass. on April 22, 1921.
 Plant A — Has a notation that this plant was 30 feet tall in 1946. It is now 40 feet, tall, 42 feet wide with a d.b.h. of 1 foot 6 inches. New season growth is 4-8 inches long.
4. Accession number 404-48: grown from seeds collected from 16779 during the autumn of 1947.
 Plant A — approximately 20 feet tall, 18 feet wide with a d.b.h. of 5 inches. New season growth was 4-6 inches long.
 Plant B — 25 feet tall, 28 feet wide with a d.b.h. of 10½ inches. New season growth was 4-6 inches long.
 Plant C — Not measured since it is alive but displays little vigor, greatly reduced growth and sickly yellow-green summer foliage.
5. Accession number 534-61: grown from seeds of an unspecified aboretum tree, sown in February 1961.
 Plant A — 18 feet tall, 16 feet wide with a d.b.h. of 2½ inches on the larger of two stems. Average new growth is 16 to 22 inches long.

These growth rates are compared to a venerable old specimen which presently grows on the lawn along the driveway across from the main house at the Hunnewell Estate in Wellesley, Massachusetts. This tree is undoubtedly the parent of our trees acquired from H. H. Hunnewell in 1896. On our behalf, Walter Hunnewell traced the origin of the plant and the records indicated that it was acquired as a seedling in a 4 inch pot from Veitch Nursery in 1866. In tracing the history of this tree we believe it was first mentioned in notes prepared by H. H. Hunnewell for the March 1867 issue of the *American Journal of Horticulture* when he says he has small plants. The next reference to this plant is recorded in *Life, Letters and Diary of Horatio Hollis Hunnewell* (1906. Vol. 3, pp. 127-8) with a 1905 notation as follows: *Pseudolarix kaempferi*, 35 feet tall with a trunk 4 feet in circumference and a spread of branches of 37 feet. This tree has produced seeds for many years and many seedlings have been raised from it." The tree has been measured annually since 1921 and Mr. Walter Hunnewell reports that in 1921 it had a circumference of 5 feet 6 inches and in 1979 after 58 years this had increased to 7 feet 11 inches. In October, 1980, this tree estimated to be 115 years old is



At 115 years, this specimen of Pseudolarix, at the Hunnewell Estate in Wellesley, Massachusetts, is one of the original and oldest of its species in North America. As of October, 1980 it was approximately 55 feet tall with a spread of 50 feet. Its circumference as of 1979 was 7 feet, 11 in. Photograph by G. Koller.

approximately 55 feet tall with branches spreading 50 feet. The lowest branch which sweeps the ground is $3\frac{1}{2}$ feet above the soil level and it spreads outward 36 feet from the trunk. This bottom branch has a diameter of 10 inches at the point where it is inserted into the trunk. Most of the branches on the driveway side of the tree were lost due to ice storm damage in 1921. As of October 1st the cones are beginning to ripen but the cone scales are still firmly attached. A quick visual examination indicates that despite a few damaged branches the tree remains sound and healthy.

In examining all of the trees reported on, I checked for signs of insects or disease. Leaves were, for the most part, intact with little to no bite or chew marks. However, the foliage of one specimen exhibited tiny, circular, randomly spaced, yellowish spots which were evident only on close examination. This may indicate a fungus infection or perhaps damage by an atmospheric pollutant.

The hardiness potential of *Pseudolarix* in both its northern and southern ranges seems to be inexactly defined. It is being grown at the Strybing Arboretum in San Francisco as listed in their 1979 guide to plants. Northern limits may not have been fully explored for it is fully hardy at the University of Illinois in Champaign-Urbana where winter temperatures drop to -20° F. Dr. Lyle Littlefield, at the University of Maine, at Orono, where average minimum winter temperatures average -20° to -25° F. reports that seedlings 6-8 inches tall survived only to the snow line. He felt that young seedlings lacked the ability to harden off properly and perhaps older and larger plants would have been more successful. At the Landscape Arboretum of the University of Minnesota, Dr. Harold Pellett has done laboratory controlled hardiness testing and has determined the lowest survival temperature of stem tissue to be -45° C. Perhaps this indicates that under cultivation, the tree has not yet found its way to the most northern limits of hardiness.

The fact that this tree still remains rare and little grown in North America may be due to the paucity of published information in horticultural books and periodicals. Perhaps a more important reason is that most trees reported in cultivation seem to have a low or erratic history of seed production. I believe that this is due to a lack of cross pollination, since many old specimens are grown as lone representatives of the genus in any geographical area. At the Arnold Arboretum the grove of *Pseudolarix* distinctly alternates in cone productivity year by year, but on good years we get an abundance of viable seeds. From our 1979 seed collection we distributed thousands of seeds and seedlings to nurserymen in addition to the autumn 1979 plant distribution to Friends of the Arnold Arboretum. Optimum germination of seeds takes place after 30-60 days of cold stratification at 40° F. Although we have attempted propagation by cuttings our experiments have never been successful. Should any readers have success with

cuttings we would appreciate information about the techniques used to produced positive results.

The literature indicates that there are several distinct selections being grown. However, a survey of the computer file of the Plant Science Data Center in Mt. Vernon, Virginia, failed to reveal any institution in North America which grows any cultivars or plants which vary from the type. In reviewing the literature, I wonder how many of those plants described separately actually exist today. In the *Manual of Cultivated Conifers* by den Ouden and Boom (1978, pp. 366-68) the cultivar 'Anneleyana' is described as dwarf and bushy, but in 1964 the type plant at Castlewellan in County Down, Ireland was described as over 100 years old and 30 meters tall. The cultivar 'Dawsonii' described as a dwarf conical shrub was raised from seed of a normal sized tree in the Hunnewell Pinetun by J. Dawson of the Arnold Arboretum in 1895. This tree no longer survives nor do we have any progeny. Perhaps it exists elsewhere. The cultivar 'Nana' is described as a artificial dwarf and from this I take it to mean that it's dwarfness was maintained by techniques similar to Bonsai. From indication of the early literature describing this tree it has long been popular as a dwarfed pot plant in China. We have plants in our collection raised from seeds collected from 'Nana' and today they are normal sized trees.

In terms of growing environment the tree grows best with an exposure of full sun but it seems to be tolerant of light shading. In the wild, seedlings normally develop in the shade of neighboring trees rather than with an exposure of full sun. As to soil conditions it seems to prefer a well drained, lime free soil.

Landscape use of this tree certainly could be more extensive. It not only makes a superb specimen tree but it is even more spectacular as a grove planting. Several people have expressed a dislike for this tree in the home landscape because it becomes too large, yet the same people plant maples, elms and lindens which grow as large or larger. It seems to me that those who would like a tree under which they can build a garden, should eagerly explore the use of this conifer. Golden larch should also be tested for its adaptability to urban growing conditions since its deciduous nature might reduce its susceptibility to salt and chemical pollutants. The fact that the needles are tiny and that the cones shatter into many segments would diminish their nuisance potential in regard to litter. And finally, the open airy canopy of a mature specimen would allow light to penetrate nearby windows while providing some shade for adjacent structures.

The correct scientific name of this plant has been a subject of dispute since it was first described. Most references list it as *Pseudolarix kaempferi*, while our taxonomists feel that it is more correctly called *Pseudolarix amabilis*, and so I have called it throughout this article. See references by Tjaden, Hara, & Brummitt, and Nicholson cited in the reference list.



A. A. 3656-B, acquired May, 1921 from Veitch & Sons Nursery in Chelsea, England. Current d.b.h. is 2 feet and height is 45 feet. Note the plated bark, widely spaced branching pattern, and the angle at which branches are inserted into the trunk. Photograph by C. Lobig.

If at this point I have aroused your interest in growing this golden larch you will need a source of plants or seeds. Landscaped sized plants are available from Weston Nurseries, Hopkinton, Massachusetts 01748; one year seedlings from Groundnut Hill Nursery, Inc., Logging Road, Cape Neddick, Maine, 03903; and seeds are available from F. W. Schumacher Co., South Sandwich, Massachusetts 02563.

GARY L. KOLLER

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Right: *Henry Winthrop Sargent, born in Boston 1810; died in Beacon, New York, 1882. Photograph by A. Sorrel, 1870.*

Back cover: *Tsuga canadensis f. pendula, A.1551 at the Arnold Arboretum. Photograph by J. Raer, 1945.*



Next Issue:

The Director's Report



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ARNOLDIA

Arnold Arboretum

40, No. 6

Nov./Dec. 1980

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On the cover: scenes from the Arnold Arboretum in autumn. Clockwise from upper left: through the white pines on the top of Bussey Hill; Franklinia alatamaha, the Franklin tree; the peeling bark of Acer griseum, the paperbark tree; the exquisite symmetry of Chionanthus retusus, the Chinese fringetree. Photographs by C. Lobig (1,3,4) and R. Weaver, Jr. (2).

The Director's Report

THE ARNOLD ARBORETUM
DURING THE FISCAL YEAR ENDED JUNE 30, 1980

In the extended introductory to my first annual report I laid out the basis for a future policy, firmly anchored in the wise precedents set by our founders, which can reconcile to mutual advantage our responsibilities in university research and instruction, and in public education and amenity. This year we have been principally concerned with planning and organization and a start has been made in a search for the necessary financial support. Readers will consequently notice several changes, and in particular, newcomers to our staff. I have been torn between writing a short summary of the year's achievements — a course advocated by some of my colleagues — and the rather detailed account which lies beyond you. I chose the latter in response to comments from some of our readers, and in the belief that many of you share a close personal interest in at least some aspects of our many endeavors.

This year past marked major progress at both Cambridge and Jamaica Plain. The new extension to the Harvard University Herbaria Building was opened on May 23rd, 1980, at a ceremony attended by President Derek Bok, Dean Richard Leahy, Professor Farish Jenkins, chairman of the Biology Department, and the directors of the Arnold

Opposite: A familiar view through the front entrance to the Administration Building of the Arnold Arboretum at Jamaica Plain. Photograph by S. Geary.



Arboretum and the Gray Herbarium. This building provides new rooms for faculty and other staff, further research laboratory space, and expansion room for the libraries as well as for the herbaria; this has been alluded to in previous reports and receives further comment in the sections on the herbaria and libraries. Plans are being prepared for reorganization of the interior of the Administration Building at Jamaica Plain, which, though it contains adequate space for current needs, lacks sufficient office facilities for our staff and is poorly organized for visitor reception. With an increase in the number of visitors to the Arnold Arboretum it is urgent that a separate reception area be provided for them; it is currently impossible to safeguard our library collection, part of which is located in a room where visitors have free access. The absence of public lavatory facilities is a source of constant and justified complaint. A manager for buildings and public services one of whose responsibilities is to seek funding for and oversee these alterations, was appointed in June 1980. Work is expected to begin in the coming year.

The renewal of the National Science Foundation Curatorial Grant to the herbaria for an additional three years, and the awarding of a grant for curation of the living collections will serve a dual purpose. They will further assist us to bring all our collections up to the highest standards of excellence for research and instruction, increasing their accessibility to the scientific community, and at the same time help to integrate the collections as a single facility with a common library and records system.

I shall be reporting on the first stages of the restoration of the living collections of the Arnold Arboretum at Jamaica Plain. The arboretum is an integral part of the Boston Parks system and this year played host to an increased number of visitors, due in part to the celebrations honoring the three hundred and fiftieth anniversary of the city of Boston, but also due to the fact that citizens are travelling less to offset increasing costs of gasoline. Our public program is expanding to better serve our visitors and we expect that when it is established, it will be self-financing from the revenues of services it will provide. Our manager of buildings and public services is also charged to coordinate and oversee these developments and to seek grants for their implementation.

A new assistant supervisor of the living collections, responsible for our Case Estates at Weston, has been appointed. This year he has concentrated on renovating the nurseries of the Arnold Arboretum situated there, and on integrating the work at the Case Estates more effectively with operations at Jamaica Plain. This work is in preparation for the new plant material that will result from current collecting expeditions by our staff, as well as from the accessions that will be acquired during restoration of the living collections. Complete reorganization of our nurseries will take several years, but in the coming year we plan to define future policy for the Case Estates.

THE LIVING COLLECTIONS

Policy was defined and agreed to the previous year. In the first half of the present Dr. Richard Weaver, horticultural taxonomist, Ms. Sheila Geary, assistant librarian at Jamaica Plain, and Ms. Jennifer Hicks, curatorial assistant for plant records, prepared a long-term plan for the restoration of the living collections. In September 1979, a feasibility study was completed in draft. This document addressed three problems: the best means to restore the collections in a manner commensurate with their original and continuing purpose and with Olmsted's and Sargent's design; the current state of the records, and the best means for their reorganization to enhance access and reliability; and, briefly stated, ways by which the collections can be interpreted for the public (see *Public Service* below). The study was presented to the Living Collections Committee and was approved. In June 1980, the National Science Foundation granted us \$99,998 over two years for the purpose of computerizing our complex records system. This involves acquiring a computer (jointly with the Harvard University Herbaria), devising a format for entering the records into computer storage, and verifying the records of our current holdings and entering them into the computer. We currently maintain records for our living collections in the computer of Plant Sciences Data Center of the American Horticultural Society in Mt. Vernon, Virginia. This will continue, for the PSDC provides us with the only available simple access to the records of other major North American collections, and access for others to ours; but storage of all our records in the PSDC computer would prove too expensive and inconvenient.

One hundred and eight maps, on which the positions of all our living accessions are recorded, form an essential adjunct to our other records that must be continuously curated if the plants are to be easily located for monitoring and for research. They have not been fully revised since 1969. They are not based on a precise land survey, and consequently have suffered progressive distortion in subsequent revisions that have followed Olmsted's original plans. Preliminary to preparation of a completely new set, precisely surveyed and on metric scale, the boundaries of the arboretum were surveyed and fixed points established. A grant proposal for the rest of the operation, which will involve complete remapping with the aid of photogrammetry and the creation of a simplified color-printed map on a single sheet for public sale, as well as a new set of reference maps, was nearing completion at the end of the fiscal year.

Under the direction of Mr. Gary Koller, supervisor of the living collections and chairman of that committee, the summer of 1979-1980 saw a marked further improvement in the level of maintenance on the grounds. This was largely thanks to the fine teamwork and enthusiasm of the grounds crew under the leadership of Mr. Henry Goodell, and to an exceptional group of summer trainees who succeeded a good group in the previous year. By 1979 certain invasive



*Due to its extensive and unprotected boundaries, ground fires and fire vandalism continued to be problems for the Arnold Arboretum. Two of the victims: a one hundred-year-old katsura tree (*Cercidiphyllum japonicum*) (upper left), torched by vandals with gasoline soaked rags; and one of the few fatalities, a white pine (*Pine strobus*), in a scorched section of Kent Field (upper right). Photographs by A. Bussewitz.*

weeds, notably black swallow wort (*Cynanchum nigrum*), Japanese knotweed (*Polygonum cuspidatum*) and blackberries and raspberries (*Rubus*) had gained hold in the collections. At the same time the deep-rooting, rhizomatous thistle *Cirsium arvense* had become a major menace in the nursery area. A drive was initiated to eliminate these weeds in particular, by combining increased manual removal with judicious use of selective herbicides. By June 1980 there were signs of improvement in the living collections though it will take several years to eliminate them entirely. The level of maintenance in the nursery has dramatically increased, and it is hoped that the *Cirsium* will have effectively been removed by the end of the current season. A close watch on possible damage by the chemicals to our accessions has not revealed deleterious effects to date.

Owing to the geographic position, long boundaries and accessibility of the Arnold Arboretum, vandalism continues. Ground fires were of the usual extent and frequency, but fortunately little damage was incurred. There was also a decline in the number of stolen cars that have been rammed through the gates at night and dismantled or torched. Beer parties and litter remain continuing problems, but the diligent efforts of Vincent Antonovich and other grounds staff has kept the problem under control. The one exception is the Peter's Hill area, where there is much neighborhood dissatisfaction and a need for new initiatives. Increased collaboration with our neighbors is a principal task for our new public relations officer, who will begin work in July. Several concrete benches were destroyed or damaged in the spring; some were repaired by the Parks Department, to whom they belonged, others removed. Vandalism to the collections has not increased, although we wish we could understand the motive of the person who unsuccessfully attempted to torch the best of our old katsura trees using kerosene soaked rags, or of the people who uprooted and scattered all the young *Philadelphus*, which had been repropagated and planted out to replace our declining collection. Fortunately, due to quick action by Luis Colon of the grounds staff, the plants were rescued in time and, although there were a few deaths, the parents in all cases still survived for a second attempt at propagation. Several young and dwarf conifers were decapitated during the Christmas season; fortunately they in no case represented an outstanding accession.

A second open winter is always a threat to our evergreens; this one was the drier of the two. Although there was widespread minor damage the only serious mortality occurred in the *Ilex crenata* cultivar collection; twelve plants had to be removed.

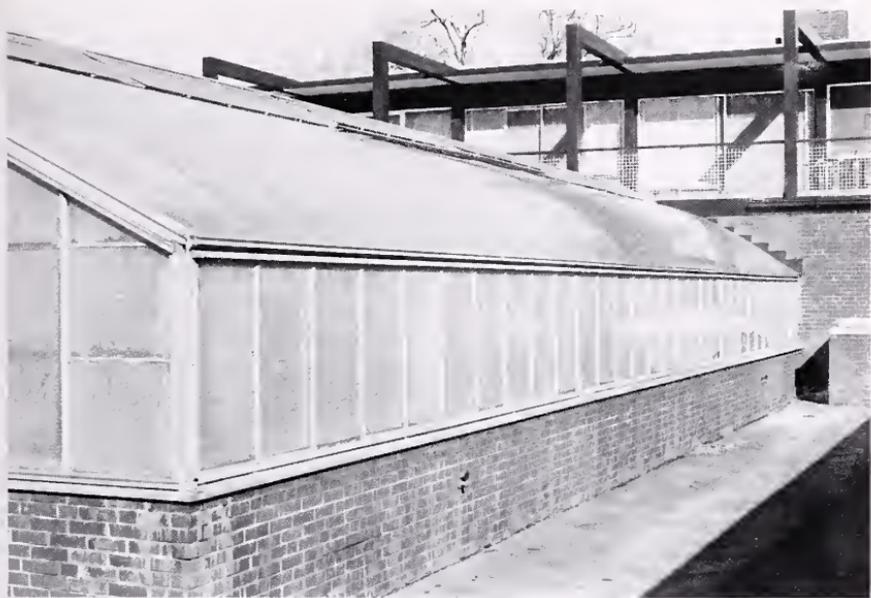
Significant improvements were made at the greenhouse complex as well. The greenhouses have been insulated with air-cap insulation applied to glazed vertical walls and air-inflated double polyethylene covering has been installed over roof areas. Both jobs were done by Maurice Sheehan and James Papargiris on our grounds staff and both have received praise for the high standard of workmanship. These,

coupled with careful cultural practices appear to have effected a 15% reduction in oil consumption, though this is a conservative estimate in view of the cold and open winter. The cold storage facility has been repainted. The exposed steel superstructure of the headhouse and administration building, which after only two years was again badly affected by rust, has been cleaned and recoated with a new rust and weather resistant paint.

During the year the Southwest Corridor Project, which was discussed in my previous report, began reconstruction operations on the section of the line abutting our South Street tract. The line was removed and the embankment lowered from the Arboretum Road underpass northwards to the present Forest Hills Station. Gary Koller assisted John Frey, the landscape architect for the new station, in plant selection and worked with the Massachusetts Bay Transportation Authority architects in site planning for a projected land link between the new station and the arboretum through the South Street tract. Two further negotiations involving use of the tract are in process. The city's water department is searching for downstream sites in the Stony Brook drainage, where dams can be constructed for temporary impoundment of floodwater, to reduce the back-up of polluted water that occurs in the Back Bay Fens following heavy rain. Goldsmith Brook, which flows through the meadow between the Administration Building and the Arborway, and Bussey Brook, which flows from the arboretum through the South Street tract of the Arnold Arboretum, both drain into the Stony Brook. A dam has been suggested along the boundary between the South Street tract and adjacent city land, and this would lead to periodic short-term flooding of the wetlands that occupy the northern sector of the tract. Meanwhile, the Boston Police Department is considering building additional stables on the same city land. An alternative site for the stables, in and toward the southern end of our South Street tract could be advantageous as it would not, like the first, impede our projected access to the new Forest Hills station. It might encourage greater visitation of the arboretum by the mounted police as well.

Following the approval of a new accessions policy by the Living Collections Committee, which is in line with our plan for eventual restoration of the Sargent and Olmsted plan, additions have been placed on the grounds following the sequence in the original Bentham and Hooker botanical classification, wherever conditions have allowed.

Dr. Stephen Spongberg earlier listed 2500 potentially hardy woody plant taxa not currently represented in our collections. Our long-term objective will be to introduce these anew from the wild. We meanwhile aim to acquire propagants from genotypes already in cultivation, where possible of known provenance. Mr. Harold Hillier, whose nurseries in Hampshire, England, contain one of the most comprehensive collections of wild woody taxa in cultivation, and to which Arnold Arboretum collectors have contributed new material over



Improvements made at the Dana Greenhouse included the addition of air-cap insulation to glazed walls, while air-inflated co-polymer film covering was installed over roof areas. The result was a 15% reduction in fuel consumption. Photograph by P. Del Tredici.

many years, has generously agreed to make available to us propagating material from his own arboretum. We take note of this example of the mutually beneficial collaboration that we continue to enjoy with the nursery trade. I will allude to others later in this report.

Several major additions to — and relocations of — individual collections have already been started. Dr. Richard Weaver, who is now proceeding with detailed plans for the restoration of individual collections, together with Mr. James Burrows personally laid out the position of each plant, oversaw and assisted with planting. Mr. Gary Koller, who has supervised all operations, has concentrated on reviewing, and, where necessary, organizing remedial action on collections in special need of horticultural attention or repropagation.

During the summer and fall of 1979, a total of 465 plants was added to the living collections in Jamaica Plain. These plants were from 114 different accessions representing 86 botanical taxa and 14 cultivars; several taxa were planted in large masses. Examples are 18 plants of dwarf *Rhododendron dauricum* (1 wild accession), 18 plants of *Elliottia paniculata* (3 accessions), 13 plants of *Kalmia latifolia* (4 accessions), all at the base of Hemlock Hill; and 21 plants of *Rhododendron chapmanii* (2 accessions), behind the rockery. During the spring of 1980, a total of 523 plants was added to the living collections in Jamaica Plain. These plants were from 285 separate

accessions representing 251 botanical taxa and 5 cultivars. All of the cultivars were planted in the new beds below the dwarf conifer collection. In general, the shrubby plants were planted in well-prepared beds. These beds may not look natural at present, but the bed preparation greatly facilitated the planting and should increase the plants' chances of survival. It is intended that the beds will eventually take on the appearance of a mass planting.

Approximately half of the existing *Philadelphus* collection was propagated in 1976 and the successful propagants, exclusive of cultivars, were planted this spring. A total of 85 individuals representing 34 accessions of 16 taxa were planted out. A few of the best remaining specimens will be maintained in their present location, the proper place in the Bentham and Hooker sequence, but so as not to clutter the area under the tree legumes, the bulk of the collection has been relocated along the path leading to the 383 South Street entrance. In order to connect the old and new collections, several groups were placed at the top of the lilac bank along Catalpa Path. All propagants of original Lemoine cultivars, as well as those of a few other cultivars cited in S. Y. Hu's monograph of the genus, were planted at the Case Estates. All plants of other cultivars were distributed.

A collection of putatively hardy bamboos, mostly *Phyllostachys* species, was selected this winter from the United States Department of Agriculture Plant Introduction Station in Savannah, Georgia, where their extensive collection is being closed down. The plants were collected on a trip to Georgia sponsored jointly with the Boston Zoological Society and the New Alchemy Institute, Woods Hole, Massachusetts. A total of 33 individuals representing 19 accessions of 17 taxa was planted out this spring. A few of these, mostly the low-growing and reliably hardy species, were planted in the present bamboo collection behind the *Aesculus* collection. A few were planted in their proper position following the Bentham and Hooker sequence in the old dwarf conifer collection. The remainder, because of their doubtful cold hardiness, were planted in protected areas elsewhere on the grounds.

Restoration of the following collections to their proper position in the Bentham and Hooker sequence was begun with the fall, 1979, and spring, 1980 plantings: Ranunculaceae, with species of *Clematis* on the parking lot fence; Guttiferae and Theaceae, with species of *Hypericum* and *Stewartia* in the azalea border; Berberidaceae, with species of *Berberis* just beyond the *Liriodendron* collection; Staphyleaceae, with species of *Staphylea* as understory shrubs in the *Acer* collection; Celastraceae, with species of *Euonymus* along the woods at the edge of the *Aesculus* collection; Vitaceae, with species of *Vitis* and *Ampelopsis* on the Arborway wall in the *Acer* collection; Hamamelidaceae and Araliaceae, with species of *Corylopsis* and *Fothergilla*, and *Aralia* and *Acanthopanax* around the middle pond; Rosaceae, with species of *Spiraea*, *Holodiscus*, *Aronia*, *Photinia*, *Amelanchier*, *Neillia*, *Aruncus*, *Prunus* and *Pyrus* around the first

pond, the area of the shrub collection, and the Forest Hills bank; Scrophulariaceae, with *Paulownia* along Catalpa Path (these are the first plants resulting from the Japan-Korea trip to be planted on the grounds); Verbenaceae, with *Vitex*, and Loganiaceae, with *Buddleia* along the walk through the tree legume collections; Saxifragaceae, with species of *Deutzia* and *Ribes* along the woods behind the tree legumes; Caprifoliaceae, with species of *Viburnum*, *Lonicera*, *Weigela* and *Sambucus* connecting the remnants of the collection on the tree legume slope with the present *Viburnum* collection by 1090 Centre Street, and the traditional *Lonicera* collection along Linden Path; and Ericaceae, with species of *Kalmia*, *Rhododendron*, *Vaccinium* and *Elliottia* along the base of Hemlock Hill and on the hill itself.

The orchard-like planting scheme of the *Malus* and *Crataegus* collections are incongruous in our collections. During September, 1979, many *Malus* were diseased and partially defoliated; those that were found to be at least 70% defoliated and regarded in the literature to be disease susceptible were removed. In addition, 30 "species" of *Crataegus* and 22 species and varieties of *Malus* were planted in a different arrangement. The former were planted in small groves on Peter's Hill, with closely related "species" together. They were usually planted in close proximity to an existing tall tree to offset the low spreading effect of the individual *Crataegus* plants. The *Malus* were also planted on Peter's Hill but scattered along the edge of the woods on top of the hill.

Dr. J. B. Phipps, of the University of Western Ontario, has offered to verify the identities of the *Crataegus* in our collection. We have started a herbarium collection program from our holdings for this purpose and members of the New England Rose Society, notably Mr. Malcolm Lowe, have kindly agreed to verify our holdings in the genus *Rosa* at Jamaica Plain and Weston. The collection has been in serious decline, but with their advice and assistance the level and quality of maintenance will be improved, and species accessions are being repropagated. The society had donated new plants for our collection, and we have provided propagating materials for their use.

Dutch elm disease has affected 18 elms in the collection this last year. Twig samples were collected for pathological analysis; a consulting plant pathologist reviewed the trees and made recommendations. To conserve genotypes, cuttings have been taken from the most significant accessions and remain healthy. Pine needle blight (*Diplodea pinea*) has affected several plants in the conifer collection and appears to be spreading. As a result, we have initiated periodic applications of fungicidal sprays and fertilizer. The spread of the disease seems to have been retarded. The *Corylus* collection was reviewed taxonomically and plants of questionable identity were removed. The remaining plants are suffering from an unidentified fungal root infection and are to be repropagated for replacement.

Areas of the arboretum that were neglected and had become over-

grown have been reviewed. Improvements were begun in the *Berberis* and *Viburnum* border near Centre Street gate, the Centre Street beds, the *Taxus* border along Bussey Street and at the base of Hemlock Hill, and the dwarf conifer collection. Gary Koller put major effort into relabeling and repropagating the existing *Populus* collections, which are deteriorating, and spent several days reviewing, evaluating, and relabelling the *Alnus* collection.

Among the more outstanding plants lost during the year were a large linden, *Tilia petiolaris* (4968), broken in a storm; an *Acer saccharinum* (1256A) which was removed after several years of decline; *Corylus avellana* cv. Contorta (4845), *Pinus bungeana* (1404-5) and *Kalopanax pictus* (12456) from unknown causes; *Laburnum* cv. Watereri (187-41-a) which had been hit earlier by a stolen car, was destroyed in a storm; and *Sorbus alnifolia* (3626-A) which had declined with fire blight.

In view of the remarkable comprehensiveness of the records of our living collections, it has been regrettable that the history recorded in their growth rings has not been retained when plants have been removed. The Center for Wood Anatomy Research at the U.S.D.A. Forest Products Laboratory, Madison, Wisconsin has agreed in the future to accept and store such samples for anatomical, dendrochronological and other research. These will consist of 3 inch wide, 1 inch deep sections from bark to core, taken from the butt of the largest basal stem along a representative radius.

I alluded last year to the report written by the Kew botanist W. J. Bean¹ following his visit to the Arnold Arboretum in 1909, when he noted that the native field flora was in those days allowed to grow and flower beneath the trees. In due course the trees shaded out much of this flora. During the 1930's labor shortages made it increasingly difficult to manage this rank vegetation, and after the neglect of the war years, a policy of more frequent mowing led to its replacement by the ubiquitous grasses that came from northern Europe with the early settlers. The arboretum's carefully planned path system, defined on gentle topography merely by close scything along the trails, thus disappeared. It is our intention to reintroduce natural herbaceous flora in selected areas and simultaneously to regrade and redefine the original paths, thus encouraging more general use of the arboretum by the public. We believe that this may in turn ameliorate our security problem. The overall plan is included in a feasibility study completed in 1979.

Thanks to the generosity of an anonymous benefactor, we have been enabled to proceed with restoration of Oak Path, and to begin to introduce an interpretative oak woodland wild garden along part of its length. Dr. Weaver describes his plan in an article that follows this report. The grounds crew has already begun regrading and contouring

¹ W. J. Bean, "A visit to the Arnold Arboretum," Kew Bulletin, 1910, no. 8, 261-269.

Restoration of the original path system is one important project requiring public support. Work on Oak Path has already begun, but restoration of Willow Path, pictured here, will require additional funding. Photographs by R. Weaver, Jr.



the path. Several masses of plants, including a mass of *Rhododendron chapmanii* (21 plants) behind the Rockery and four masses of *Cimicifuga racemosa* have already been put in place. These latter masses are made up of twenty plants apiece, and they will all be added to as more plants become available. This restoration will serve as a prototype for the others we hope to implement if public support can be obtained.

Acquisition of wild plants has begun for herbaceous plantings along several paths. *Dalibarda repens* and *Dryopteris phegopteris* are being propagated for use as ground covers on Hemlock Hill, where a northern coniferous forest and a mountain summit wild garden are envisaged. To see how plants would fare here, with respect to both the elements and vandals, two species of *Vaccinium* with two dwarf *Betula* species were planted on the rocky ledge at the very top of the hill. One plant has disappeared, but the remainder are doing well. Other plants, notably a mass of *Rhododendron fortunei* hybrids and also small shade-tolerant *Acer* species, were planted lower on the hill. Limited herbaceous plantings including masses of *Cimifuga racemosa*, *Trillium grandiflorum*, and patches of *Tiarella cordifolia*, *Phlox stolonifera*, and *Omphalodes verna*, have begun in the Leitneria Swamp at the end of Linden Path. Plants of the last three species were donated by Mrs. Sheila Magullion.

Several short collecting expeditions by staff were made within North America during the year. Richard Weaver and James Nickerson, head pruner, visited North Carolina for two weeks in September, 1979, returning with 108 collections from wild sources. Besides woody plants, a number of herbs were also collected. During December, 1979, 34 taxa, of which 30 were of wild origin, were obtained by Gary Koller and Jack Alexander in southern Missouri following a meeting they attended at the Missouri Botanical Garden. Robert Nicholson, greenhouse technician, sustained his reputation as a plant hunter by completing four trips. Three were in Vermont in connection with his project on sugar maple. The fourth, to the mountains of California, aimed to collect genotypes of tender species from their limits of cold hardiness, yielding 35 collections from six localities; of greatest potential interest were *Sequoiadendron giganteum*, *Leucothoë davisiae*, *Arbutus menziesii* and *Lithocarpus densiflorus*.

The propagator, Jack Alexander, this year received 160 shipments for propagation, consisting of 839 taxa from 23 countries, including material collected by staff. Three hundred and sixteen taxa were propagated from our own accessions, to replace deteriorating specimens or to increase numbers pending collection from new wild provenances.

Acquisition of materials for propagation, in general, has been carried on in the routine manner. However, almost without exception, no seeds were ordered from *Indices Seminum* unless they had been collected in the wild. A generous gift from Forest Farm in Williams, Oregon, has added wild collected plants of 18 species to our collec-



Fruits of Magnolia virginiana, and cones of Tsuga canadensis and Sequoiadendron gigantea, drying prior to propagation at the Dana Greenhouse. Photograph by C. Lobig.

tions. These plants are all native to the western United States, and all are new to our collections.

Two hundred shipments, comprising 783 taxa were distributed to cooperating institutions, nurseries, and individuals in 15 countries. A further 723 were propagated to fulfill special requests; excess material resulting from these was also distributed.

Ms. Jennifer Hicks, curatorial assistant for mapping and labeling, accomplished much during the year. Her painstaking review of the living collections record system, and her planning for its rationalization, verification, and computerization have been referred to already. She was able to redraw four of the collection master maps and to complete rechecking of a further seven. Also, the existing master maps have been photoreduced to half scale and cleaned up for reproduction as new map books for use on the grounds.

James A. Burrows was appointed assistant supervisor of the living collections, in charge of the Case Estates, on July 9th, 1979. He concentrated during his first year on reviewing and reorganizing the nurseries, which were in a state of relative neglect, and on integrating this program closely with the planting and propagation programs at Jamaica Plain. This is a vital preliminary to the anticipated future increase in accessions.

The nurseries at the Case Estates comprise both temporary and permanent beds. The temporary ones containing plants that are grown until big enough to be planted out in the arboretum, received first priority. An inventory of the holdings was completed, followed by a review of records in order to identify plants that fail to comply with our current accessions policy. Plants that meet present criteria are to be moved to the arboretum as soon as possible, while the remainder will be distributed to the Friends and to other institutions. In future, the nursery area is to be planted on a rotation basis to improve operational efficiency and allow more easy control of soil fertility.

Because of the current serious shortage of outside space for young plants in the saran house at Jamaica Plain, occasioned by the recent increase in accession rate, a saran house was re-established inside the old ericaceous nursery area at the Case Estates; here the plants will be

protected from wind by the tall enclosing coniferous hedge. This new area, which is already nearly full, has also facilitated integration of operations at the two nursery locations. Half of the plants will be ready for transplanting out into the temporary beds in spring 1981.

Because of the increasing demand for nursery space, a new nursery area will be prepared in the coming year, replacing the now derelict pruning demonstration plot. The existing nursery beds are arranged by a number series as indicated on the map. Most of the plants formerly on the terraces (rows 1-40 and the 100's), have been transplanted to the arboretum during the year, leaving 80% of the area for planting up in spring 1981. The 300 rows next to the saran house contain mainly rhododendron cultivars. These have been checked for flower color and flowering time and will be transplanted by fall, 1980, leaving the area available for extension of the saran. The 400 rows contain evergreens; an inventory and planting list is currently being prepared prior to transplanting of material from 80% of the area in fall 1980. The 900 rows were replanted in the fall of 1979 with larger plants whose transfer from Jamaica Plain had been delayed; they should be ready to return to the arboretum in 1982. Finally, the 950 rows were totally renovated by soil improvement and fumigation; half the rows were planted out with material from Jamaica Plain in spring, 1980, and the rest will be filled in the fall. Harvesting of these is anticipated between 1984 and 1986.

As stated in my last report, the permanent nurseries were set out as a collection, partially transferred from the arboretum itself, of taxa considered not to be of ornamental value. In line with our present accessions policy, a complete inventory is being made, and collections worthy of replanting in the arboretum identified. Major collections of *Berberis*, *Philadelphus*, and *Rosa* in particular were found. As an emergency measure more intensive maintenance of these nurseries has begun this summer, and plants in imminent danger repropagated. The complete propagation or transfer of the valuable accessions will take 5-6 years.

Now that urgent renovations are in hand Mr. Burrows, in collaboration with Mr. Koller and the manager of buildings and public services, Ms. Wendy Marks, will critically review our operations at the Case Estates, to prepare a financially viable plan for their future use.

The perennial garden, designed for Marian Case by John Wister, had fallen into disarray with many of its woody plants having outgrown the original design. With Mr. Wister's approval we plan to simplify the design, obviating the need for major and expensive changes in the plantings. This work should be completed by summer, 1981. The garden will then be an interpretive collection of native American perennial herbs with the more noteworthy cultivars that have been derived from them. Seeds of 75 plants, either native American species or cultivars of these, were received from the Park Seed Co.; most have been planted in the cold frames at the Case Estates. A total of 140 plants, mostly cultivars of native American species, was



Making room for new accessions involved major transplanting of existing nursery stock from the Case Estates in Weston to the living collections at Jamaica Plain. Tom Kinahan (above) and Dennis Harris (below) work at moving Crataegus and Ulmus from the grounds at Weston. Photographs by J. Burrows.

also purchased and planted in the Case Estates nurseries. We are pleased to have the collaboration of the Weston Garden Club in this project, which has volunteered to assist with its development and future maintenance. One noticeable improvement was made rather quickly. The tall, dry fieldstone wall, erected sixty years ago to support espaliered fruit trees was obscured by a vine trellis. This has now been removed.

A site for the Rhododendron display garden which is being planned jointly with the Massachusetts Chapter of the American Rhododendron Society has been chosen in the woods behind the tall stone wall. Clearing was started during the winter, and some weed control undertaken early this summer. It is hoped that the chapter will begin planting shortly. Meanwhile the American Iris Society, which will hold its 1983 convention in Boston, has requested the use of part of the field in front of the stone wall for the temporary display of 4000 iris cultivars.

At the end of 1980 the Arnold Arboretum will complete its term as cultivar registration authority for those genera of cultivated woody plants that lack authorities, under the auspices of the American Association of Botanic Gardens and Arboreta; thereafter the U.S. National Arboretum will act on behalf of the Association. Dr. Stephen Spongberg has continued meanwhile to act as registrar for these, as well as those genera for which the Arboretum continues to serve as International Registration Authority.²

The living collections of the Arnold Arboretum are increasingly being used for research. Taxonomist Dr. Stephen Spongberg has continued to use the collections for his own work. Bullard Fellow Dr. Amar Hans pursued studies on the pollination biology of *Ulmus*. Ph.D. candidate Michael Donoghue continues his fruitful research on *Viburnum*. His studies of growth problems in the living collections have furthered understanding of infrageneric relationships and have led to his being awarded the Cooley Prize by the American Society of Plant Taxonomists. Similarly, Paul Groff's senior thesis, completed during the year under Dr. Stevens' supervision, used our collections to throw light on generic limits in Ericaceae tribe Phyllodoceae. Graduate student Steven Rogstad is making studies of the growth and branching pattern of *Asimina*, Annonaceae, preliminary to studies in the tropical annonaceous genus *Polyalthia*. Professor Solbrig's students continue to use space in our greenhouses for their bio-systematic research into *Viola*. Among several scientists from other institutions to use our collections, Dr. Lester Nichols, Plant Pathologist at Pennsylvania State University conducted his eighteenth annual disease survey of our *Malus* collection; Dr. Frank Santamour, research geneticist at the National Arboretum, gathered specimens of various *Acer* species for chemical analysis; and Dr. Harold Pellett, University of Minnesota,

² Those are *Chaenomeles*, *Cornus*, *Fagus*, *Forsythia*, *Gleditsia*, *Lantana*, *Malus* (ornamental varieties only), *Philadelphus*, *Pieris*, *Ulmus* and *Weigela*.

conducted controlled tissue-hardiness tests utilizing specimens supplied by the arboretum.

It will be recalled by readers of my last report that supervisory staff are being encouraged to develop their own research or to participate in the work of others, as far as time allows. Projects undertaken this year include the initiation of a program to breed mildew-free *Syringa* by Jack Alexander; a morphogenetic study of branching in *Tsuga canadensis* f. *pendula* by Peter del Tredici, and hybridization experiments in Hamamelidaceae and studies of sugar maple by Robert Nicholson.

The Royal Horticultural Society this year honored the Arnold Arboretum by awarding it the Reginald Corey Memorial Cup for the *Magnolia* cultivar 'Merrill,' a hybrid that had been developed by former director Karl Sax and named in honor of his predecessor, E. D. Merrill.

Members of the living collections staff have made extensive and appreciated contributions to our Friends and Public Service programs, propagating thousands of cuttings and seeds as gifts, giving lectures and tours for private groups. In addition to attending professional meetings, they prepared and erected our prize-winning exhibit at the spring flower show of the Massachusetts Horticultural Society, and assisted numerous students, nurserymen, horticulturists, botanists, and landscape architects by telephone and by letter.

Three staff members at Jamaica Plain left during the year. Eileen Twohig had worked as custodian of the Administration Building for 22 years. Of tireless energy and cast-iron reliability, Eileen brightened our lives with her good humor and her honest no-nonsense frankness. She retired in glory on May 31st, 1980, following a rousing party in her honor. We will miss both her and her husband Joe who so frequently volunteered to help out when something special was in preparation. We welcome Ms. Kathy Newman as our new custodian.

Constance Derderian, who has been honorary curator for our historic bonsai collection for many years retired for family reasons; we will be hard put to find a replacement with comparable skill and devotion. We are glad, though, that Connie is offering her popular course again in our fall 1980 program.

Mildred Pelkus, who had been accounts clerk at Jamaica Plain for 14 years, retired at the end of December, 1979. Her place was taken by Anne Johnson, who had joined the staff in October. Horticultural secretary Jeanne Sattely, resigned in January after a short stay, and has been replaced by Margaret Quinn. The reappointment of James Burrows has already been reported. Patrick Willoughby filled the vacant post of assistant superintendent in March, and James Papargiris filled a vacancy on the grounds staff.

A special tribute should be paid to the 14 summer horticultural trainees of 1980. Carefully selected from over 70 applicants, they came from nine states and most were college students in plant sciences. Five started early in the growing season, the others arriving as



An exceptional group of summer horticultural trainees were selected from applicants from 9 states. Posing in the branches of a cork tree (*Phellodendron amurense*) from left to right, standing — Imogene Villeneuve, Mike Eliot, 1st. row, seated — Mark O'Connor, Beth Robertson, Debbie Cahill, Greg Waters; 2nd row, seated — Kelly Kearns, Carol Hipple, Ed Bemis, Bob Turecek, Steve Winterfeldt, Michael Koralewski, Laura Durr. Photograph by H. Wise.

usual at the beginning of June. Careful attention to supervision and organization, and a stimulating program of talks contributed to a high morale. They have done a superb job.

THE HERBARIUM

Dr. Norton G. Miller's appointment as supervisor of the Gray and Arnold Arboretum Herbaria and chairman of the Herbarium Committee, a position he held for the past five and one-half years, ended as the fiscal year closed. Associate Professor Peter F. Stevens will assume both responsibilities. Dr. Miller will continue on the staff as botanist, Arnold Arboretum and Gray Herbarium.

The following curatorial accomplishments were made during the past year: An identification list for R. Barneby's monograph of *Dalea* (Leguminosae) was compiled. This was used as a basis for annotations of 1000 sheets in the combined herbaria. T. C. Whitmore's revision of *Macaranga* (Kew Bull., 1980) was used as a source for annotations of 600 sheets of this genus in our collection. Using the identification list of Ding Hou (*Flora Malesiana*, 1980) 1200 sheets of western Malaysian Anacardiaceae were annotated. Part of our holdings of the same family from Papuaia and the Philippines has also been annotated. The Merrill collection of rubbings and fragments (Anacardiaceae only) has been mounted, annotated, and inserted into the general and type collections. Numerous annotations of specimens

in the *Amaranthaceae* (especially cultivated species) were added. Annotations of 759 species of *Neotropical Rubiaceae*, tribe *Psychotrieae* were completed. Materials representing 40 genera new to the herbaria were added during the year. Type folders were replaced in families 92 to 125. Geographical tags for the four New World regions were added to folders of families 105 to 127. There has been no insertion in the herbarium in Cambridge since preparations for the herbarium move have already begun.

The National Science Foundation this year awarded a further curatorial grant to the combined herbaria which will enable us to continue to curate families recently monographed, to search for unrecognized types, and otherwise to bring the collections to a condition of better annotation. In combination with the grant to be awarded for curation of the living collection records, the current grant provides for acquisition of a small computer in which the records of our type collection are to be stored.

An inventory of the herbarium and storage at Jamaica Plain, preliminary to a proposed renovation of the Administration Building was made in autumn, 1979. Volunteers under the supervision of Ida H. Burch are working on a project to collect specimens of the arboretum living accessions that are of documented wild origin in eastern Asia. Ten sets are being collected, and the duplicates will be used for exchange; collections number 214 so far. The group, headed by Cora Warren, includes Susan Davis, and Mary Wolcott, as well as staff member Kristin Clausen.

By the end of the fiscal year there were 1,102,306 sheets in the arboretum's herbarium at Cambridge. During the year, 10,357 sheets were mounted, 75 added directly, 12 removed. In Jamaica Plain there were eventually 168,048 sheets in the herbarium of cultivated plants, 810 being added during the year. Thirty-one sheets were repaired in the two herbaria. Of the accessions, 4827 were received by exchange, 392 as gifts, 447 by subsidy, and 721 for identification by staff. This year the major provenance was South America (1250 sheets), followed by East Asia (981), India (963) and Western Malesia (657), Europe (626) and Papuaia (603). Staff made 1187 collections. During the year, 147 sheets were sent on exchange, 30 orchid collections were placed on indefinite loan in the Oakes Ames Orchid Herbarium; 1187 specimens were received on loan for staff members of the combined herbaria, and a further 4676 for students; 7969 sheets, received on loan for staff members in previous years were returned, and 3112 likewise for students. The combined herbaria sent out 30,463 specimens for study at other institutions, and received back 14,647.

The extension to the Harvard University Herbaria Building was completed during the year, although the air-conditioning continued to malfunction as it had done off and on through the two years during which alterations were being made. The paired compactor banks in each of the twelve new compactor rooms have been installed, and apart from the absence of gaskets, locking mechanisms, and a thor-

ough cleaning, they are ready to receive the mounted sheets. A major effort was made to finalize plans for the transfer of specimens to the new compactor space and rearrangement in cabinets in the original building. The basement curatorial area was completely reorganized and new metal cabinets from elsewhere in the building were put in place of the old tin-covered storage cases, which were in large part discarded. When the herbarium move is completed, there will at last be adequate storage for specimens awaiting processing or insertion, although the mounting materials storage room was reduced to half its original size during construction alterations. Ultimately, it will be necessary to make an accommodation for new storage space for our inventory of large-volume mounting and packaging supplies.

A number of staff changes should be noted. Rita Silverman, herbarium secretary, left during the autumn and was replaced on a temporary, part-time basis by Anita Fahey who worked nearly to the end of the fiscal year; Colleen Sliney was hired on 18 June, 1980, as the herbarium secretary. Olga Peixoto, part-time mounter, resigned in the autumn just before the birth of a child; no replacement was sought. Laurie Feine Dudley was hired as a curatorial assistant to replace R. James Hickey, who resigned to undertake graduate studies in botany at the University of Connecticut. Sarah Mellen, curatorial assistant, resigned and was replaced by Patricia Adakonis.

The present curatorial staff of the Combined Herbaria consists of M. A. Canoso, manager of systematic collections; Walter Kittredge, senior curatorial assistant; Laurie Feine-Dudley, curatorial assistant, Patricia Adakonis, curatorial assistant and Zepur Elmayan and Edith Hollender, mounters. Ida Hay Burch serves as curatorial assistant in the herbarium at Jamaica Plain; Anne Sholes and Helen Fleming are herbarium preparators there.

THE LIBRARIES AND ARCHIVES

The total number of volumes and pamphlets at the end of the fiscal year was 87,565: 172 added at Cambridge and 96 at Jamaica Plain by cataloguing, and 170 and 106 respectively by binding. In addition, 110 reprints were catalogued. Four hundred twenty journals are currently received at Cambridge, 223 at Jamaica Plain; 7 represent new subscriptions. Fifteen microfiches were added at Jamaica Plain; we now have 10,867 microfiches and 179 microfilm reels, acquired jointly with the Gray Herbarium; and 20,095 other non-book collections.

Eighty-eight of the volumes added this year were gifts; we acknowledge with thanks the donation of books by Mr. A. I. Baranov, Mr. Norton Batkin, Mr. Charles Boewe, Mr. Paul A. Cox, Dr. Otto Degener, Dr. Peter S. Green, Mrs. John D. Houghton, Dr. Richard A. Howard, Dr. S. Y. Hu, the Korean Ginseng Research Institute, Dr. Elbert Little, Mr. C. R. Long, Dr. Michael Madison, Dr. Ernest Mayr, Dr. and Mrs. Norton G. Miller, Dr. J. K. Morton, Dr. Lily M. Perry, Dr.

L. S. Plotnikova, Mr. Calvin Sperling, Dr. Stephen A. Sponberg, Dr. Peter F. Stevens, Mrs. Edward J. Thompson and Dr. Carroll E. Wood.

The completion of the addition to the Herbaria Building in Cambridge has alleviated space problems in the library. Cambridge staff started reorganization of the library when the new space became available for occupancy in August, 1979. To create a more efficient work area for library staff, a wall between two of the three library offices was removed and the new space was reorganized to provide separate work space according to functions. Shelving for periodicals in various stages of preparation for the bindery was installed. Three tables were arranged to provide a large work surface for processing material for the stacks. The new work area for staff is proving to be an efficient and satisfactory arrangement. Storage space, however, remains a problem.

The library privileges policy, which provides only limited access to the Harvard University Herbaria library for outside users and requires payment of a user fee, has been in effect for 15 months. Whether the policy has had an effect on screening visitors is hard to measure because of the unusual circumstances of the past year. The three weeks during which the library was closed for construction and the ongoing addition to the herbarium for most of the academic year may have discouraged outsiders from visiting the library. Two hundred twenty visitors did register however — an increase of 43 over last year. Coordination with the herbarium office when visitors from other institutions register to work in the herbarium has also helped to monitor visitor use.

A continuing project of removing pamphlet material from highly acidic covers and rebinding in cloth will ensure that the material will be in good condition for hundreds of years to come. William Prince's *Short Treatise on Horticulture* (1828) was in deteriorating condition and has now been disbound, the paper deacidified, re sewn and rebound, preserving the original covers. The National Science Foundation's curatorial grant supported the rebinding and repair of Gilliam, *Travels over the Table Lands and Cordilleras of Mexico* (1846), and Browne, *Civil and Natural History of Jamaica* (1756). The University has received a third grant for microfilming rare or deteriorating library material under the Strengthening Research Libraries Program provided by Title II-C of the Higher Education Act. The Arnold Arboretum is continuing to submit titles for microfilming under this program.

At Jamaica Plain, space has not been so much a problem as the arrangement of the collection in it. At present, the collection is divided between first and third floors of the Administration Building. Sheila Geary, assistant librarian there, made an inventory of existing shelf space and of files, documents and archival materials. From this she derived a projection of future library space needs, as part of a preliminary plan for the reorganization of the interior of the building that she assembled in collaboration with Ida Hay Burch, and Eugenia Frey, public information and education coordinator.

Volunteers of the library over the past year made an important contribution to the operation. Approximately 110 hours were spent on various library tasks. Lou Segal and Al Thompson continued their work on treatment of leather bindings. Other work was performed by Amy Linssen, Gertrude Cronk and Helen Pino. Horticultural intern Ed Bemis also assisted in the library. With the help of volunteers Linda Bowman and Richard Warren, the contents and indices of C. S. Sargent's publication *Garden and Forest* have been photocopied and will be bound. The contents of this journal are valuable, as they reflect the state of botany and horticulture during the formative years of our institution.

Much work was done on the important negative and slide collections at Jamaica Plain. Volunteers Barbara O'Connor, Marie Dempsey, and Mary Ashton, under the expert direction of Dodie Loomis, spent 214 hours on the curation and maintenance of our extensive slide collection. Sheila Geary reorganized the section of the collection that depicts general views of the arboretum, following the Bentham and Hooker botanical classification by which the living collections themselves are ordered. Special topics are now grouped by subject at the end of the sequence. In addition, Sheila Geary photographed and added approximately 250 slides of the living collections, aiming both to fill deficiencies and to record the restoration now beginning on the original path system. In this she had the cooperation of staff members Richard Weaver, Stephen Sponberg and Jennifer Hicks. One hundred slides of trees in the Arnold Arboretum were also provided by the Chanticleer Press, who took the photographs for the Audobon Society's new Field Guide, *North American Trees, Eastern Region*.

Norton Batkin and Sheila Geary made a survey of the collection while gathering material for a grant proposal for their curation. They undertook an inventory and identified target problem areas, including deteriorating nitrate negatives in danger of becoming hazardous. Sheila Geary has begun to keep a numbered list of negatives in the collection that have broken glass plates. She has also reorganized the accession lists that document the collection. There are currently 15 separate lists, which indicate the photographers, the date, and the subject, and provide the only means of access to the collection.

Several projects using the archives and photographic collections at Jamaica Plain were undertaken during the year. Sheila Geary undertook research into the early history and collections policy of the Arnold Arboretum, in preparation of our successful grant application to the National Science Foundation for curatorial support for the living collections records.

This research was then extended with Ida Hay Burch, volunteer and Visiting Committee member B. June Hutchinson, and Norton Batkin to prepare a further grant application to the National Endowment for the Humanities for funds to prepare a guidebook to the living collections. This project will be discussed under publications. The portions of the guide for which we are seeking funding will draw

heavily on archival material; in preparation for this work Sheila Geary and June Hutchinson searched not only our own archives, but those of Harvard University Archives and at the Graduate School of Design, the Massachusetts Horticultural Society, the Northeastern Genealogical Society, the Massachusetts Historical Society and the federal records housed at Waltham, Massachusetts. We are grateful to these institutions for allowing us access to their records. They also spent over 70 hours this year at the offices of Olmsted Associates, examining the original planting plans of the arboretum; 164 complete and sectional maps were duplicated for our archives. They visited the National Archives on February 8 and 9th, 1980, to assess the written records associated with the plans, acquired by the Library of Congress several years ago. This year the Olmsted offices in Brookline became a National Historic Site, under the jurisdiction of the National Parks Service. Owing to the collaboration they have now established with the Park Service staff, special permission for their continued access to the material has been granted. A precursory article, entitled "Jackson Thornton Dawson, Plantsman" has been submitted to *Arnoldia*. This served as additional documentation for the guidebook grant proposal and as a test case to establish whether the research undertaken would, as envisaged, document the history of the arboretum in humanistic terms.

A survey of funding sources for E. H. Wilson's plant exploration expeditions to China, including a list of donors, was prepared and added to our archives.

As a consequence of all this work our own archives have expanded three linear feet.

In her capacity as archivist at Jamaica Plain, Sheila Geary handled a variety of reference questions, including some from descendants of former staff members. Horticultural intern, Ed Bemis, was able to provide information on the Jesup Wood Collection to a correspondent in Portland, Oregon. The information, culled from various sources in the library, was gathered and added to the archival collection. Twelve queries drawing on the Arnold Arboretum's archival resources were filled or referred to the Gray Herbarium. One hundred and sixty copies of archival material were supplied.

When the addition to the Herbaria Building was formally opened on May 23, the library mounted a small exhibit of staff publications.

RESEARCH

The official visit to the Arnold Arboretum by a party of botanists from the People's Republic of China in May, 1979, has been followed by a welcome and increasing collaboration in research. In August Professor Chin Yung Cheng, of Peking Medical College and a former student of Professor Reed Rollins of the Gray Herbarium, came to extend her work in the herbarium and library on Chinese Celas-traceae. Professor Cheng, who remained until the end of November

was the recipient of a Mercer Fellowship. We are anticipating additional and longer-term visitors within the next two years. Dr. Stephen Spongberg, who in June, 1979, had attended the meetings in California that terminated the visit of the Chinese party, in the coming fiscal year will represent the Arnold Arboretum, one of five American institutions which together will mount the first Sino-American field expedition since the 1950 Chinese revolution. The expedition is being sponsored by the Botanical Society of America; while in China it will be hosted by the government of the People's Republic.

The director, with assistance from the Atkins Fund of Harvard University, visited Indonesia in June, 1980, where he completed his taxonomic revision of the Dipterocarpaceae of the Far East. Following this visit he attended the second Dipterocarp Round Table at the Forest Research Institute, Malaysia, where he presented a paper and chaired the final session. The publication of his semimonographic revision of the family for Flora Malesiana is imminent. A further paper on the new American Subfamily Pakaraimoideae was published, with Dr. Bassett Maguire of the New York Botanical Garden. While in Indonesia Dr. Ashton had discussions with the director and staff of the National Biological Institute, and an agreement for collaboration in research and training was drafted. With Dr. Stevens, Dr. Ashton has been awarded a grant by the U.S. Department of Agriculture Forest Service, to supervise a postdoctoral appointee who will conduct research on wild bread-fruits and tree figs (Moraceae) for the Sarawak, East Malaysia, Forest Department over two years. Dr. Richard Primack, a former Harvard student and now an assistant professor at Boston University, was appointed in April, 1980; he left for Sarawak in early July. Dr. Primack is interested in future collaboration with the Arnold Arboretum in the research training of botanists from the Far Eastern tropics; this field research will therefore provide him with a useful opportunity to broaden his experience of this region.

Dr. Ashton continued to serve on a committee of the National Academy of Sciences, chaired by Dr. Peter H. Raven, charged to establish research priorities in tropical biology. He convened and chaired a panel of Asian biologists in Thailand to select an Asian site for long-term ecosystem research, and coauthored the final report of the committee which was published in 1980. Dr. Ashton gave the Barnes lecture at the Morris Arboretum of the University of Pennsylvania as well as invited lectures at Duke University, the University of Massachusetts at Amherst, the Universities of Western Ontario and of Guelph, and the Missouri Botanical Garden. He talked to the New England Botanical Club and the Society for Expeditionary Biology at Harvard. He presented a paper at a workshop on the aging and measurement of growth of tropical trees sponsored by the National Research Council and held at Harvard Forest. He also attended the annual convention of the American Association of Botanic Gardens and Arboreta at Atlanta, Georgia. While in Indonesia, Dr. Ashton gave

a seminar at BIOTROP, the regional center for tropical biology of the Southeast Asian Ministries of Education Organization.

First year graduate student Steven Rogstad is advised by Dr. Ashton; he is investigating the infrageneric classification of *Polyalthia* (Annonaceae), understory trees in Old World tropical forests, with a view of pursuing field research on niche differentiation among closely allied species sharing the same physical habitat. With Dr. Otto T. Solbrig, Dr. Ashton advises Paul A. Cox, who is completing research on the reproductive biology of *Freycinetia reineckii* (Pandaceae), a Samoan epiphytic vine; and, with Dr. Thomas Givnish, first year graduate student Paul Rich.

Professor R. A. Howard has concentrated this year on his research into the flora of the West Indies. A grant from the National Science Foundation supports this study. The third volume of his *Flora of the Lesser Antilles* appeared in July. This volume treats the families of Monocotyledoneae; work is continuing on Dicotyledoneae. He is engaged also in two studies in historical botany: the transliteration, editing and eventual publication of an unpublished "Hortus of the West Indies," written by Alexander Anderson in 1803 and on loan from the Linnean Society of London; and biographical and bibliographical research on William Hamilton, with an evaluation of his *Prodromus Plantarum Indiae Occidentalis* of 1825. Dr. Howard has prepared a checklist of the flora of Montserrat for the Montserrat National Trust, and is engaged in collaborative ecological studies on the changes in the vegetation following the 1977 eruption of the Soufrière of Guadeloupe with the staff of the Office of Forests. Dr. Howard studied in the libraries and herbaria at Kew, the British Museum, the Linnean Society, Royal Society and Royal Geographical Society in London in July and August, 1979. In February and March, 1980 he was in the West Indies, conducting field work in Jamaica, Puerto Rico, St. Thomas, Barbados, St. Vincent, and Montserrat. He was able to search church and government records in Barbados and St. Vincent for information on Anderson. He climbed the Soufrière of St. Vincent to photograph, collect and record data on the 1979 eruption. He collected in Montserrat in cooperation with the National Trust of that island; there he rediscovered the shrub *Xylosma serrata*, previously known only from the original nineteenth century collection.

Dr. Howard also found time to complete a manuscript on E. H. Wilson as a botanist, discussed further under publications. As a member of its editorial board, he attended the meeting of the Organization Flora Neotropica held in January, 1980, where he gave a seminar; that of the American Institute of Botanical Sciences at Stillwater, Oklahoma in August, 1979, also presenting a paper; and that of the A.A.B.G.A., of which he is a past president, in Atlanta, Georgia in April, 1980. At Atlanta he was the recipient of an Award of Merit from the A.A.B.G.A. He attended meetings, as scientific advisor, of the board of the Bloedel Reserve of the University of Washington Arboreta, and of the Dallas, Texas Arboretum Society where he lectured.



In addition to research at the Arnold Arboretum staff members carried their work to distant places. Among them, Director Peter Ashton worked in Indonesia (upper left) on the Dipterocarpaceae; Dr. Bernice Schubert (upper right) pursued research on Desmodieae at the National Herbarium in Mexico City, and Dr. Richard Howard climbed the Soufriere of St. Vincent (bottom) recording the effects of its 1979 eruption.

He also lectured at the Brooklyn Botanic Garden, at Framingham State College, Massachusetts, and at the Winterthur, Delaware, Gardens Conference.

Dr. Shiu-ying Hu, though retired, continues her research on Chinese medicinal plants. She attended the third annual symposium of the Society of Herbs at the University of California, Santa Cruz, in August, 1979, presenting a paper at the ginseng session; at this meeting she was honored with the Agnes Arber Distinguished Service Award. In September she participated at the first International Conference on Traditional Asian Medicine at Canberra, Australia, where she helped organize the International Association for the Study of Traditional Asian Medicine. She later visited New Zealand where she gave a seminar at Christchurch University, and Fiji. In May, 1980 she spoke on Chinese women in the practice and knowledge of herbal medicine at a celebration of the role of women in herbs at Cornell Plantations, and the dedication of a sculpture, "The Yarb Woman," by Elfriede Abbe, in the Robinson York State Herb Garden at Cornell University. Dr. Hu received the Certificate of Honor of the Holly Society of America for her outstanding contributions to the greater appreciation and scientific knowledge of the genus *Ilex*.

Dr. Norton G. Miller this year identified bryophytes (22 species) in an assemblage of fossil plants recovered from early or middle Illinoian sediments (ca. 100,000 years old) located in southern Illinois. The assemblage is comprised of calciphilous mosses of various upland and lowland habitats. The species are now largely restricted to north temperate and boreal latitudes, and thus their occurrence in mid-latitude North America represents a disjunction of considerable significance. The results of this study will be integrated with other kinds of data in an effort to define the paleoenvironments and paleoecology of the region. Few other data from this region and period of time are available. The project was undertaken in association with S. T. Jackson, a graduate student at Indiana University. An additional 300 pounds of sediment from the Columbia Bridge deposit (see previous report) has been processed for plant fossils, and many new additions to the flora were discovered. These have been identified in part by use of the scanning electron microscope and in part by other techniques. When the new material has been studied thoroughly it will be the basis of a paper in which the paleoecology of the site will be discussed in much more detail than was possible earlier. Information from specialists on the animal groups Ostracoda and Coleoptera, fossils of which are present in the sediments, will also be integrated. During April and May work on a revision of the taxonomy of the Australasian moss genus *Trachyloma* was resumed. In spite of some knotty problems, the solution of which is hampered by inadequate herbarium collections, progress has been made, and it is anticipated that the revision will be completed by the end of the summer.

Dr. Miller has directed the research of three graduate students. Peter Alpert's thesis research, co-sponsored with Professor R. E. Cook,

has been pursued with the assistance of an NSF Doctoral Dissertation Improvement Grant. It concerns the general scarcity of bryophytes in arid environments, which he considers to be a function of a plant's inability to maintain a positive carbon balance under such conditions. Cecilia Lenk is investigating the post-glacial population dynamics of *Fagus grandifolia* at its northernmost distributional limit in northeastern North America by use of a combination of ecological and palynological techniques. Brent Mischler's dissertation research is a taxonomic study of *Tortula* (Musci: Pottiaceae) in North America and Mexico. With support of the Anderson Fund Brent has been in Canada and in part of the western United States locating and observing populations and gathering materials for study in Cambridge.

Dr. Miller presented a paper at the AIBS meeting at Stillwater, and another at the Taxonomic Workshop of the International Association of Bryologists at the Geneva Botanic Gardens in late August, when he also chaired the session on Bryophyte floristics in the temperate Americas and in the polar regions. While in Switzerland he participated in an excursion of the Bryologisch-Lichenologische Arbeitsgemeinschaft für Mitteleuropa to Grimsel in the central Swiss Alps. He also lectured at Wake Forest University and at Duke University, North Carolina, and to the New England Botanical Club. With D. T. Webb of Brown University, he organized the Northeastern North America Palynology Workshop, which was held at Harvard Forest in September, 1979.

Dr. Bernice Schubert has been able to give full attention this year to her research in Leguminosae subtribe Desmodieae; a study is soon to be completed. A treatment of *Desmodium* for the *Flora of Panama* was completed and submitted for publication. This treated 24 species; the large number of recent collections necessitated extensive study. Critical studies on three difficult Central American species groups in the same genus are in progress. A larger scale revision of the species occurring in Oaxaca, Mexico will be Dr. Schubert's contribution to a collaborative effort, with colleagues in the National Herbarium at the Institute of Biology, University of Mexico, to a treatment of Leguminosae of Oaxaca.

During the past year also, through the kindness of Professor Gerald B. Ownbey, University of Minnesota (Saint Paul), the Arnold Arboretum was the recipient of that portion of the botanical reliquiae of the late Dr. Temple Clayton pertaining to *Dioscorea*, and consisting of specimens, photographs, manuscripts, observations, and other materials. The process of evaluating this material and incorporating whatever possible into our collections has begun and should be completed by the end of the summer; any part of this gift added to our collections will subsequently be appropriately labeled. Since Dr. Clayton studied and photographed many types of *Dioscorea*, this material will be most useful in continuation of the current studies of the genus. A good many other interesting specimens, including species previously unrepresented in our collections have been curated and added. Some progress has nevertheless been made towards a revision of *Dioscorea* for

the *Flora of Veracruz*, in collaboration with colleagues in Instituto Nacional de Investigaciones sobre Recursos Bioticos (INIREB) at Xalapa. Dr. Schubert spent two weeks in Mexico during November, 1979, on this work.

Dr. Schubert visited Mexico again between February 22 and April 12, 1980, when she was sponsored by the University of Mexico to run a course in botanical nomenclature and taxonomic techniques. This gave her the opportunity also to study recent collections of *Desmodium* at the University herbarium, and particularly those from Oaxaca. She served there on a degree committee, and also lectured to the Sociedad Botanica de México and again, briefly, visited Xalapa.

In September, 1979, Dr. Schubert attended the national convention of the American Begonia Society.

Dr. Stephen Spongberg's research during the past year has continued to be centered around the theaceous genus *Hartia* but has expanded to include the simple-leaved species of *Sorbus* from eastern and southeastern Asia. The large number of unidentified specimens in the herbarium of the Arnold Arboretum have been tentatively identified and work toward a revision of the Asian species will be continued.

In connection with his own work, and to facilitate the taxonomic studies of other arboretum staff members, Dr. Spongberg has regularly scanned all incoming periodicals in the combined libraries of the Arnold Arboretum and Gray Herbarium in Cambridge and Jamaica Plain. Bibliographic references have been made to all articles pertaining to woody plants of the northern and southern Temperate Zones for addition to the set of "Rehder cards" housed in Jamaica Plain. Over the past year, 1283 references have been added to the card file. At the end of the year Dr. Howard kindly volunteered to collaborate in this time-consuming but invaluable task.

Work also progressed toward a new book on the poisonous plants of northeastern North America, a project that is a collaborative effort between Dr. Spongberg and Ida Hay Burch (See *Publications* below).

During a visit to England in February, 1980, Spongberg was able to spend four days at the Royal Botanic Gardens, Kew, where he worked in the library and herbarium examining their holdings of *Sorbus* and also genera in the Theaceae and Magnoliaceae. He also visited the Westonbirt Arboretum where he examined living collections.

Dr. Peter F. Stevens received promotion from assistant to associate professor during the year; at the end of the year he was appointed to supervise the Gray and Arnold Arboretum herbaria. Much of his time this year was spent in seeing his monograph of *Calophyllum* through to publication in the *Journal of the Arnold Arboretum*; this is now imminent. Preliminary work, which will ultimately lead to a monograph of *Mesua*, also in Guttiferae has begun. A manuscript on how to determine which character states are advanced and which primitive has been submitted and accepted for publication.

Paul Groff completed his senior thesis, for which Dr. Stevens was

advisor, on aspects of the growth patterns of Ericaceae tribe Phyllodoceae. Additional data now being collected, and a survey Dr. Stevens is making of other characters, will culminate in an evaluation of phylogenetic relationships in the group. Groff's work has demonstrated the great benefit to be obtained from making observations of growth characters on living plants, many of which were growing in our collections. The characters Groff observed proved of systematic value at generic, infrageneric and infraspecific levels, of considerable intrinsic morphological interest, and of importance in providing a basis for the better understanding of the ecology of the plants. Dr. Stevens is extending his own observations on the morphology and dynamics of branching with particular reference to Sapotaceae and the Urticales. In both these groups there seem to be common patterns of lateral branch construction that are maintained despite their different methods of growth. As a result of this, each group can apparently be reorganized by certain inconspicuous but constant characters, their consistency seemingly consequent on developmental constraints. Elizabeth Taylor completed her first year as Dr. Stevens advisee; Stevens also continued, with Professor R. E. Schultes, to advise Jeff Hart on his research into some South American Labiatae.

Dr. Richard Weaver, notwithstanding commitments to the planning and implementation of the restoration of the living collections as well as their curation, and to the compilation of a guidebook to the arboretum, has continued his taxonomic revision of *Staphylea*. A popular treatment has been submitted to *Arnoldia*, and a formal one will follow before the end of 1980.

This spring Dr. Weaver, with Dr. Alice Tryon collaborated with and advised undergraduate William Baikama, who made chromosome counts in Hamamelidaceae growing in the living collections. Baikama verified previously reported numbers in several taxa and successfully made the first known count of *Loropetalum chinense*. The work is to be continued in fall 1980 before being written up.

Professor Carroll E. Wood pursued no personal research during the year, but advised three graduate students, Christopher S. Campbell, Elizabeth Coombs, and Michael Donoghue, and a junior, Roger Cantu. Campbell completed his thesis, entitled "Biosystematic Studies in the *Andropogon virginicus* Complex (Gramineae)" in May, receiving his doctorate in June. He has been appointed to an assistant professorship at Rutgers University, New Jersey. Donoghue received the George R. Cooley Award for the best paper presented at the annual meeting of the American Society of Plant Taxonomists in Stillwater, Oklahoma, in August, 1979. His paper, "Growth Patterns in *Viburnum* (Caprifoliaceae) and Their Taxonomic Significance," was based in large part on plants of the 60 species of *Viburnum* growing in the living collections of the arboretum. A second paper based on these living collections has been published this year in *Arnoldia*. He is continuing his studies in *Viburnum*, extending his observations on our living collections by two trips for field work in Jamaica, Central America and

southern Mexico; these were supported by a Doctoral Dissertation Grant in Systematic Biology from the National Science Foundation. He expects to submit his thesis in 1981. Elizabeth Coombs started in Fall, 1979. She was awarded a grant by the National Science Foundation to support field research on the biosystematics of the *Poa sandbergii* complex, work that she initiated at the University of Idaho. Elizabeth Taylor accompanied her in May and June to the coast ranges of California, working from San Diego northwards, from where Coombs returned briefly to the University of Idaho to transfer her living collections to Cambridge; they were found to have received an application of volcanic ash from Mt. St. Helens. A detachment from the Harvard University Herbaria, aided by a supply of potables, helped in the planting of her collections in the experimental garden.

On January 28th a reception was held in the Harvard University Herbaria Library, to celebrate the publication of Lily M. Perry's monumental and long-awaited treatise on the medicinal properties attributed to plants in East and South-East Asia. Miss Perry was on the staff of the arboretum between 1937 and 1979; this work is the product of a painstaking search for information on herbarium labels and in the literature.

Karen Stoutzenberger, who was on the arboretum staff from November, 1970, to May, 1980, first as botanical illustrator for *The Generic Flora of the Southeastern United States*, edited by Dr. Wood and more recently as botanical illustrator on the staff of the Arnold Arboretum, married David Ku, of Atlanta, Georgia, on March 15. Many of Karen's accurate and beautiful illustrations have been published in the *Journal of the Arnold Arboretum* and in *A Student's Atlas of Flowering Plants: Some Dicotyledons of Eastern North America*. Her strong sense of design can be seen on the covers of the *Journal of the Arnold Arboretum*, 1972-1980. Brook Thompson-Mills, research assistant to Dr. Howard, resigned on August 24, 1979; her place was taken by Miss Kristin Clausen. Katherine Holland, secretary to the research staff resigned on August 22nd and was replaced by Lisa Frost.

EDUCATION

The contribution of our faculty to the advising of graduate students is reported in the section on research.

For readers unfamiliar with the Harvard University courses of instruction, the numbering system requires explanation. Biology courses fall into four sequences: 1-99, an introductory series for undergraduates; 100-119, at middle level and offered for both undergraduates and graduates; 200-299, which are primarily for graduate students but which undergraduates can attend, if sanctioned by their instructor, in their final years; and 300-399, graduate courses of reading and research.

Professors Carroll E. Wood and Norton G. Miller, with Professors

Donald Pfister and P. Barry Tomlinson gave Biology 18, "Diversity in the Plant Kingdom" in the fall; it was rated highly by the students. Professor Wood's Biology 103, "The Taxonomy of Seed-bearing Plants," again received superb ratings in all categories; graduate student Michael Donahue earned high acclaim for his contributions as a teaching fellow in the spring of 1980. Professor Wood also gave Biology 313, "Systematics of Vascular Plants" to three graduate students, and supervised one junior in a Biology 90r research course.

Besides his contribution to the highly rated Biology 18, Dr. Miller gave an undergraduate research course 91r, "Readings in Bryology," and two Biology 305 courses: "Topics in Systematics and Paleobotany"; and "Topics in Paleoecology and Bryology."

Professor Peter F. Stevens gave, with zoologist Professor William L. Fink, their course Biology 148, "Systematic Biology," in the fall. Professor Stevens taught 300 level courses and Biology 90r (supervised undergraduate research), in both fall and spring semesters. He also supervised two students' reading on aspects of plant growth, a Biology 91r course, and gave an honors tutorial. In the summer of 1979 he taught Biology S105 with Dr. J. B. Fisher, of the Fairchild Tropical Garden, Miami, a Harvard summer school course that is based at the Fairchild Garden; this course, as always, was attended by several Harvard students.

Professor Richard A. Howard taught his course Biology 209, "The Phylogeny of the Flowering Plants," in the fall semester. Dr. Howard also presented a guest lecture entitled "Survival and Poisonous Plants," in Professor Richard E. Schultes' Biology 104, "Plants and Human Affairs."

With Professor Rolla M. Tryon of the Gray Herbarium, Professor Peter S. Ashton participated in Biology 147, "Biogeography." In addition, Professor Ashton gave a research course (387, "Tropical Botany") in both semesters.

Eugenia Frey, who joined the staff as plant information coordinator in July, 1979, has taken over responsibility for our public education program in preparation for expansion, which begin in the spring. Our staff has continued to make an important contribution to instruction, with Gary Koller contributing this year in 11 offerings, Richard Weaver in 7, James Burrows and Peter Del Tredici 4 each, Jack Alexander 3, Margo Reynolds 2, and Ida Burch, Eugenia Frey, Sheila Geary, Bruce Munch, Barbara Epstein, James Nickerson, Robert Nicholson, and Jennifer Hicks one each. This year, in addition, graduate students Michael Donoghue, Elizabeth Coombs, Paul Cox, Laurie Dudley, and Christopher Campbell contributed, as did several outside speakers.

Several courses, tours and workshops were offered in collaboration with other organizations in the Boston area; these included the New England Wildflower Society, the Massachusetts Horticultural Society, and Habitat. Our aims here are to demonstrate the cooperative spirit that exists between our organizations, to highlight the distinct role that

each of us plays, and to work together in fields where collaboration will manifestly be to our mutual benefit. In order to attract more good speakers for our growing program, and to operate on an equal footing with our collaborators, this spring speakers were for the first time offered honoraria. This necessitated an increase in the fee charged to participants. With assistance from Norton Batkin, an elegant, new, two-color course brochure was designed.

In fall 1979, 7 courses and 3 workshops (single session courses) were offered; two courses were cancelled for lack of attendance. In the spring 18 courses were offered although 7 were similarly cancelled; there were also 6 workshops, 3 tours to other gardens. The Administration Building and the Dana Greenhouse area offered visitor information for an extended number of weekends, this spring, thanks to staff and volunteer help. In addition, a number of weekend programs were offered. Walks in the arboretum, with five bilingual walks, in Spanish and English, were given. A series entitled "Open Spaces in Boston: A Record of Citizen Involvement," to which Bostonians prominent in environmental affairs contributed, was held on Sunday afternoons. The Wednesday luncheon series, at which staff speak on alternate weeks from October through April continued to be popular. The series "Evenings with Friends" was held again at the Red Schoolhouse at the Case Estates on Tuesday evenings in the fall, as was the spring program that traditionally has complemented it, entitled "Meet the Staff." An average of 65 attended the Wednesday luncheon series, which are free. Registration for the remaining fall 1979 offerings was 171, but in the spring there were 370 registered, which we anticipate will be exceeded in fall 1980. Anne Johnson and Nancy LeMay provided much help in the administration and organization of the programs.

Four exhibitions were mounted at Jamaica Plain. Volunteer Cora Warren's exhibit "Spreading Roots," spanning the history of plant introductions and exchanges in North America, was shown during August–October, 1979, followed in November–January by "New England Gardens Open to the Public," a selection of photographs by Cymie R. Payne and from the Arnold Arboretum collection. During February–May an exhibit entitled "Roots" was shown, prepared by the Morris Arboretum for the University of Pennsylvania and presenting the growth, distribution, function and cultural needs of tree roots. Finally, "The Tallgrass Prairie: An American Landscape," was loaned from the Smithsonian Institution Traveling Exhibition Service between May–July. The arboretum exhibit at the Massachusetts' Horticultural Society's Spring Flower Show is described in the section on public service.

With the help of Harvard senior Debbie Van Ryn, Eugenia Frey organized an education program to complement the work schedules of the 1980 Summer Horticultural Trainees. A series of ten walks, twelve lunchtime lectures and three special events, two of which were trips, was organized. The active participation of many staff and volun-

teers make this a valuable program and contributed to the excellent morale and performance of the trainees this season.

PUBLICATIONS

Our current publications policy was summarized in my last annual report. I there discussed our intention to increase the circulation of *Arnoldia*, and plans for the future publication of four books. Norton Batkin assumed the position of publications officer in August, 1979.

In July, 1979, the third volume of Dr. Howard's *Flora of the Lesser Antilles*, which treats the Monocotyledons, appeared with family revisions by himself and several collaborators.

Stephen Spongberg and Ida Hay Burch continued their work on a book on the poisonous plants of the northeastern United States. Thanks to a donation from Mr. Walter Hunnewell and the Gillette Company, plans to illustrate the book with fine photographs are proceeding. Mr. David C. Twichell is collaborating on the photographic work, which neared completion this year with the accumulation of contact prints of all but a few of the species to be included. The text will be based partly on study of references at the Countway Medical Library of Harvard University.

The illustrations for a book on the China of Ernest Wilson, the great plant explorer who worked for the Arnold Arboretum between 1908-1930, have been prepared by photographer Peter Chvany. Research for the text has been completed by Richard Howard, and two preliminary articles are to appear in the May-June, and July-August, 1980, issues of *Arnoldia*. The publication of this book and of a collection of Esther Heins' watercolors of plants growing in the Arnold Arboretum, has been delayed by the absence of a source of funding. Grant proposals are to be prepared.

The editor of the *Journal of the Arnold Arboretum* is Dr. Stephen Spongberg; Elizabeth B. Schmidt, formerly assistant editor, has been appointed managing editor. During the past year the Editorial Committee was reorganized to include Dr. Ashton, and Dr. K. S. Bawa of the University of Massachusetts, Boston, as our outside member.

The long association of the *Journal* with the Harvard University Printing Office, conveniently located in the Allston section of Boston, ended in 1979 with the publication of the October number of Volume 60. For reasons of economy, as well as the eventual phase-out of hot type composition at the Harvard University Printing Office, the Editorial Committee decided, after a considerable number of bids had been received, to give the contract to Edwards Brothers, Inc., of Ann Arbor, Michigan, for the production of Volume 61 (1980). While paper and cover stock remain the same, cold type composition is being utilized,

requiring a different type face. Slight changes have also been adopted including the placement of copyright (where applicable) and bibliographic citation (journal title, volume number, pagination, and date) at the bottom of the title page of each article, and the initiation of each article on a right-hand page. These changes have facilitated printing and binding of offprints and have allowed the use of identical offprint covers (printed on *Journal* cover stock) for all offprints of a given volume. The January, 1980, number attests to the quality of Edwards Brothers' work; despite the distance between the editorial office and the printer, work has continued to run smoothly and at considerable savings.

Despite the economies realized, the Editorial Committee determined it necessary and reasonable to request authors to help defray production expenses. Beginning with manuscripts received and accepted for publication as of March, 1980, a page charge of \$20 is to be levied. Acceptance of manuscripts for the *Journal* will continue to be based solely on appropriateness and scientific merit rather than on an author's ability to meet page costs. As a result of these changes, the subscription price of \$25.00 per volume will be maintained for the time being. Our custom of providing authors with free reprints (50 for outside authors, 100 for those in-house) will be continued. Further, an updated set of instructions to authors will be published once annually in the *Journal*; the use of standardized bibliographic abbreviations may be introduced. Subscriptions, including library exchanges, currently number 706.

The July, 1979, number of the *Journal of the Arnold Arboretum*, the first to be published during the fiscal year just ended, was appropriately dedicated to Bernice G. Schubert, who had recently completed fifteen years of devoted and tireless service as editor and chairman of the Editorial Committee.

During the last fiscal year three numbers of the *Journal of the Arnold Arboretum* have been published. The last number has been delayed intentionally and will be published simultaneously with the July, 1980, issue; both numbers will be exclusively devoted to P. F. Stevens' manuscript, "A Revision of the Old World Species of *Calophyllum* (Guttiferae)," and together will have more than 600 pages. Publication of this large manuscript is consistent with the emphasis on monographic taxonomic research at the arboretum; the *Journal*, with its wide and established circulation in Asia where *Calophyllum* has its center of diversity, is clearly the most appropriate medium of publication. To mark the publication of this monograph, a new cover design as well as new devices were drawn by Karen Stoutenberger for Volume 61. These are based on the shoots and fruits, as well as on hairs which are of so much taxonomic importance in *Calophyllum*.

The three numbers of the *Journal* (Volume 60, numbers 3 and 4; Volume 61, number 1) published during fiscal year 1979-1980 include 334 pages devoted to seventeen articles by nineteen authors. S. Y. Hu



The Arnold Arboretum can provide extraordinary opportunities for nature photographers. Volunteer Al Bussewitz, one of the finest photographers working on the arboretum grounds, captured these images of wildflowers growing in the living collections.



During the year the Arnold Arboretum played host to Mrs. Barbara Abbott, the sole direct descendant of plant explorer, E. H. Wilson. Mrs. Abbott (right) made a surprise gift to the arboretum: an unpublished manuscript by her illustrious forebear (left).

and S. A. Sponberg were arboretum staff who published in the *Journal* during this period. Six of the nineteen authors are associated with foreign institutions (in Argentina, the Federal Republic of Germany, and New Zealand), while the remaining authors have affiliations with American institutions. The majority of articles report studies that have directly or indirectly utilized the herbarium and associated collections held by the Arnold Arboretum and other botanical institutions at Harvard University.

Manuscripts are presently on hand for issues into Volume 62, which will appear in 1981. Seventeen manuscripts have been received during the past fiscal year; of these, two were withdrawn by the author, five were rejected, one is currently being reviewed, and the remainder accepted for publication. The delay in publication time has been, in part, caused by the publication of Stevens' large *Calophyllum* manuscript, and mention should be made of the unflagging efforts and skill of Elizabeth Schmidt, the managing editor, in handling it. Thanks are rendered to our many outside reviewers, and to the members of the Editorial Committee for the time spent in reviewing manuscripts and offering help and advice on technical matters during the past year. Particular thanks are also extended to Dr. Schubert, who was unflinching in her help and advice during the transition of editorship and who has continued in her willingness to help in any way possible. The following persons are also to be thanked for the tedious and often thankless job of reading galley proofs during the past year: Margaret Campbell, Marion Carter, Laura Durr, Emily Lott, Heather

Miller, Martha Smith, and particularly Sara Cook, who read galley proofs for both the April and July, 1980, numbers.

There was much change in the editorial staff of *Arnoldia* during the fiscal year. Initially Dr. Weaver assumed editorial duties, but when Norton Batkin was appointed as publications officer he became managing editor of *Arnoldia*, with Weaver remaining editor. Barbara Epstein remained circulation manager. An editorial committee was formed; it now includes R. Weaver, chairman; P. Ashton, N. Batkin, J. Burrows, B. Epstein, R. Howard, and Roger Swain, who is scientific editor for *Horticulture* magazine as outside member. The principal responsibilities of the Editorial Committee are to review manuscripts before publication, to advise on policy matters, and to help solicit articles.

During fiscal year 1979–1980 the last three issues of Volume 39 were published, with a total of 134 pages. Only the first issue of Volume 40 has been published to date, with a total of 48 pages. The average number of pages per issue is 48, a size we feel to be ideal. Number 2 (March–April), containing 3 articles, will appear in early August; and issue 3 (May–June) in late August, containing 3 articles.

In the past the great majority of articles were written by staff members. This year, of the 17 articles for the fiscal year 5 were contributions from outside our staff, and 1 was from a foreign author. "Flowering Times in Viburnums" by Michael Donoghue was the first article written by a graduate student to appear in *Arnoldia* in recent years while the "Introduction of North American trees into China" by C. K. Cheng represented the first article written by a foreign author. This broadening is consistent with our plan to serve a larger readership.

There have been other significant innovations in *Arnoldia* but the regrettable lateness of the issues has counteracted any constructive changes. These include the use of an illustration on the back as well as the front cover (July–August, 1979); the use of a second color in cover photographs and the addition of a staff list on the inside front cover (September–October, 1979); and the initiation of a regular series featuring outstanding plants of the Arnold Arboretum, as well as a list of books received from publishers to be considered for review (March–April, 1980). Less tangible improvements include tightening up the format of the magazine, more careful editing, and improvement in the quality of the photographs.

Sheila Geary, Ida Hay Burch, and June Hutchinson have undertaken extensive research in preparation for a first comprehensive guidebook to the Arnold Arboretum. It is intended that this be published in an innovative format. A core will describe the history, design and purpose of the arboretum and will be published in a loose-leaf form whilst additional chapters will address a range of subjects, from detailed guides to individual collections, accounts for the seasons and botanical texts for teachers taking classes in the arboretum, to descriptions of the ethno-botany of North American trees. These will be

sold separately and added to the core; they can also be added to as authors are found, and independently reprinted or revised as necessary. A grant proposal for partial outside funding has been prepared and submitted.

As mentioned in the section on the living collections, a proposal has also been prepared to assist in funding a new map for our collections. Simplified and reduced onto one sheet, it will be printed and placed on public sale as an accessory to the guidebook.

We this year reestablished links with Barbara Abbott, sole direct descendant of E. H. Wilson. Mrs. Abbott has been made an honorary Friend of the Arnold Arboretum. We were surprised and excited to receive the gift of a typescript by Wilson for a three volume popular work which he had planned to publish on his best known introductions. Incomplete and in need of extensive editing to bring it to contemporary audiences, it nonetheless has considerable potential and we hope, in due course, to have it prepared for publication.

Harvard University Printing Office used the Arnold Arboretum as the theme for the photographs for this year's university calendar. Norton Batkin and Sheila Geary assisted in the selection of the photographs from our collection.

A list of publications of staff and associates that appeared during the 1979-1980 fiscal year follows this report.

PUBLIC SERVICE

The Arnold Arboretum is situated within the city of Boston and forms part of the City Parks System. Frederick Law Olmsted conceived of the arboretum as the component within the "emerald necklace" which should have education as its most significant function. Public education remains an important function of the Arnold Arboretum. However, the majority of our visitors come primarily to relax: to jog, exercise the dog, walk with the children or lie in the cool shade of an old tree.

The future of the Arnold Arboretum lies in the hands of its visitors, and especially those who reside in Boston. Without the participation of our neighbors, for instance, it will become increasingly difficult to maintain the collection and grounds in the healthy, tranquil and litter-free condition which we all desire. We are convinced that increasing visitation, and a close and active collaboration with our neighbors, can do much to limit the vandalism and litter problems that we presently suffer. We have therefore practical reasons as well as a moral responsibility to provide increased service to the community.

For their part, members of the community contribute to our work by serving as volunteers, by joining our member organization, the Friends of the Arnold Arboretum, or — and the importance of this



Frederick Law Olmsted and Charles Sprague Sargent intended the Arnold Arboretum for a dual purpose: education and recreation. There is no doubt that the majority of visitors see the arboretum as an appealing setting for relaxation, for exercise, even for art. Photographs by C. Lobig, R. Weaver, and A. Bussewitz.



An unexpected gift of five electric trams from the St. Joe Minerals Corporation in St. Louis brought internal transportation to the Arnold Arboretum, years ahead of schedule. Photographs by N. Lemay.

cannot be overemphasized -- by maintaining an active interest and speaking on our behalf in the community.

We have kept this in mind in building our staff and filling vacancies over the past year. Several changes in our staff should be noted. Ms. Margo Reynolds, public relations officer and chairman of our public relations committee, resigned at the end of April, 1980. Ms. Hope Wise has been appointed in her place, beginning in July. As reported last year, Ms. Eugenia Frey joined us as public information coordinator in July, 1979; her work in organizing the expansion of our public education program has been mentioned above. Norton Batkin, became the arboretum's first publications officer during the past year, and Wendy Marks filled the new position of manager of buildings and public services on June 1st. In addition she is currently acting as chairman of the public relations committee.

It is intended that the manager of buildings and public services will negotiate funding sources and implement various special projects aimed at enhancing public facilities at the Arnold Arboretum. Owing to the unanticipated receipt of five electric trams donated by the St. Joe Minerals Corporation of New York, Ms. Marks has so far concentrated on establishing routing and a regular schedule for them, recording a tour, setting up and implementing a fee that will eventually insure their financial self-sufficiency, and planning the formal inauguration of the service. Each tram carries ten passengers; three, provided with trailers, can take up to sixteen. This past year, they ran on a weekend schedule through November 15th, with special tours for groups by appointment at other times. There have been technical difficulties, partially through our inexperience and partially owing to the hilly terrain of the arboretum.

Under Eugenia Frey's leadership the arboretum staff currently conducts free tours for professional plant people and high school and college groups. Trained volunteers provide garden clubs and other amateur groups with tours on payment of a fee. The 60 tours at the arboretum this spring, a third of which were for schools, represent a threefold increase over the previous year. Five volunteer guides went through a training review program this spring which acquainted them with areas of the collections, the history of the arboretum and the work of the staff. Plans are underway to substantially improve the training of our guides so that we can confidently offer a thorough and well-presented tour program.

Ms. Frey has also been reviewing the plant information service that the Arnold Arboretum offers the public. She has instituted a record keeping system which documents the questions asked, the method of inquiry, the time taken to find an answer and the staff involved. At this stage, owing to incompleteness, the record probably indicates less than two-thirds of the total number of inquiries. During the fiscal year a total of 955 inquiries was recorded, mostly by telephone and during the spring and summer; of this 362 were concerned with cultural questions, 293 with the poisonous properties of plants, 82 requesting sources of particular plants, 61 for identification, 35 regarding propa-

gation and 6 on library references; the rest spanned a variety of areas. A plant information hot-line was established, from 1-2 p.m., Monday-Thursday. During that time Ms. Frey answers simple questions quickly, and calls back or writes to those people who need more obscure information. It appears to have been well received. With Ida Burch, she has established protocol and procedures for calls directed to us by the Massachusetts Poison Information Center. She has also sought legal advice concerning liability for inadvertent supply of mistaken information; the current procedure appears to be the correct one. Ms. Frey has had much continuing help in answering inquiries from Gary Koller, Richard Weaver, Ida Burch, the propagation staff and others.

The Arnold Arboretum community gardens scheme made a degree of progress last year. During 1978-79 there were serious problems of vandalism, the shortage of water, and lack of coordination among the gardeners themselves. These remain concerns, although much has happened this year to help the project run more smoothly. A steering committee was set up to share work and decision making. Headed by Terry Buck, it met twice a month through the year at the Dana Greenhouses. Guidelines for the gardeners were set up, and the general organization of the group is improved. Two workdays were held during the spring and summer to clean up the garden in the South Street area, and an educational program was arranged with consultation from the Greenstock staff of the Suffolk County Extension Service. Two of the gardeners have set up and supervised a successful pilot children's garden. In March a well was dug; a hand pump is now on order. For its protection, 3 steel I-beams will be placed around the pump, and it will be enclosed in a locked metal barrel. Ninety-one plots have been assigned this year, and people from Jamaica Plain, Brookline, Cambridge, Roslindale, Milton, Boston, Roxbury, Dorchester, and Mattapan are participating. When people of many backgrounds and levels of experience are encouraged to garden together, results are varied: the best side of this is the wide range of produce raised and methods used. The Steering Committee evaluated the plots and reassigned those not gardened on June 1, 1980. They will attempt to advise beginning gardeners, but it has proven difficult to do so because of the different times that people go to the garden area. Vandalism will remain a problem because of the garden site's exposure and accessibility from all sides, and because unlike most other Boston urban gardens, ours is not the responsibility of a single neighborhood. As a result produce is destroyed, communication between gardeners is impeded, and group morale is dampened. To combat these difficulties, the Steering Committee recommended that gardeners do not plant vine-ripening produce, or construct fencing, both of which seem to invite vandalism. An arrangement for quick relay of telephone messages among gardeners has been established.

On September 25, 1979, Margo Reynolds arranged a press breakfast in the Jamaica Plain Administration Building as part of an effort to appraise the various media of the arboretum's facilities, programs



*Director Peter Ashton talks with Deputy Mayor Katherine Kane during Arbor Day ceremonies held in the Boston Public Gardens, on April 25, 1980. The Arnold Arboretum planted two Korean mountain ash trees (*Sorbus alnifolia*) near the Charles Street fence. Photograph by M. Reynolds.*



*Over the past year excess plant material was made available to community groups through Boston Urban Gardeners for plantings throughout the city. Jim Burrows works with volunteer Lynn Borman, removing *Ilex* specimens for distribution. Photograph by C. Lobig.*

and other activities. Representatives of TV, newspapers, and local magazines listened to a talk by Gary Koller on fall foliage coloration, participated in a discussion during which information packets were distributed, and finally accompanied Gary on a tour of the arboretum.

In January, 1980, the arboretum became a member of the Council of Museums of Boston once again after a lapse of several years. Comprised of museums in the greater Boston area, this group meets monthly to discuss items of general interest and to share ideas and suggestions.

The arboretum helped to celebrate Arbor Day in a number of ways. On Friday, April 25, 1980, Director Peter Ashton and Margo Reynolds, along with Deputy Mayor Katherine Kane, City Environmental Coordinator Eugenie Beale and members of the Friends of the Public Garden, took part in a tree planting ceremony on the Boston Common that honored both Arbor Day and the city's 350 year anniversary. The arboretum contributed two fully grown Korean mountain ashes, *Sorbus alnifolia*, for the occasion; we thank Mrs. G. Kennard Wakefield for contributing the cost of transplantation. On April 26, 1980, Margo Reynolds attended a further celebration, at Jamaica Plain's Armenian Nursing Home, at which some conifers were donated for their garden; she prepared an article on tree planting for them, and other literature on tree culture was provided.

Once again the arboretum participated in the Spring Flower Show of the Massachusetts Horticultural Society. This year's exhibit was entitled, "Landscaping with Foliage." It received the Massachusetts Horticultural Society's Trustee's Trophy, the Creative Design Certificate and a gold medal. The second annual Arnold Arboretum Award, for excellence in the use of rare and unusual north temperate (hardy) woody plants in a complementary landscape setting, was presented at the Spring Flower Show to David A. Haskell and Peter R. Sadeck of New Bedford, Massachusetts for their exhibit entitled "A Pleasure Garden."

Our staff contributed in numerous ways to the programs of amateur horticultural groups, and to the horticultural profession throughout the year. Several classes of public instruction were oriented toward the interests of such groups. Worthy of note was a plant propagators workshop, organized by supervisor of the living collections, Gary Koller, and propagator, Jack Alexander, at which cuttings of over 60 taxa were made available to the professional plantsmen who participated. Two hundred packets of seed of the pink form of *Cladrastis kentukea*, from plants grown at the Perkins School in Watertown, Massachusetts were collected and distributed at the annual convention of the International Plant Propagator's Society.

Arboretum staff lectured extensively in the community. Jack Alexander spoke to the New England Chapter of the American Rock Garden Society and the Brookline Garden Club; Peter Ashton was a keynote speaker at the annual convention of the American Rhododendron Society and spoke to the Chestnut Hill Garden Club, Brookline Emery Bag Club, and Weston Senior Citizens Association, and the

Friends of Boston Public Garden. Richard Howard spoke to the Garden Writers of America symposium at Callaway Gardens, Georgia, to the Horticultural Club of Boston, the Women's Education and Industrial Union, the Wayland Garden Club, the Women's City Club of Boston, the Weston Garden Club, and the Hillsborough County Conservation District; and Gary Koller to the Newport Garden Club, the summer employees of the Boston Zoological Society, the New York Nurserymen's Association, the Transportation Research Board, the Maine Nurserymen's Association, the New England Nurserymen's Association, the Massachusetts Arborist and Tree Warden's Association, the Conservation Commission's Agricultural Extension Service in Suffolk County, Massachusetts as well as the Massachusetts Landscape Contractors, the Garden Club Federation of Massachusetts, and the American Rock Garden Society (N.E. chapter), and at Blithewold Gardens and Arboretum. He also helped organize and conduct a day-long tour for the Cabbages and Kings Horticultural Group.

Sheila Geary, assistant librarian at Jamaica Plain has prepared an annotated slide show that traces the early history and purpose of the Arnold Arboretum and then outlines our present policy and plans for restoration. Dr. Ashton gave talks based on this show at the Fogg Museum and the Boston Museum of Fine Arts.

The New England Bromeliad Society has held monthly meetings at the Dana Greenhouses. Peter Ashton participated in the WGBH, Boston public television Channel 2 auction; Gary Koller participated in the Sharon King television show and the Doug Debruin Show and was interviewed for First 4 (Channel 4) News.

VOLUNTEERS

Volunteers have helped in almost every phase of our work, and their work has been alluded to many times in this report. Among other achievements, a new system in our slide collection was set up and implemented completely by our volunteers. Volunteers have taught classes, set up exhibits, participated in our Wednesday lecture series and written articles for *Arnoldia*. Further, we have depended upon the volunteers for help in staffing the flower show exhibit as well as the front reception desk during peak season. Many of our volunteers prefer outdoor occupations and have requested work on the grounds. These jobs include inventories in Jamaica Plain and Weston, collection of specimens for the herbaria, and assistance in mapping and labeling. Volunteers have also helped to reestablish the perennial garden and the ground cover plots in Weston. The greenhouse continues to be a big attraction for our volunteers. Some are employed in seed cleaning or potting. Others conduct the weekly guided tours there. Those who prefer to be indoors have provided valuable assistance in the library and with clerical work. We are especially grateful to one of our loyal volunteers who, along with many other duties keeps the entrance hall of the Administration Building attractive with beautiful seasonal arrangements, all properly labeled.



Volunteers, once again, generously donated time to the Arnold Arboretum, providing essential help in almost every area of operation. Photographs by H. Wise and S. Geary.



Most volunteers have expressed the opinion that while it gives them satisfaction to know that they are helpful, indeed indispensable to the arboretum, they also find that the experience has been personally rewarding.

FRIENDS

The Arnold Arboretum is fortunate in having a group of people, known as the Friends who subscribe, and in many cases donate, to our work, and who participate in our programs. In turn they receive unusual plants and other benefits from us. The Friends organization is coordinated by Barbara Epstein, with the able assistance of the public relations officer, Hope Wise. We have continued in our effort to attract new membership, which currently stands at 2200. As part of our policy to involve our neighbors more actively in our work and in the future developments at the arboretum, special emphasis is now being placed on attracting increased membership from our immediate neighborhood. The new drive is beginning to achieve success.

This year we have, as before, offered course participation at special rates, preview receptions to our exhibitions, and our horticultural magazine, *Arnoldia*, to our Friends. On September 30th, 1979, we held our ever popular plant distribution at which special plants, generally unavailable from nurseries and in excess of our needs, were offered to Friends in the barn at the Case Estates. Members were able to select from an unusually wide assortment of over 700 rooted cuttings and seedlings, some of which represented progeny from plants collected during Dick Weaver and Steve Spongberg's 1978 expedition to Korea and Japan. Over 200 Friends attended, coming from every state in New England. The event also attracted a number of new members who received a gift publication along with their plants.

In order to involve our newest Friends in our activities, we extended them an invitation to join some of our seasoned volunteers and the staff in manning our exhibit at the Massachusetts Horticultural Society's Spring Flower Show. Each participant attended a talk on the history of the arboretum, its purpose and future plans, and seven staff members assisted in an orientation program to familiarize them with the material to be exhibited. This proved highly successful, and contributed to our success at the show; it will be repeated in the future.

In April, Friends received their biennial plant dividend. This time Jack Alexander propagated 2000 rooted cuttings of *Itea virginica*, which were sent out by mail. This beautiful plant is a native, and it is the first time that a North American native plant has been distributed.

The series, "Evenings with Friends," was again presented in the schoolhouse at the Case Estates during the fall, with five Friends sharing their horticultural experience with other members. Friends also received special invitations to our Wednesday luncheon lecture series through fall and spring; this year the series began with Dr. Ashton's talk, "Ceylon: Garden of Asia." Several Friends themselves contributed to the program.

GIFTS

Readers may wonder how the Arnold Arboretum is able to embark on a major restoration of its living collections, and simultaneously to expand its public services in a time of severe inflation. The arboretum continues to derive income from the interest on the endowment that past benefactors have donated, and the gifts it receives from its Friends. A major effort is now being made to obtain increased foundation support for the scientific research of our staff, the renovation of buildings and for the curation of our unsurpassed collections. The Arnold Arboretum is fortunate in possessing a modest balance of unexpended funds from previous years; this has allowed us to expand our staff in public service, but this program can only be sustained if in a short time it becomes self-supporting. It is, however, unlikely that grants will be obtained for the much needed restoration and maintenance of the living collections. There is also continuing need for plant exploration, which can only partly be thus subsidized through foundation grants. It is for these purposes in particular that the Arnold Arboretum is dependent on the generosity of its Friends.

The work of the arboretum is significantly enhanced by many of our Friends who choose to sponsor our work by contributing annually as sustaining (\$35 p.a.) or sponsoring (\$100-500) members, as patrons (\$500-1000) or as donors (gifts of more than \$1000). We are particularly grateful to those who, realizing that the real income of endowed institutions such as ours is seriously declining, have increased their contributions over the past year to help compensate.

Last year the Arnold Arboretum was the recipient of a generous bequest. Mr. Charles Mead of Weston gave his homesite, of eleven acres together with a house, a garage and an apartment, together with an endowment to maintain the property, to Harvard University for the use of the Arnold Arboretum. The house was built by Mr. Mead's father, Samuel W. Mead of the well known Boston architectural firm Cabot and Mead, who was responsible for the design, among many notable buildings, of the Boston Athenaeum, and of the first Weston High School and Wayland Public Library. On the property are some very old specimen trees originally obtained by Mr. Mead's parents from the Arnold Arboretum through the kindness of Jackson Dawson, our propagator from 1873 to 1916. Of historic interest is a collection of rhododendrons and broad-leaved evergreens begun by Mr. and Mrs. Samuel Mead and further developed by Charles Mead and his wife. These collections are being studied to develop an inventory. Additions to the collection will be made from the species and cultivars being grown at the Case Estates.

We wish also to thank the anonymous benefactor who has given us the means to establish an oak woodland wild garden, to be developed along the Oak Path which passes along the southern slopes of Bussey Hill. This inaugurates our planned restoration of the original path systems described in the section on the living collections. Dick Weaver outlines his plan for this wild garden in an article following this report.

Further restoration of the paths, and simultaneous development of the interpretive wild gardens that we would like to install along them, will be made possible by the future support of our Friends.

Thanks to a gift from Mr. Walter Hunnewell, matched by the Gillette Company, Steve Sponberg and Ida Burch will be able to proceed with the publication of their fully illustrated guide to poisonous plants.

The unexpected gift of five electric trams (three of which have trailers) by St. Joe Minerals Corporation of New York has allowed us to install an internal public transportation system, silent and pollution-free, several years earlier than we had projected. These are described in the section on public service.

We continue to receive valuable donations of plant material from nurseries; this year we have the pleasure of thanking the following companies for such gifts: Lawyer Nursery, Plains, Montana; Weston Nurseries, Hopkinton, Massachusetts; Princeton Nurseries, Princeton, and John Vermuelen and Son, Neshanic Station, New Jersey; Herman Losely and Sons, Inc., Perry, Ohio; and Forest Farm Williams, Oregon.

PETER SHAW ASHTON

Appendix: Published Writings of the Staff and Associates
July 1, 1979–June 30, 1980

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*Appendix: Staff Members of the Arnold Arboretum
Who Left or Retired During the Fiscal Year 1979-1980*

Eileen Twohig, *Custodian*
 Mildred Pelkus, *Accounting Clerk*
 Jeanne Sattley, *Horticultural Secretary*
 Rita Silverman, *Herbarium Secretary*
 Olga Peixoto, *Mounter*
 James Hickey, *Curatorial Assistant*
 Sarah Mellen, *Curatorial Assistant*
 Margo Reynolds, *Public Relations Officer*
 Albert MacNeil, *Grounds Staff*

Appendix:

Weather Station Data for 1979

	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Extreme Max. (°F)	Extreme Min. (°F)	Precipitation (inches)	Snowfall (inches)
Jan.	37	21	29	55	2	12.17	7
Feb.	30	13	21	57	-6	3.51	7
Mar.	49	33	41	72	11	2.83	—
Apr.	57	37	47	78	26	4.44	2
May	70	52	61	96	36	4.12	—
June	81	54	68	93	43	.96	—
July	87	64	76	99	48	4.62	—
Aug.	82	61	72	95	48	5.73	—
Sept.	78	52	65	90	36	4.26	—
Oct.	62	43	53	91	28	3.75	1
Nov.	56	39	48	74	26	4.12	—
Dec.	42	27	35	62	3	1.54	2.5

Average maximum temperature	61°F
Average minimum temperature	41°F
Precipitation	52.05"
Snowfall	19.5"
Warmest temperature	99°F on July 14
Coldest temperature	-6°F on February 14 and 15
Date of last frost in spring	April 21
Date of first frost in autumn	October 11
Growing Season*	172 days

* The growing season is defined as the number of days between the last day with killing frost in spring and the first day with killing frost in autumn. This period is determined by the last spring and the first fall temperature of 32°F or lower.

Weather Station Data for the First Six Months of 1980

	Avg. Max. Temp. (qF)	Avg. Min. Temp. (°F)	Avg. Temp. (°F)	Extreme Max. (°F)	Extreme Min. (°F)	Precipitation (inches)	Snowfall (inches)
Jan.	36	20	28	57	6	.73	.3
Feb.	36	16	26	56	5	.90	4.8
Mar.	45	28	37	63	3	5.80	3.0
Apr.	58	40	49	76	29	4.50	—
May	69	48	59	90	37	1.83	—
June	79	53	66	96	40	3.82	—

Average maximum temperature	54°F
Average minimum temperature	34°F
Precipitation	17.58"
Snowfall during winter 79-80	11.6"
Continuous snow cover	Feb. 16-24, 1980
Warmest temperature	96° on June 26
Coldest temperature	3° on March 1
Date of last frost in spring	April 18
Continuous freezing temperature	Jan. 31-Feb. 6, 1980

JOHN H. ALEXANDER III

The Restoration of Oak Path

A favorite walk of mine in the Arboretum is the Oak Path leading from a point on the Meadow Road nearly opposite the Centre Street gate and joining the Azalea Path on the southern slope of Bussey Hill. This walk leads past some of the first oaks planted in the Arboretum. Beautiful views toward the west of the Juniper dell and the Hemlock grove are obtained from it and it passes by some of the finest Azalea groups. It is a cool and shaded place in the summer and in the autumn canopied by vivid autumnal foliage. I think, however, I like it best in the springtime when the oak leaves are unfolding in soft grays, pinks and varying shades of red. (Wilson, E. H. 1925. *America's Greatest Garden*, p. 67. Boston: Stratford Co.)

An intricate and extensive pathway system, offering both casual visitors and serious observers intimate access to the collections, was visualized by F. L. Olmsted in the original layout of the Arnold Arboretum. The concept was expanded upon and eventually carried out by Charles S. Sargent. The paths were unsurfaced and consisted primarily of broad, closely mown strips within a grassy ground cover that was otherwise mown but twice a year. A few of these pathways are still in general use; some have become access roads for our service vehicles. But most have been almost completely obliterated with time and with the practice of close mowing the ground cover.

The original plantings beautifully complemented the varied terrain of the Arnold Arboretum, retaining the integrity of the major ecological habitat represented, which include deciduous and coniferous



A section of Oak Path as it appeared in 1913. Photograph from the Arnold Arboretum archives.

forest, swamp forest, and meadow. We hope eventually, funds permitting, to restore the majority of the pathway system as part of our general restoration, and to define the paths as they were originally, by reverting to less frequent grass mowing along their borders than is currently practiced. Restoration of the pathways would encourage use of and provide access to some of the little-known parts of the arboretum, of which Hemlock Hill is a noteworthy example. It would also give us the opportunity to expand and restore the existing collections along the pathways and to institute complementary interpretive collections for the general public.

Keeping in mind our accessions policy of ultimately having each taxon represented by three individuals, each of a different wild accession, planting according to the Bentham and Hooker sequence will continue to be followed as long as space permits. In some cases, due to space limitations, only one of these three individuals of a particular taxon would be planted in the sequence. In other cases, particularly when the main collection of the group is in an ecologically inappropriate site, up to two individuals may be used out of sequence to enhance interpretive plantings.

Individual plants would be sited to avoid visual clutter and to reinforce the structural integrity of each habitat. That is, tree groups would be underplanted or at least grouped with related shrub groups of similar ecological requirements. These plantings would be complemented by native trees and shrubs characteristic of the habitat with masses of a few appropriate herbaceous plants. The use of native species would reinforce the essential naturalness of the Arnold Arboretum as Sargent and Olmsted originally intended.

Restoration of the Oak Path has already begun. This path was the first chosen to be restored, partly because of its exemplary character and partly because its restoration will not involve major grading or structural costs. Fortunately, good documentation of its original condition is available through photographs and such descriptions as Ernest Wilson's quoted above.

The enclosed map shows a tentative plan for the development of the lower portion of Oak Path and adjacent areas. The path begins in the *Juglans* or walnut collection, near the intersection of Bussey Hill and Valley Roads. The "grove" of black walnuts (*Juglans nigra*) presently consists of six individuals. It will be partially restored with the addition of four individuals from throughout the natural range of the species. The grassy area beyond the walnuts will be allowed to grow up into a meadow, through which the path will be cut. Seeds of the following meadow wildflowers will be introduced:

- black-eyed susan (*Rudbeckia hirta*)
- ox-eye daisy (*Chrysanthemum leucanthemum*)
- asters (*Aster* spp.)
- goldenrods (*Solidago* spp.)
- gayfeathers (*Liatris* spp.)



All necessary grading has been completed along Oak Path, and weed eradication is underway. A generous gift will enable us to plant herbaceous groundcover along its borders.

beebalm (*Monarda fistulosa*)
penstemon (*Penstemon digitalis*)
butterflyweed (*Asclepias tuberosa*)
bluestar (*Amsonia tabernaemontana*)
ironweed (*Vernonia noveboracensis*)

In the oak collection itself, the path will proceed through an interpretive planting simulating an oak woodland with the oaks as canopy trees. Although this area will remain the primary focus of the *Quercus* collection, additions must be made judiciously as the site cannot support many more large trees without becoming cluttered. Further expansion of this important collection will be made on Peter's Hill. Understory trees are mostly absent now, but groups of flowering dogwoods (*Cornus florida*), redbuds (*Cercis canadensis*), and shadbushes (*Amelanchier* spp.) will be planted. The shrub layer will consist entirely of masses of American azalea species, extending the period of bloom of the large masses of flame azaleas (*Rhododendron calendulaceum*) already present, and beginning our general restoration of the Heath Family or Ericaceae in this area. Individuals will be selected from throughout the natural range of each species, insuring a maximum of genetic diversity; the area will eventually support our primary collection of American azaleas. Masses of selected species of native wildflowers typical of deciduous woodlands will complete the planting. As the path enters the oak collection, the herbaceous mas-

ses will consist entirely of goatsbeard (*Aruncus dioicus*). Anyone who has seen this species as it is naturalized under oaks in Olmsted Park in Brookline can appreciate the effect we hope to create. Further along the path three layers of herbaceous ground cover will be used in each of the masses. Plants to be used include lily-of-the-valley (*Convallaria majalis*) and foamflower (*Tiarella cordifolia*), Solomon's seal (*Polygonatum* spp.) and false Solomon's seal (*Smilacina racemosa*), and bugbane or black cohosh (*Cimicifuga racemosa*). These can all compete with the grass, and all are shade tolerant, blooming at different times. Further along, masses of white trillium (*Trillium grandiflorum*), turk's cap lily (*Lilium superbum*), asters (*Aster cordifolius*), and other woodland herbs will be attempted.

The lower portion of the path, from its beginning in the black walnuts will be delimited simply by regular mowing of the grass. The surrounding grass will be allowed to grow naturally except for mowing each spring and fall. Shade will prevent it from growing so long as to look unkempt, but will allow it to grow long enough to make the mown path distinct. The grass was managed this way last year on an experimental basis with satisfactory results.

The present openness of the oak collection, appreciable both from the Valley Road looking in, as well as from within the collection looking out, is one of its most appealing characteristics. We will maintain this character. The masses of azaleas under the oaks will be carefully planted to avoid clutter. The plant masses along the road will be situated so as to provide some visual barriers, but also to allow for sweeping vistas from under the oak stand, onto the azaleas on the upper slopes, rising to Bussey Hill.

The proposed timetable for completion of the Oak Path is as follows:

PHASE 1.

Grading of the upper part of the path; removal of plants which are excess or in poor condition; mowing of the lower end of the path to establish its identity; establishment of a permanent mowed border. Projected completion: August, 1980.

PHASE 2.

Eradication of *Rubus* and other perennial weeds in the existing groups of azaleas both manually and by the judicious application of herbicides. Projected completion: immediately along the path — September, 1980; throughout the oak collection — September, 1981.

PHASE 3.

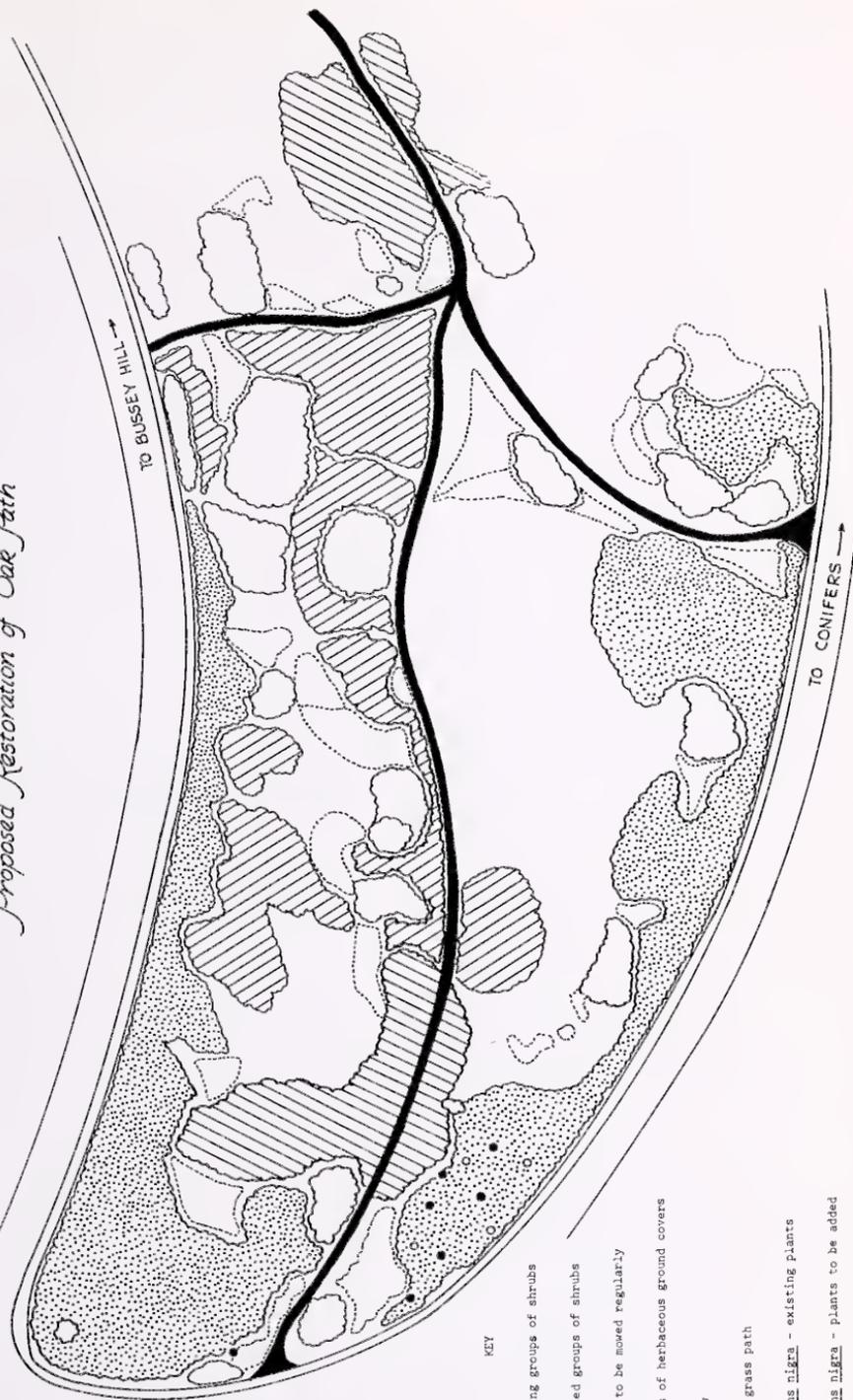
Establishment of two areas of meadow. Projected completion: initial plowing — June, 1981; soil preparation, final plowing, seeding — September, 1981.

PHASE 4.

Establishment of other herbaceous masses. Projected

TO CENTRE ST. GATE

Proposed Restoration of Oak Path



KEY

-  Existing groups of shrubs
-  Proposed groups of shrubs
-  Areas to be moved regularly
-  Masses of herbaceous ground covers
-  Meadow
-  Moved grass path
-  Juglans nigra - existing plants
-  Juglans nigra - plants to be added

completion: plant acquisition — June, 1981; bed preparation and planting — September, 1982.

PHASE 5.

Establishment of azalea masses gradually as the plants become available. Wild-collected plants in our living collections have been propagated and will be ready for planting in 1982. Other plants will be wild-collected in 1982 and will be ready in 1983. Plants grown from seed wild-collected in 1980 and 1981 will be ready in 1984 and 1985. Projected completion: June, 1985.

RICHARD E. WEAVER, JR.

Back cover: A view from Willow Path across the meadow, after its annual mowing in October. Photograph by C. Lobig.

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