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Cover: Pencil and ink drawing of a flowering tree of Cladrastis lutea by Anton Hockstein (1829–1911); reproduced with the permission of the Gray Herbarium of Harvard University.
Cladrastis: the Yellow-Woods

by Kenneth R. Robertson *

A contest held to select the most beautiful flowering tree native to eastern North America (exclusive of southern Florida) would certainly bring forth a number of entrants, each staunchly supported by many admirers. A leading contender for the title would be the evergreen magnolia or bull bay, Magnolia grandiflora. The catalpa trees, Catalpa speciosa and C. bignoniioides, would likely be nominated, along with the Franklin-tree, Franklinia alatamaha, the black locust, Robinia pseudoacacia, the Carolina silverbell, Halesia carolina, the sourwood, Oxydendrum arboreum, and the tulip-tree, Liriodendron tulipifera. A number of small trees would also have to be considered, including the flowering dogwood, Cornus florida, the eastern redbud, Cercis canadensis, the native crabapples, Malus species, the shadbushes, Amelanchier arborea and A. laevis, and the hawthorns, Crataegus species. All of these trees are outstanding ornamentals, being attractive not only when in flower but throughout most of the year, and they are all commonly cultivated in the eastern United States wherever they are hardy.

There is, however, another plant, rare in nature and in cultivation, that is worthy in every respect of being considered one of the most beautiful trees of eastern North America. This is the yellowwood, Cladrastis lutea, which was discovered in March of 1796 by André Michaux, as related in his Journal.

"The 2nd remained over in order to pull young shoots of a new Sophora I had remarked in the vicinity of Fleen's Creek about 12 miles from the Fort [Fort Blount, on the north bank of the Cumberland River near the present town of Gainesboro, Tennessee]. Snow covered the ground and I was unable to get any young shoots but Captain Williams, the young [officer] stationed in the Fort, cut down some trees and I found some good seeds.

"I also pulled up some roots of those trees to replant them in my garden in Carolina.

"The same day I had occasion to write to Governor Blount."

I do not know if plants were successfully propagated from these seeds and roots. André Michaux died of a tropical fever in Madagascar in 1802, but his son, François André, who had accompanied his father on many collecting trips in the Carolinas, continued to explore

the southeastern United States. In the year of his father's death, François also came across yellow-wood trees, as mentioned in his Travels.

"We found particularly, in these forests, a tree which, by the shape of its fruit and the disposition of its leaves, appears to have great affinity with the *Sophora japonica*, the wood of which is used by the Chinese for dyeing yellow. My father, who discovered this tree in 1796, thought that it might be employed for the same use, and become an important object of traffic for the country. He imparted his conjectures to Mr. Blount, then governor of this state, and his letter was inserted in the Gazette at Knoxville on the 15th of March 1796. Several persons in the country having a great desire to know whether it was possible to fix the beautiful yellow which the wood of this tree communicated to the water by the simple infusion, cold, I profited by my stay at Nashville to send twenty pounds of it to New York, the half of which was remitted to Dr. Mitchell, professor of chemistry, and the other addressed to Paris, to the Board of Agriculture, attached to the Minister of the Interior, in order to verify the degree of utility that might be derived from it. This tree very seldom rises above forty feet, and grows, in preference, on the knobs, species of little hills, where the soil is very rich. Several of the inhabitants have remarked that there is not in the country a single species of tree that produces so great an abundance of sap. The quantity that it supplies exceeds even that of the sugar maple, although the latter is twice its bulk. The epoch of my stay at Nashville being that when the seeds of this tree were ripe, I gathered a small quantity of them, which I brought over with me, and which have all come up. Several of the plants are at the present moment ten or fifteen inches high. It is very probable that this tree may be reared in France, and that it will endure the cold of our winters, and more so, as, according to what I have been told, the winters are as severe in Tennessee as in any parts of France."

The yellow-wood tree was not included by André Michaux in his posthumously published *Flora boreali-americanae* of 1803. However, his son did describe it in his *Histoire de arbres forestiers de l'Amérique septentrionale* of 1813, naming it *Virgilia lutea*. At that time, the genus *Virgilia* was used for a number of species that had been included previously in *Sophora*. (Today, *Virgilia* is restricted to one or two species of South Africa.) In 1824, C. S. Rafinesque published a new generic name, *Cladrastis*, for this tree, renaming the species *C. tinctoria*. The International Code of Botanical Nomenclature recognizes the principle of priority so that the proper scientific name of a plant is the combination of the earliest available legitimate specific epithet with the correct generic name. For many years, the accepted scientific name of the yellow-wood tree has been *Cladrastis lutea* (Michaux f.) K. Koch. However, Rudd (1971) adopts the name *C. kentukea* (Dum.-Cours.) Rudd. This specific name is based on a description published by Dumont de Courset in 1811 of a young, non-flowering plant cultivated in France. Although the description appears to correspond to the yellow-wood, there are differences, and I am hesitant to accept this name change.

Yellow-wood is a moderate-size deciduous tree, with mature plants reaching a height of 50 feet (Cover, Figures 1 and 4). The trunk,
Fig. 1. a–c, Cladrastis lutea in winter: a, grove of four trees on the Tree Legume slope in the Arnold Arboretum; b, base of tree with short trunk and several main branches; c, smooth, beech-like bark of a main branch. Photos: K. R. Robertson (from colored slides).
often 2 or 3 feet in diameter, is short and soon forks into a few wide-
spreading branches, and the tree has a graceful, broad rounded top.
The record tree in Morristown, Pennsylvania is 58 feet tall with a
crown spread of 70 feet and a trunk circumference of 16 feet. The
heart-wood is a clear yellow when first cut, partly changing to a light
brown. The hard, heavy, strong, and close-grained wood takes a
good polish, and early pioneers used it to make gunstocks and small
articles of furniture. Fortunately for the sake of the species, but not
for cabinetmakers, the trunks of wild trees fork too closely to the
ground for the species to be harvested commercially for lumber.
Also, the wood tends to crack and check unless carefully dried. The
bark (Figure 1c) is smooth and silvery-gray, much resembling that
of beech trees. As a result, yellow-wood trees in parks and arboreta
usually bear the marks of young lovers and others who like to carve
their initials on trees. The root system, deep and extensive, does not
interfere with neighboring trees or a lawn (although it possibly might
clog underground drainage systems) and enables well established
yellow-wood trees to endure periods of drought. Branches of the
yellow-wood are brittle (the generic name comes from the Greek
klados, branch, and thraustos, fragile), and the crotch of the tree
trunks also are weak; thus, yellow-wood trees, particularly old ones,
are susceptible to damage by strong winds. Young yellow-wood trees
may be pruned to a single upright bole that is considerably more re-
sistant to wind damage.

The winter buds are very distinctive (Figure 2a). They are in
superposed clusters of usually three sessile, densely pubescent buds
that are nearly encircled by a prominent C- or V-shaped leaf scar
(the bud cluster was entirely enclosed by the base of a petiole of the
previous year). A true terminal bud is lacking (although the last
axillary bud is often produced very near the tip of the twigs) and
branching is thus sympodial, with the twigs often being slightly zig-
zagged. In midspring, the uppermost bud of the more apical bud
clusters (Figure 2b, c) and also some of the lower axillary clusters
enlarge and quickly send out the growth of the year. Since the new
shoot with its leaves and inflorescence is largely preformed in the
winter bud, growth and expansion is quite rapid. Each new shoot on
mature trees is only a few inches long and is terminated on flowering
branches by the very long inflorescences. The leaves expand to their
full size quickly, but the flowers do not open until early summer; thus
there is a period of several weeks when the pendulous inflorescences,
hanging below the foliage, give yellow-wood trees an unusual, rather
graceful appearance (Figure 2d). The leaves of Cladrastis lutea are
arranged alternately along the branches, are pinnately compound with
an odd number, usually seven (five to eleven), of leaflets per leaf,
and are mostly 10 to 15 inches long at maturity. The lateral leaflets
are broadly elliptic or ovate in outline, with acuminate tips, tapering or
slightly rounded bases, and entire margins; the terminal leaflet is more
Fig. 2. Cladrastis. a–h, C. lutea: a, winter twig — note superposed buds surrounded by leaf scar, b, tip of twig in early spring with two leaves and inflorescence emerging; c, branch later in spring with expanding leaves and young inflorescences; d, fully expanded leaves and pendulous inflorescences, the flowers not yet open; e, inflorescence with open flowers, f, lower part of flowering tree; g, large tree in full flower; h, tip of summer twig with bases of two leaves, the base of the leaf to the right pulled away from the twig to show how it encloses the winter buds; i, Fruits of C. platycarpa. Photos: K. R. Robertson (from colored slides).
or less rounded-rhomboid in outline with a cuneate base and an abruptly acuminate tip and is shorter and broader than the lateral ones. The upper lateral leaflets are usually 4 to 6 inches long and 2 to 3½ inches wide at maturity, with the lower lateral leaflets being somewhat smaller. A characteristic feature of leaves of Cladrastis is that the lateral leaflets are arranged alternately along the rachis of the leaf (Figure 4b). This feature, plus the relatively large size of the leaflets, could cause the casual observer to think that the leaves were simple instead of being compound (the first leaves produced by seedlings are, in fact, simple). Stipules and stipels are absent. In autumn, the leaflets turn a clear bright yellow. As mentioned earlier, the base of the petiole is swollen and completely encloses the winter buds (Figure 2h).

The white flowers, opening in June, are borne in long, many-flowered, pendulous, Wisteria-like panicles that terminate the growth of the current year (Figure 2e, f). Flowers are produced in abundance usually every second or third year, but in a good year, the trees are spectacular! (see Figure 2g.) The papilionaceous (pealike) flowers show that Cladrastis is a member of the pea subfamily of the legume family (Leguminosae subfamily Faboideae). The sepals are united into a green tube with five calyx teeth. The five petals are of three different sorts (Figure 3). The upper "banner" petal is outermost and, in bud, encloses the two lateral "wing" petals and the two inner "keel" petals. All the petals are clawed below, and they fit together so that the banner petal, which has a yellow area toward the base of the blade, is very conspicuous and attracts insect pollinators, while the all white wing and keel petals function as a landing platform for insects. The flowers are quite fragrant, particularly in the evening. The ten stamens are enclosed by the keel petals. In Cladrastis, the filaments of the stamens are all free from one another. This feature indicates that this genus is allied with Sophora, pagoda trees, Mackia, and numerous other genera. As in nearly all Leguminosae, the pistil is of one simple carpel. The cylindrical ovary is shortly stalked below and tapers above into an elongate style that is tipped by a small stigma.

The fruit of Cladrastis lutea is a flattened legume, somewhat like that of redbud (the genus Cercis), up to 4 inches long and mostly ¾ inch wide (Figure 4c). There are one to several seeds in each fruit, and the fruits are often slightly constricted laterally between the seeds (perhaps the best botanical description would be "flattened tortulose"). The fruits mature in size by August and in September are brown and dry. They remain on the trees for a short period after the fall of the leaves, but they soon fall to the ground. The fruits on the trees, both during the summer and after the leaves have fallen, detract from the appearance of the trees, but at least they do not remain on the trees during winter. After the fruits have fallen to the ground, the fruits either dehisce or they decay over winter to release
Fig. 3. Cladrastis lutea. Original drawing by C. E. Faxon from which the engraving for Tab. CXIX in Vol. 3 of Sargent's Silva was made. Shown in the illustration are: a flowering branch, the petals of a flower (lower left), a diagram of a flower, a stamen, a vertical section of a flower and an ovary, and an ovule (all to the lower right). From the Library of the Arnold Arboretum.
Fig. 4. Cladrastis lutea. a, grove of trees on Tree Legume slope in summer; b, mature leaves; c, fruit. Photos: K. R. Robertson.
the seeds. The seeds are olive-brown and beanlike, slightly laterally flattened, and about ¼ inch long and ⅛ inch wide; the hilum is quite off-center.

Cladrastis lutea is endemic to the eastern United States, occurring from Brown County, Ohio and Brown County, Indiana west through southern Illinois to southwestern Missouri, northern and central Arkansas, and extreme eastern Oklahoma, south through central Tennessee to central and southern Alabama, and east to the mountains of eastern Tennessee, North Carolina, and extreme northern Georgia. However, this overall distribution does not really reflect the distribution of C. lutea since the species occurs disjunctly in numerous scattered localities (Figure 5). Wild yellow-woods are found in two quite different habitats: cliffs along river systems and openings in hardwood or hemlock forests of moist coves. Cove forests are most common in the southern Appalachian Mountains, and yellow-wood trees of these forests are tall with erect, flat crowns and trunks that fork fairly close to the ground. Toward the western and southern part of their range, yellow-wood trees occur primarily at the brink of cliffs, along ledges on cliffs, or sometimes toward the base of cliffs. Yellow-wood trees of the cliff habitat are small and have trunks that fork about half way up (much of the above information from Pittillo, 1963). Steyermark has noted that thousands of these rare trees have been destroyed by the construction of dams (Bull Shoals, Taneycomo, and Table Rock) along the White River and its tributaries of northern Arkansas and southwestern Missouri. Because of its rare occurrence, scattered distribution, and presence in areas subject to flooding by man-made dams, yellow-wood has been included in the Federal list of endangered plant species.

Yellow-wood is not for mass planting as a yard or street tree; it is, instead, for the discriminating gardener who will give it a prominent place among other rarities. Such a person will be rewarded. In winter, the beech-like bark and overall appearance of the tree is very attractive. In late spring, the tree is truly spectacular when in full bloom (heavy flowering occurs only every other year or so). The rounded shape of the crown, the rich green color and medium texture of the foliage, and the short trunk make the yellow-wood a nice tree during the summer. In autumn, the leaves turn a rich yellow. In short, the yellow-wood has something ornamental to offer at all seasons. The only unattractive period is when the fruits mature and, for a short time, hang on the trees in the fall. Perhaps someday plant breeders will develop a sterile form that does not set fruit and that might flower more regularly every year. Yellow-wood is hardy nearly throughout the eastern United States and southern Canada. It is not bothered by insect or fungal pests, is tolerant of most soil types, and can withstand moderate drought once it is established.

Yellow-wood is also for the patient gardener. First of all, it is rather difficult to find in nurseries, and, when available, it is usually
Fig. 5. Distribution map by county of Cladrastis lutea.
in limited quantities. It also is slow growing, taking ten to twenty years to flower for the first time, and it only flowers heavily every second or third year.

Although yellow-wood is not commonly cultivated, there are a number of fine specimens in Cambridge, Massachusetts, particularly in the vicinity of the Botanic Garden Apartments on Garden Street (former site of the Harvard Botanic Garden), in Mount Auburn Cemetery, and in the Tercentenary Theater of Harvard Yard between Memorial Church and Widener Library. The Arnold Arboretum’s grove of yellow-woods is on the Tree Legume slope (Figures 1 and 4).

Yellow-wood may be propagated by root cuttings or by seed, which should be covered with hot water (190°F), allowed to set overnight, then stratified for three months at 40°F.

On the grounds of the Perkins School for the Blind in Watertown, Massachusetts is a pink-flowered yellow-wood. It is not at all clear where this tree originated, and there is no report of a pink-flowered form from the wild. This tree has been propagated by scions and distributed to the Arnold Arboretum and to the Brimfield Nurseries in Connecticut. A number of years ago, the Morton Arboretum, Lisle, Illinois, and the Arboretum of the Barnes Foundation, Merion, Pennsylvania obtained plants from the Brimfield Nurseries. The plant at the Morton Arboretum first flowered in 1970, while that at the Barnes Foundation first flowered in 1976. The plants at the Arnold Arboretum have not yet flowered. For more information on the pink-flowered yellow-wood, see Fogg (1976) and Wyman (1963).

While *Cladrastis lutea* is the only species of the genus native to the New World, there are four other species in eastern Asia. These are: *C. sinensis* Hemsl. of central and western China (Figure 6), *C. Wilsonii* Takeda of central China, and *C. platycarpa* (Maxim.) Makino and *C. shikohiana* Makino of Japan. All of these, except for the last species, are cultivated in Europe, but only *C. platycarpa* and *C. sinensis* are occasionally grown as botanical curiosities in this country. They are not as ornamental or as reliably hardy as our native *C. lutea*. *Cladrastis* is closely related to *Maackia*, and the two genera are sometimes united under the former name. *Maackia amurensis*, a native of Manchuria, is occasionally cultivated in the eastern United States for its July bloom.

**KEY TO THE CULTIVATED YELLOW-WOODS**

1. Legumes flattened but not winged, stipels absent.
2. Leaflets broadly elliptic or ovate with acuminate tips and tapering or slightly rounded bases; ovary glabrous, panicles mostly drooping. *C. lutea*.

2. Leaflets oblong to oblanceolate with obtuse or acutish apices and rounded bases, ovary finely pubescent, panicles upright. *C. sinensis*.

1. Legumes flattened, winged all the way around; stipels present. *C. platycarpa*. 
Fig. 6. A 60- x 10-foot specimen of Cladrastis sinensis at base of Fei-Yüeh-ling in Ching Chi Hsien (5,000-foot altitude). Photo. E. H. Wilson, 1908.
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Buckleya - The Oldest Cultivated Plant in the Arnold Arboretum

by Richard A. Howard

Although the Arnold Arboretum was legally established in 1872, the first plantings on the grounds did not occur for several years. It is of interest, therefore, that a plant collected in Tennessee by Asa Gray in 1843 was transplanted to Hemlock Hill in Jamaica Plain in 1946 and so represents the oldest documented cultivated plant in the Arnold Arboretum. Strangely, it is a semi-parasitic plant with an unusual history. It is not common in cultivation, has no well-known common name, and is to be recommended only for its oddity.

Buckleya distichophylla (Nutt.) Torrey was first seen by Thomas Nuttall in his travels along the French Broad River in East Tennessee in 1816. Nuttall, an English-American botanist and ornithologist, was to become the director of the Harvard Botanic Garden in Cambridge, Mass., in 1822, preceding the more famous Asa Gray. His discovery was described by him as Borya distichophylla, in his book, The Genera of North American Plants, in 1818. Unfortunately, he assigned it incorrectly to a genus in the Oleaceae, the olive family.

The plant was found again in the spring of 1843 by Samuel Bradford Buckley, a naturalist and plant collector for Prof. John Torrey of Columbia College. Torrey then correctly assessed the plant to represent a new genus of the sandal-wood family, Santalaceae, and named it Buckleya in honor of Mr. Buckley. Torrey recognized that the proper specific name was that published earlier by Nuttall, and made the transfer and new combination. Professors Torrey and Gray had published A Flora of North America, containing short descriptions of all the known indigenous and naturalized plants growing north of Mexico and were continuing a program of collecting unusual plants. Thus Gray sought out Buckleya in the fall of 1843 and returned with herbarium specimens and plants and fruits of the rare Buckleya for cultivation at the Harvard Botanic Garden, then under his direction. The introduction to cultivation of a living partially parasitic plant is unusual, yet it was successful. Herbarium specimens from this plant labelled “Hort. Cantab.” or “Botanic Garden of Harvard University” are dated 1852, 1879, 1926 and 1930, the last two, by John George Jack for the Arnold Arboretum herbarium.

Charles Sargent was the director of the Botanic Garden of Harvard University in Cambridge from 1873 until 1879, and there he pre-
pared plans and plants for the development of the Arnold Arboretum property in Jamaica Plain. One can assume that Sargent noted the lack of fertile fruits on the Buckleya in the botanical garden and attempted vegetative propagation. When this was unsuccessful, he sought additional plants from the wild and in 1888 he and W. M. Canby made a trip across the Smoky Mountains of Tennessee, including a "detour to the French Broad for the purpose of looking up Buckleya." He reported that he found plants in ripe fruit at Paint Rock and sent back several hundred seeds packed in damp soil as well as a number of small seedlings. All arrived at the Arboretum in
good order, and the seeds germinated "at once." These accessions were recorded in the numbered inventory of the Arnold Arboretum as "#3255," a plant collected by Sargent at Paint Rock, Tenn., Oct 1888, and "3255-1 seeds" from the same area. Herbarium vouchers of fruiting specimens support the collection data. We have no record of the length of time the plants or seedlings obtained by Sargent were maintained in the living collections, for the existing records show only the undated annotation "dead or disposed of," representing a period when non-ornamental plants were removed from the living collections.

Sargent wrote of his search for this plant and of its introduction to cultivation in an article on "New or Little Known Plants" in Garden and Forest in 1890. A plate prepared by Charles Faxon was included and is reproduced here. *Buckleya*, as a native plant, was not included in any edition of *A Manual of Botany* as prepared by Asa Gray, although several of these editions included the state of Virginia, where the plant has been found. It was first mentioned in the 8th edition of Gray's *Manual of Botany* published by M. L. Fernald in 1950 Sargent mentioned the plant only briefly in a footnote in his *Silva of North America*. *Buckleya* is included in Rehder's *Manual of Cultivated Trees and Shrubs*, but supporting specimens for this record are only those of the Botanic Garden of Harvard University.

When the Botanic Garden in Cambridge was abandoned in favor of university-sponsored housing at the end of World War II, the shrub introduced by Asa Gray in 1843 and cared for by Charles Sargent in 1873 was transplanted to the grounds of the Arnold Arboretum in 1946. It continues to thrive in a natural stand of *Tsuga canadensis*, the Canada Hemlock.

*Buckleya* is a genus of dioecious shrubs, the male and female flowers occurring on different plants. The specimen Asa Gray collected is a female plant. *Buckleya* is known to be a semi-parasitic plant, that is, during part of its development it is dependent as a parasite on the attachment of its roots to those of other plants. The plant becomes a shrub, has green leaves, and does manufacture its own food. I have not been able to locate a 19th century reference to this parasitism, but herbarium specimens from the Biltmore Herbarium, collected in 1897, were made deliberately to show the haustorial connection with *Tsuga canadensis*. Since the natural range of *Buckleya distichophylla* is also that of the Carolina Hemlock, botanists speculate that *Tsuga caroliniana* might have been the original host plant. In the last decade, other botanists have reported an association of *Buckleya* with species of *Pinus*, and, in fact, as many as twenty-five different forbs, grasses and ferns as well as broad-leafed trees. Even today it is not clear at what stages of growth or for how long or to what degree *Buckleya* must be dependent on a host plant.

Sargent reported in 1890 the lack of success in attempts to propagate vegetatively the specimen of *Buckleya* in the Botanic Garden in
Cambridge. Since that time the Arnold Arboretum has acquired several seed lots of *Buckleya distichophylla* from native locations and from other plants in cultivation in the United States, and one infertile seed lot from the Forest Botanic Garden, Charlottenlund, Denmark. Mr. Fordham, longtime plant propagator for the Arnold Arboretum, has conducted many experiments with this species. In spite of Sargent’s early report that seeds germinate “at once,” Mr. Fordham has found that seeds failed to germinate when planted directly upon receipt. However, seeds given a cold treatment of 40 degrees for two or three months produced seedlings in over 50% of the cases. In 1962 a generous quantity of seeds and cuttings was received from Mr. Fred Lape from plants growing in the George Landis Arboretum in Esperance, New York. Mr. Lape wrote that the original plants in his collection came from seed collected by F. M. Crayton of Biltmore, North Carolina; they germinated well and are established in the Landis Arboretum as well as in an old woodlot. He reported that in one place “there is a spread of it the size of a small room,” and that the large plants fruit heavily each year.

The cuttings received rooted poorly under mist propagation and developed roots only at the very base of the cutting. Other cuttings treated with Amchem 60-89 diluted to 5,000 ppm produced better roots. The seeds developed and the seedlings appeared to flourish without a *Tsuga* or any other host plant present in the container. Thirty-five of the vigorous seedlings were planted on Hemlock Hill in the Arboretum in 1963, but by the fall of 1964 all had died. Other seedlings planted near a hemlock in the nursery area persist to the present but have yet to flower and so are unsexed. Regrettably, these plants, even if staminate, are too far from the older pistillate plant for normal cross-pollination.

The fruits of the American *Buckleya distichophylla* are drupes resembling a small olive in size and shape. When mature they are a yellow-green in color and they turn a tan or light brown color on drying. The fruits may possess four narrow lanceolate bracts at the summit which are shorter than the fruit. These often fall early but if they persist are certainly of no aid in dispersal.

In 1846 the German botanical collectors Philip Siebold and Joseph Zuccarini described in their *Flora of Japan* a plant they called *Quadriala lanceolata*, literally referring in the name to the four large bracts found on the fruit. Friedrich Miquel, in 1870, recognized this plant to be of the same genus as *Buckleya distichophylla* of the United States, and published the combination. Thus *Buckleya* was recognized as one of the many plants occurring in the southeastern United States and in Japan and China. *Buckleya distichophylla* is known today from Tennessee, Virginia and North Carolina. *Buckleya lanceolata* (Sieb. & Zucc.) Miq. is known from Japan (Honshu) and China (Hona, Hupeh, Shensi, Szechwan) with a possible second Asiatic species, *B. graebneriana* Diels from Shensi in China. Two other
species from Asia have been referred to *B. lanceolata* in herbarium annotations made by Rehder.

In 1892 on a collecting trip to Japan, Charles Sargent found fruiting specimens of *Buckleya lanceolata* on the steep banks of the Kiso-gawa near Agematsu in Nagano prefecture of central Honshu in Japan. Upon his return Sargent wrote in *Garden and Forest* of the Japanese *Buckleya*: “Indeed it is so common in some parts of the country that the fruit, which is gathered when about two-thirds grown, having been subjected to some pickling or preserving process, is sold as a condiment, packed in small, neat wooden boxes. Nikko is the headquarters of the industry, and in late autumn the fruit of *Buckleya* is displayed in many of the shops which line the street leading through the straggling village up to the burial place of the founder of the dynasty of the Tokugawa Shoguns. To appreciate the flavor of *Buckleya*, the culture and refinement of the Japanese palate is essential.” There is no record of the seeds Sargent described being grown at the Arnold Arboretum, but in 1905 John George Jack, Sargent’s colleague, returned to the same area and obtained comparable fruiting herbarium specimens. It appears that both men might have attempted to introduce this species into cultivation. In 1964 the Arnold Arboretum received fruits of *Buckleya lanceolata* from the Kobe Municipal Arboretum in Kobe, Japan. After a cold treatment of 40 degrees for three months, several seeds germinated, but the seedlings could not be established. In 1902 the Japanese botanist, S. Kusano, in an article in the *Journal of the College of Science of the Imperial University of Tokyo*, noted that no information had been published on the host plants of *Buckleya* or for the abundant local species. He described the haustorial connections with species of *Cryptomeria, Abies, and Chamaecyparis* as well as nine genera of dicotyledonous trees and shrubs. Although he did not locate naturally occurring parasitism with *Pinus* or *Torreyia*, he was able to establish such relationships experimentally.

*Buckleya* lacks a common name and never will be widely cultivated or useful as an ornamental plant. It is, however, a good example of a rare plant of limited distribution showing unusual phytogeographical relationships, representative of a small family, and worthy of a place in the educational collections of an arboretum. The oldest cultivated plant in the Arnold Arboretum also has an historical connection with several of America’s distinguished botanists.
A map of modern China showing the possible route for a botanical tour with the places of interest marked by numbers: 1. Hongkong, 2. Canton, 3. Hanchow, 4. Shanghai, 5. Soochow, 6. Nanking, 7. Peking, 8. Wu-Han, 9E. Lu Shan Botanical Garden, 9W. Chang Sha, and 10. Kweilin. The insert shows the relative position of China in comparison with continental USA. Latitudewise, Peking is comparable to Gettysburg or Harrisburg, Pennsylvania (see text for explanation).
More About Tours of Botanists and Gardeners in China

by Shiu Ying Hu

Recently, an unusually large number of letters came to me from Arnoldia readers regarding my report on the “Tour of a Botanist in China” (35: 264-295. 1975). Two letters came from botanical friends in Peking, suggesting areas that need corrections; the other letters brought questions from botanists, horticulturists, dendrologists, landscape gardeners, etc., who are interested in going to the People’s Republic of China to visit gardens and experimental stations. The purpose of this short article is to make necessary corrections in my former report, and to answer questions concerning the application for, and planning of, tours to China.

Corrections in Former Report

Regarding the Institute of Botany, Academia Sinica, referred to on page 276, the herbarium and library of the Institute have the collections of the former Fan Memorial Institute of Biology and those of the former Laboratory of Botany, National Academy of Peiping. On the next page, the Flora Reipublicae Popularis Sinicae was mentioned. The four volumes already published are: Pteridophyta: Ophioglossaceae — Oleandraceae, Rosaceae, Cyperaceae, and Scrophulariaceae (Part II). In the same paragraph, the enlarged Sixth National Convention was called by the Academia Sinica.

In order to prepare a report on my tour in China while my memory was fresh, I wrote the article in Hongkong, where the library facilities for botanical publications are inadequate. It was published before I returned to the Arnold Arboretum where the volumes of the flora mentioned above are available. The outline map used for illustrating the route of my trip is an old one used by people outside China. The contemporary term for “Manchuria” is the Northeast.

Answers to Inquiries

The questions that I have received from people interested in visiting China may be grouped into three categories: (1) application,
(2) places to visit, and (3) time and expenses. Readers are advised to refer to my former report, and to consider the following information as supplementary material.

Application: The first rule about tours to China is that the application for entry visas must be made with the official representatives of the People's Republic of China in the country of the applicants. In the United States of America, this is the Liaison Office, People's Republic of China, 2300 Connecticut Avenue, N.W., Washington, D. C. 20008. In other countries it may be the Chinese Embassy or Consulate.

The procedure for applying varies with the size of the visiting group. I have known people who went to China as individuals, or in small groups representing academic or research institutions, or as special interest tours of twenty to twenty-five. People who intend to make the trip as individuals can write to the consulate or the liaison office, or go in person, to ask for application forms. Those who plan to visit China in groups must have a leader who represents them in all communication with the liaison office. In writing to ask for the application forms, it will be helpful to state the nature of the group, the purpose of the visit, a list of the participants, and the places hoped to be included in the tour.

Programs of touring groups within China are prepared by the China Travel Service (CTS), which has various routes for different interest groups. However, it will help the CTS program makers when they know the intention of the group in visiting certain places, gardens, institutions, and people. In consultation with the botanical, horticultural, agricultural, and forestry organizations of the country, officers of CTS often try to include the specific places and people desired. In the tour in which I participated in the summer of 1975, I was the only person interested in botanical institutions and botanists in China. In my application, I listed over two dozen people and botanical gardens and institutions. Arrangements were made for me to see a large number of these.

Places to Visit: In 1963, I participated in a tour of the International Dendrological Society in the eastern United States of America. From this experience, I know the kind of gardens, natural areas, and botanical institutions European and American visitors like to see. My limited experience of living and traveling in China, and the information that my friends shared with me, enable me to tell approximately what places are available in China to satisfy the botanically minded or horticulturally inclined foreign visitors. For these reasons, I venture to offer a tentative itinerary for the reference of future tour planners.

The places suggested are marked by numbers on a map. Some of the places are mentioned in the letters of inquiry received. The insert of the map shows the longitudinally and latitudinally comparable positions of China and the USA and may help some tourists to plan the
kind of clothes to take along. There is no luggage problem within China, for all transportation and baggage are taken care of by the CTS.

1. Hongkong: Assuming that the tour lasts for a month and the group enters China via Hongkong, two or three days should be scheduled for seeing the vegetation and gardens there. The vegetation of Victoria Island has been under protection from fire for over one hundred years. The walk over the Peak will give a general idea of the species of Hongkong forests. In the New Territories, there is a beautiful 300-acre private garden — Kadoorie Farm — which is open to the public. It has a unique natural setting with streams, falls, colorful plantings, and spectacular view of the surrounding countryside with farms in the plains and a vegetation of fire-climax on the hillsides. If time allows, a stop should be made at the Tai-po-Kau Forestry Station of the Hongkong Government. Here one can see the results of afforestation under government management, the regeneration of a natural forest from a former village woods protected from cutting and fire, and the magnificent bamboo gardens planted in the 1930s when F. A. McClure was studying the bamboos of South China. Some of his species can be seen in this garden.

2. Canton: If the group is interested in the tropical gardens of China, two or three days should be allowed for Canton. In addition to the parks and gardens scheduled by CTS, requests should be made for visits to Kwangtung Botanical Garden, and the present Sunyatsen University located in the campus of former Lingnan University where F. A. McClure planted his Bamboo Garden. Permission may be obtained for visiting the following places of botanical and horticultural interest: Huang-pu (Whampao) where Peter Osbeck collected for Linnaeus in 1751 and Henry Fletcher Hance resided for a quarter of a century from 1860 onward; and Hua-ti (Fate-Flower Gardens) where William Kerr, the Botanical Collector of the Royal Botanic Gardens at Kew, obtained his specimens in the 1800s and where John Reeves got his plants for the Royal Horticultural Society, London in the 1810–20s.

3. Hangchow. Three or four days should be saved for this garden city of China. The CTS program covers many gardens by lakes and in hills (Fig. 1) and temple grounds. Special request must be made for visiting the Hangchow Botanical Garden, with particular emphasis on seeing the portion set aside as a natural reservation.

4. Shanghai: When our party was in Shanghai, we were shown schools and industry. After I returned to Canton, I was told of Miss S. K. Cheng’s work in establishing the Shanghai Botanical Garden. Request should be made to see it.

5. Soochow. A minimum of three days should be allowed for this area. The program of CTS includes many gardens within the city, and the Tai Lake commune which takes the group into the countryside. The gardens in Soochow with the moon gates (Figure 2), and
the rock work are famous throughout China, and have been treated as a stereotype of Chinese gardens in many western books. They are old, and some of them can be traced to the Ming Dynasty or earlier. The Tiger Hill (Hu-ch’iu), which is a public park now, is the only one which has a natural setting of massive cliffs and steep gorges. It has a tea house and a slanting pagoda. The other gardens formerly were private and are small. By skillful use of rocks and water, the designers were able to express nature in a reduced scale (Figures 3-4). Thus, in a small courtyard, one may feel the effect of hills, streams, cliffs and lakes, with plantings to fit with the ecological background.

6. Nanking: Two or three days should be scheduled for Nanking. The CTS program includes the Tomb area of Dr. Sunyatsen, the father of China as a republic. In the vicinity of the Tomb area the
Kiangsu Institute of Agricultural Sciences and the Kiangsu Botanical Institute and the Associated Botanical Garden, situated at the Ming Tomb, are two interesting places to visit. The vegetation of the Spirit Valley is better preserved than is that of the Tomb area, and the group may want to see a deciduous forest of eastern China there. Special requests must be made in advance for visiting the Nanking Technical Institute of Forest Products to see the result of Prof. P. C. Yeh's tree breeding, and the plantings of the medicinal plant gardens of the Nanking College of Traditional Chinese Medicine.

7. Peking: Four or five days should be set aside for Peking. There are many interesting places to see in this ancient city which is also the present capital. Botanically, Peking was the site where Alexander

Fig. 2. The moongate in a Soochow garden.
von Bunge collected in 1830–31. Many of our common ornamental garden trees and shrubs came from the Peking Hills, originally sent as seeds to the Arnold Arboretum and several European botanical gardens by Emil Bretschneider between 1866 and 1883. My time in Peking was too short to visit the hills. From the Palace ground I could see beautiful woods on the hills to the north, and also above the lake area of I Ho Yuan (Garden of Smiling Harmony, also known as the Summer Palace). My suggestion is that the tour leaders of botanical groups write to botanists in the Institutum Botanicum, Academia Sinica, 141 Hsi Chih Men Wai Ta Chie, Peking, for advice.

8–9. Central China. The following information I obtained from friends who visited Central China in the summer of 1973, and Kweilin in 1974. Hotel facilities are available for foreign visitors in Wu-Han (8) of Hupeh Province, and in Chang Sha (9w) in Hunan Province. People who have inquired about visits to Lu Shan Botanical Garden may like to know that Wu-Han is the nearest metropolis to Lu Shan. The name is an abbreviation of two adjacent cities, Wu Chang and Hankow (Han Kou). Botanists of the Hupeh Institute of Botany may answer questions about places of botanical interest in Wu-Han and about arrangements for visiting Lu Shan Botanical Garden.

Looking at a map of China, one may see that Wu-Han and Chang Sha are on a central artery of communication between Peking and Canton. It would be a very interesting trip if arrangements could be made for leaving Peking by train and stopping at Wu-Han for a few
days, then continuing the trip to Chang Sha by train. After visiting the hometown of Chairman Mao in Hunan, the group could proceed forward to Kweilin (Kwei Lin) in Kwangsi.

10. Kweilin: The natural beauty of Kweilin is well known in China. There is a saying that describes the superb scenery of the area: "The hills and waters of Kweilin is FIRST under heaven." There is a direct flight between Kweilin and Canton. A minimum of two days should be allowed for visiting this area.

Time and Expenses

The expenses of the trip depend primarily upon the time spent in China, and on personal likes and dislikes. Here I can only give my personal experience as a rough reference. I went to China with a Hongkong group (CTS Group 57). This designation was our identification and our address within China. It should be mentioned that when the name of an individual, the group number, and the city within China were given, all mail, telegrams, and long distance telephone calls were received.

In the summer of 1975, a Hongkong dollar was equivalent to US 20 cents; now its value is slightly higher. For the basic expenses of the tour, which was originally scheduled for July 12th (leaving Hongkong in early morning) to August 6th (leaving Canton at 8:20 A.M. and arriving Hongkong about noontime), each member paid in advance $4,000.00HK. This covered transportation, food, hotel (double room), and luggage. Later, our request for an extension of one more day in Peking was granted, and we each paid an additional charge of $100 00HK. The food was good and plentiful, the service excellent, the hotel rooms comfortable and with private baths, and the program full, including many entertainments in the evenings.

Drinks ranging from soft drink to beer, etc., are available in the dining rooms of the hotels at extra charge. In each hotel, there also is a shop for fruits, cigarettes, candy, and small gifts. In every city visited there was a Friendship Store that carried antiques as well as expensive modern articles. Such stores are open only to tourists.

Finally, it should be mentioned that hotel facilities for accommodating foreign visitors are limited in number and capacity. All the overseas Chinese holding passports of their naturalized countries are treated in China as foreign guests. On account of the large number of applications of these people who want to return to see relatives and friends, applicants often have to wait a long time for permission to travel in China. It pays to apply as early as possible and to be patient in waiting for the permit.

Acknowledgement

My deep appreciation is due to Miss C. H. Young and Mr. K. B. Liu for the photographs and for much help during my tour in China.

Fig. 3. Soochow garden rock work.
Ehretia thrysiflora. Photo: P. Chvany.

Of all the potentially productive forest land in this country, 59 percent — 300 million acres — is under private, non-industrial ownership. In the eastern part of the country the figure is as high as 73 percent. This book addresses itself to these woodland owners, who number 4.5 million, emphasizing their responsibilities and privileges. Having worked for many years with the U.S. Forest Service at forest experimental stations and being now Adjunct Professor at SUNY College of Environmental Science and Forestry at Syracuse, the author knows his subject and his readership. He provides detailed information on the forces that bear on their woodlands and on techniques of channelling these forces towards economic and esthetic goals.

The book, which deals exclusively with the eastern U.S., begins with a concise description of forestry and silviculture. Then follows a systematic presentation of the seven types of eastern forests, the five classes of tree for timber production, the five methods of timber cutting and the seven principles of planting. An important chapter focuses on the relation of woodland management to wildlife and fish habitat.

Modern dilemmas are laid out on the table. "Wildlife and fish belong to the people, their harvest is controlled by the state, but the land where the wildlife lives and the shores of the streams are controlled by the landowner." Professor Minckler does not have the answer, but it is refreshing to see clear-sighted definitions of this and similar problems. He is a straight shooter. For example, pond management in his view is relatively simply stated: "The only way to have an attractive and useful pond is to have it properly constructed in the first place and then to prevent pollution."

The three appendices contain addresses of agencies and book references to which the woodland owner can turn for advice and actual help. It is stimulating to find a book on ecology that does not devote itself to crying havoc, but provides a well-written set of practical and philosophical guidelines for the future management of our forests.

Richard Warren


The author has lifelong experience teaching children, and judging from the warm enthusiasm throughout her book, she must have been a marvelous inspiration to countless youngsters. Geared toward use by grade school teachers, the book presents a series of investigative "lessons" designed to teach the principles of nature study. As a source of ideas and information, it is equally valuable to parents, camp counselors and teachers of older children.

The institutional method makes full use of outdoor materials at hand, encouraging students to observe and investigate. A lesson on the dandelion brings together a multitude of disciplines. Counting individual flowerets and estimating reproductive possibilities teaches statistics and demography; etymology comes to the fore when one explains the deriv-
tion of the name from the French "dents-de-lion" and notices the supposed resemblance of the flowers to lion's teeth, in learning that the greens are edible, students are introduced to cultural and culinary practices of other people in other times.

Ten Minute Field Trips is a "learn and do" manual of exceptionally high quality. It deserves a position of prominence in classrooms throughout the country.

Elinore B. Trowbridge


The sprouted carrot top, sweet potato or avocado growing in a container of water has long adorned the kitchen window in many homes. This attractive, expensive, illustrated volume elaborates on the method of soilless culture, proposing that commercial or experimental methods of hydroponics can be used in the home or greenhouse. The point is stretched considerably with the suggestion that cauliflower, cabbage and squash can be so produced.

Richard A. Howard


There are many books on "how," but too few that emphasize the "when." Mr. Hudak's new book is of value to the amateur gardener whose interest has been limited to the evanescent world of annuals, and it also will assist the professional in plant selection. Each chapter represents a month of the growing season and is preceded by a listing of the color values of various perennials selected for hardiness and growth characteristics. This information on time, color, and site should mitigate the concern of those who wish to plant perennials but are afraid that their mistakes will confront them for many seasons.

The descriptive material is clearly written, and the pictures are good. Although the selection of plants for a book of this size admittedly cannot be encyclopedic, it is eminently practical and satisfies the writer's criteria of endurance, growth habits, and flowering traits. A pleasant bonus is an alphabetically arranged descriptive list of hardy ferns and an addendum of plants for specific conditions such as perennials with a blooming period of eight weeks or more, perennials having the bonus of foliage effects with or after blooming, etc.

While the book's emphasis is on useful practicality, it is also enjoyable reading and can be recommended without reservation.

Barbara O. Epstein


Cook books and manuals on growing house plants continue to proliferate. This simple, clear and instructive book on house plant pruning and propagation will certainly be of great assistance to the beginner. If it is read with care, the pleasures of plant propagation should be within the grasp of the ranker amateur.

An index of plants, listed both botanically and by their common names, and stating how they are best propagated, should be of much value to anyone who wishes to increase his house plant collection.

The format of the book is most attractive and the illustrations by Lauren Jarrett are both clear and charming.

Apples are ancient, delicious, mythological, medicinal, sexually symbolic and beautiful in flower and fruit. A book on their multiple aspects and assets should be welcome, but unfortunately, this book is not adequate. It attempts to cover the apple’s history, culture and folklore, with a hundred pages of recipes as a final chapter. But the history is too brief, the culture written in an over-simplistic and patronizing style (surely we do not have to be told that "each blossom has five petals"), and the folklore is too long and too speculative. The recipes are mainly adapted from Victorian cook books, and consist of such standard fare as “Brown Betty” and apple pie.

CORA L. WARREN


This 14½” x 10½” paperback compendium, copiously illustrated with line drawings in the Victorian manner, is nothing more than a product of the scissors and the photocopier. In general, The Gardener’s Catalogue consists of brief articles, lists and garden catalogue excerpts grouped under various topics. There are extensive lists of plant societies, plant sources, etc., some of them including England and Australia, so the editors obviously aspire to some sort of international market. Although there is a three-page index at the back, it is by no means complete.
For serious reference work, this book has many inaccuracies. A novice gardener will surely end up with horticultural indigestion. Because of its emphasis on the current popularity of nostalgia, however, it probably will sell well — only to grace many a white elephant table next year.


For more than thirty-five years, Alexander Skutch made a living in Costa Rica by providing herbarium specimens for institutions. He lived among the natives, acquiring a knowledge of their ornithology, horticulture, religion and economy. Despite the inexorable march of civilization and the resultant deforestation, vandalism and ecological upset, the author's joy in his surroundings is clearly felt. Skutch philosophizes on the myth that the tropical environment is one of easy bounty and explains how the "slash and burn" horticulture of the Mayans produced the present day nomadic population.

This work has the charm of the journals of Fairchild, Wilson and Teale. It is recommended to botanists travelling to Central America, to field naturalists in training, to armchair naturalists, and to those with a love of nature. I endorse it highly!

**Elinore B. Trowbridge**


The author introduces the need for changing to loamless potting compost by a comparison of the advantages and disadvantages of both loam and loamless based composts. An informative description of most available alternative compost components is followed by an analysis of the physical aspects of compost formulation, the principles of nutrition, and the procedures involved in compost preparation, fertilization and irrigation.

The manual, being written for the professional horticulturist, student and scientific hobbyist, includes many graphs, tables and figures which demonstrate the interactions between the potting compost, the plant material, and the cultural practices. The technical information, which is based on studies made in England, U.S.A. and several European countries, and the appendices, which contain important conversion tables and chemical constants, constitute a valuable reference manual for anyone intending to prepare composites for pot plants.

**Kenneth D. Shaw**

**House Plants Indoors/Outdoors.** San Francisco: Ortho Book Division, Chevron Chemical Co 97 pages, illustrated. $3.98.

Over 350 color photographs make this an attractive volume to glance through at leisure, but pictures are definitely not its only attributes. A clear, well-written text explains everything from air layering Dracaenas to Zebrina propagation. Many excellent photographs illustrate such processes as repotting, pinching and watering. These visual aids should delight the beginning gardener, and in this case, a single clear photograph is worth a thousand words.

In addition to the usual sections on artificial lights, pests and diseases, bulbs and individual house plants, there is an interesting calendar that tells you what you should be doing with certain of your plants month by month. A source list gives some of the retail outlets for common and not-so-common house plants.

A book such as this certainly ought to recruit legions of indoor plant fanciers. In addition, with its reasonable cost and lucid presentation, it ought to find its way onto many experienced gardeners' shelves as well.

**Margo W. Reynolds**
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