New Trees for Urban Landscapes

by Gary L. Koller

Across North America, nurserymen, landscape architects and horticulturists recommend specific tree species for urban use. Usually the trees are selected because of tolerance to infertile and compacted soils, drought, reflected heat, atmospheric pollutants, salts, and adaptability to limited maintenance.

Because plants are sought that thrive under the widest range of adverse conditions, the potential list of acceptable trees is restricted to perhaps fifty or sixty known and used species, varieties and cultivars. Of this total, perhaps fifteen or twenty are used commonly in a specific location because of availability, ease of transplanting, growth rate and cost.

The urban trees most commonly planted in North Temperate areas include the following: Acer platanoides, Acer rubrum, Acer saccharum, Cornus florida, Crataegus phaenopyrum, Crataegus crusgalli, Fraxinus americana, Fraxinus pensylvanica, Ginkgo biloba, Gleditsia triacanthos var. inermis, Liquidambar styraciflua, Malus sp. (Crabapples), Platanus occidentalis, Prunus sargentii, Pyrus calleryana, Quercus palustris, Quercus rubra, Sophora japonica, Tilia cordata and Zelkova serrata. These species are successful and popular, but there also has been an explosion of cultivars of each. This has resulted in the fact that more and more streets and parks are being planted to a wider array of fewer species of plants. This monoculture of trees can cause disastrous effects if they are attacked by insects and disease. Environmental stresses such as high water table, air pollution, abnormally low winter temperatures or highway de-icing salts also influence the health and well-being of the plants. An example is the American Elm (Ulmus americana). Plants across North America have been ravaged by Dutch Elm disease regardless of variation in form, foliage and growth rates, and attempts to locate disease resistant cultivars have been ineffective.

Species diversity in any living community adds long term stability to the total complex of organisms. Because of the few species presently utilized, coupled with the abundance of cultivars, urban foresters often recommend that no city or town plant more than 10% of the total tree population to a single species, including cultivars. Cultivars of a species might show variation in growth rate, form, flowers or autumn coloration, but possess essentially identical resistance, or lack of resistance, to environmental and cultural pressures.
This author believes that the cultivar approach to street tree selection has been overworked and has deprived our urban landscapes of the full richness of species diversity. The Arnold Arboretum traditionally has encouraged the introduction and testing of new plant species such as the following four trees, which have had limited but successful use under urban growing conditions.

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<th><strong>Cedrela sinensis</strong></th>
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Chinese Cedar possesses several landscape features that contribute to the success of an urban tree species: it is rapid growing; thrives in a wide diversity of soils; is tolerant of high applications of road salts; and has an open canopy that allows the passage of filtered light. It produces a clear yellow autumn color and the bark has distinctive plates that loosen to become shaggy strips. Most interesting is the fact that the leaves and young shoots can be eaten.

In sunny open situations the tree’s habit is upright and spreading, reaching heights of 60–70 feet and spreading 30–50 feet, a shape adapted to specimen use. When the tree is crowded or shaded, however, it tends to stretch upward producing a long thin bole with a spreading tuft of foliage at the top. This habit allows the tree to be used in groves where it develops visually exciting stem clusters.

Cedrela is undemanding from a cultural standpoint. Soil pH can be acid or alkaline; it requires a well drained soil and prefers full sun. Because of its limited cultivation in North America, little to no data has been collected on damage from insects and diseases. Hardiness has been observed to −25°F. During the winter of 1976–77, a large multi-stemmed plant at the Rowe Arboretum in Cincinnati, Ohio, survived with no dieback, according to Michael Dirr of the University of Illinois, Urbana.

Fall is the Cedrela’s season of ornamental beauty, for the cool nights and shortening days trigger the change from light green summer foliage color to clear pale yellow which contrasts beautifully with the tan-brown color of the shaggy bark. Seed pods high in the canopy open and fall to the ground, and their resemblance to tiny flowers makes them useful additions to projects using dried plant material for Christmas decorations.

From a landscape perspective this plant possesses several features that may detract from its use. It seeds vigorously, sends up root suckers, and has a useful landscape life of only sixty to eighty years before it begins senescence.

People who are not inclined to grow it for ornamental reasons may want to test Cedrela as a food source. The leaves and young shoots
are very tasty, possessing a distinct flavor somewhat similar to that of onions. According to Dr. S. Y. Hu of the Arnold Arboretum, Cedrela is a delicacy in China. Shoots and leaves are picked as they emerge in spring and before the shoots expand more than 4–6 inches. Omelets are made using the following recipe: chop and brown onions; as the onions turn color, add minced shoots and leaves of Cedrela. Toss lightly, slowly stir in beaten eggs, add salt and pepper to adjust seasoning and cook to desired consistency. Dr. Hu states that the plant is eaten more frequently in northern China where temperatures are cooler, for in Szechuan and southern areas the young shoots have a bitter flavor.

In mid- to late summer, old leaves are boiled in water and the liquid is used in baths for the relief of heat rash.
During a recent trip to the People's Republic of China, Dr. Richard A. Howard noted that Cedrela (Toona) is often interplanted in peach orchards where it is kept low and compact by continuous cropping for the edible foliage. In other areas, trees growing beside houses appeared as topiary sculptures for they are frequently climbed for the judicious removal of young stems and leaves.

The wood is reddish-brown, fine-grained and used in China as a substitute for mahogany. It is one of the best of the Chinese woods for furniture and wood details in building interiors.

Cedrela sinensis lining Vernon Road, Mt. Airy, Philadelphia, Pa. Photograph taken October 1976. Plants estimated to be approximately 80 years old. Photo: G. Koller.
Propagation experiments conducted at the Morris Arboretum in Philadelphia have proven that this tree is easily reproduced vegetatively. Best results were obtained by taking hardwood cuttings 6–8 inches long from juvenile or young trees in January or February. The cuttings were inserted in a soil mix of equal parts peat, perlite and sand and placed under mist or in a closed case. Bottom heat was maintained at 80°F. Cuttings rooted and began growth in eight to ten weeks and produced a plant 24–30 inches tall by the end of the first growing season.

According to Arnold Arboretum propagation records, seeds need no pretreatment prior to germination. However, a note indicated that seedlings are highly prone to damping off, so appropriate precautions such as a sterile soil, fungicidal soil drench and good air circulation around the seedlings may be helpful.

We have been unable to locate a commercial source for this tree in North America. However, specimens exist at the following public gardens which may share propagating material with interested nursery-people. Arnold Arboretum; Morris Arboretum; Skylands Botanic Park, Ringwood, N.J.; Morton Arboretum; National Arboretum; University of Washington Arboretum; Planting Fields Arboretum; Dawes Arboretum.
**Eucommia ulmoides**

Zone 5  
Height 40–50 ft.  
Family: Eucommiaceae  
Nativity: C. China

The lustrous dark green foliage of this tree is distinct and dramatic enough to set it apart from neighboring trees. The leaves are toothed and deeply veined, and resemble those of the American Elm. Its clean foliage is an asset to municipal arborists for where it has been used it has needed no spray applications to control insects and disease; in fact, no foliage problems have been reported.

Plant habit is variable and ranges from horizontal and wide-spreading branches to more ascending branching producing a rounded form. Ralph Shugurt, horticulturist at American Garden Cole, says that young seedlings produce straight stems but tend to be bushy and require corrective pruning for a good branch structure.

Eucommia is the only North Temperate tree that contains latex. During World War II, latex supplies from the South Pacific were restricted because of armed conflict. At this time, Eucommia was evaluated to determine its potential for use in creating a domestic rubber supply. The quantity and quality were low and extraction methods difficult, however, and these factors combined to eliminate its use as an economic crop; as a result the tree was almost forgotten.

At some point, street tree plantings were started in Cleveland, Ohio, and Indianapolis, Indiana, and as these trees reach maturity they are proving to be adaptable and desirable, attracting the attention of local landscape architects.
Eucommia is known medicinally as Tu-chung. Here a Chinese man transports bark to market where it will be brewed into tea, valued for centuries as a tonic medicine. Photographed in Yunyang Hsien, Eastern Szechuan, China, in July 1910 by E. H. Wilson.

Limited street tree trials indicate that the trees are tolerant of acid and alkaline soils and require only good drainage. Preferred exposure is full sun as growth rate and plant form are inferior under shaded conditions. They seem to possess a high tolerance to air pollution, which is perhaps due to a thick cuticle and a slick, glossy leaf surface from which dust and dirt easily slide. Tolerance of reflected heat and light, drought and restricted root space seem to be high.

The plant is interesting medicinally, for it has had a long history of use in Chinese herbal medicine and is known as Tu-chung in this context. The bark of Eucommia is roasted and used to prepare a tea that lowers blood pressure. In 1976, researchers at the University of Wisconsin analyzed the extract and isolated and synthesized the major anti-hypertension principle. During 1977, the People's Republic of China banned all export of the bark because of its extensive use and limited supply; as a result, bark is extremely expensive and hard to obtain in Chinese-American stores.

Left: Eucommia is valued for its glossy, dark green foliage which is remarkably free of insects and disease. Photo: G. Koller.
Right: Eucommia contains latex, and in this photograph the bark has been arranged to display the elastic fibers. Fruits are shown above. Photographed in Ichang, China, in 1911 by E. H. Wilson.
This male plant of Eucommia has a height of 30 feet and a circumference of 4 feet. Photographed near Patung Hsien, China, in January 1909 by E. H. Wilson.

Young trees are said to flower and fruit at the age of seven years. Insignificant flowers emerge in spring before or with the appearance of leaves. Separate plants are male or female and the female trees bear light green winged fruits 1½ inches long. The fruits contain 27% oil, and in China this oil is extracted for various industrial uses.

Propagation is easily accomplished by use of seeds, which can be collected in the autumn and planted directly into seedbeds outdoors with no treatment of the seed coat. Seeds to be started indoors require sixty to ninety days of stratification at 40°F prior to planting. Germination is rapid and the majority of the seedlings will be 12–18 inches tall at the end of the first growing season, with a few reaching 24–30 inches tall. Ralph Shugart reports that seedlings vary in vigor, leaf size and leaf color.

Chinese literature indicates that hardwood cuttings can be taken from one-year branchlets during early spring, before the leaves unfold. We have not yet attempted to test this propagation method at the Arnold Arboretum.

Commercial sources seem to be nonexistent in New England. The plant is available wholesale from American Garden Cole, Circleville, Ohio.
Pistacia chinensis Chinese Pistache
Zone 5 Height': 40-60 ft. Spread: 30-50 ft.
Family: Anacardiaceae Nativity: China

*Pistacia chinensis* has achieved popularity as a street tree in southern California, but it is virtually unknown in eastern and midwestern gardens. One might ask why this tree is so little known and grown. I believe it is because the plant's hardiness potential has never been fully evaluated and because there has been so little in the way of publicity promoting this tree species. This author has observed large plants growing at the Glen Dale Plant Introduction Station near Washington, D.C., at the Morris Arboretum in Philadelphia, and at the O. E. White Research Arboretum in Boyce, Virginia. At each location, the plant seemed not only to be surviving, but thriving.

In attempting to evaluate cold hardiness potential, I contacted Dr. William Ackerman of the National Arboretum. He related that scions were received at the Plant Introduction Station in Glen Dale, Maryland, from trees at the Plant Introduction Center in Chico, California. Grafting took place in 1959 and two plants are being grown today. At the end of the 1977 growing season, or eighteen years from grafting, plant A had a D.B.H. of 8 inches, a height of 20 feet and a spread of 16 feet. Plant B had a D.B.H. of 6 inches, a height of 15 feet and a spread of 18 feet. They also have fifteen plants grown from seed in 1962. In 1977, at the end of the fifteenth season, the plants averaged a D.B.H. of 4 inches, were an average of 14 feet tall and had an average spread of 10 feet. Dr. Ackerman further states that the lowest temperature to which the plants have been subjected since they have been grown outdoors in Maryland has been $-10^\circ$F, with no apparent dieback or structural damage from ice and snow.

Paul Meyer, Curator at the Morris Arboretum, states that their plant had no damage when winter temperatures dropped to $-15^\circ$F during the winter of 1976–77. Their plant was received as a B&B plant in 1961 and at the time of the coldest weather it was well established in its growing location and sheltered by a hill from sweeping winds.

Michael Dirr has observed one plant fifteen to twenty years old growing in a home landscape in Champaign-Urbana, Illinois. The plant is 15 feet tall and is protected from the sweeping west winds by a house. While the plant hasn't grown well, it has survived temperatures of $-20^\circ$F during the winter of 1976–77.

During the spring of 1977, the Arnold Arboretum received twenty test seedlings, 6 inches tall, from Monrovia Nursery Co. in California. These plants were left out-of-doors for the 1977–78 winter in an unprotected saran house. Minimum temperature for the winter was $-1^\circ$F and there was a deep and constant snow cover from early
Pistacia chinensis is valued for its brilliant red to purple autumn foliage. Photo: G. Koller.

January through mid-March. In spring 1978, the seedlings were transplanted to a larger growing area and in late July fifteen plants survive. We are not sure whether the five plants that died off did so because of lack of hardiness or because of transplant difficulties.

These successes are by no means fair or reliable indicators of hardiness, but they do illustrate that the plant may be harder than generally assumed and cultivation is worth attempting in areas with winter temperatures as low as −15°F. Unfortunately, plants now grown in North America seem to represent limited genetic diversity because most have originated from the same source. To extend the plant's useful landscape range, we need to secure seedling populations grown from northern, high elevation locations in the People's Republic of China or northern areas of Korea.

Pistacia chinensis at the ascent of Fet-Yüel-ling, near Tung River, China. Tree has a height of 80 feet, a stem circumference of 10 feet, and is growing at an altitude of 6500 feet. Photographed in August 1908 by E. H. Wilson.
The compound leaves of Pistacia are an ornamental reddish-purple as they emerge, turning to a light green at maturity. Autumn color ranges from yellow-orange through reddish-purple and color varies among seedlings; individual seedlings differ from season to season. Dr. Skimina of Monrovia Nursery Co. reports that in southern California trees are not colorful but in cooler areas the autumn foliage ranges from orange to red. Dr. S. Y. Hu recalls that during her childhood in the People's Republic of China an annual event was a trip to Senyatsen Tomb National Park near Nanking to see the brilliant autumn display provided by Chinese Pistache.

In this species, sexes are separated into male and female trees. Flowers are insignificant, but, according to Dr. Ackerman, fruiting clusters are extremely ornamental, frequently with a mixture of blue-green (fertilized) and bright red or sometimes white (unfertilized — with empty seed capsules) fruits in the same or adjacent fruit clusters. Growth seems to be more rapid in male plants.

All people questioned stated that this tree is free of insects and disease, easy to transplant and tolerant of urban conditions, adapting to acid or alkaline soils. One notable attribute is adaptability to drought conditions, perhaps due to its tap root which provides strong anchorage as well as the ability to reach deeper water sources. *Pistacia chinensis* requires good soil drainage and exposure to full sun to encourage optimum growth and best form.

The pinnately compound foliage creates an open canopy allowing the passage of filtered light. Correspondents observe that small groves of the plant are often more effective visually than are single specimen plants.

Growers state that the plant is somewhat floppy in youth and requires staking and corrective pruning in order to develop good structure and a high canopy. General concensus from the nurserymen and landscape architects who know and grow this plant is that *Pistacia chinensis* deserves more widespread use.

While this plant has potential modern applications, ancient and traditional uses are many. According to the *Illustrated Manual of Chinese Trees and Shrubs* by Chen Yung, the wood is light yellow, fine-grained, and in China is used for furniture, farm implements, stakes and carving. Monks in the mountains of Chekiang and Hupeh pick and dry the tender young shoots for later use as a tea. The fruits are gathered by farmers and pressed to remove the oil which is used in cooking and to fuel lamps.

*Pistacia chinensis* is easily propagated by seeds. Prior to planting, the pulp should be removed and the seed should be soaked in water for sixteen hours. No information was discovered regarding vegetative propagation of this species.

Plants are available wholesale from Monrovia Nursery Co., in Azusa, California.

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*Trunk of the largest specimen of Pistacia chinensis E. H. Wilson observed in China.*
**Sorbus alnifolia**

Zone 5 (4?) Height: 30-60 ft. Spread: 25-50 ft.

Family: Rosaceae Nativity: China, Korea, Japan

Korean Mountain Ash combines abundant flowers and fruit production, golden to orange-bronze autumn color and attractive smooth gray bark, giving it a multiseason landscape value and making it the perfect choice for the home as well as the urban setting.

Flat-topped terminal clusters of single white flowers ¾-inch across appear in early May; young trees show alternate-year flowering and fruiting characteristics. Highly ornamental small, pea-sized fruits ripen in September and vary in color from bright reddish-pink to reddish-purple, color being dependent on seedling variation. As the fruit ripens, the leaves change from dark green to a stunning blend of oranges and browns. The autumn foliage provides a colorful stage to highlight the outer fruit clusters; the inner clusters are hidden. Autumn color is most effective after the leaves have fallen away and the small reddish-pink fruits stand alone. Due to the abundance of fruits and the bright coloration, they provide a glow or aura to the tree in the waning autumn sunlight.

Growth rates are moderate in young trees and slow as the tree reaches maturity. Habit varies depending on training during young stages. The plant can be grown single-stemmed by encouraging

*Sorbus alnifolia* combines golden to orange foliage and bright red to purple fruit for a stunning autumn display. Photo: G. Koller.
branching to begin at the 8- to 10-foot level. Where space is available, the tree can be grown multistemmed from directly above the soil level and will develop into a huge rounded mass 40-50 feet tall.

During the winter the rounded silhouette is enhanced by the tracery of the smooth silver-gray stems and larger branches. The branches are strongly upswung giving rise to narrow crotch angles which one would assume to be structurally weak. However, this author's observations fail to reveal a propensity to damage from ice loads and strong winds.

*Sorbus alnifolia* adapts to an acid or alkaline soil pH and is not particular as to soil type as long as drainage is adequate. Fibrous branching roots contribute to ease of transplanting and rapid re-establishment.
Sorbus alnifolia can be grown multistemmed or headed up to create a single stemmed street tree. Mature habit is rounded. Photo: G. Koller.

Preferred exposure is full sun. While this species thrives in a wide climatic range along the East Coast and Midwest, it seems to perform best in cooler areas from the ornamental perspective of autumn foliage and fruit color. Damage from insects and disease are minimal, although this author has seen mild cases of leaf spotting and the tree is said to be susceptible to fire blight.

Mountain-ash (Sorbus aucuparia), a related species, has been widely used as a street tree in some northern areas. However, success has been greatly reduced because it is prone, especially under stress, to attack from stem borers which cause the tree to decline and die at an early age. Sorbus alnifolia, on the other hand, seems to resist borers, giving this species the attribute of longer survival potential under urban conditions.

Korean Mountain Ash is easily grown from seed which is collected in the autumn, cleaned of fleshy pulp and placed in outdoor seedbeds for germination the following spring. Indoors, a cold stratification at 40°F for sixty days ensures optimum germination.

During spring 1979, this plant will be available in the Boston area from Seltzer's Garden City, Inc., in Newton, and from Weston Nurseries in Hopkinton; it is available wholesale from Princeton Nurseries in Princeton, New Jersey. Seeds may be obtained from Koryodang International Flower Service, Central C.P.O. Box 1718, Seoul, Korea.

In this article I have proposed four trees that are old-timers in American botanical gardens and may prove to be tough, adaptable materials for urban landscapes. What is needed now is a group of progressive nurserymen, street tree commissioners, landscape architects and individual homeowners who will install test plantings for long-term evaluations under a variety of growing conditions. Only in this way will we adequately determine the cultural and environmental adaptability of these new trees for urban landscapes.