LITTLE–KNOWN ELMS FROM CHINA: LANDSCAPE TREE POSSIBILITIES

by George H. Ware

Abstract. Elms from China offer good possibilities as urban trees because of good levels of disease resistance, stress tolerance, and aesthetic appeal. Success in obtaining seeds of little–known elm species has made possible the assembling of a large collection of elms at the Morton Arboretum. Assessment of the potential of these elms as urban trees is proceeding. Some of the elms from China are producing flowers, giving opportunities for hybridization. Several recently received species are new to North America, with arboricultural qualities and urban–use potential virtually unknown. Descriptive information has been obtained from a translated monograph on elms of China.

Elms from China offer great opportunities for increasing diversity of tree species in urban landscapes. Indeed, the need for diversity has been dramatically demonstrated by the tragic fate of an elm. American elm (*Ulmus americana*) has long been considered to be the closest to an ideal street tree in the U.S. because of its form, size, vigor, toughness, longevity, appeal, and general acceptability. Unfortunately, Dutch elm disease (DED) has made the future of American elm uncertain. In recent years good progress has been made in the development of DED– resistant strains of American elm. Much progress has also been made in the development of DED–resistant hybrids that involve both European and Asian species.

Before DED decimated the streetscapes of eastern North America, lofty arcades of American elm trees left indelible impressions and nostalgic memories. There were some sobering outcomes and lessons from the DED devastation. Among them were increases in expense for tree removal and emerging challenges as to what trees to plant as replacements. These events had much to do with the facilitation and acceleration of the growth of the profession of arboriculture. A significant lesson was that the widespread popularity of a single species may lead to serious negative landscape and economic consequences. Even today lessons on the vulnerability of a "monoculture" have not yet been sufficiently learned. Reports of problems with overplanted species and cultivars are common. Encouragingly, there is growing awareness of the need to diversify. New elm species from China may have a place in increasing the diversity of urban tree plantings.

The Morton Arboretum has an extensive collection of elms, with origins dating back to the establishment of the Arboretum in 1922. In the early years, much of the elm material consisted of European species and hybrids. Remarkably, few of these old–timers have succumbed to DED, though most are considered to be susceptible. The collection contains all six of the species native to the U.S., all of which are known to be susceptible.

Pest Resistance

Asian elms appear to have good levels of resistance to DED. Of the more than 20 species of elms native to China, results of testing have been sufficiently encouraging to indicate that elms from China may be a great reservoir of germplasm for increasing diversity and enhancing the attractiveness of urban landscapes of North America. But, until recently, obtaining seeds of little– known elm species from China was exceedingly difficult.

Two elm species from China, Siberian elm (*U. pumila*) and lace–bark elm (*U. parvifolia*), are sometimes seen on urban landscapes. These trees have been available in the United States for many years. Siberian elm (often incorrectly called Chinese elm) is a fast–growing, widely planted street tree. It is used throughout the Midwest and Great Plains. Though it provides quick shade, it is often damaged by high winds or icing (1). It is highly susceptible to leaf damage and disfigurement from elm leaf beetles. It is not, therefore, regarded as a quality landscape tree. Lace–bark

elm (or true Chinese elm) is an attractive medium–sized tree with small, leathery, glossy leaves. It is not commonly planted but is promising as an urban tree in many parts of the United States. Unfortunately, it is not sufficiently hardy for dependable use in northern States. Selections with greater winter hardiness are needed.

Asian elms are generally free from several maladies affecting American and European elms. In feeding tests with elm leaf beetles, Asian elms have shown generally good levels of repugnance to the beetles; *U. pumila* is a significant exception (2). Elm leaf miners may seriously disfigure European and certain North American elm species. Miners appear to have little effect on Asian elms except for *U. laciniata*. Carter and Carter (3) note that Asian species are not affected by elm yellows (phloem necrosis). Thus, it appears that Asian elms have some good credentials as subjects for selection and breeding toward increasing diversity and enhancing American urban landscapes. Asian elms figure prominently in discussions of elm cultivars (4,5).

Some favorable events in the past fifteen years have made possible the enlargement of the collection of elm species at the Morton Arboretum. The elm research program reached an important milestone in the late 1970's after China became accessible to American scientists. By 1980 professional interactions had brought seeds of six rare elm species from botanical centers in Beijing, Hangchow, and Harbin. These were the following: Szechuan elm (*U. szechuanica*), large–fruit elm (*U. macrocarpa*), Gansu elm (*U. glaucescens*), David elm (*U. davidiana*), Hebei elm (*U. lamellosa*), and corkbark elm (*U. propinqua*). Two promising species, Japanese elm (*U. japonica*) and Wilson elm (*U. wilsoniana*) were already in Arboretum collections. These eight species are now flowering and producing seed crops. The following descriptions of these elm species are based upon a detailed study of elms by Fu (6).

The *Ulmus davidiana* Complex

In his *Ulmus* monograph, Fu considers *U. davidiana* to include a number of related taxa. However, four of these taxa may be treated as species because of their separate geographic ranges, special ecological attributes and distinctive qualities related to their promise as useful landscape trees. The *U. davidiana* complex includes: *U. davidiana*, *U. japonica*, *U. wilsoniana*, and *U. propinqua*. Fu recognizes the closely related *U. szechuanica* as a separate species. All of these elm entities have medium–sized leaves and branching patterns somewhat similar to those of American elm. A distinctive difference is that all five have numerous obovate leaves in contrast to the ovate leaves of American elm (Figure 1).

All four taxa of the *U. davidiana* complex and *U. szechuanica* appear to have promise as urban trees. *U. davidiana* as observed in Heilongjiang Province in northeastern China has several favorable features that seem to equip it for successful urban use (7). In Heilongjiang, it attains a height of 15 to 20 meters. The resemblance of countryside specimens in Heilongjiang to American elm is remarkable (Figure 2). Foliage is a deep green with impressive glossiness. Leaves are mostly obovate and slightly smaller than those of American

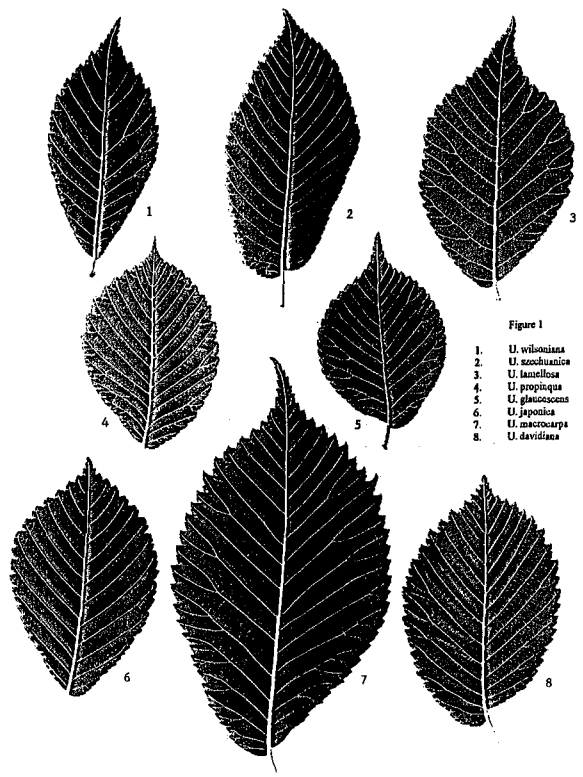

Figure 1. Leaf prints of eight species of Asian elms.

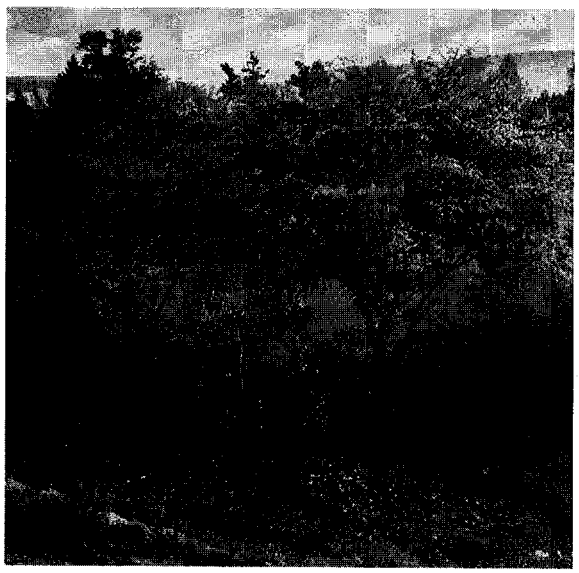

Figure 2. Fifteen meter tall trees of *U. davidiana* in Heilongjiang Province in northern China.

elm. Spontaneous trees colonize open areas, pastures, and riverine places. Tolerance of poor soils is good.

U. japonica occurs in the same regions as *U. davidiana* but is closely associated with forest land. *U. japonica* was observed in Heilongjiang as a tall tree (20 to 25 meters) with a somewhat dominant central trunk. It appears to be associated with well– drained slopes as an integral part of the forest community. Open–grown specimens appear to be remnants following logging. Even these specimens retain a narrow crown. Specimens of *U. japonica* growing on well–drained soil at the Morton Arboretum have done well but specimens growing on clayey soils have grown very slowly. In contrast, specimens of *U. davidiana* (Figure 3) at the Morton Arboretum appear to tolerate clayey soils satisfactorily.

U. szechuanica is native to the upper Yangtze River region in Szechuan and Hubei Provinces. It appears to be a forest tree, growing best in well–drained soils. It is a small to medium tree (8 to 10 meters) with a spreading umbrella–like crown. Emergent foliage is reddish for several weeks in springtime. Bark is grayish–black with superficial, peeling vertical scales. *U. wilsoniana* is related to *U. szechuanica* but appears to be a somewhat

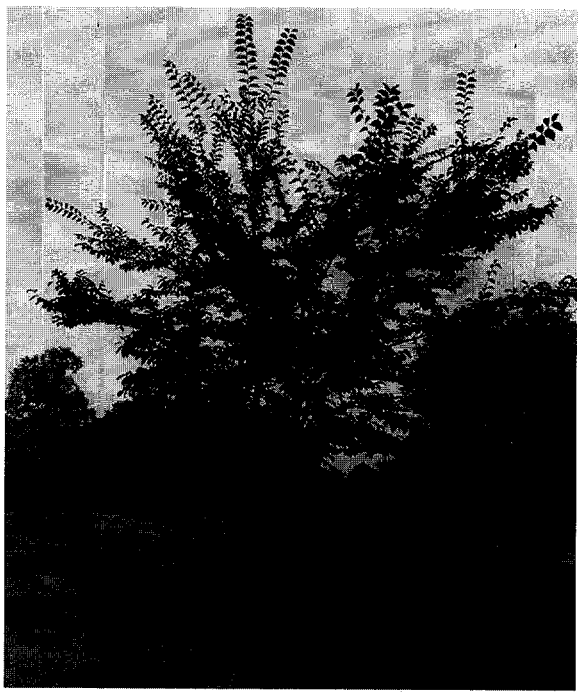

Figure 3. Specimen of *U. davidiana* in the Morton Arboretum.

larger tree. *U. wilsoniana* also develops a spreading crown with wand–like branches elongating well into summer. Reddish emerging foliage is also a feature of *U. wilsoniana*. In contrast to the dark bark of *U. szechuanica*, *U. wilsoniana* has light gray bark with small separate vertical scales. Both *U. szechuanica* and *U. wilsoniana* appear to have branches more easily breakable than those of *U. davidiana* and *U. japonica*. Both *U. wilsoniana* and *U. szechuanica* grow best on well–drained soil but tolerate somewhat adverse sites. Both appear to tolerate conditions of Horticultural Zone 5 but may suffer occasional winter damage.

U. propinqua is a small tree (8 to 10 meters) that appears to tolerate a wide range of soil situations, but appears to be more slow–growing than other elms of the *U. davidiana* complex. The branches of *U. propinqua* are often markedly corky; pubescent twigs are reddish brown. Its obovate leaves are pubescent on both surfaces. Leaves are medium–green without glossiness. *U. propinqua* is native to Inner Mongolia and regions beyond the forest toward grasslands in northern

China. *U. propinqua* appears to have considerable promise as a landscape tree for adverse downtown places but its tolerance of seasonal soil wetness is not known.

Other Asian Elms

Another group of Asian elms includes *U. macrocarpa, U. lamellosa,* and *U. glaucescens. U. macrocarpa* was named for its unusually large fruit which appears to be the largest fruit among all elms, with a diameter up to 3.0 cm. The leaves of this elm are large and obovate, having a somewhat acuminate tip (Figure 1). Twigs often develop corky wings that may persist for a few years. The bark becomes rough–surfaced with uneven vertical ridges. Ten–year–old trees at the Morton Arboretum resemble American elm but have a somewhat stiffer branching pattern (Figure 4). This elm may attain a height of 14 meters or more. It grows in generally adverse situations in the mountains of northern China. It does best in well–drained soils and does not tolerate prolonged soil wetness or inundation. It is a suitable tree for parks, campuses, and other open areas and may also be a possibility for streetscape use.

U. lamellosa (Figure 5) is related to *U. macrocarpa* but is distinguished by its flaking mottled bark. It has obovate leaves similar to those of U. macrocarpa but smaller. A rounded crown is supported by a slender trunk and slender branches. It appears to be a suitable tree for parks, campuses and open areas and possibly for street use. It attains a height of 10 to 12 meters. Fall color is a rich golden yellow.

A third species in this group is *U. glaucescens*, a small tree of northern China, from dry regions. It appears to reach 8 to 10 meters in height. It does not tolerate wet soils. Some specimens show peeling mottled bark similar to that of *U. lamellosa.*

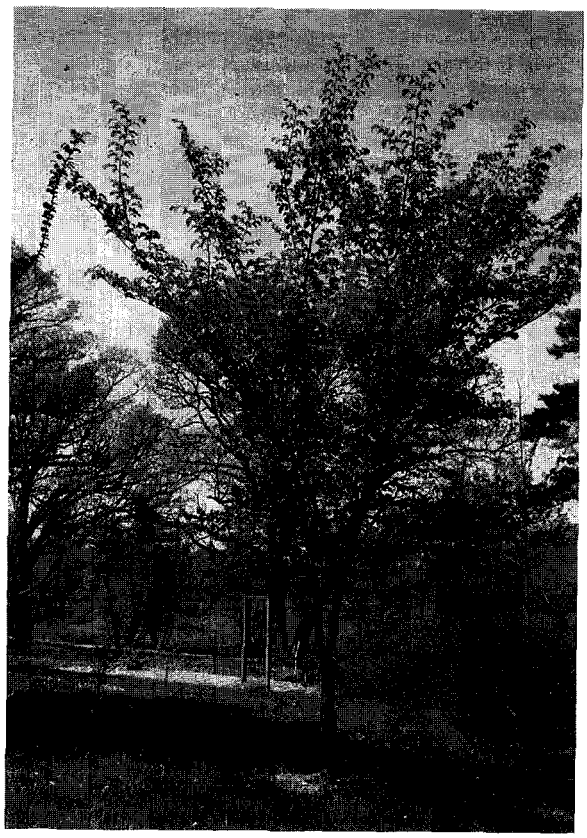

Figure 4. Specimen of *U. macrocarpa* at the Morton Arboretum.

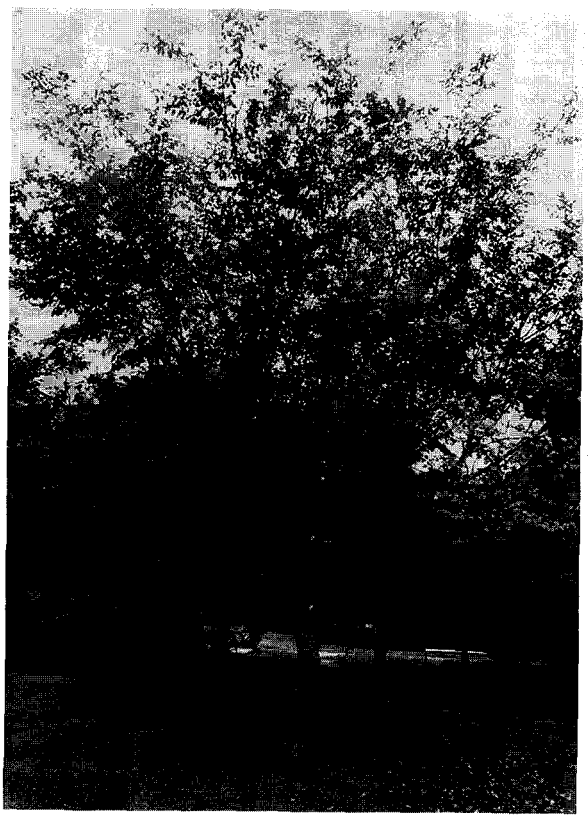

Figure 5. A ten-meter tree, *U. lamellosa*, at the Botanical Garden of the Academy of Science, Bejing, China.

Little is known of its ecological and edaphic qualities but it appears to have limited promise as an urban tree, but its drought tolerance could be an advantage for use in the Great Plains.

These eight little-known elm species provide numerous possibilities for selection and introduction of new trees for urban landscapes. Selective hybridization among these elms is extending the potential for developing, even tailoring elms for specialized urban uses. An interesting example is a *U. davidiana* x *U. propinqua* hybrid attaining a height of no more than 5 to 8 meters. Its strong horizontal branches make it an excellent possibility for use under power lines. Consistently good red fall color is a great bonus.

New Arboretum Additions

In 1993, a second major milestone was reached in Arboretum elm research. New contacts with Chinese foresters yielded seeds of eight additional elm species and varieties, most of which came from remote regions of China, collected on specially commissioned field trips.

These new elms are the following: *U. elongata, U. gaussenii, U. chenmoui, U. castaneifolia, U. changii, U. bergmanniana* and its variety *lasiophylla, and U. propinqua* var. *suberosa.* These "treasures" are especially valuable for enlarging the size and enhancing the quality of the Arboretum's elm collection. Observations of the growth, appearance, and promise of these new elms will provide new and valuable information to American arboriculture.

Still another episode in the saga of new elms from China occurred in 1995 when seeds of additional elms arrived: *U. lanceaefolia* from Yunnan Province and *U. taihangshanensis* from Hainan Province. Little is known about either of these species.

Germination of seeds of all of the new species has been good and observation of the plants is underway, with rapidly growing seedlings. Assessing the arboricultural qualities – and shortcomings – is an exciting and challenging prospect.

Conclusion

The value and desirability of promoting elms are supported by their special attributes: the richness of potential urban tree material; their general adversity–tolerance; their widely admired attractiveness; and their suitability and acceptability for urban use. Hans Heybroek, noted Dutch elm researcher, asserts that "elm is perhaps the most versatile and durable urban tree" (8).

Literature Cited

1. Webb, W.E. 1948. *A report on Ulmus pumila in the Great Plains region of the United States.* J. Forestry 46(4): 174–278.
2. Miller, F. and G. Ware. 1994. *Preference for and suitability of selected elms (Ulmus spp.) and their hybrids for the elm leaf beetle (Pyrrhalta luteola Coeoptera: Chrysomelidae).* J. Environ. Hort. 12(4): 231–235.
3. Carter, J.C. and L.R. Carter. 1974. *An urban epiphytotic of phloem necrosis and Dutch elm disease, 1944–1972.* Illinois Natural History Survey Bulletin 31: 113–143.
4. Guries, R.P. and E.B. Smalley. 1986. Elms for today and tomorrow. Proceedings of the Third National Urban Forestry Conference. pp. 214–218
5. Santamour, F.S. and S.E. Bentz. 1995. *Updated checklist of elm (Ulmus) cultivars in North America.* J. Arboric. 21(3): 122–131.
6. Fu, Li-Guo. 1980. *Studies in the genus Ulmus in China.* J. North–Eastern Forestry Institute 3: 1–40.
7. Ware, G.H. 1992. *Elm breeding and improvement at the Morton Arboretum.* The Morton Arboretum Quarterly 28(1): 1–5.
8. Heybroek, H.M. 1993. Why bother about the elm? **In** Sticklen, M.B. and J.L. Sherald, Dutch Elm Disease Research: Cellular and Molecular Approaches. Springer–Verlag. 343 pp.

Research Associate
The Morton Arboretum
Route 53
Lisle, IL 60532