Introduction of North American Trees into China

A brief summary

by C. K. Sheng

In developing their own agricultural, silvicultural and horticultural enterprises, the Chinese people have made a great effort to introduce economic and garden plants from foreign countries since very remote times. Plant introduction not only has enriched Chinese plant resources and bettered livelihood and social economy, but it also is a beautiful chapter in the history of the mutual exchange of friendship and civilization between the peoples of China and of other countries.

In spite of the fact that China is one of the centers of diversity of cultivated plants, the uneven distribution and geographic isolation of plants in the world has compelled the Chinese people to explore for and introduce plants they wanted from abroad.

The vast territory, the complicated climatic and edaphic conditions, and the diversity of agricultural practices in China afford a great possibility for plant introduction and acclimatization. For a thousand years, but especially after the founding of the People's Republic, the Chinese people have greatly benefited from their efforts in the collection of useful plants not indigenous to their country.

After the discovery of the New World, North American plants, es-

Professor Sheng was a member of a delegation of botanists from the People's Republic of China which visited the Arnold Arboretum in early May of 1979. We are honored to present this article of his to the readers of Arnoldia. Present address: Botanic Garden of Nanking, Institute of Botany, Kiangsu, People's Republic of China.
pecially those from the United States of America, became new settlers in China via different channels, and in no lesser way Chinese plants became immigrants to the New World through enthusiastic American plant hunters.

To summarize the whole story of the introduction of American plants into China would be a rather tedious task, and even the present discussion of the introduction of woody plants can by no means be given in great detail.

The introduction of North American trees into China has a history of about one hundred years. By the end of the last century sporadic introduction was carried on here and there by some Chinese nurseries and garden amateurs, as well as by American citizens and diplomats in China. Robinia pseudoacacia, Carya illinoiensis, Juglans nigra, Taxodium distichum, T. ascendens, Ulmus americana, and Catalpa speciosa were the forerunners.

During the thirties of this century conditions improved for plant introduction, although only two botanic gardens were then established: those at Nanking and Lushan. North American conifers such as Pinus elliottii, P. taeda, P. palustris, P. echinata, P. rigida, Cupressus arizonica, and Thuja occidentalis, and broad-leaved trees such as Platanus occidentalis, Liriodendron tulipifera, and Magnolia grandiflora were the newcomers which adorned the Chinese landscape and campus in the coastal cities of the subtropical provinces in eastern China. Meanwhile, interest in introducing Chinese trees was greatly promoted on the American continent. It is worth mentioning Professors R. W. Chaney and E. D. Merrill, as a result of whose extreme interest in Chinese plants the first package of seeds of Metasequoia was sent from Nanking in December 1947, arriving at the Arnold Arboretum on January 5, 1948.

After the founding of the People's Republic, the introduction of North American trees into China was put on the right trail for the first time. More botanic gardens were established in the various provinces and districts, and these acted as trial grounds for tree introduction. Among the fifteen exotic coniferous trees on the official introduction list, the following thirteen are North American species:
Growth of some North American trees in China

CONIFERS

Pinus: About twenty species of North American pines have been introduced. They may be grouped into three categories according to their degree of adaptability after introduction.

1. Promising species, extensively planted in the Yangtze and Pearl River Valleys — Pinus elliottii, P. taeda, P. palustris, P. caribaea, P. serotina, etc.

2. Growth normal, but not yet to the stage for commercial planting — Pinus echinata, P. ponderosa, P. strobus, P. rigida, etc.

3. Species with uncertain possibilities — Pinus banksiana, P. leiophylla, P. jeffreyi, etc.

Among Pinus species, P. elliottii and P. taeda have been fast growing in the district of Nanking. They both produce new shoots three to four times during the growing season. Their straight boles and almost complete immunity to the infection of Dendrolimus punctatum and Matsucoccus matsumurae, which threatened the growth of P. massoniana, have made them valuable timber trees. The resin yield of the adult tree of P. taeda in Kwangsi is 50% higher than that of P. massoniana. But sporogenesis and the development of the young cone of P. elliottii are handicapped by low spring temperatures in the district of Nanking, while the fertility of the hardier P. taeda reaches 60–70%.

<table>
<thead>
<tr>
<th>Table 1. Growth of American Species of Pinus.</th>
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<tbody>
<tr>
<td>Specie</td>
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<tr>
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</tr>
<tr>
<td>Pinus elliottii</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td>Pinus taeda</td>
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<td></td>
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<tr>
<td>Pinus palustris</td>
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**Taxodium**: It has been forty to fifty years since *Taxodium* species were introduced to Nanking and Wuhan. Their characteristically fast growth and their ability to withstand strong wind and water-logged soil attracted the appreciation of the people and they soon became familiar trees in eastern and southern China.

**Table 2. Growth of American Species of *Taxodium***

<table>
<thead>
<tr>
<th>Species</th>
<th>Years of introduction</th>
<th>Av. height (m.)</th>
<th>DBH (cm.)</th>
<th>Age (yrs.)</th>
<th>Locality</th>
<th>Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Taxodium distichum</em></td>
<td>1917, 1957, 1959</td>
<td>17.0</td>
<td>39.5</td>
<td>50</td>
<td>Nanking</td>
<td>low</td>
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<td></td>
<td></td>
<td>5.0</td>
<td>15.0</td>
<td>14</td>
<td>&quot;</td>
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<tr>
<td></td>
<td></td>
<td>7.5-10</td>
<td>19-24</td>
<td>16</td>
<td>Wuhan</td>
<td></td>
</tr>
<tr>
<td><em>Taxodium ascendens</em></td>
<td>&quot;</td>
<td>14.0</td>
<td>30.5</td>
<td>50</td>
<td>Nanking</td>
<td>40-50%</td>
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<tr>
<td></td>
<td></td>
<td>6.6</td>
<td>11.7</td>
<td>14</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td><em>Taxodium mucronatum</em></td>
<td>1933</td>
<td>21.0</td>
<td>80.0</td>
<td>40</td>
<td>&quot;</td>
<td>low</td>
</tr>
</tbody>
</table>

**Table 3. Growth of American Species of *Sabina (Juniperus)* and *Cupressus***

<table>
<thead>
<tr>
<th>Species</th>
<th>Years of introduction</th>
<th>Av. height (m.)</th>
<th>DBH (cm.)</th>
<th>Age (yrs.)</th>
<th>Locality</th>
<th>Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sabina (Juniperus)</em></td>
<td>1930</td>
<td>12.4</td>
<td>28.6</td>
<td>21</td>
<td>Nanking</td>
<td>high</td>
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<tr>
<td><em>virginiana</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Cupressus lusitanica</em></td>
<td>1959</td>
<td>13.0</td>
<td>30.0</td>
<td>20</td>
<td>&quot;</td>
<td>difficult to form &quot;female&quot; cones</td>
</tr>
<tr>
<td><em>var. benthamii</em></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cupressus arizonica</em></td>
<td>1934</td>
<td>9.0</td>
<td>23.6</td>
<td>24</td>
<td>&quot;</td>
<td>low</td>
</tr>
</tbody>
</table>

*Cupressaceae*: Four genera [*Thuja, Cupressus, Chamaecyparis, and Sabina (Juniperus)*] and fifteen species of North American Cupressaceae have been introduced into China. Among them *Thuja occidentalis* and *Chamaecyparis lawsoniana* have always suffered from the hot dry summer in Nanking, and they prefer the mild summer climate at Lushan Botanic Garden (1100–1200 m.). *Sabina (Juni-
perus) *virginiana*, *Cupressus lusitanica* var. *benthamii* and *C. arizonica* are three other species which were introduced into Nanking. Two ecotypes and various forms of *Sabina (Juniperus) virginiana* were found among the introduced population and the growth rate of the selected individuals exceeded that of both *Biotia (Thuja) orientalis* and *Sabina (Juniperus) chinensis*. *Cupressus lusitanica* var. *benthamii* grows faster than local *C. funebris* and it has even surpassed exotic pines, but the cold spring in Nanking prevents it from fruiting.

The newcomers among Taxodiaceae are *Sequoia sempervirens* and *Sequoiadendron giganteum*, both of which were bestowed upon the Botanic Garden of Hangchow by former President Nixon as a token of friendship between the Chinese and American peoples. Chinese silviculturists are busy attempting to establish a redwood forest along coastal regions in Chekiang province.

Other conifers besides those mentioned above include:

- *Cupressus goveniana*
- *C. macrocarpa*
- *C. macnabiana*
- *Pinus banksiana*
- *P. glabra*
- *Pinus leiophylla*
- *P. monticola*
- *P. muricata*
- *P. virginiana*
- *Pseudotsuga menziesii*

**BROAD-LEAVED TREES**

Only about thirty genera and fifty species of North American broad-leaved trees have been introduced into China. Two members of the family Leguminosae — *Robinia pseudoacacia* and *Amorpha fruticosa* — are the most popular ones among them. The former made its earliest appearance at Tsingtao more than seventy years ago and since then it has been widely planted in the cities and the countryside at regions between Lat. 23°-46° N and Long. 86°-124° E. *Liriodendron tulipifera* was introduced to Nanking in 1936, and 40-year-old trees are now 20 m. high with a DBH of 60 cm. Artificial pollination or mass planting has been necessary since the abundant flowers of a solitary tree rarely yield fertile seeds. Hybridization between the Chinese and American species was carried out by the late Professor P. T. Yeh of the College of Technology of Forest Products, Nanking, in 1963 and 1965. The average increments in height and diameter of the F1 hybrid trees were 42.3% and 13.7% respectively, and the date of abscission of the leaves came later than that of either of the parents.

The Pecan (*Carya illinoiensis*) was introduced into China about seventy-five years ago with Nanking as the center of introduction. Trees 55-years-old had an average height of 20 m. with a DBH of 85.4 cm. The mature trees were all raised from chance seedlings. Five fruit types were identified, but the productivity was low and unstable, 60 kg. being the highest yield per fruiting tree, with an average of only a few kilograms. The introduction of better clones and
the improvement of horticultural practices will be necessary for good nut production.

*Magnolia grandiflora* and *Platanus occidentalis* are two attractive garden trees introduced to the Yangtze Delta some fifty years ago. The lustrous evergreen leaves and magnificent white flowers of the former often win the admiration of the public.

Other examples of the introduced broad-leaved species include:

- *Acer negundo*  
- *A. saccharum*  
- *A. saccharinum*  
- *Calycanthus fertilis*  
- *Campis radicans*  
- *Catalpa × hybrida*  
- *C. speciosa*  
- *Cercis canadensis*  
- *Cornus amomum*  
- *C. sericea*  
- *C. pubescens*

* Diospyros virginiana  
* Fraxinus americana  
* F. pennsylvanica var. lanceolata  
* F. rotundifolia  
* Gleditsia triacanthos  
* Gymnocladus dioicus  
* Hypericum densiflorum  
* Juglans nigra  
* Liquidambar styraciflua  
* Populus canadensis  
* Ulmus americana

**Discussion**

1. The adaptibility of the trees introduced from North America has proved superior in eastern China to that exhibited by trees originating in the Mediterranean region and central Asia. From a phytogeographic point of view there is a close but temporally remote relationship between the floras of North America and eastern China. This has been verified by successful plant introduction between the corresponding geographic regions of China and the United States, and it affords further possibilities for the mutual exchange of woody plants.

2. Whenever successful introduction is anticipated, one should locate introduced species in regions with ecological conditions more or less similar to those in their native environments. The sensitivity of southern pines and other coniferous trees from North America to changing growing conditions should never be overlooked. Selection for clones of suitable provenance is desirable whenever possible.

3. Selection of desirable variants from populations of different provenances should be carried out at a suitable time. Hybridization between Chinese and North American tree species could eventually give promising results (e.g., *Liriodendron chinense* × *L. tulipifera*, *Carya illinoiensis* × *C. cathayensis*, *Taxodium ascendens* × *Cunninghamia lanceolata*, *Cupressus arizonica* × *Cryptomeria japonica*, *Pinus taeda* × *P. yunnanensis*, etc.).

4. We are looking ahead to promote and strengthen the mutual exchange of trees and other plants between our two countries and to learn from our American colleagues.
The Dawn Redwood, *Metasequoia glyptostroboides*, is one of the most notable plants introduced from China in the last 30 years, and the Arnold Arboretum is responsible for having distributed it widely throughout the world. Native to only a small area in China and with no close relatives, it is perhaps the most uniquely Chinese of plants. Besides being an outstanding ornamental, it has an interesting history in that it was described from fossil remains before living plants were known to exist. The first living material was collected in 1944 by Tsang Wang, a Chinese forester. The specimen above, planted across Meadow Road from the Administration Building, is one of the most shapely and conspicuous in the Arnold Arboretum.