The Propagation of Lesser Known and Unusual Maple Species

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INTRODUCTION

Urban trees are highly valued by urban populations although their lifespan is often severely curtailed. Lack of adequate planting space is perhaps the single most difficult problem that urban trees face as they continue to be squeezed into seemingly impossible situations. Soil in these sites is often quite compacted, preventing root growth while pavement further complicates the situation by preventing precipitation from reaching the root zone. As a result, trees can be left with less than adequate soil moisture for satisfactory growth. What water does get into the root zone may be contaminated by road salt providing even more stress. To make matters even worse, the abundance of concrete in buildings and sidewalks drives soil pH to very high levels limiting the availability of iron, manganese, and zinc (Craul, 1992).

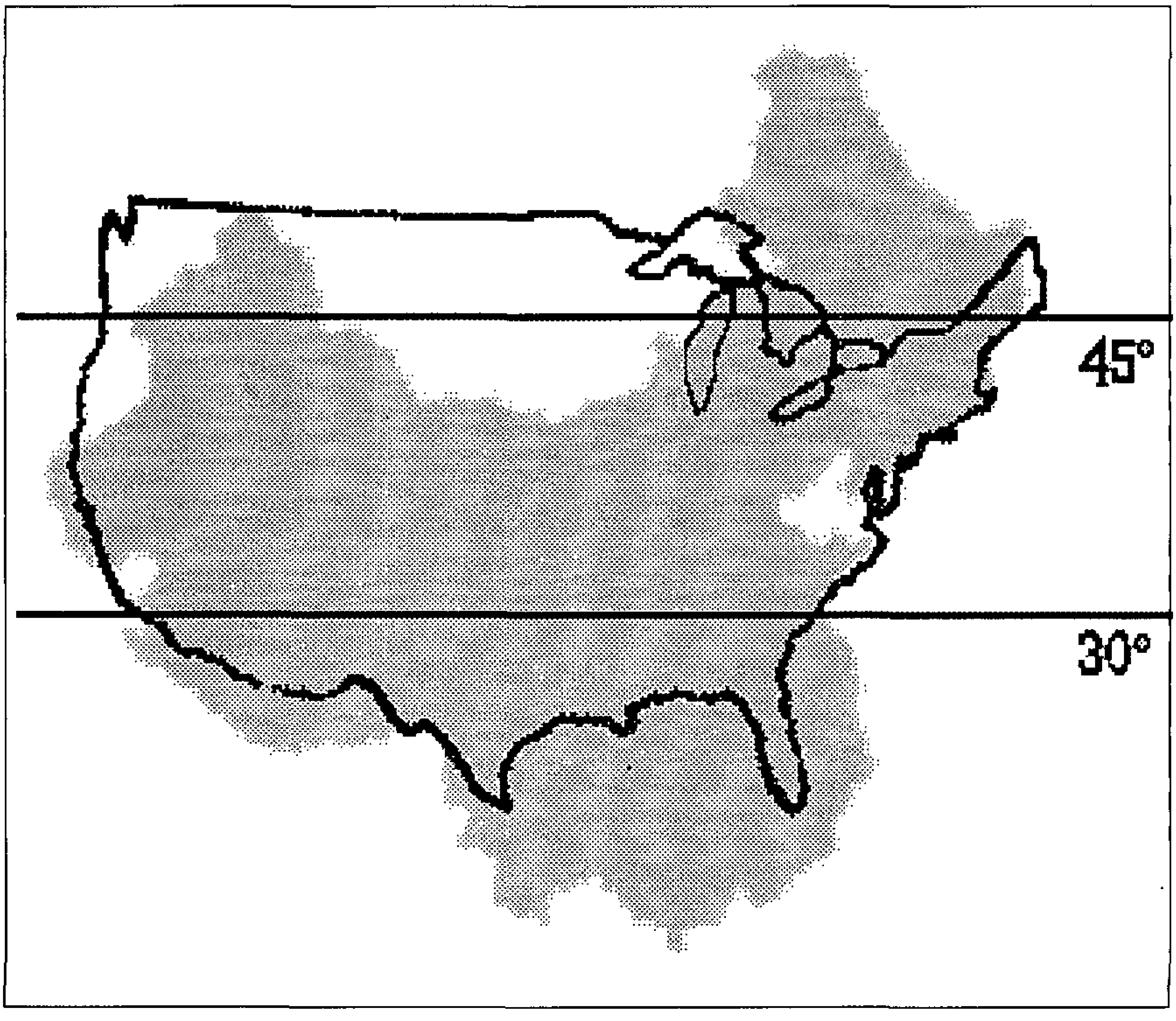

Figure 1. Similarity in latitude between North America and China.

Table 1. Purported tree characteristics.

Acer species	USDA zone	Height	Habitat	Fall color	Origin	High pH	Comments
carpinifolium	3-4	7-8 m	Small tree	Yellows and browns	China	Yes	The most unusual leaf of the maples, more beech like than maple. Very thick lustrous leaves with a beautiful texture.
cissifolium	5	10-12 m	Tree	Yellow, pink, and orange	China and Japan	Yes	Related to the American box elder but not invasive, trees are either male or female, excellent compact branching habit.
glabrum	3-4	7-8 m	Small tree	Yellow, reds, and orange	Western U.S.	?	Extremely variable in habit and possibly, hardiness. Ranges over a wide variety of habitats from Alaska to Mexico. Red twigs in the winter and very colorful in the fall.
mandschuricum	5	8-10 m	Tree	Yellow, red, an orange turning to dark pink	China and Siberia	?	Related to *A. griseum* but much more tolerant of drought and more cold hardy. Fine texture foliage resembles bamboo. Colors up earlier than most trees.
miyabei	5	10-12 m	Tree	Yellow	Japan	Yes	Uniform in habit since most material originated from one source. Hybridizes with *A. campestre* and can often be difficult to differentiate hybrids from the true species. Possess all the virtues of *A. campestre* but grows more upright.

monspessulanum	4-5	6-12 m	Tree	Yellow, pink, red, and orange	Western and Central Europe	Yes	Highly variable, most forms known are bushy and slow growing while others grow rapidly into excellent small trees
pseudosieboldianum	4	10-12 m	Tree	Brilliant yellow, red, and orange	China	?	Closely related to *A. palmatum* but significantly more drought tolerant and cold hardy
truncatum	5	8-10 m	Tree	Yellow, red, orange	China	Yes	Extremely variable in leaf form, habit and possibly, hardiness Apparently only one form in the trade Crosses with *A. platanoides* (e.g 'Pacific Sunset' and 'Norwegian Sunset'

Obviously with all these adversities it makes sense to think carefully about tree selection in the urban environment. Trees must not only be adaptable to city life but they must also be able to fit in the limited spaces often afforded urban trees. Tall growing trees must be frequently pruned away from utility lines and large vigorous roots may heave sidewalks and clog pipes.

Where do we look for tough trees that can stand up to all the hardships associated with city living? All trees used for planting originally came from the wild yet nowhere have trees evolved to grow in cities. What makes some species more urban adaptable than others are the attributes which made them successful in their native habitats which may mimic certain urban environments. By carefully observing the climate and soil profiles of a region, likely locations with potentially good trees can be found. One such place has provided a wealth of horticultural treasures and is not about to stop yielding surprises is China (Zhang and Jia, 1992). The most interesting feature of China is that in addition to tropical and subtropical regions it also has many temperate areas with similar climates to those in the United States. From Figure 1 the similarity in latitude between North America and China is apparent.

However, due to the local weather patterns and the moderating effect of the ocean, China's climate is a bit more mild around the coastal region compared to regions of the United States with similar latitudes. The most promising areas are the inland, northeastern regions which are colder and dryer (Chang and Yang, 1993). China is a very unique place which not only has an abundance of calcareous-based soil (Wang and Zhu, 1990) in the north but it is also known for its harsh summers and winters (Chang and Yang, 1993; Gilbert, 1994).

Moreover, this region also has a very unique geologic history. Fortunate to have been spared by the worst of the last major glacial episode, it possesses flora that had been extirpated from other temperate regions around the northern hemisphere (Li, 1992). China is a botanical wonderland full of hardy plants which are well adapted to some of the harshest conditions encountered in temperate North America (Xie et al., 1991; Zhang and Jia, 1992).

However, China is not the only place to find good plant material. The Mediterranean regions of the world are full of plants which are naturally adapted to drought. What's more, not all Mediterranean regions are warm year round so there are some places with winter temperatures similar to temperate North America. Also of important consideration is that many regions in Turkey, Greece, Italy, and France possess calcareous soil. Last but not least there are some locations in North America such as the eastern side of the Rocky Mountains which due to altitude, shadow effects, and calcareous soil conditions (Eicher and Diner, 1989) also possess potential sources for urban trees.

MATERIALS AND METHODS

Once a region has been selected and potential urban trees identified, their propagation, testing, and introduction to the trade comes next. All too often, there have been many good plants which were rarely available due to difficulties in their propagation. Here we have chosen several species of *Acer* to work with based on studies of their native habitats, reported characteristics and landscape preferences (Gelderen, 1994; Dirr, 1993; Fang, 1939; Hortorium, 1976). A summary of these characteristics is presented in Table 1.

Where stock plant material was available, we used the techniques of etiolation and

Table 2. Good rooting potential.

Acer species	Source of cuttings	IBA (ppm)	Light grown (%)	Light grown with band (%)	Etiolation (%)	Etiolation and band (%)	Plant age
carpinifolium	Greenhouse	0	15.0±7.64*				4-5 years
		1000	38.3±8.50				
		5000	85.0±7.64	90.0±4.08	93.2±4.86	95.0±3.34	
		10,000	33.0±9.37				
	Field	0	48.4±8.96				~90 years
		1000	41.2±5.96				
		5000	88.6±4.89				
		10,000	86.6±3.76				
cissifolium	Field	0	51.1±10.06				~60 years
		1000	90.0±5.38				
		5000	94.0±3.06				
		10000	83.3±6.05				
truncatum	Greenhouse	0	51.1±10.06	44.4±11.44			4 years
		1000	56.0±11.47	84.0±8.84			
		5000	24.5±8.83	43.5±8.63	74.6±7.18	88.0±9.98	
		10,000	32.5±10.06	39.4±9.07			
	Field	0	0.0				~16 years
		1000	15.8±5.61				
		5000	21.3±6.10				
		10,000	15.7±7.55				

*=Percent rooted ± standard error.

Table 3. Moderate rooting potential.

Acer species	Source of cuttings	IBA (ppm)	Light grown (%)	Etiolation and band (%)	Plant age
glabrum	Greenhouse	0	45.8±9.35*		4-5 years
		1000	36.7±10.68		
		5000	46.9±6.46		
		10,000	34.2±9.79		
	Field	0	16.5±15.9		~30 years
		1000	15.8±18.48		
		5000	9.0±11.7		
		10,000	19.3±18.6		
monspessulanum	Greenhouse	5000	23.3±9.19	41.7±10.85	4 years
	Field	0	10.0±4.47		~100 years
		1000	32.8±8.58		
		5000	52.0±11.15		
		10000	25.7±7.54		

*= Percent rooted ± standard error.

banding described by Maynard and Bassuk (1987). However some plant material was difficult to acquire so only basic softwood cutting propagation was employed.

The work involved containerized stock plants which were 3 to 5 years of age. They were given 3 months of chilling in a 36 to 38F cooler and were then brought out of dormancy starting in February into a 68F day and 58F night greenhouse. Half of the plants were enclosed in a tent made of a double layer of black cloth to exclude all light (etiolation treatment) and the other half were grown in full light. Shoots soon emerged and half of the light grown and the etiolated shoots were banded as soon as they were 2.8 cm or more with a 2.5 by 2.5 cm band of black Velcro™ (Maynard, 1987). Immediately after, one side of the etiolation tent was gradually pulled up day by day over 1 week until the etiolated plants were exposed to full light. After 3 weeks, shoots were taken and made into cuttings. All except for the controls were dipped for 20 sec in various concentrations of IBA dissolved in 50% aqueous ethanol. Cuttings were then stuck in peat and perlite medium (1 : 2, v:v) under intermittent mist. Rooting occurred in 3 to 4 weeks.

RESULTS AND DISCUSSION

Results are divided into three groups based on ease of rooting: Good Rooting Potential, Moderate Rooting Potential and Minimal Rooting Potential (Tables 2, 3, 4). *Acer carpinifolium, A. cissifolium,* and *A. truncatum* are listed in the first table: Good Root Potential. Greenhouse-grown cuttings of *A. carpinifolium* rooted 15%, 38.3%, 85%, and 76.7% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. Further results were obtained, with light-grown banded, etiolated, and banded + etiolated treatments using 5000 ppm IBA; they were: 90%, 93.2%, and 95% respectively. Field-collected cuttings of *A. carpinifolium* from a nearly 90-year-old tree rooted 48.4%, 41.2%, 88.6%, and 86.6% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. The next species, *A. cissifolium* rooted 51.1%, 90%, 94%, and 83.3% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. The age of the tree which provided the cuttings was approximately 60 years old. Lastly, *A. truncatum* rooted 51.1%, 56%, 24.5%, and 32.5% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. Further results were obtained just with light-grown banded cuttings at 0, 1000, 5000, and 10,000 ppm IBA; they were: 44.4%, 84%, 43.5%, and 39.4%, respectively. Etiolation and 5000 ppm IBA resulted in 74.6%, rooting while etiolated + banded rooted 88.0%. Field-collected cuttings of *A. truncatum* from several 16-year-old trees rooted 0%, 15.8%, 21.3%, and 15.7% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm.

The Moderate Rooting category includes the species *A. glabrum* and *A. monspessulanum*. Greenhouse-grown cuttings of *A. glabrum* rooted 45.8%, 36.7%, 46.9%, and 34.2% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. Field-collected cuttings rooted 16.5%, 15.8%, 9.0%, and 19.3% with respect to 0, 1000, 5000, and 10,000 ppm of IBA. Light-grown cuttings from greenhouse-grown stock of *A. monspessulanum* rooted 23.3 % when treated with 5000 ppm IBA while etiolated + banded cuttings rooted 41.7%. Field-collected cuttings rooted 10%, 32.8%, 52%, and 25.7 with respect to 0, 1000, 5000, and 10,000 ppm treatments of IBA.

The last category includes *A. mandschuricum, A. miyabei,* and *A. pseudosieboldianum*. Greenhouse-grown cuttings of *A. mandschuricum* rooted 0%, 3%, 16%, and 33% with respect to 0, 1000, 5000, and 10,000 ppm of IBA. Field-

Table 4. Minimal rooting potential.

Acer species	Source of cuttings	IBA (ppm)	Light grown (%)	Light grown with band (%)	Etiolation (%)	Etiolation and band (%)	Plant age
mandshuricum	Greenhouse	0	0.0				4-5 years
		1000	3.0±2.04*				
		5000	16.0±6.87	29.0±9.54	63.0±11.2	85.0±4.15	
		10,000	33.0±9.37				
	Field	0	0.0				~90 years
		5000	0.0				
miyabei	Greenhouse	0	2.5±2.5	5.7±3.45			4 years
		1000	8.6±5.95	17.1±14.23			
		5000	0.0	16.7±9.54	40.0±12.4	57.1±13.4	
		10,000	7.5±5.26	17.1±8.59			
	Field	0	4.5±3.03				~10 years
		1000	29.1±7.31				
		5000	33.3±10.0				
		10000	19.0±6.05				
pseudosieboldianum	Greenhouse	0	1.4±1.4	0.0			4-5 years
		1000	5.3±4.06	9.7±5.42			
		5000	9.2±5.33	26.4±10.16	54.8±12.2	55.0±10.3	
		10,000	18.1±7.83	38.1±10.13			

Field-tree 1	0	14.3±0.0	16 years
	1000	31.0±2.39	
	5000	58.3±8.36	
	10,000	60.7±10.75	
Field-tree 2	0	0.0	16 years
	1000	0.0	
	5000	0.0	
	10,000	0.0	
Field-tree 3	0	0.0	16 years
	1000	0.0	
	5000	0.0	
	10,000	0.0	
Field-tree 4	0	0.0	16 years
	1000	0.0	
	5000	0.0	
	10,000	14.3 ±14.33	

*= Percent rooted ± standard error.

collected cuttings treated with 5000 ppm produced 0% rooting. Greenhouse-grown cuttings of *A. miyabei* rooted 2.5%, 8.6%, 0%, and 7.5% with respect to 0, 1000, 5000, and 10,000 ppm of IBA. Further results were obtained just with banding, and 0, 1000, 5000, and 10,000 ppm IBA; they were: 5.7%, 17.1%, 16.7%, and 17.1%. Etiolation, and 5000 ppm IBA resulted in 40% rooting while etiolation + band rooted 57.1%. Field-collected cuttings of *A. miyabei* from a 60-year-old tree rooted 4.5%, 29.1%, 33.3%, and 19.0% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. Lastly, greenhouse-grown cuttings of *A. pseudosieboldianum* rooted 1.4%, 5.3%, 9.2%, and 18.1% with respect to 0, 1000, 5000, and 10,000 ppm of IBA. Further results were obtained just with banding, and 0, 1000, 5000, and 10,000 ppm IBA; they were 0%, 9.7%, 26.4%, and 38.1%. Etiolation, and 5000 ppm IBA resulted in 54.8% rooting while etiolation+band rooted 55%. Out of four 16-year-old, field-grown trees, only one produced relatively fair rooting percentages of 4.5%, 29.1%, 33.3%, and 19.0% respective to hormone levels of 0, 1000, 5000, and 10,000 ppm. Two did not root with any or the four hormone levels previously mention but the last one did root 14% with 10,000 ppm IBA.

It appears that the addition of some combination of etiolation, and banding significantly increased rooting in all but the easiest-to-root species. With further research the appropriate combinations of light, and IBA will be determined.

The genus *Acer* is diverse in form and habit; represented by species form all parts of the northern hemisphere. Only a handful were mentioned here due to limited availability of stock plants for our research. Even though many of these trees may require some not-so-traditional means of propagation such as etiolation or banding, they deserve to be propagated not only for ornamental purposes but because the may prove to be adaptable urban trees. For the most difficult-to-root species it is good to know that etiolation or banding can provide better rooting, and in some instances the combination of the two techniques provides exceptional results. Further, the different rooting abilities noted with *A. pseudosieboldianum* demonstrate the need for cultivar selection for characters such as rootability.

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