

Grafting Trifoliolate Maples

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If a plant species is an excellent garden subject and no cultivars are in the trade it usually signals some problem with clonal propagation. Such is the case with the trifoliolate maples.

Trifoliolate maples have a compound rather than simple leaf, and are composed of three similar leaflets, one terminal leaflet with two attending laterals.

They were first introduced to the United States as early as 1891 when C.S. Sargent of Boston's Arnold Arboretum brought back seed of *Acer nikoense* from the mountains of Japan. Since then three more species of trifoliolate maple have been introduced and are now among the most highly regarded landscape trees.

Japan and Central China are home to a species of trifoliolate maple known as the Nikko maple. Originally named for the Japanese temple city of Nikko, the tree was once known as *Acer nikoense* but a nomenclature change has brought it to its present Latin name of *A. maximowiczianum*. It is a component of the cool-temperate forest, preferring moist and fertile soils near streams. In central China it grows with such genera as *Tilia*, *Carpinus*, *Betula*, *Fagus*, *Davidia*, and other species of *Acer*. Trees of 65 ft have been reported from the wild but most mature trees in cultivation are from 40 to 50 ft. A tree raised from Sargent's seed collection 100 years ago now measures 45 ft high with a broadly domed canopy of 40 ft. Its 2-foot-thick trunk shows a number of main branches close to the ground, the first at 3 ft, and these rise at a 45° angle upward to the canopy. The bark, when compared to the other trifoliolate maples is a more subtle sell, being a tight medium gray, sometimes forming small plates and with curious vertical rows of bumps. The Nikko maple distinguishes itself most by its foliage as it has the largest leaves of the trifoliolate group. Each leaf is made of three leaflets, with two-lateral leaflets near to a right angle to the terminal leaflet. These thick leathery leaflets are oblong-ovate in shape, deep green above, pale green below with the lower leaf surface and petiole having felty, silvery white hairs. The edges of these leaflets are slightly wavy and a few coarse teeth may be present. The size averages from 3 to 5 in. long and 1.5 to 2.5 in. wide although trees from China have been reported with 7-in.-long leaflets. This crisp fresh greenery is the main attribute of this species, especially, when it changes hue in mid-October, (all times are for Boston, Massachusetts). Luminous shades of scarlet and orange are made even more pronounced by the darkness of the gray bark. Oddly the underside of the leaf remains a duller color. The flowers are held in threes, each a 1/3 in. long with 10 chartreuse petals in two rings of five. While interesting on close examination it is really a flower only a botanist could love.

The plants in cultivation in the U.S. have been reported to come through winters with lows of -25F without damage. As a woodland native the Nikko maple will prefer fertile brown soils and a moist site. The proportions of *A. maximowiczianum* make it an ideal tree for suburban gardens for if grown as a specimen tree on a lawn it will keep in good scale to most houses and not attain too large a size.

The star of the trifoliolate group is the renowned paperbark maple, *A. griseum*. Native only to the Central Chinese provinces of Hubei, Sichuan, Honan, and Shensi,

it was introduced into cultivation by the prolific plant hunter, E.H. Wilson, and it has come to be regarded as perhaps the best of his hundreds of plant introductions. He first found the plant in May of 1901 and he jotted in his field notebook "Hupeh's best maple". He later came to regard it as "China's best maple" and modern horticulturists may go even further. Wilson recorded the species on steep slopes of moist rich woodlands of Western Hubei between 4000 and 5500 ft. The maximum size of the tree was 60 ft with an 8-ft circumference but trees of 30 to 45 ft were more typical. Seed from these trees was collected for the Veitch Nursery of England in 1901 and for the Arnold Arboretum in 1907. Veitch raised a hundred plants from their seed and the Arnold Arboretum raised one seedling to pair with two plantlets Wilson had dug up in China and brought home to Boston.

Despite other collector's efforts, it seems that so far, Wilson's collections in 1901 and 1907 are the only introductions that have resulted in progeny and that all trees in cultivation are descendants of these. A genetic profile of Paperbark maple in cultivation comparing U.S. and U.K. populations would be a fascinating case study and would probably show a narrowing genetic base.

The bark of this Chinese species is unique in the maple family, a striking collage of textures and colors. The oldest bark, at the base of mature trees is often a interlocking puzzle of irregular plates of copper and smoky gray. Younger wood is sheathed in tight bark of a ruddy maroon-brown with patinas of orange brown and weathered bronzy olive surrendering curled shavings of cinnamon. The wood is hard, dense and at certain points looks sinewy. The effect of this singular stem is of a dense, aged, metallic pillar of exotic alloy.

The foliage of the paperbark maple is reddish brown when first unfurling in the spring but soon turns to a soft, deep green above, pale green and felty below. The margins of the leaflets are coarsely toothed with two to five large teeth to each leaflet's side. The foliage turns a striking, strong crimson in late October and early November, blending beautifully with the coppery bark. Flowers are similar in size and color to the Nikko maple but the petioles are less hirsute.

The oldest paperbark maple that we are aware of graces the grounds of Boston's Arnold Arboretum and is one of E.H. Wilson's original trio. Unlike other *A. griseum* trees in the collection, this specimen has a squat fat trunk that begins to branch at 3-1/2 ft. It has a broad dome, some 40 ft wide and is 25 ft high. It is a venerable and monumental tree, a piece of living sculpture that honors its collector far more nobly than any work from the artist's hand.

The paperbark maple is an ideally proportioned tree for lawn and specimen plantings as it doesn't attain a tall stature in these full-sun situations. It works particularly well alongside the red brick dormitories and lecture halls of our Smith College campus. But it would be superb as a focal point in a woodland or courtyard garden or, as a grove of 20, an unsurpassable luxury.

The woodland forests of Korea have very fine fall foliage color, mainly due to its nine maple species. *Acer pseudosieboldianum* has the most vivid colors, scarlets and reds, but a close second are two trifoliate species native to the mountains—*A. triflorum*, the three-flowered maple, and *A. mandshuricum*, the Manchurian maple.

The three-flowered maple ranges from South Korea, where Nicholson saw it at 600 m in the foothills of the Odae Mountains, north into Northeastern China with isolated disjunct stands in Shensi Province growing at 1700 m. It is a tree that

usually grows about 50 ft high but older trees in the wild have been recorded to grow as high as 70 ft. Nicholson collected seed in the Odae Mountains where the species was found next to a brook, on the edge of a forest of huge *Abies holophylla*, the Manchurian fir. A mile up the road was the ancient temple complex of Hwoamsa and on a crisp fall day in the mountain forests I found the beautiful tableau of Two Maples with Temple. To the front was a small tree of *A. pseudosieboldianum*, its branches covered in leaves of pink and brilliant cardinal red. The temple was small, with a sedate gray tile roof and covered two chambers facing an open middle. Intricately painted beam work and panels counterbalanced the somber roof and straightforward architecture. But behind it, fronting a screen of dark firs, was a glowing-orange, three-flowered maple, its lowest branches peeking through the alcove of the temple. Standing at 65 ft high with a basal trunk diameter of 3 ft it was far bigger than the tree downriver. The bark at the lower portion of the trunk was splashed in pale gray-green lichens, these contrasting pleasantly with the gray and buff colored bark.

Bark on trees in cultivation we have surveyed is a silvery-beige, flaking in small plates to reveal coppery-orange and even pinkish tones beneath. These trees were both over 60 ft high at 70 years of age and were more upright in habit than the Nikko maple. Unlike the Nikko maple, the three-flowered maple tends toward a single dominant trunk.

The trifoliate leaf is distinct from the others of the group due to its bristly upper surface (the lower has a hairy midrib). Leaflets are medium green above, paler beneath, and are up to 3.5 in. long and half as wide with two to four coarse teeth along the margin. In Boston it is usually in fall color during mid to late October and is a blend of pumpkin, yellow, and wines with orange being the dominant hue.

Table 1. Grafting success with trifoliate maples on sugar maple (*Acer saccharum*) understock.

| <i>Acer</i> species | Graft type | | | | Overall |
|---------------------------|------------------------|------------|----------------------|-----------|------------|
| | Saddle | Side | Side whip and tongue | Cleft | |
| 1-year understock | | | | | |
| <i>griseum</i> | 8/10 (80) ¹ | 7/10 (70) | 3/10 (30) | | 18/30 (60) |
| <i>triflorum</i> | 3/7 (42) | 5/9 (55) | 6/10 (60) | 4/7 (57) | 18/33 (52) |
| <i>mandshuricum</i> | 0/6 (0) | 0/11 (0) | 0/9 (0) | 0/4 (0) | 0/35 (0) |
| 2-year understock | | | | | |
| <i>griseum</i> | | | 4/4 (100) | | |
| <i>triflorum</i> | | | 2/4 (50) | | |
| <i>mandshuricum</i> | | | 0/5 (0) | | |
| overall (%) by graft type | 11/23 (48) | 12/30 (40) | 15/42 (36) | 4/11 (36) | |

¹ The fractional number equals the number of successes over the total number grafted with the percentage success in brackets.

A hike from the Hwoamsa Temple complex to the highest point in the park, Mt. Pirobong at 1550 m, is a 2-1/2 km climb through sublime fall forest, an interplay of the blazing maple and solid somber green of fir. At 1150 m, a small grove of Manchurian maple, *A. mandshuricum*, was growing on a sharply steep, cool slope anchored in dry brown soil. Sharing the hillside were *Betula schmidtii*, *B. davorica*, *Viburnum wrightii*, *Magnolia sieboldii*, *Rhododendron schlippenbachii*, *R. brachycarpum*, *A. pseudosieboldianum*, *A. ukurundense*, *Astilbe koreanum*, and *Hepatica asiatica*. In this tight competitive canopy, the Manchurian maples were tall trees to 80 ft, with first branches at 35 ft, yet had a relatively thin trunk diameter of 1 ft. Toward the top of the mountain, 300 m higher, the canopy was squatter and more open and here the Manchurian maple was a round-headed tree of 35 ft. Bark was tight, slightly plating, and of a dark battleship gray color. The leaves of *A. mandshuricum* leaves have narrower leaflets when compared with its cousins, the two laterals held at a closer angle to the terminal and sometimes overlapping it. The oblanceolate leaves are a dark, glossy green above and pale green below with a long tapered tip and a margin of up to 20 small teeth. The leaves are carried in dense tufts at the ends of the branches and give this species a finer, more feathery texture. It was striking how much variation there was in the fall color of this species, especially when recalling those trees cultivated stateside. In the wild, a dull ruddy purple to soft maroon seems to be most common color and to these hues, undertones of pink, orange, and yellow blend. Among the yellows of birch and poplar in the high mountains, these reddening plumes were the standouts. In sharp contrast to these plants is the fall color of a specimen at Boston's Arnold Arboretum. Grown from seed sent by the St. Petersburg Botanic Garden in 1906, the tree grows in full sun and measures 55 ft high by 50 ft wide. It colors early, usually the first week of October displaying a superb soft rose color to the leaves. Once turned they last but a few short glorious days then drop too soon. Based on its fall color alone this striking tree is worthy of cultivar status.

Flowers of the Mandshurian maple are less prone to the chartreuse coloration of the other trifoliate maples, and can be a dull pink. But by late May, clusters of dark pink and chartreuse samaras are forming and these contrast beautifully with the soft green undersides of the leaves.

Of all the trifoliate maples, *A. mandshuricum* is probably the hardiest, growing near to the tops of frigid mountains in S. Korea, and surviving the brutal winters in Northeastern China. It can probably withstand temperatures of -25 to -30F.

A few varieties of trifoliate maples have been described in Chinese journals but are not now known to be in cultivation in any botanic garden. Originally described as a new species, *A. kansuense* was later reduced to a subspecies of the Mandchurian maple and is now known as *A. mandshuricum* ssp. *kansuense*. If this report is accurate, this maple, from the drier province of Gansu could be an interesting more drought-tolerant trifoliate maple.

Other obscure varieties include two of *A. triflorum*—var. *subcoriacea* differs from the species by the leaves being sparingly papillose on both surfaces and the variety *leiopodum* was described in 1934 from a specimen collected by G. Fenzel from a temple woods in Shensi Province in north central China. It is described as having smaller leaflets which are glaucous below and slightly pilose or nearly glabrous on the nerves and petioles. As Joseph Hers later collected *A. griseum* from the same mountain, we question whether the initial identity of the *A. triflorum* tree is correct.

Lastly, the Chinese trees of *A. maximowiczianum* were assigned by the taxonomist Alfred Rehder to the variety *megalocarpum*, showing greater size to every part and greater pubescence, but Chinese botanists consider it synonymous with the typical species.

From the hands of a very few plant explorers have passed the seed of these legacy maples. Over several generations their horticultural reputation has grown and only now are they in the trade to any degree. The elegance and beauty of these rare and wonderful trees is almost mystical. They become more striking, noble, and desirable as they age. We should all be so lucky in life.

We first observed a trifoliate maple (*A. griseum*) grafted onto sugar maple at Dr. Sidney Waxman's trial grounds at the University of Connecticut and were surprised at the rapid growth rate of the plant. It seemed to have grown longer and thicker stems in one season than any trifoliate maple grafted onto its own kind. Based on his results we decided to try a few grafts of our own.

Grafts were made from mid March to early April, sealed with Parafilm, brought to a cool greenhouse (50F), and were inserted into a bed of moist peat, bottom heated to 75F.

Four different grafts were used—saddle, side, side whip, and tongue, and cleft. Understock used was *A. saccharum*, with the majority of these having been potted up the previous fall. A few pots of older understock left over from the year before were also used. These were brought in from a cold frame three weeks prior to grafting. Results are tabulated, a fraction indicating "takes" over total attempts with an accompanying percentage figure, and overall percentage of success by grafting type and by species. *Acer griseum* and *A. triflorum* were about equal in their overall success rate, but *A. mandshuricum*, which was grafted under the same set of conditions, failed in every graft. We can only attribute this to a total incompatibility or to the extremely narrow cambium layer in the Mandshurian maple as compared to the other two species tried which made lining up a good union difficult.

It remains to be seen if these will be good, stable, long-term graft unions or if there will be an incompatibility problem down the road. One option this grafting opens up would be to create stock block hedges of the trifoliate maples which can then be a source of cutting material. We hope to plant out some of our grafts on the Smith College campus and will monitor these grafts over the next few decades.