Stewartia 'Scarlet Sentinel'

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The cultivation of plants from different parts of the world in specialized gardens is a tradition that dates back at least to the time of the ancient Egyptians. Migrating from place to place, people carried along their plants, animals, and technologies and exchanged them with the people they met. More than anything else, the evolution of modern human culture is characterized by the free flow of information, products, and living organisms.

Christopher Columbus' "discovery" of the new world in 1492 provided endless opportunities for plant exploration and stimulated the development of botanical gardens throughout Europe for the cultivation of these new, exotic plants. With each advance in transportation and information technology, the process of transferring plants from one part of the world to another became less time-consuming and consequently more successful. In our own time, airplanes have reduced travel time to far-flung destinations from weeks or months to hours or days.

The flower of Stewartia ovata *f* grandiflora.

The biological implications of the transportation revolution have been profound. Species that evolved over millions of years—isolated from one another by mountains, rivers, deserts, or oceans—could now be cultivated together in a "common garden." In these gardens, the barriers that separated plants in nature were suddenly gone, leaving the plants to interbreed freely. Like it or not, botanical gardens have always been centers of uncontrolled experiments in genetic recombination.

Many of our important food plants originated as spontaneous hybrids in botanical gardens—strawberries and rhubarb are modern examples—as did many ornamental plants. Like its European counterparts, the Arnold Arboretum has produced its share of spontaneous garden hybrids, including the famous 'Arnold Promise' witch hazel, a cross between the Japanese and Chinese witch hazels. This article introduces the latest Arnold Arboretum hybrid, in the genus *Stewartia*, in the tea family (Theaceae).

Members of the *Stewartia* genus are among the choice ornamental plants that are avidly

The "camouflage" bark of Stewartia pseudocamellia.

sought by connoisseurs. The most widely grown species, *S. pseudocamellia*—commonly called the Japanese or Korean stewartia—is the quintessence of the horticultural Holy Grail, with multiseason interest and stately elegance rolled into one plant. A medium-sized tree that grows to twenty to forty feet, it produces an abundance of gorgeous flowers in early summer, rich color in the red-burgundy-purple range in autumn, and most famously, spectacular exfoliating bark in shades of ivory, buff, and tan that enlivens the winter and early spring landscape. Children who see the tree at the Arboretum typically call it the "camouflage" tree, while mature horticulturists develop a faraway look in their eyes as they stroke the trunk.

The Korean stewartia is the best-known member of the genus, but others are worthy of note: Chinese stewartia *(Stewartia sinensis)* has smaller flowers and exfoliating bark with the look and feel of alabaster; the bark of the tall stewartia, the Japanese species *S. monodelpha,* is smooth and cinnamon-colored. Two species are native to North America. One is *S. malacodendron* from the mid-Atlantic coastal plain, which has four-inch flowers with showy, bright purple anther filaments; unfortunately it is not reliably hardy in Boston's climate. The other is the mountain stewartia *(S. ovata),* which is a hardier, more upland species that produces flowers about three inches across with white or yellowish anther filaments. There are two varieties of mountain stewartia—var. *ovata* with yellow anther filaments and the more striking var. *grandiflora* with dark purple anther filaments. Neither of the American species possesses the exfoliating bark that is characteristic of the three Asiatic species described above.

The Arboretum's new hybrid stewartia has been given the cultivar name 'Scarlet Sentinel' and was formally described in a recent issue of *HortScience*—37 (2): 412–414. Initially the plant's heritage was unknown, but subsequent research has demonstrated that its parents are *Stewartia pseudocamellia* and *S. ovata* var. *grandiflora.* The original plant was collected in late spring of 1982 as one of a group of spontaneous seedlings growing beneath two mature specimens of *S. pseudocamellia* on Chinese Path.

The flower of Stewartia pseudocamellia.

(These plants, AA 11440-A & B, are among the handsomest trees in the Arboretum; they were collected in Korea by E. H. Wilson in 1918.) Fellow propagator Rob Nicholson and I were collecting the stewartia seedlings for distribution at the Arboretum's annual fall plant sale. The seedlings, presumed to be *S. pseudocamellia*, were given the Arboretum accession number 538-82 and were potted up and placed under shadecloth in an alleyway between two greenhouses. Over the course of the summer the seedlings flourished, growing several inches taller. As I was loading the flats of seedlings onto the truck for delivery to the Case Estates, I remembered that I "needed" a Korean stewartia for the front yard of the house I had recently purchased in Harvard, Massachusetts. Without thinking much about it, I scanned the flat of seedlings and quickly selected the one plant that stood out above the rest. Later that week I planted the seedling about ten feet from my front door, intending to admire its exfoliating bark in my dotage.

The little seedling flourished in its new home and even survived a close brush with death when my car, which I had forgotten to put in park, rolled over it on its way down to the bottom of the hill the house is perched on. But the tree sprang back to life—quite literally—and grew rapidly. Despite its tenacity, I was disappointed because it failed to show the beautifully patterned bark that I had expected. In fact, after waiting expectantly for nearly ten years, I began to contemplate replacing it with a "proper" Korean stewartia with the exfoliating bark I so coveted. Such thoughts evaporated one early morning in July 1992 when I noticed a spent stewartia flower on the ground, the first one the tree had ever produced. I picked it up and to my utter amazement I saw that unlike the flower of *Stewartia pseudocamellia*, which has a ring of yellow anther filaments, this one had bright, cherry-red anther filaments, quite unlike any stewartia flower I had ever seen.

I collected the few flowers still on the tree and brought them to the Arboretum for more careful study. Based on their comparative morphology, I decided that the plant was probably a hybrid between *Stewartia pseudocamellia* and *S. ovata* var. *grandiflora*, a specimen of which was growing between the two Korean stewartias that E. H. Wilson had collected. This plant (AA 18244-C), which had been collected by a Mr. T. G. Harbison in 1925 from the wilds of Highlands, North Carolina, has striking purple anther filaments and tight, nonexfoliating bark. 'Scarlet Sentinel' is intermediate between the two in most of its morphology including its bark, which flakes off in thin, linear strips. Stephen Spongberg, then taxonomist at the Arboretum, agreed with my opinion about the new hybrid's parentage and showed me another plant at the Arboretum with similar characters, which he had determined to be a hybrid between *S. pseudocamellia* and *S. ovata* var. *ovata*. It had the same bark as my plant, but the flowers had yellow rather than red anther filaments. This independent corroboration made me even more certain about my tree's parentage, but absolute confirmation had to wait for several years, until Jianhua Li,

The flower of Stewartia *'Scarlet Sentinel'.*

The bark of Stewartia *'Scarlet Sentinel*

the Arboretum's present taxonomist, performed the detailed genetic analysis that confirmed my original hypothesis.

Description

'Scarlet Sentinel' has a narrow, upright growth habit. At twelve years of age, when it bore its first flowers, the plant was twenty feet tall by eight feet wide. At twenty-two years of age the tree is about thirty feet tall and fifteen feet wide, having become more wide-spreading following the loss of its leader in a heavy snowstorm in December 1996. Its leaves are alternate, simple, and ovate-to-broad-elliptic in shape. Both the upper and lower leaf surfaces are smooth or slightly pubescent and waxy to the touch. The petiole is less than one-half-inch (one cm) long, with slight wings that enclose the developing bud. The leaves are three to four-and-a-half inches (8 to 12 cm) long by one-and-one-half to just under three inches (4 to 7 cm) wide, with a pointed tip and a rounded base. The leaf margins are finely serrated.

'Scarlet Sentinel' produces large flowers that are between three and four inches (8 to 20 cm) wide when fully open. The most conspicuous feature of these flowers is their scarlet-colored anther filaments (Royal Horticultural Society color chart #58B in the red-purple group). The ovary in the center of the flower is about one quarter-of-an-inch (6 mm) long and covered with dense hairs; its five styles are fused for the lower third of their length, the upper two-thirds being free. The flowers typically have

five petals, but many of them also have an extra one or two small, petal-like structures. The flowers appear to be sterile, producing little, if any, viable pollen and no mature fruits despite the presence nearby of a flowering specimen of *S. pseudocamellia* (which I finally went out and purchased). Table 1 summarizes the morphological intermediacy of 'Scarlet Sentinel' relative to *S. pseudocamellia* and *S. ovata* f. *grandiflora*.

The upright growth habit of Stewartia *'Scarlet Sentinel' prior to losing its leader in an ice storm.*

Propagation

The one source of frustration surrounding the development of 'Scarlet Sentinel' has been its propagation. Despite repeated efforts dating back to 1992, I have been unable to produce a single propagule that has lived longer than two years. This despite the fact that softwood cuttings collected between mid June and early August and placed under intermittent mist root in the range of sixty to one hundred percent. While most of the rooted cuttings initiated growth the following spring, many of them died during the following summer after producing two to four inches (5 to 10 cm) of new growth. Modification in the rooting medium, the type of container, the mode of overwintering, and the timing of transplanting increased the longevity of some of the cuttings, but all were dead by the end of their second summer (see table 2).

No doubt the rarity of stewartia cultivars in the nursery trade is the result of problems associated with vegetative propagation. At present, only one commercial nursery, Broken Arrow in Hamden, Connecticut, has been able to propagate and offer 'Scarlet Sentinel' for sale. A characteristic feature of the dead 'Scarlet Sentinel' cuttings at the Arboretum is that the tips die before the roots do. The first symptom of trouble is the browning of the leaves, starting with the tip and working back toward the petiole. The leaves then wither and fall, one by one, over a period of weeks or months, eventually leaving a lifeless, desiccated twig. The most curious aspect of this demoralizing sequence

Table 1. Morphology of 'Scarlet Sentinel' in comparison to its parents, *Stewartia ovata* f. *grandiflora* and *S. pseudocamellia*. Measurements represent the range of variation observed in ten flowers per taxon.

Morphological Feature	*Stewartia ovata* f. *grandiflora* (AA #18244-C)	*Stewartia pseudocamellia* (AA #11440-A)	'Scarlet Sentinel'
Number of floral bracts	1	2	2
Length of floral bracts (mm)(average)	10–13 (11.0)	2–4; 7–8 (2.8; 7.6)	4–10; 7–12 (6.0; 8.8)
Petiole type	winged	non-winged	semi-winged
Fully open flower diameter (cm)	7–9	7.5–9.5	8–10
Sepal length (mm)	15–22	10–14	12–14
Ovary length (mm)	5	6–9	6
Style length (mm)	12–13	8–12	9–12
Styles free or fused	100% free	100% fused	fused for the basal 30% of their length
Anther filament color (RHS chart)	83C (violet group)	16B (yellow-orange group)	58B (red-purple group)
Bloom times (USDA zone 6)	most of July	mid June to mid July	late June to late July
Fall color of leaves	yellow to red-purple	red to burgundy	orange to red
Bark type	nonexfoliating	exfoliating in large, irregular plates	exfoliating in thin, linear strips

Table 2. The history of efforts to propagate 'Scarlet Sentinel' at the Arnold Arboretum, 1992 to 2002.

Acc. #	Date	Treatment	# Cuttings Stuck	# Cuttings Rooted	Rooting Percentages
400-92	7 Aug 92	5,000 KIBA	24	24	100
400-92	7 Aug 92	10,000 KIBA	24	19	79
400-92	13 Aug 92	5,000 KIBA	24	11	46
400-92	13 Aug 92	10,000 KIBA	24	22	92
400-94	13 Jun 94	control	24	23	96
400-94	13 Jun 94	2,500 KIBA (3-6")	24	20	83
400-94	13 Jun 94	5,000 KIBA	48	40	83
400-94	13 Jun 94	10,000 KIBA	24	24	100
400-94	13 Jun 94	2,500 KIBA (2-3")	55	39	71
480-94	7 Jul 94	5,000 KIBA	49	29	59
399-95	26 Jun 95	10,000 KIBA	63	58	92
399-95	26 Jun 95	control	45	41	91
419-95	11 Jul 95	10,000 KIBA (direct stuck)	72	51	71
192-96	10 Jun 96	10,000 KIBA	42	40	95
177-2000	28 Jul 02	5,000 KIBA	38	28	74
390-2002	24 Jul 02	5,000 KIBA	39	31	79
Totals			619	500	81

A comparison of the flowers of Stewartia *'Scarlet Sentinel' (center) with its parents,* S. ovata *f* grandiflora *(left) and* S. pseudocamellia *(right).*

becomes evident when the pot is tipped over and the plant is removed with its root system fully intact, healthy and turgid, with bright white, vigorously growing root tips. This is especially surprising because in my experience root system failure is the usual cause of death for rooted cuttings. We have screened many of the dying and dead plants for a variety of bacterial and fungal pathogens—including the dreaded Pierce's disease, which is caused by the bacteria *Xylella fastidiosa*—and have so far come up empty.

While this propagation failure has been personally frustrating, the success that Richard Jaynes of Broken Arrow Nursery has had with the plant indicates that the problems are not insurmountable. Currently two young plants of 'Scarlet Sentinel' from Broken Arrow are growing at the Arboretum and perhaps cuttings taken from them will improve our chances for propagation success in the future.

To end on a more positive note, the author encourages all readers of *Arnoldia* who might have purchased a stewartia seedling at the Arboretum's 1982 plant sale to check their plants to see if they might, perhaps, have a hybrid seedling like 'Scarlet Sentinel'. If you do, please let me know and I'll come by to check it out.

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