



Stewartia pseudocamellia 'Mint Frills' has been selected for its ruffled petals and green tinged flowers

Timothy Boland

Stewartia in cultivation

ERIC HSU, TIMOTHY BOLAND and KOEN CAMELBEKE provide an overview of the cultivated species and highlight some new cultivars

IF THERE IS A TREE that embodies the Japanese principle of wabi-sabi, the intuitive appreciation of understated beauty, it is the genus *Stewartia*. This is evident from its graceful form, irregularly mottled bark and demure white flowers. When the zenith of spring-flowering trees has passed, stewartias fill that quiet moment in early summer with

their camellia-like flowers. Their preference for acidic soils notwithstanding, they are suitable subjects for small gardens since their growth, at best, is modest.

Genus characteristics

The solitary white flowers of *Stewartia* convince any botanically inclined or knowledgeable gardener

that the genus is in the *Theaceae*, along with other ornamental genera such as *Camellia*, *Franklinia* and *Schima*. Depending on taxonomic point of view, *Stewartia* encompasses approximately 20 species. However, the genus has a surprisingly wide geographical distribution, from the moist montane forests of China into the Japanese archipelago, and to the

Taxonomic history

The earliest reference to the genus is attributed to Reverend John Clayton's *Account of Virginia* in 1687 in which he described a tree on Archers Hope Creek, near Williamsburg, Virginia (Baldwin 1969, Sponberg 1974). The genus was introduced to cultivation about 50 years later, to the Fulham garden of the English traveller and naturalist Mark Catesby, who received *S. malacodendron* from another John Clayton, an English naturalist in Virginia. It flowered in 1742 and he passed plants to John Stuart, the 3rd Earl of Bute who was assisting with the founding of the botanical garden at Kew. Linnaeus later acquired dried specimens upon which he honoured John Stuart – the nomenclatural confusion began here because Linnaeus was misled about the spelling of his name and published it as *Stewartia*. The spelling *Stuartaia* is used by some authorities, and nomenclaturist Dick Brummit (pers. comm.) has long petitioned to adopt this spelling.

The majority of species are native to China; the *Flora of China* (Shu 2007) recognises 15, four of which are in cultivation. The rest await introduction; a few may be too tender for temperate gardens, while others may not offer much horticultural merit. Three species are recognized from Japan, Korea and surrounding islands, and two from southeast USA. Sponberg's review of the deciduous species (1974) remains the most comprehensive, although a full monograph of the genus has yet to be published.

Phylogenetic relationships have been examined (Li 1996), including the use of DNA data (Prince and Parks 1997, Li *et al.* 2002), but this needs additional work since the relationship between the New World and Old World taxa is uncertain, and the majority of Chinese species have yet to be included. ➤



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Stewartia pseudocamellia is usually regarded as the best species for autumn colour

ecologically-rich river corridors of the southeastern United States. All but the subtropical species are in cultivation, equally at home in the cold climate of Massachusetts as they are in the mild regions of western Britain.

They are either evergreen or deciduous trees (rarely shrubs) and are best known for the smooth, mottled, exfoliating bark of some species, although in some it is fissured and in others it is drab and unremarkable. The alternate leaves are ovate or elliptic with serrate margins, the pubescence varying from none to moderate. The 5-petalled flowers look similar across the genus but differ significantly in size. Depending on the climate, they open between late May and late June. The stamens are numerous yet their filaments can be white, purple, or yellow, depending

on the species. One to two bracteoles usually subtend the calyx. The woody brown fruit capsules can persist on the branches for a year or more before being shed.

All the species discussed here are deciduous except *S. calcicola*, *S. laotica* and *S. pteropetiolata*. Autumn colour is one of the striking characteristics of most *Stewartia*. Plants in the eastern US and Belgium have revealed the same sequence of autumn colour in the following order: *S. serrata*, *S. malacodendron*, *S. pseudocamellia*, *S. rostrata*, *S. sinensis*, *S. monadelphica* and *S. ovata*. *Stewartia malacodendron* and *S. ovata* generally have disappointing autumn colour, although *S. ovata* may turn yellow. *Stewartia pseudocamellia* is the most reliable for autumn colour. The hybrids have intermediate timing, depending on their parentage.

Stewartia calcicola

This evergreen species, a native of forests at 900–1,700m in southwest Guangxi and southeast Yunnan, China, is scarce in cultivation. It is readily distinguishable from the other evergreen species by its pubescent leaf midveins and bracteoles nearly one half as long as the sepals. The small to medium-sized flowers are not as showy as those of *S. pseudocamellia*.

There is a containerised specimen at Arboretum Wespelaar and Garden of Herkenrode, Belgium, which until recently spent the winters in the glasshouse. It has now been planted out and has survived its first winter outside without frost damage. It roots easily from cuttings, which have been distributed to other institutions with milder climates. To date, it has not been trialled outside in Europe.

Stewartia x henryae

This hybrid first occurred as a spontaneous cross between *S. monadelphica* and *S. pseudocamellia* at the Henry Foundation for Botanical Research, Gladwyne, Pennsylvania, and described in 1964. It is distinguished from the latter parent by the larger bracteoles not adpressed to the sepals and the smaller petals. The bark is intermediate between its putative parents.

Spongberg (1974) remarked that the flowers of *S. x henryae* are indicative of *S. monadelphica*, but reserved judgment on its hybrid status until cytological and controlled hybridisation studies are carried out. However, he identified one of the seedlings raised at Polly Hill Arboretum, Massachusetts, as *S. x henryae*, which has been named 'Skyrocket' (Huttleston 1993). *Stewartia x henryae* 'Skyrocket' has enormous potential for narrow spaces due to its fastigiate habit, but it has been difficult to propagate, thereby limiting its

availability in commerce.

Several self-sown seedlings at the Polly Hill Arboretum and Arboretum Wespelaar have characteristics akin to *S. x henryae*. They can display excellent autumn colour.

Stewartia laotica

Restricted to Guangxi and southeast Yunnan, China, as well as Laos and Vietnam at 900–1,800m, *S. laotica* is an evergreen species recently introduced in 2006 from northern Vietnam, collected at 1,900m (Peter Wharton pers. comm.). Its performance in Western cultivation is not known.

Stewartia malacodendron

Found in sparse populations in the southeastern US from Virginia to Florida and west to Mississippi, Louisiana, and Arkansas, as well as Texas, *S. malacodendron* has spectacular flowers – the white petals set off by red-purple stamens. It is rarely seen in western Europe since late spring frosts tend to debilitate it and the summers are not hot enough to ripen the wood. In such conditions it is best to provide a protected, partially shaded location. At Herkenrode, Belgium, a plant is flourishing underneath *Sequoia sempervirens* and between rhododendrons. At the Arnold Arboretum, Massachusetts, plants either fail or dieback due to the region's cold winters.

Stewartia malacodendron 'Delmarva' (Huttleston 1993) was raised from wild seed collected on the Delmarva Peninsula by Jacque Legendre and given to Polly Hill (founder of the eponymous arboretum) by Legendre's friend William Frederick, a Delaware plantsman. A sibling of 'Delmarva' still survives in the Frederick garden. Hill was able to grow two plants from the eight seeds she received; one died after being girdled by mice in 1971 while the other flowered after 27 years from seed. The cultivar

was selected for its 5cm wide flowers with red-streaked petals and purple stamens. However, this ornamental feature is not necessarily unique as it is not uncommon among plants in the wild. Only one existing specimen of *S. malacodendron* 'Delmarva' exists at the Polly Hill Arboretum since repeated efforts to propagate it by cuttings have failed.

Stewartia monadelphica

Distributed through the mountainous south-central Honshu, Kyushu, and Shikoku, Japan, *S. monadelphica* has small, delicate flowers. These would be overlooked if they were not borne in such profusion, on established trees. Even the bracteoles can be attractive, resembling green butterflies before the flowers open. Although the bark may not be as polished as *S. pseudocamellia* or *S. sinensis*, it peels to reveal a handsome cinnamon-red colour.

The diminutive size of the flowers, fruit and leaves belies the size of mature trees in the wild. During his expedition in February 1914, plant collector Ernest Wilson photographed several large trees growing with *Trochodendron aralioides* on Yakushima island; one in his photograph measured 17m tall and 2.5m diameter at breast height. The de Belder family in Hemelrijk, Belgium, have a core piece of a 300-year-old specimen from Yakushima. However, trees in cultivation do not approach the scale of their wild counterparts as they grow moderately.

Stewartia monadelphica is the last hardy deciduous species to colour in autumn. The presence or absence of summer heat can determine the autumn colouration; plants with longer growing seasons often turn scarlet, while those with shorter growing seasons tend towards purple. Nonetheless, *S. monadelphica*



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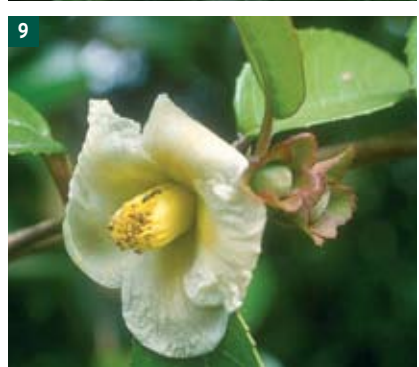


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1 *Stewartia sinensis*, at Lushan, China
 2 *S. sinensis*, a clone with particularly fine bark at Trewithen Gardens, Cornwall
 3 *S. ovata*
 4 *S. monadelpha*
 5 *S. malacodendron*
 6 *S. rostrata*, at Lushan, China
 7 *S. pseudocamellia*



has demonstrated excellent heat tolerance and full sun exposure.

Stewartia monadelphica 'Black Dog' has been selected for its dark purple foliage, which may appear black under certain light.

Stewartia ovata

As with *S. malacodendron*, this species is restricted to the southeastern US, from Florida and Virginia in the east, westwards to Mississippi. Spongberg (1974) stated that *S. ovata* and *S. malacodendron* reputedly overlap in range. This overlap was recently confirmed by the Stewartia Working Group in autumn 2007 who observed these two species growing in tandem in the Bankhead National Forest, Winston County, Alabama and collected seed.

This species is readily recognised by its winged petioles which hide the buds, separate styles and a single bracteole. As long as a long growing season and adequate vernalisation is ensured, *S. ovata* is an equal, if not better, contender to its American cousin, for it is exceptionally hardy (a tree grew in a Michigan garden (Zone 5, -26 to -29°C)). The large white flowers, 5–10cm wide, have beautifully ruffled petals and an attractive boss of stamens. The varying rate with which the flowers open prolongs the display. Interestingly, trees at the Polly Hill Arboretum possess darker green foliage than those in the wild, which may exhibit chlorotic foliage, a possible symptom of drought stress. Presumably, due to the area's maritime climate, its performance at

Arboretum Wespelaar and Garden of Herkenrode has been disappointing for the flowers tend to shed as quickly as they open, and in some instances, may fail to open at all.

Two varieties are recognized—var. *ovata* with yellow stamen filaments and var. *grandiflora* with purple stamen filaments.

The cultivars 'Red Rose', 'Royal Purple' and 'White Satin' (Huttleston 1993) to some extent represent natural variation in stamen colour in wild populations. Although these cultivars should not be dismissed, the authors caution that variants within populations should be observed carefully before considered for cultivar distinction.

Stewartia pseudocamellia

If there is one species frequently encountered in cultivation, it is *S. pseudocamellia*, native to Japan and Korea. In Japan, it grows in open to dense mixed woodland of *Acer* species, *Clethra barbinervis*, *Enkianthus campanulatus*, *Pinus densiflora*, *Quercus acuta* and *Q. serrata*, between 175 and 1,450m. In South Korea, *S. pseudocamellia* is found in similar habitats with *Acer* species, *Aralia elata*, *Hydrangea serrata* and *Viburnum* species.

The Korean and Japanese populations are a taxonomic quandary due to their superficial similarities and subtle differences; Korean populations have been treated as *S. koreana*, *S. pseudocamellia* var. *koreana*, *S. pseudocamellia* 'Koreana Group' and *S. pseudocamellia* 'Korean Splendor'. It is thought that the majority in cultivation are of Korean origin, whereas those of Japanese origin are rare due to their less robust constitution. However, the differences between Korean and Japanese populations cited in the literature, whether they be autumn colour, zigzag orientation of the branches, or flower form, do not

seem constant nor significant enough to justify recognition at specific, varietal or cultivar group level. Attributing plants with traits of the Korean populations to 'Korean Splendor' is problematic, given the inclusion and variability of plants raised from open-pollinated seed distributed by nurseries.

However, such taxonomic problems should not obscure the horticultural merits of *S. pseudocamellia*. Along with *S. sinensis*, the bark of *S. pseudocamellia* ranks as the best in the genus and is consistently cited in articles praising ornamental tree bark. One cannot deny its visual and tactile pleasures—the mottled shades of brown, grey and burnt ochre combined with the feel of polished alabaster. Although they do not open simultaneously for a magnificent display, the 9–10cm wide, creamy white flowers with a boss of yellow stamens are produced prolifically over a long period before dropping from the branches. It is a striking sight to see the shed flowers carpeting the ground beneath a tree. Autumn colour ranges from darkest claret to bright red-orange.

The Arnold Arboretum of Harvard University may have the oldest, documented living specimens of *S. pseudocamellia*, which are descended from Korean collections by Ernest Wilson in 1918. Their survival through nine decades of Boston's vicarious winters attests to their remarkable hardiness. Unlike the snake-bark maples, whose much-prized striated bark may disappear with age, the venerable Arnold specimens still retain their beautiful mottled, exfoliating bark. At the Polly Hill Arboretum, an old *S. pseudocamellia*, acquired from Brooklyn Botanic Garden and planted in 1961, is already showing similar characteristics to those at the Arnold Arboretum. ➤

- 1 *S. sinensis*
- 2 *S. serrata*
- 3 *S. pseudocamellia*, a variant with bullate leaves
- 4 *S. malacodendron* 'Delmarva'
- 5 *S. monadelphica*
- 6 *S. ovata*
- 7 *S. rostrata*
- 8 *S. malacodendron*
- 9 *S. pteropetiolata*

It would be interesting to survey the genetic variation of *S. pseudocamellia* in cultivation and determine whether they are descended from one or two clones at the Arnold Arboretum. There is a need to expand and diversify the number of wild-origin *S. pseudocamellia* from Korea. Polly Hill Arboretum, Quarryhill Botanical Garden, in California, and Royal Botanic Garden Edinburgh have recently introduced seed from Japanese populations. Quarryhill has one of the few older plants, collected at 1,210m in Honshu, Japan in 1989.

Stewartia pseudocamellia 'Ballet' is the best of three seedlings named by Polly Hill Arboretum from open-pollinated seed collected at the Arnold Arboretum in 1966. It was originally registered as a cultivar of *S. koreana* (Dudley 1984). The original tree is 14m in height, 30cm diameter at breast height, and has a canopy spread of 10m. It flowers in July with 9cm wide flowers. The larger fruits, longer shoots, and glossier leaves underscore the robust vigour of 'Ballet', and the grace with which the branches sweep down led to the choice of name.

Stewartia pseudocamellia 'Milk and Honey' was first registered in 1992 under *S. koreana* (Huttleston 1993). It originated from seed harvested in 1966 at the Arnold Arboretum and differs from the typical species in having 10cm wide, ruffled, white flowers with a boss of yellow stamens that are held flat rather than cupped. The autumn colour is a radiant orange-red that contrasts handsomely with the silvery and burnt timber exfoliating bark. The original tree is 12m high with three main stems and a canopy spread of 9m.

The flowers of *S. pseudocamellia* 'Mint Frills' (Clemants 1997) are lightly washed with pale green. However, this distinguishing trait is not

unique as it does occur in other plants of this species. The original tree at Polly Hill Arboretum is 12m high with two trunks and a spread of 8.8m.

Stewartia pseudocamellia 'Harold Hillier', originating from the Hillier Nurseries, UK, and named by Philippe de Spoelberch, Herkenrode, Belgium, has excellent, reliable autumn colour under various light conditions, including shade.

One of the seedlings at Arboretum Wespelaar and Garden of Herkenrode raised from seed wild-collected at Chiri San, South Korea, has proved to be distinctive in its shrubby habit, zigzag and reddish branches, and excellent hardiness. Worth naming, it has struck readily from cuttings, a noteworthy characteristic for a genus notoriously difficult to propagate.

Several vigorous and tree-like plants at Arboretum Wespelaar and Garden of Herkenrode have single vertical stems and prominently bullate leaves. They have not been named but the leaves may have thicker cuticles and more sun tolerance.

Stewartia pteropetiolata

This evergreen species is restricted to forests at 1,200–2,600m in south and west Yunnan, China, and Vietnam. There is one young plant, grown from seed collected at Luchun, south Yunnan, at approximately 2,100m, recently planted in the David C. Lam Asian Garden at the University of British Columbia Botanical Garden, Vancouver, Canada. According to the Curator, Peter Wharton, it has survived -5°C without leaf damage. Wharton believes that the Vietnamese populations are likely to be hardier than those in China.

Older, flowering specimens can be admired at Villa Taranto, Italy, and the Royal Tasmanian Botanical



Timothy Boland

Stewartia 'Scarlet Sentinel' (above), named for its columnar habit and red filaments, and *S. monadelphica* 'Black Dog' (right), with purple leaves

Gardens, Hobart, Tasmania, where the small to medium-sized flowers are followed by attractive red fruits.

Stewartia rostrata

This species was first introduced in 1936 to the US via the Lu Shan Botanic Garden, China, and a plant from this introduction can be seen at the Arnold Arboretum. However, it was not regarded as distinct from *S. sinensis* until Spongberg's review (1974). It was first collected by Ernest Wilson in Kiangsi Province, China, but the herbarium specimens were mixed with those of *S. sinensis* under the same collection number of 1722.

It can be distinguished from *S. sinensis* by its twisted sepals, fruits that are globose, mostly glabrous and abruptly beaked with four as opposed to two seeds per chamber, and unremarkable bark. *Stewartia rostrata* has a widespread distribution in China where it is found along streams in forests at 600–1,500m in Anhui, Henan, Hubei, east Hunan, Jiangxi and Zhejiang.

Flowering in May, it is one of the earliest Asiatic species to flower. The flowers are 3–5cm in diameter and the immature red fruits and reddish tinged foliage are compensation for its rather nondescript bark.



Philippe de Spoelberch

The autumn colour can be a pleasing rich scarlet. Trees reach up to 12m in the wild but the largest documented in cultivation (Seattle, Washington State) are between 7 and 7.6m (Jacobson 1996).

Stewartia rostrata has shown readiness to hybridise with other species, particularly *S. sinensis*. Adam Wheeler of Broken Arrow Nursery, Connecticut, is currently evaluating several hundred open-pollinated seedlings from this species, some of which are showing intermediate characters.

Plants in cultivation are variable – some are reluctant to flower even after 15 years and 8m tall, so there is a need to select a good floriferous clone. Those in Europe are often propagated and sold as *S. gemmata*, a synonym of *S. sinensis*, when they are actually *S. rostrata*.

Stewartia rostrata 'Hulsdonk Pink' is reputed to have pink flower buds that open to a pink-tinted flower.

Stewartia serrata

This Japanese species is the first *Stewartia* to come into leaf and flower. It has reddish young shoots, serrate leaves with red petioles, and regular, reddish bracteoles that are similar in size to the sepals. The flowers are bell-shaped and pendent, and despite

being short-lived, have a demure daintiness.

Stewartia serrata 'Pendula' has a weeping habit but unfortunately the flowers are concealed beneath the branches. A specimen can be seen at Arboretum Kalmthout but efforts to propagate it have not been successful.

Stewartia sinensis

Of the deciduous species, *S. sinensis* is rare in cultivation and typically mistaken for other species. A grove labelled *S. sinensis* at the University of Washington Botanic Garden, Seattle, are likely to be *S. x henryae*. Plants grown from seed acquired in 1934 from Sun Yat Sen Memorial Park in Nanking, China, and initially labelled as *S. monadelphica* at the Arnold Arboretum were later recognized as *S. sinensis*. De Spoelberch (2002) reported that young plants are not very hardy, which may explain its rarity. Likewise, its status in China may be vulnerable as it is scattered in forests at 500–2,200m in the central and eastern provinces. Del Tredici *et al.* (1995) witnessed on Wudang Shan, Hubei, at 1,100m a magnificent specimen 15m tall and 55cm in diameter at breast height and remarked that it was a sacred tree where Taoist pilgrims offer and burn consecrated paper symbolising money.

Appearing before *S. pseudocamellia*, the 5–6cm wide flowers are borne profusely, but their impact is lessened by their failure to open fully. The Flora of China (Shu 2007) recognizes four varieties, which are differentiated by shape, size, and texture of the petioles, bracteoles and sepals: var. *acutisepala*, var. *brevicalyx*, var. *shensiensis* and var. *sinensis*. This variation may account for the differences seen among trees in Europe and US compared to those in China. A variant with particularly attractive bark that should be conserved can be seen in the UK

gardens of Trewithen, Wakehurst Place and Borde Hill. This was probably the one that Bean (1981) described as 'smooth as alabaster and the colour of weathered sandstone.' In woodland areas near Lushan Botanical Garden, China, *S. sinensis* resembles *S. monadelphica* in its mottled bark and conical and pubescent seed capsules; age does not seem to influence bark appearance since a 300-year-old tree on Hanpo Pass, Lushan, had rather mottled bark (de Spoelberch pers. comm.).

Stewartia sinensis 'Panache' is variegated with speckled leaves, but it is perhaps better known as a horticultural curiosity.

Stewartia sinensis 'Mei Lu Shu' (Clemants 1997) was one of two seedlings raised at the Polly Hill Arboretum from seed harvested at the Arnold Arboretum in November 1984. When it first produced its 4cm wide white flowers in June 1993, Polly Hill's grandson, Alexander Hill, suggested the name that means 'beautiful tree' in Mandarin Chinese. Because 'Mei Lu Shu' was raised from seed of cultivated origin, it would be interesting to determine whether it is a hybrid or a pure species.

***Stewartia* 'Purple Lance'**

This cultivar is reputed to be a hybrid between *S. monadelphica* and *S. rostrata*, the original specimen is in the garden of Karl E Flink, Bjuv, Sweden. Initially dark purple at the beginning of the summer, the leaves eventually assume a handsome, dark green, glossy veneer. 'Purple Lance' is floriferous, but the flowers can be obscured by the leaves.

***Stewartia* 'Scarlet Sentinel'**

This cultivar is perhaps the best documented and confirmed hybrid between *S. ovata* f. *grandiflora* and ➤

S. pseudocamellia. It arose as a chance seedling in the Chinese Path area at the Arnold Arboretum (Del Tredici and Li 2002, Del Tredici 2003). Originally destined for an Arboretum plant sale, it was taken and cultivated by Peter Del Tredici in his garden at Harvard, Massachusetts. The hybrid nature was not revealed until the tree flowered 12 years later. With its nearly columnar habit, 6.5m high with a 2.5m spread in 12 years, the original plant, now at least 9 x 5m, has proved to be an ideal plant for small gardens. From late June to early July, large white flowers with prominent scarlet filaments nearly obscure the leaves. Although not as showy or attractively mottled as its parent *S. pseudocamellia*, the grey-brown bark does exfoliate in thin strips up to 5mm wide. Any fruits that form soon abort.

Significant collections in North America and Europe

In the US, the Arnold Arboretum, Massachusetts, and the Polly Hill Arboretum, Massachusetts, hold the North American Plant Collection Consortium collection of *Stewartia*. Much of the collection at the former originated from Ernest Wilson's gatherings in Korea and China, as well as subsequent expeditions by the Arboretum staff through institutional relationships with Chinese botanic gardens.

The latter collection began as a result of Polly Hill's visits to the Arnold Arboretum and her link with the Delmarva Peninsula. In the maritime climate and sandy acidic soils of the Polly Hill Arboretum, *Stewartia* have performed exceedingly well (Boland 2006). Although the collection is largely composed of taxa of cultivated origin, it is due to be augmented by those of wild documented origins

after the completion of two expeditions to Japan and one to the southeastern US.

In addition, the Polly Hill Arboretum is part of the new collaborative Stewartia Working Group (SWG) which consists of the following members: Mt. Cuba Center, Delaware; Birmingham Botanical Gardens, Alabama; Yew Dell Gardens, Kentucky; and Smithgall Woodland Garden (Atlanta Botanical Garden), Georgia. This group will focus on the conservation of the two North American species.

Other institutions where *Stewartia* can be seen include the Morris Arboretum, Pennsylvania; the Scott Arboretum, Pennsylvania; the University of Washington Botanic Garden, Washington State; Quarryhill Botanical Garden, California; and the University of British Columbia Botanic Garden, Vancouver, Canada.



Stewartia pseudocamellia 'Harold Hiller' colours well in the autumn, even in relatively shady sites



Philippe de Smet/berch

Stewartia rostrata is distinguished by its wavy-edged sepals and the red fruit is one of its ornamental characteristics

In the UK, High Beeches Gardens holds the National Plant Collection of *Stewartia*, although other gardens in the area, such as Wakehurst Place, Borde Hill and Nymans have respectable, if not venerable, specimens. Despite the youth of the trees, Arboretum Wespelaar and Garden of Herkenrode, Belgium, has an impressive collection with some of the species planted as groves.

Because *Stewartia* hybridise readily in cultivation it is important that reference collections with well-documented specimens of known wild provenance exist. Institutions that propagate plants from open-pollinated seed for sale or distribution need to be aware that they may have hybrids on their hands.

Conservation

The conservation status of the Chinese species is not well known, although habitat degradation by human activity such as farming, logging or mining threatens many populations. American species are vulnerable or endangered; the severe drought in the southeast US, particularly Georgia, has added considerable stress to populations that may already suffer from inbreeding depression. Very few occurrences of seedling regeneration were observed during the SWG

autumn 2007 expedition.

Cultivation

The east Asian species generally perform better in cool maritime regions, whereas those from the eastern US require consistent summer warmth. All species prefer moist, acidic soils, and need light shade if the afternoon sunlight is intense. Their foliage will often exhibit chlorotic symptoms if soil pH is unsatisfactory, and it can become marked by necrosis during severe droughts. In rare instances where late spring frosts have occurred, *Stewartia* may not flower at all. Pests and diseases are not common in cultivation.

Propagation

Despite research into propagation protocols (Curtis *et al.* 1996, Struve and Lagrimini 1999), *Stewartia* remains scarce and expensive in the nursery trade. It is typical for softwood cuttings taken in spring to root successfully, only to suffer high mortality after overwintering. However, a 50% success rate can be achieved if a young mother plant is used. *Stewartia rostrata* and its hybrids are generally the easiest to propagate.

Propagation from seed is more difficult than that from cuttings. Seed needs to be as fresh as possible and no single treatment is best; it

can take four years to germinate (Jack Johnston, pers. comm.). Spontaneous seedlings, especially of *S. monadelphica* and *S. pseudocamellia* hybrids, often arise near parent trees, whereas attempts to raise them in pots are rarely successful. Of the deciduous-leaved species, *S. pseudocamellia*, *S. monadelphica* and *S. sinensis* appear to be the least difficult.

One of the crucial factors for the survival of seedlings and cuttings may be the pH of the potting medium or irrigation water (Del Tredici, pers. comm.), and research is being undertaken on this.

Young cuttings or seedlings have to be protected from frost until they

are three or more years of age.

Conclusion

Stewartia may not have the robust showmanship of *Magnolia*, *Malus* or *Prunus*, yet this deficiency is made up for by their ornamental merits at all seasons.

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