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Cover: Stewartia pseudocamellia 'Korean Splendor'. Photo: P. Chavny.
Certainly some of the most interesting and unusual small trees and shrubs available for use in ornamental plantings are the deciduous species of the genus *Stewartia*. And although the horticultural merits of these plants have occasionally been ex- tolled, we feel justified in bringing them to your attention again, particularly since a new species, already in cultivation at the Arnold Arboretum, has recently been discovered and named. Moreover, the methods given below of propagation of *Stewartias* from seed and cuttings will hopefully encourage growers to increase the numbers of these pest-free plants so that they can receive the widespread use and popularity we feel they deserve.

*Stewartia* is a member of the tea family, the Theaceae, and plants of the genus are easily recognized in our cultivated flora by their numerous creamy white flowers that are produced individually on short to long pedicels in the axils of the leaves. The small, sometimes bushy trees or shrubs have alternate, simple, dark green leaves that lack stipules; the leaf margins are serrated or toothed, and the under surfaces are often finely pubescent when young. In the Boston area *Stewartias* bloom during late June and early July, a period when most of the spring-flowering woody ornamentals have past. The flowers are produced on the current season's growth, and the flower buds, enveloped by the calyx and subtended by one or usually two floral bracts, are evident early in spring as the leaves expand.

The calyx is comprised of five sepals that are usually similar in size and shape to the floral bracts, and in some species both are conspicuously foliaceous. The five (or sometimes up to eight) petals of *Stewartia* flowers are essentially scallop-shaped in outline and form and are silky pubescent on their outer surfaces; in one species the petals are flushed with red on the outer surface near the base. The stamens are numerous, and the filaments are united to one another towards the base where they
are usually attached to the base of the petals as well. After flowering, the petals and stamens fall to the ground still attached to one another.

The flowers of Stewartias are similar in size, general structure, and appearance to a single *Camellia* flower. This fact is not surprising since these two genera, along with *Franklinia* and *Gordonia*, belong to the same subfamily of the Theaceae. A key to these genera and other genera of Theaceae in cultivation has been published previously in *Arnoldia* (17: 1–12. 1957) in an interesting and informative article by Dr. C. E. Wood, Jr.

Equally intriguing as the flowers, the relatively large fruits are rounded or conical, usually five-ribbed, woody capsules that are tapered at their upper ends into beaklike projections. The capsules develop from the superior, compound ovaries found at the center of the flowers. When in bloom, the ovaries of the flowers are usually hidden from view by the numerous stamens. Green at first and subtended by the persistent sepals and floral bracts, the capsules gradually assume a rich, light or dark brown color at maturity when they open to disclose the seeds in five internal locules or compartments. The capsules of most species remain on the branches during the winter months, providing an attractive accent to the delicate tracery of the branches.

But perhaps the most notable aspect of several species during the winter months is the fact that, once the colorful fall foliage drops, the bark of trunks and limbs is exposed to full view. Four of the deciduous species develop smooth, mottled bark, and on larger trunks and branches soft fawn, silvery or pinkish-brown, or buff colored areas alternate in irregular patterns with one another or with darker cinnamon or reddish-brown areas. The beautiful bark colors and patterns alone are reasons enough to plant these species of *Stewartia*.

As it is now understood, the genus *Stewartia* consists of both evergreen and deciduous species, although the latter are by far the most familiar horticultural subjects. Only one evergreen species, *Stewartia pteropetiolata* Cheng, is known to be cultivated in western gardens, and we have documentation of its cultivation in southern California and in England. While the exact number of evergreen species (sometimes grouped as comprising the separate genus *Hartia*) remains indefinite (probably

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*Fig. 1. Close-up photograph of the mottled bark pattern developed on the trunks of Stewartia pseudocamellia. Photo: P. Bruns*
not exceeding eight or nine), seven deciduous species and one hybrid are currently recognized, and all have been introduced into cultivation (see G. P. DeWolf, Jr., The introduction of our hardy Stewartias. *Arnoldia* 29: 41–48. 1969). All of the evergreen species and five of the deciduous species are native to eastern Asia, but the two additional deciduous species occur naturally in the southeastern United States. Thus, *Stewartia* exhibits one of the fascinating distribution patterns that illustrates the floristic relationships between eastern North America and eastern Asia.

The first plants of *Stewartia* on record were found in Virginia by the Reverend Mr. John Clayton in about 1687. The plants Clayton described and distinguished from the dogwood (*Cornus florida* L.) were from a population near Williamsburg on Archer's Hope Creek; that population is still in existence today. Fifty-five years after the Reverend Mr. Clayton had discovered these plants, Mark Catesby, the English traveler and naturalist, received a new shrub for his garden at Fulham, England, from another John Clayton, an English naturalist in Virginia. The plants flowered in May of 1742, and it is suspected that Catesby, recognizing their ornamental value and botanical interest, gave plants of the new shrub to John Stuart, the third Earl of Bute, for the botanical garden he was helping to establish at Kew.

In addition to his gift of living plants to Catesby, the younger Clayton also sent dried herbarium specimens of the shrub to Gronovius, a Dutch botanist who forwarded one to Linnaeus. The name *Stewartia* (sometimes incorrectly spelled *Stuartia*), honoring John Stuart, was given to the new genus and first published by Linnaeus in 1746.

An interesting and ironic historic note to the dual discovery of *Stewartia* by the two John Claytons lies in the fact that both men had discovered different species of the genus. All of the subsequently discovered species of *Stewartia* have been found in eastern Asia, and like several other ornamental genera with eastern Asiatic and eastern American distributions, certain Asiatic Stewartias are the most commonly cultivated ones in western gardens. However the following key, based primarily on floral and fruit characters, will serve to distinguish between all the deciduous species, American and Asiatic. Following the key are notes on the individual species and the one hybrid, an account of the rather unexpected discovery of *S. rostrata* from within the Arboretum's collection, and in conclusion, notes on the propagation of Stewartias.
**Key to the Deciduous Species of Stewartia**

1. Styles 5, distinct, petioles widely winged, enclosing the lateral and terminal buds; floral bract 1. **S. ovata.**

1. Styles united, terminating in 5 or 6 stigmatic crests or arms; petioles narrowly winged, not enclosing the lateral and terminal buds; floral bracts 2. 2.

2. Stamens with purplish filaments and bluish anthers, capsules dehiscent by the outward folding of the valve margins, the apices of the valves ± coherent; seeds angular. **S. malacodendron.**

2. Stamens with whitish filaments and yellow or orange anthers; capsules apically dehiscent, the valves spreading apart from the apex, seeds planoconvex. 3.

3. Floral bracts about equaling or longer than the calyx; small or large trees or shrubs with smooth or fissured bark, young branches usually terete, not zigzagged. 4.

4. Stamens with purplish filaments and bluish anthers; capsules dehiscent by the outward folding of the valve margins, the apices of the valves ± coherent; seeds angular. **S. malacodendron.**

2. Stamens with whitish filaments and yellow or orange anthers; capsules apically dehiscent, the valves spreading apart from the apex, seeds planoconvex. 3.

3. Floral bracts about equaling or longer than the calyx; small or large trees or shrubs with smooth or fissured bark, young branches usually terete, not zigzagged. 4.

4. Ovaries and/or capsules subglobose, completely glabrous or pubescent only at the very base. 5.

5. Ovaries and/or capsules completely glabrous; 2 ovules or seeds per locule; bark on older branches smooth and mottled. **S. serrata.**

5. Ovaries and/or capsules pubescent only at the very base; 4 ovules or seeds per locule; bark on older branches finely fissured. **S. rostrata.**

4. Ovaries and/or capsules conical, pilose or appressed pubescent over the entire surface. 6.

6. Sepals oblong or ovate with acute apices. 7.

7. Floral bracts ovate, subequal to the sepals; styles 6–8 mm. long; seeds 7–9 mm. long. **S. sinensis.**

7. Floral bracts oblong, conspicuously longer than the sepals; styles 3–4 mm. long; seeds 5–6 mm. long. **S. monadelpha.**

6. Sepals ovoid with rounded, ciliate apices. **S. × henryae.**

3. Floral bracts conspicuously shorter than the calyx, small trees with smooth, mottled bark; young branches usually compressed and zigzagged, rarely terete.

**Stewartia ovata** (Cavanilles) Weatherby

**Stewartia pentagyna** L'Heritier

**Stewartia ovata** occurs naturally in the mountains and on the adjacent Piedmont of North and South Carolina, Georgia, Alabama, Kentucky, and Tennessee. It is also known from two isolated stations on the Virginia Coastal Plain in the vicinity of Williamsburg, and it was at one of these localities that the species was first discovered by the Reverend Mr. John Clayton.
Fig. 2. Stewartia. a–e, S. rostrata: a, dormant winter buds, × 2; b, floral bract, × 2; c, ovary and style × 2, note pubescence only at the base of the ovary; d, dehisced capsule with persistent floral bracts and sepals × 1 1/2; e, seed, × 4. f–j, S. sinensis: f, dormant winter bud, × 2; g, floral bract, × 2; h, pubescent ovary and style, × 2; i, dehisced capsule with persistent floral bracts and sepals, × 1 1/2; j, seed, × 4. k–o, S. monadelpha: k, floral bract, × 2; l, stamens, × 2; m, pubescent ovary and style, × 2; n, dehisced capsule with persistent floral bracts and sepals, × 1 1/2; o, seed, × 4. Illustrations by Virginia Savage.
This species is easily distinguished from other Stewartias by the single floral bract that subtends each of its flowers and by its five distinct styles. The flowers, about 2½ inches in diameter, are among the largest produced by any *Stewartia*, and f. *grandiflora* (Bean) Kobuski, a form that occurs sporadically throughout the natural range, is of particular horticultural interest due to its slightly larger flowers (up to 3½ inches across) with five to eight petals. In addition, the stamen filaments in f. *grandiflora* may be purplish rather than the usual white or yellowish color. At the Arnold Arboretum, one plant of f. *grandiflora*, which came originally from Highlands, North Carolina, produces flowers with both purplish and yellowish stamen filaments.

Although the bark of *Stewartia ovata* does not exfoliate to produce a smooth, mottled pattern, the plants develop into small bushy trees or shrubs to about 18 feet in height. And despite its natural southern range, the species and f. *grandiflora* are hardy as far north as the Boston region.

**Stewartia malacodendron** Linnaeus  
*Silky Stewartia*  

Native to the Coastal Plain and Piedmont of the Southeastern United States from Virginia south to northern Florida and west to Arkansas and eastern Texas, *Stewartia malacodendron* is the species that John Clayton, the naturalist, discovered growing in Virginia. While the Silky Stewartia is rather infrequently encountered in cultivation, it produces, in our opinion, the most beautiful of all *Stewartia* flowers. The five large white petals form a contrasting, saucer-shaped background, 3 to 3½ inches across, for the erect boss of stamens that are entirely purplish-blue. The color of the stamens alone is sufficient to identify the species when they are in flower. Unlike the other species of the genus, the reddish-brown capsules of *S. malacodendron* open along the sides rather than from the apex. Furthermore, the seeds are a dark, shining, reddish-brown color and are un-winged and angular in outline. Other Stewartias produce more or less flat, narrowly winged, pale brown seeds.

Although we have attempted to grow *Stewartia malacodendron* several times at the Arnold Arboretum, it has not proved hardy. However, the plants, which develop into large, albeit rather spindly shrubs or small trees to about 20 feet, have been successfully grown as far north as Long Island.
Stewartia serrata Maximowicz

Including Stewartia epitricha Nakai

With the exception of Stewartia × henryae, S. serrata is perhaps the least frequently encountered Stewartia in American gardens. Native to Japan, where it inhabits mountainous regions of Honshu, Shikoku, and Kyushu Islands, it is represented in our herbarium of cultivated plants by only a few collections. It is, however, known to be hardy as far north as Connecticut.

A small tree with horizontal branches and smooth, reddish-brown, mottled bark, Stewartia serrata will be recognized by its petals that are flushed with red near the base on the outer surfaces, as well as by its completely glabrous ovaries. The capsules, like the ovaries, are completely devoid of hairs and are strongly five-ribbed; two seeds are produced in each locule. In England, where it is apparently more commonly cultivated, S. serrata is reported to begin flowering before the other species in early June.

Stewartia rostrata Spongberg

In 1939, the Arnold Arboretum received seed of a Stewartia from the Lu Shan Arboretum in Kiukiang, China, under the name S. sinensis, a species Alfred Rehder and E. H. Wilson had described in 1915. Subsequently, one plant grown from that seed lot was planted in the Stewartia collection on Bussey Hill in the Arboretum. Only recently, however, did the name and identity of our plant come into question. As one of us was checking the identities of our living specimens, this plant did not seem to correspond to the published descriptions of S. sinensis.

On consulting Dr. G. P. DeWolf, Jr., and Mr. R. S. Hebb of the Arboretum staff, it was found that they, too, were aware that something was strange about our plant labeled Stewartia sinensis. Mr. Hebb's recollection of S. sinensis grown at Kew in England was of an upright tree with reddish-brown, exfoliating, smooth, mottled bark. Our Arboretum plant, now 38 years old, is a small bushy tree with several limbs from near the base and with tight, non-exfoliating, finely fissured gray bark.

As a result of these contradictions, further study was undertaken in the herbarium and library. Examination of the holotype specimen of Stewartia sinensis, a specimen collected in eastern Hunan Province, China, by Wilson in 1901, showed that Mr. Hebb's memory had served him well. The specimen represents a species with smooth, exfoliating bark; furthermore,
the ovaries in the center of the flowers are finely pubescent. The ovaries from flowers of the Arboretum tree have hairs only at the very base.

Other herbarium specimens that Rehder and Wilson had annotated as *Stewartia sinensis* included some plants that agreed in bark and flower characters with the holotype specimen. Additional specimens, however, appeared to represent the same species as the Arboretum tree on Bussey Hill. Further study revealed other differences between the two species, differences that are most readily observed when the plants are in fruit.

Once it was determined that the Bussey Hill plant was not *Stewartia sinensis*, the question remained whether it belonged to another species already described, or if it were, indeed, a new undescribed species. In an attempt to answer this question, the taxonomy of the entire genus was reviewed (see the *Journal of the Arnold Arboretum* 55: 182–214. 1974), and all of the published names and as many type specimens as possible were examined. During this process, *S. gemmata*, a name by which several of our living plants were known, also became suspect.
On checking type herbarium specimens of this name it was discovered that Chien and Cheng, the Chinese botanists who had published *S. gemmata*, had redescribed *S. sinensis*. Chien and Cheng had obviously realized that two species were passing under the name *S. sinensis*, but in an attempt to remedy this situation they chose to give the name *S. gemmata* to the species Rehder and Wilson had described and named in 1915. This aspect of the confusion, incidentally, points out the great value of type herbarium specimens in determining the correct application of botanical names. Had Chien and Cheng studied the type of *S. sinensis*, they, too, would have realized that the species that lacked a name was the tree with non-exfoliating bark and flowers with the ovaries pubescent only at the very base. The name *S. rostrata* has been proposed for this new species because of its distinctive rostrate or beaked, five-ribbed capsules that remain on the branches over winter and sometimes into a second or third growing season.

It is of note that *Stewartia rostrata* is the only deciduous Asiatic species that, like the two American species, has tight, non-exfoliating fissured bark. And herbarium data indicate that it is apparently confined in nature to mountainous regions of Chekiang, Kiangsi, and eastern Hunan Provinces in China. In cultivation, it is included in the collections of the Barnes and Morris Arboreta and at Longwood Gardens, as well as at the Arnold Arboretum.

**Stewartia sinensis** Rehder and Wilson  
**Stewartia gemmata** Chien & Cheng

Once it was realized that the Arboretum’s plant labeled as *Stewartia sinensis* was not that species, we were momentarily disappointed that our collection lacked a plant of this Chinese *Stewartia*. It had been discovered by E. H. Wilson, and Alfred Rehder and Wilson had named and described it as new. However, during the taxonomic studies that were initiated because of the unknown identity of *S. rostrata*, it was recognized that plants on Bussey Hill labeled as *S. monadelpha*, a species native to Japan, were actually plants of *S. sinensis*. These plants had been grown from seed obtained in 1934 from the Sun Yat Sen Memorial Park in Nanking, China, and despite the mobility of ornamental plants, it had seemed strange that we had received a Japanese species from a Chinese source.

An erect tree or ascending shrub to about 60 feet, *Stewartia sinensis* is characterized by its attractive, smooth, exfoliating,
mottled bark, its pubescent ovaries, and its foliaceous floral bracts that are about as long as, or slightly longer than, the similar appearing sepals. The capsules are conical and densely pubescent, and two seeds are produced in each locule. The flowers, while smaller than those of some other species (about 2 inches across), are produced in great numbers. In nature this species occurs in mountainous regions of eastern central China, and its closest ally, with which our plants were originally confused, appears to be the Japanese *S. monadelpha*.

**Stewartia monadelpha** Siebold & Zuccarini

*Including Stewartia sericea* Nakai

Known to attain a height of 50 feet in Japan, *Stewartia monadelpha* is native to mountainous areas of southern Honshu, Kyushu, and Shikoku Islands. In American gardens, however, it is usually a smaller tree that is noted for its beautiful reddish-brown bark on both the trunk and delicate horizontal branches. Its flowers are the smallest produced by any deciduous *Stewartia* (a little over an inch in diameter), and it is easily identified in bud, flower, and fruit by the oblong, persistent floral bracts that are conspicuously longer than the five sepals.

**Stewartia pseudocamellia** Maximowicz

*Including Stewartia koreana* Rehder

Readily distinguished from other members of the genus by its small, kidney-shaped or rounded floral bracts that are considerably smaller than the densely silky-pubescent sepals, and by its branchlets that are usually compressed or flattened and zigzagged, *Stewartia pseudocamellia* is the most widely cultivated species of the genus. The flower buds, rounded before opening, and the flowers which are up to 3½ inches in diameter, are borne on long pedicels. The boss of stamens with orange anthers suggest those of a single *Camellia* flower. The ground beneath the small trees or shrubs becomes carpeted with the fallen corollas and the attached stamens as the flowering season progresses.

Native to Japan, where it is also cultivated, *Stewartia pseudocamellia* is also known to occur naturally in southern Korea, and the Korean plants grown at the Arnold Arboretum were germinated from seed collected by E. H. Wilson in 1917. Originally regarded as a distinct species (*S. koreana* Rehder), and then as a variety of *S. pseudocamellia* (var. *koreana* (Rehder) Sealy),
the Korean plants do not appear to be morphologically distinct from the plants of Japanese origin. Korean plants at the Arnold Arboretum do, however, differ from Japanese plants in their more saucer-shaped flowers, their extended blooming period, and in the coloration of the leaves in fall. The foliage of the Japanese plants becomes a deep burgundy-red in fall, while leaves of the Korean plants turn a bright yellow- or reddish-orange. As a result of these behavioral differences, differences that are significant to nurserymen and horticulturists, we propose here that the Korean plants henceforth be designated as a cultivar, and we suggest the cultivar name 'Korean Splendor'.

Observations made here at the Arboretum indicate that individual flowers of 'Korean Splendor' persist on the plants for slightly longer than 24 hours once the buds have opened fully. The prolonged blooming season (as compared with the Japanese plants) is not the result of the persistence of individual flowers, but is apparently the result of a greater production of flowers coupled with the less synchronous maturation of the buds. We

Fig. 4. The camellia-like flowers of S. pseudocamellia 'Korean Splendor' are accented by the rich green foliage. Note the rounded, silky buds yet to open. Photo: P. Bruns
have also noted that small bumblebees are attracted to, and force their way into, the unopened buds of *S. pseudocamellia* and 'Korean Splendor', apparently in search of pollen. The value of *S. pseudocamellia* and 'Korean Splendor' as summer-flowering trees is extended and enhanced by their equal beauty in winter when the mottled bark is viewed against snow-covered ground.

**Stewartia** × *henryae* Li

*Stewartia pseudocamellia* 'Korean Splendor' × *S. monadelpha*

This putative hybrid between the two above listed Stewartias originated spontaneously in the collections of the Henry Foundation for Botanical Research in Gladwyne, Pennsylvania. It differs only slightly from *S. pseudocamellia*, but can be distinguished from that species by its oblong floral bracts that resemble those of *S. monadelpha*, its slightly smaller flower size, and the presence of two seeds per capsule locule. *Stewartia pseudocamellia* produces four seeds per locule, although two are often abortive. From *S. monadelpha* the hybrid can be distinguished by its ovoid sepals with rounded, ciliate apices, and by its larger flower size.

This small tree is known from several specimens at the Henry Foundation where both of the presumed parental species grow in close association with the hybrid, and it is also known in cultivation at Barnard's Inn Farm on Martha's Vineyard. Cuttings obtained from the latter source have been rooted in the Arboretum greenhouses, and young plants of *S. × henryae* will soon be added to the Arboretum collection; to our knowledge, it does not occur elsewhere in American gardens.

**Propagation of Stewartias by Seed**

*Stewartia* seeds are produced within the five-locular, woody capsules, and each locule, depending upon the species, contains two or four seeds. In some instances fewer seeds are produced in each locule due to the abortion of one or more of the ovules; abortion results because the egg within the ovule either was not fertilized, or the egg failed to develop after fertilization. Natural dispersal of the narrowly-winged, flattened seeds of most species is by wind, and in the latitude of Boston the capsules open and the seeds are available for dispersal (or collection) during late September and early October.
A careful watch must be maintained if one intends to collect the seeds from the dehisced capsules on the plants, since tightly closed capsules can open unexpectedly, and the seeds may be scattered quickly. As a result, it is best to collect capsules before they have dehisced. Maturity of seeds is indicated by a change in the appearance of the capsules; about mid-September they begin turning from green to brown, and at this stage the seeds are fully developed and viable, and the capsules can be gathered. Separation of the seeds from the capsules is easy if the fruits are placed in a paper bag, tray, or other container that is then placed in a dry location. In a few days the closed capsules will have opened, and when the container is shaken the seeds will fall out. Separation of the seeds from the capsules can then be accomplished by emptying the contents into a screen of suitable mesh size to retain the capsules but to permit the passage and final collection of the seeds.

Difficulty in the separation of seeds from capsules may be experienced with the fruits of *Stewartia malacodendron*. As mentioned previously, the capsules and seeds of this species differ from those of other species. The angular seeds are often held tightly within the locules, and their removal may require the forceable opening of the capsule by hand. Since the hard woody capsules of this species dehisce naturally along the sides, a blow on the top of the capsule with a small hammer may be necessary to release the seeds.

When kept in dry storage, *Stewartia* seeds lose their viability quickly. As a result they should be sown or placed in pretreatment without delay after they have been harvested. All of the species grown and tested at the Arnold Arboretum (*S. ovata*, *S. pseudocamellia* and 'Korean Splendor', *S. rostrata*, and *S. sinensis*) produce seeds that are doubly dormant, and in their natural habitats the seeds would require two years to germinate. In other words, seeds dispersed in October of 1974 would be physiologically prepared to germinate by natural seasonal changes in the spring of 1976. However, by placing the seeds in a stratifying medium and providing artificial seasons, the seeds can be induced to germinate in about seven months. This pretreatment must be done in two stages, and the container for the seeds and stratifying medium during the process should be a polyethylene bag. Polyethylene film has the property of being air permeable yet vaporproof. Twisting the top of the bag and binding it with a rubber band makes the stratifying unit vaporproof for the entire treatment, and it should not be opened until the treatment has been completed.
At the Arboretum greenhouses, a stratifying medium composed of equal parts sand and peatmoss has worked well with *Stewartia* seeds. This mixture is dampened (moist but not wet) and, in proportion, the medium should be two or three times the volume of the seeds. This factor is important since at sowing time the seeds are not separated from the medium and the entire contents of the polyethylene bag are sown.

Using seeds of those species in cultivation at the Arnold Arboretum, it has been determined that a period of warm stratification for four months followed by cold stratification for three months satisfies the requirements for germination. Seeds placed in warm stratification in early October are transferred to cold pretreatment in early February, and the seeds are ready for sowing in the greenhouse or out-of-doors in early May. This timetable is excellent, since the seedlings will respond favorably to the warm and lengthening days of spring.

Warm stratification can be accomplished by placing the sealed bags in a location where the temperature is subject to normal day and night fluctuations. We place our bags in bins on a greenhouse bench where the temperature has ranged between 60° and 100°F. Any location where the day and night temperatures vary would be satisfactory; full sun, however, should be avoided since it might lead to high temperatures within the bags that would be detrimental to the seeds. When the period of warm stratification has been completed, the bag is simply transferred to a refrigerator to satisfy the need for cold treatment. At the Arboretum, cold pretreatment is accomplished at about 40°F.; however this temperature is arbitrary, and the temperature maintained in the storage compartment of any refrigerator should suffice for the cold treatment.

**Propagation of Stewartias by Cuttings**

As an alternative method of propagation, soft-wood cuttings may be taken from Stewartias to be rooted, and depending upon the availability of donor plants, large numbers of new plants can be asexually initiated. At the Arboretum, cuttings of Stewartias have been taken as early as June 23 and as late as August 20. Although rooting has been partially successful in all our attempts over this time period, the greatest number of cuttings was successfully rooted when the cuttings were taken and treated between June 23 and mid-July.
Although a wide variety of root-inducing chemicals have been used with success with Stewartia cuttings, we have found that Indolebutyric acid (IBA) has proven to be the best rooting stimulant. Normally, the cut ends of the cuttings are dusted with a 0.8% treatment of IBA in talc with the fungicide 'Thiram' added at the rate of 15 percent. High percentages of rooting have also occurred employing quick-dip treatments using a combination of IBA plus NAA (Napthalene acetic acid) at the rate of 2500 parts per million of each in water. Quick-dip treatment involves immersing the bases of prepared cuttings in the liquid preparation for five seconds.

Rooted cuttings of Stewartia, particularly those made late in the growing season, have presented a survival problem during the subsequent winter. When potted or flatted after rooting, the plants have gone into dormancy and never recovered. This loss can be averted, however, if the cuttings are not disturbed after they have rooted. The procedure we use is to fill plastic flats with a rooting medium of half 'Perlite' and half sand by volume. The cuttings are made, treated, and inserted in the flats which are then placed under intermittent mist. When rooting has occurred, the cuttings are left in the flats and hardened off. In November they are transferred to our cold storage unit where the temperature is maintained at approximately 34°F. In February or March the flats are returned to a warm greenhouse, and when new growth begins to appear, the plants are transferred to containers. When handled in this manner, the rooted cuttings can be expected to survive and grow.

When a Stewartia is planted in the garden, it is advisable to place the plant in its permanent location where it will be exposed to full sun or high, only partial, shade. The plants appear to grow best in moist, acid soils, and it has been reported that larger plants transplant poorly. However we have had no difficulty transplanting plants upwards of 7 or 8 feet if a sufficient ball of soil is taken. Ideally, the plants should be grown as specimen trees and shrubs so that the full beauty of form, flowers, and bark can be enjoyed from all aspects and at all seasons of the year.
The many services that an arboretum performs for the public at large are too well known to require elaboration. So also is the educational importance of an arboretum attached to a college or university. Less frequently appreciated are the services that an arboretum performs for the commercial nursery industry. And in exchange there are services that the nursery can perform for arboreta, so the relationship can be a two-way street; in short, a symbiotic one.

Perhaps the most important arboretum function of all, from the nurseryman’s point of view, is to serve as a show case for the products that he grows and sells. Most nurseries, being relatively small commercial enterprises, must make every acre count from a production standpoint. In the case of plant markets unattached to field production, space is even more limited and the efficient manager tries to make every square yard count. Therefore, few nurseries indeed can find the room to grow to full size and display mature specimens of the many tree and shrub species that they offer for sale. This limitation is especially evident in the case of shade trees, many of which need a quarter of an acre or more of ground space at maturity. While it is true that many of the important nursery plants can be found in mature form and size in the average older residential town, they are almost never labeled for identification and similar species or clones are rarely if ever planted adjacent to each other so that meaningful comparisons can be made. Consequently, fortunate is the retail nurseryman whose establishment is near an arboretum. Not all customers wish to research very thoroughly the trees and shrubs that they propose to plant; but for those who want to see the differences and special qualities for themselves, a nearby arboretum or botanical garden offers the best answer to their many questions.

* An address presented at the Annual Meeting of the American Association of Botanic Gardens and Arboreta in Jamaica Plain, Mass. on October 5, 1974.
The “show case” function of an Arboretum can be a valuable sales tool for a nursery too. Displays of mature plants in full bloom often serve as a strong stimulus to the public to seek out a nursery and buy some younger specimens for their home grounds. This is particularly true of collections of showy flowering shrubs like Azaleas, Lilacs, and Rhododendrons. I know of one retail nurseryman located near an arboretum famous for its lilac collection. He regularly stocks a container-grown selection of the best cultivars because he knows he will have a brisk demand for them each spring following “Lilac Sunday.”

Of equal importance to the nursery industry is the arboretum’s function as the only source of many authenticated true-to-name species and cultivars. If a grower wishes to add a rare plant to his production schedule, he frequently has nowhere else to turn for foundation stock. In the vicissitudes of human error, mistakes do occur in the propagation department and clones become mixed, to everybody’s chagrin. This is particularly true in the case of very similar appearing plants that are slow to come into bloom, like lilacs, cherries or crabapples. In such a plight, a request to an arboretum specializing in the group can provide a new supply of true-to-name scions or cuttings.
For a limited number of nurseries engaged in breeding programs arboreta are invaluable genetic "banks" for parent breeding material. It is impractical for a nursery to maintain in perpetuity, true-to-name plants of all the parent stock that might someday be wanted for a breeding program. Yet, taken as a whole, our North American arboreta do this as a matter of routine operation, and this resource is invaluable for the serious private or institutional plant breeder.

The nursery industry, particularly its mail order segment, thrives on new and improved plants. All arboreta that maintain a policy of adding new plants to their collections for testing and display are an important source of new plants for nurserymen. Those which have an active breeding program are even more important because they are actually producing new and improved clones themselves. The National Arboretum in Washington, with its many breeding programs and its plant exploration trips (in part financed by Longwood Gardens) is doing especially noteworthy work in this area at present. The new and unbelievably hardy Azaleas being produced by the University of Minnesota's Landscape Arboretum is another example, as is the imposing list of woody ornamentals introduced by the Arnold Arboretum in Massachusetts. It is difficult to appreciate the enormous contribution that arboreta and botanical gardens have made to our nursery industry and thence to the gardening public.

Arboreta have a new and growing role in the preservation and dissemination of rare native species and races of plants. Just as zoological gardens may end up as the sole hope for the survival of rare and endangered mammals and birds, so arboreta may become the sole hope for endangered plants. Suburbanization and other changes in land use patterns are taking an increasing toll of rare plants each year. When possible, the creation of sanctuaries for rare plants or biomes is the best solution, but all too often local indifference or even greed may militate against such a hope. In these cases the concern and skill of an arboretum can save the day for posterity. The case of the Franklinia is a well known illustration. One small private botanical garden literally saved this handsome small tree for the gardens of today. A unique natural population of Franklinia was extirpated by collecting and export to England where the climate was unsuited to it. The sole surviving parent tree in Philadelphia was the source of all the Franklinias that we enjoy today.
A final important Arboretum function is research in propagation techniques and the dissemination of the findings. This is particularly important in the area of rare or little-grown plants.

The Arnold Arboretum's Alfred Fordham recently received the Award of Merit of the International Plant Propagators' Society for his lifetime of contributions to this field. Research in how to germinate seeds of rare plants, often with peculiar dormancy requirements, research in the rooting of cuttings and in finding and evaluating understocks for clones that must be reproduced by grafting, have made important contributions to the nursery industry. In the field of propagation, the last word has never been said, and the future will hold many happy surprises for the nursery propagator, as a result of arboretum research.

On the opposite side of the equation, there is much that the nursery community can and does do to further the work of the arboreta and botanical gardens. Especially important is the dissemination to the gardening public of the new plants that they create. An arboretum has neither the space and staff, nor the finances to distribute new plants to the public at large. The best that can be accomplished is to send new introductions to cooperating producing nurseries, the solution presently in effect. Not all new plants have commercial possibilities, and
there are bound to be some disappointments. Arboretum breeders are by no means immune to the temptation of commercial ones, that tendency to think that each creation is unique and valuable in itself. A fairly recent example was the flood of Glen Dale Azaleas, a group of hundreds of cultivars whose acceptance by the trade was buried under an avalanche of “look alike” clones. The harsh reality of commerce is necessary to separate the unique yet vigorous clones from the competing “also rans.”

Commercial nurseries also can provide, free or at a nominal cost, the understocks needed for routine arboretum propagation and research. Space and facilities are always at a premium, especially in the limitations imposed by an urban location, and nurseries that grow such understocks in enormous quantities can provide exactly the kinds and sizes wanted, thus relieving limited Arboretum propagation facilities of the burden. For establishments with a propagator on the staff, and many are

*Propagating unit in the Arboretum's Dana Greenhouses.*
now in this situation, nurserymen can propagate the young plants needed for replacement or addition to the collection quickly and efficiently. Each year finds our firm engaged in such activity for arboreta that have no propagator or the specialized structures and techniques needed for certain unusual propagation practices; and many other nurseries regularly take on such special work for favored institutions.

Nurseries, as individuals and through their state and national associations, also can and do assist in financing arboretum work. Our firm and many others regularly make grants of funds and plant material; the latter especially useful for the establishment of the many new arboreta springing up across the country, especially teaching arboreta associated with the new community colleges. The assembly of “one of each” orders for arboretum planting is especially costly and time-consuming, but we think it a very valuable investment for future generations of plant lovers. More and more arboreta and botanical gardens are forming associations of “Friends of The XYZ Arboretum.” Such groups, properly led and encouraged, can provide financial assistance, tour guides to relieve pressure on the Arboretum Staff, and volunteer teachers for classes and children’s activities. “Friends” associations are an invaluable first line of defense when condemnation proceedings arise, as they sometimes do. And a devoted group of wealthy “Friends” is almost the only source for bequests when death takes its toll. Such a valuable association, like any other, must be carefully cultivated to bear fruit. Nurserymen are more than glad to provide quantities of small rare or new plants to be distributed as gifts to members of such supportive groups. The scope of this kind of industry cooperation and support is bound to grow in the years to come.

Symbiosis is an association of living organisms from which both derive benefits they could not have alone. It is a term that can truly characterize the fruitful relationship between the members of the AABGA and the nursery community.

Mr. Flemer is President of Princeton Nurseries, Princeton, New Jersey.

The Botanical Society of the British Isles is an association of amateur and professional botanists whose common interest lies in the study and conservation of flowering plants and ferns. The Society has sponsored a series of conferences, and since 1948 many of the papers presented at individual conferences have been published as symposium volumes. In 1973 we welcomed "Plants, Wild and Cultivated" edited by P. S. Green. The current volume relates to a three-day conference held in the same year.

"The British Oak" is a comprehensive study of two native species, Quercus petraea and Q. robur. Peats and sediments provide a pollen record indicating that the oak has been dominant over large areas of the British lowlands for some 8,000 years. Today Q. robur and Q. petraea remain the dominant trees in all of the British Isles.

As chapters in this volume, twenty-one papers by botanists, foresters and historians cover the taxonomy, cytology, morphology, reproduction, regeneration, productivity, and the ecological role of the oak. The wealth of information makes this an excellent reference work and demonstrates the value of such conferences. The pattern is one that might well be followed to consolidate the knowledge of equally valuable American trees.

Richard A. Howard


Nearly everyone knows of Peter Collinson, the Quaker Merchant of Mill Hill who subsidized and encouraged John Bartram. Less known is his contemporary, the Quaker physician, Dr. John Fothergill, and his garden at Upton. Fothergill's contacts were world-wide. It is recorded that, in the most flourishing
period, his garden contained nearly 3,400 kinds of glasshouse exotics and about 3,000 kinds of hardy plants.

Fothergill is of interest to Americans because of his support of, and contact with, horticulturists in the Philadelphia area (including William Bartram), and because he is commemorated in the genus *Fothergilla*.

These selected letters of Dr. John Fothergill give us a glimpse of English society as seen through Quaker eyes in the middle of the 18th century. It includes, incidentally, some background to the political troubles that culminated in the American Revolution. Altogether a delightful and interesting book.

GORDON P. DEWOLF, JR.

It is unfortunate that in many areas cherries are threatened by a virus that, added to their other problems, now makes these spring favorites a poor choice for the average small garden. However for those who are prepared to ignore the hazards, this is a reasonably priced and well-written book that should fulfill the late author's hope that he can help the cherry lover to select, plant, and grow the best variety for his purpose.

The 58 cultivars and species described have been selected from the hundreds that have evolved since the cherry first became popular in the Orient centuries ago, and are arranged according to habit of growth. This at first appears to be awkward; but with the aid of the index it proves to be simple and quite effective. The real problem will arise when the gardener has selected the tree that he wants and then tries to locate it commercially.

The chapter on cultivation contains sound information and advice, but I feel that the disease and pest problems are dismissed too lightly. To add variety and complete this very pleasant volume there is also a list, with short descriptions, of trees and shrubs for use as foil and background.

SHEILA MAGULLION


This work is a pocket-sized tree and, occasionally, shrub guide to specimens in northern areas. The key is described as unique, but substantially represents the usual dichotomous keys to woody plants.

The descriptions of particular species are fuller than usual and there are good, brief descriptions of habitat. Although it has a glossary at the back, this little volume is virtually useless to anyone who does not have a good basic course in botany and/or taxonomy. A book best suited to the expert rather than the novice.

ELINORE B. TROWBRIDGE

Devotees of British Colonial literature recognize Nepal as the home of the Gurkha, legendary fighting men of the wars in the Indian sub continent. Nepal is also an Indian state in one of the most horticulturally and botanically interesting regions of the world. It has been only recently however, that westerners have been allowed to travel in the country.

Between 1954 and 1969 J. D. A. Stainton made 18 plant collecting trips to Nepal. The present volume is a synoptic overview of the plant association to be found in that country. It is written for the interested lay person who may have the good fortune to visit Nepal.

Supplementing the text are 156 colored reproductions of photographs and a folding map which shows the physiography and the botanical regions. All in all a useful and interesting book.

GORDON P. DEWOLF, JR.


The White Mountains on the California/Nevada border are celebrated as the home of the oldest known living things: the Great Basin bristle-cone pines. This manual details our knowledge of the plants and plant communities of this area.

The little book is a model of what a local flora should be. A map shows the location of various areas mentioned. Chapters deal with the geology of the area, the phytogeographical relationship of the plants and the plant communities and vegetation.

For pilgrims to the bristle-cone pine forests this little book will be indispensable.

GORDON P. DEWOLF, JR.

The author is a well-known contributor to various garden magazines. Lawn management is his horticultural specialty. On the basis of decades of study of grasses, fertilizers, disease identification and treatment, he distills his wisdom in this treatise. Everything is here. Emphasis is on starting newly or anew. We read how to site, grade, prepare the soil, fertilize, select appropriate grasses for seeding or sodding. We are instructed in how to nurse the grass, recognize ailments and engage in the necessary chemotherapy.

The treatment is so complete, so scientific, and so dull that most readers will find their salvation in the chapter “Places Where Grass Doesn’t Grow.” The author’s solution to that dilemma: ground-covers. This should arouse the ire of an Arnold Arboretum staff member who is fond of stating, “the best ground-cover in the long run is — grass.” He obviously hasn’t read Milton Carleton’s book or his reply might be, “anything but grass — grass is SO MUCH WORK.”

Elinore B. Trowbridge

One of the most useful indices of plant names available to taxonomists has been A Dictionary of Flowering Plants and Ferns compiled by J. C. Willis (6th ed. 1931). The 7th edition of this work (1966), edited by H. K. Airy Shaw, eliminated for brevity much of the general information on economic uses, as has the 8th edition (1973). The present volume compiled by the late Keeper of the Museum at the Royal Botanical Gardens, Kew, consists of that material extended and brought up to date. It is said to include the "common names of plants throughout the world, where English is, or has been spoken or used." Trade names and the names of economic or commercial plant products, including timbers, are included and given in English. No dictionary could ever be complete since common names are so variable in use and in spelling. "British-English" spelling commonly is not the same as an "American-English" spelling. The information supplied varies considerably from long detailed discussions to very brief statements. Most data is supplied under the common name, requiring a cross reference from a generic or scientific name; the cross references are not always adequate. A number of the binomials used do not represent the correct scientific name. Recognizing such limitation, the work of Howes will be useful for occasional reference and probably best used as a starting point for further research on an otherwise obscure English common name.

Richard A. Howard


The colonial economy of New England was based upon fishing, farming, and lumbering. While most of us have heard, in a general way, about the King’s Trees, I think we are rather ignorant about the colonial timber trade. This volume tells, in a few pages, a great deal about the economic impact of various forest products upon England and Europe and the West Indies. Along with R. G. Albion’s “Forests and Sea Power” it should be on the shelf of every New England colonial history buff.

Gordon P. DeWolf, Jr.

The most appropriate, accurate description of this volume is supplied by the artist on the third flap of the dust jacket which, in time, will be lost. It is worth repetition. "This book is not intended to be a reference book and certainly not a field guide. It is by no means complete; however, it may serve to identify some of the less familiar plants and to draw attention to others which may have escaped notice. I have made a real effort to

draw the plants accurately, true to form and color. In general the plates are arranged in the sequence of bloom, beginning with skunk cabbage which appears in March and ending with the seeds and berries of autumn. The book is intended for pleasure rather than instruction and I hope it may in some measure achieve its goal."

The brief commentary rarely exceeding fifty words of free verse which Ms. Sargent provides for each plate is indeed an "enthusiastic response to the life around me." Both the artist and the writer have achieved their goals in this expensive, attractive, well-bound and pleasing volume.

RICHARD A. HOWARD


Viability is defined as: "ability to live, grow and develop." "Viability of Seeds" is an attempt to assess the state of our knowledge of the factors which affect or influence seed viability. It is apparent that much of the work on this subject has been done with a limited number of species of crop plants and weeds; thus the data base is still too limited to allow sure generalizations to be made.

The present volume is welcomed as a summary of present knowledge and an indication of the vast quantity of work to be done.

GORDON P. DEWOLF, JR.


This work is part of a long series of titles published by Southern Living, a regional magazine. The contents are, therefore, suited to readers who reside in Zones 8 or 9, and for visitors to azalea country in spring and early summer.

In a pleasant and comfortable style, the author, director of the Callaway Gardens in Georgia, fully describes and illustrates basic procedures relating to azalea growing. The first half of the text includes digging, planting, weeding, feeding, pruning, mulching and watering. There is attention to selecting suitable sites for "naturalistic" plantings; there are lists and discussions
of complementary "companion plants." Azaleas in containers, including Bonsai, are treated. Propagation and disease diagnosis and treatment have complete but not excessive space. The final half considers particular species and hybrids thereof with color descriptions, hardiness ratings, sunshine requirements at various altitudes, and the like.

Several pages are devoted to a state-by-state listing of various southern "azalea show gardens." For one in the northeast this little book is still a good buy. The cultural information alone is worth the price of the volume.

ELINORE B. TROWBRIDGE

The variation in form between seedlings of different species is familiar to all gardeners. We are less apt to observe the change in form of the successive leaves produced by the germinating seed until the mature pattern of leaf position, size and shape is established. The young plant in its cotyledons and first few leaves does offer characteristics by which the species can be identified.

Dr. Burger obtained fruits from known native and cultivated plants and germinated the seeds. In this volume 187 species of 49 families are described and illustrated. The book will be useful primarily to foresters in South East Asia. When used along with James Duke's comparable work on plants of Panama and Puerto Rico (Ann. Mo. Bot. Gard. 52: 314-350. 1965; 56: 125-161. 1969) a good coverage of seedling morphology of tropical families is obtained.

The present volume was prepared for publication in Dutch in 1924, but was never published. In 1967-1971 the manuscript was translated into English for the present publication. Regrettably the translation has resulted in many awkward sentences and questionable use of punctuation. The identification keys supplied for a few families seem superfluous considering the few taxa treated. The illustrations are excellent and useful.

RICHARD A. HOWARD

ARNOLDIA is a publication of the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts, U.S.A.