

Notes on Persimmons, Kakis, Date Plums, and Chapotes

Stephen A. Spongberg

As horticultural taxonomist at the Arboretum for over twenty years, Dr. Spongberg's interests are very wide ranging. Among them are the persimmons, a group he came to admire during the course of his many trips to the orient.

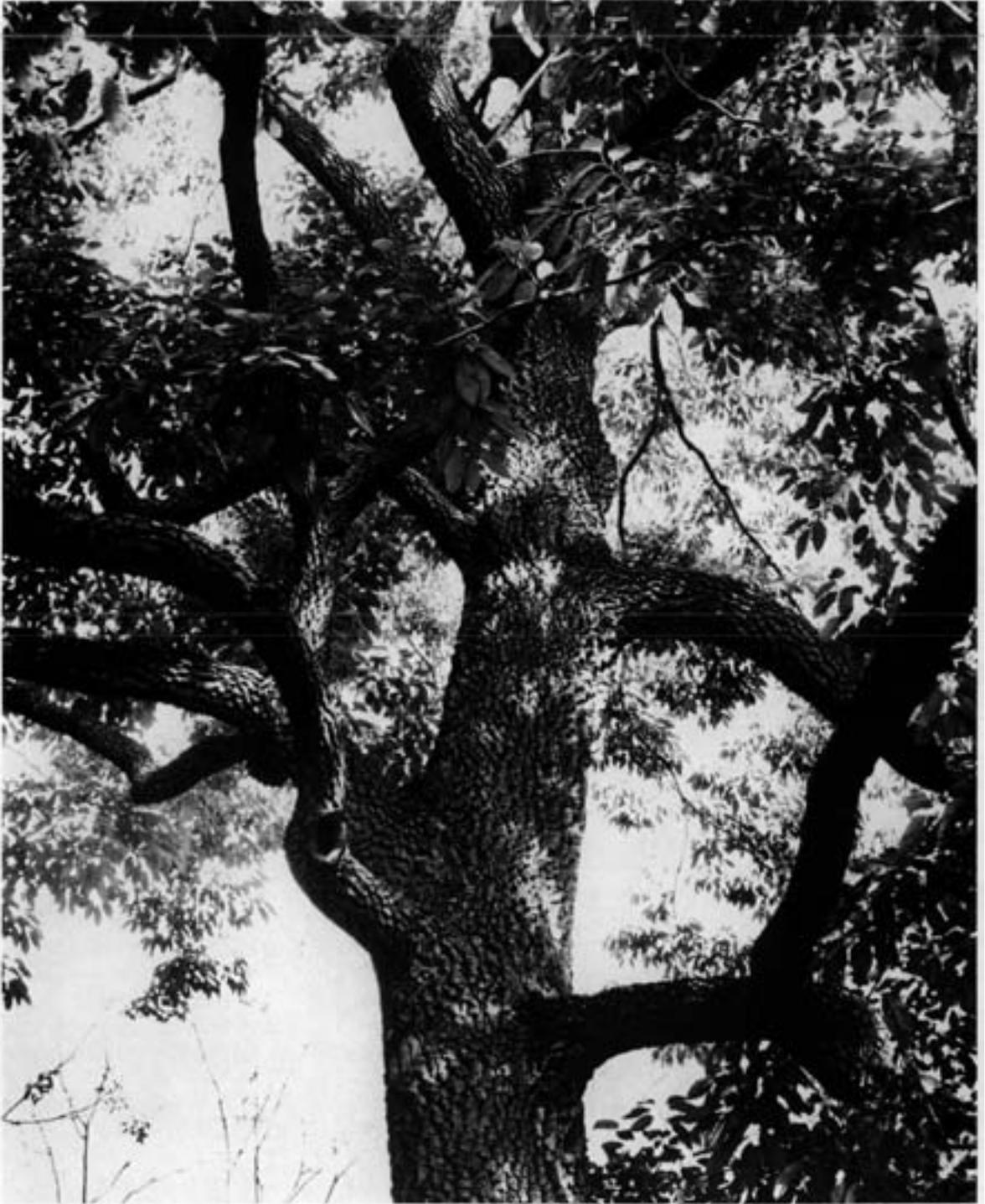
The genus *Diospyros* is not at present an important genus of ornamental woody plants in North America, and while native persimmons once were valuable fruits in the eastern United States, the fruits produced by *Diospyros* species no longer are important food items in the American home. In the countries of eastern Asia at least two species of *Diospyros* are among the most common trees encountered in dooryard gardens and orchards, where they are cultivated for their edible fruits as well as for other uses and for their ornamental beauty. J. J. Rein, a German traveler and author, wrote in 1889 that *Diospyros kaki* Linnaeus f. was "undeniably the most widely distributed, most important, and most beautiful fruit tree in Japan, Korea, and Northern China." And in Japan, where *D. kaki* is second in importance as an orchard crop only to citrus fruit, the kaki often is referred to as the national fruit.

The rarity with which species of *Diospyros* are found in cultivation in cool-temperate North America is partially due to the fact that most are native to regions of tropical and subtropical climate and are not hardy in areas of temperate climate. A member of the

Ebenaceae or Ebony Family, the genus contains upwards of 400 species that occur in both the Old and New Worlds with the greatest concentrations of species occurring in Madagascar (over 100 species), in Malaysia, and in Africa. The relatively few species native to regions of temperate climate come primarily from eastern Asia, but two species, *D. virginiana* and *D. texana*, are indigenous to the United States.

A second reason even the hardy exotic and native species are rarely cultivated undoubtedly is related to a general lack of knowledge concerning when and how the fruits can be eaten, stored for future use, and prepared. While I always begin to look for persimmons in local markets and on Arnold Arboretum trees as the fall advances, many persons' experiences with these fruits understandably end when they first bite into a hard, astringent, and puckery persimmon. Such disappointments no doubt have contributed to a lack of demand for persimmons in American markets.

Despite the fancy prices asked for oriental persimmons or kakis in local vegetable stands and supermarkets, I am hopeful this article will stimulate enough interest to encourage readers to buy and enjoy a persimmon or two



The American persimmon, Diospyros virginiana, growing at the Arnold Arboretum. Photo by Rácz and Debreczy.

and to experiment with different ways of serving, and perhaps, preserving them. If native or American persimmons grow nearby, they can be gathered at little or no cost. I also am hopeful that both the oriental and American species will be more widely planted both for their fruits and as biologically interesting ornamentals.

Characteristics of Hardy Exotic and Native Persimmons

The genus *Diospyros*, the name derived from the Greek *Dios*, of Zeus or of Jove, and *pyros*, grain, in allusion to the sweet fruits fit for the gods, consists of trees and shrubs, and while some are evergreen plants, all of the species considered below are deciduous. The wood of the majority of species is very hard with a watery sap, and the heart wood is often blackish. The heart wood of several of the tropical species, especially that of *D. ebenum* Koenig ex Retzius, is the source of ebony, a hard, black wood often used for piano keys and for other inlaid cabinetry work and undoubtedly the most widely known product of this otherwise little-known genus. . . .

The sexuality of persimmon trees and the production of persimmon fruits are poorly understood and in need of further detailed study. From what is known, persimmons are a biologically intriguing example of a variable and complex reproductive system. In general, the staminate and carpellate flowers are restricted to different individual plants, and the species is classified as dioecious (i.e., two households, male and female individuals separated). However, in some instances, flowers of both sexes occur on a single individual plant, a few branchlets of an otherwise carpellate tree bearing staminate flowers or vice versa. Under these circumstances the species is said to be monoecious (i.e., one household, separate male and female flowers on the same plant). Yet another added complexity in *Diospyros* is that some plants consistently produce flowers of both sexes, but others change from year to year, producing flowers of both sexes in one year, but not in

another. In still other, rarer instances, a few perfect flowers, that is, flowers that contain both functional male and female parts, may occur on staminate or carpellate plants or on plants producing both carpellate and staminate flowers.

Flowering occurs in late spring and early summer, usually during late May and June in the Arnold Arboretum, and swarms of small honey bees have been noted to work the flowers during this period. Due to their small size, their nodding position in the leaf axils, and also because of their greenish and whitish to yellowish color, flowers of *Diospyros* are often unnoticed, and it may be only the activity of large numbers of insects visiting the flowers for pollen or nectar or both that draws attention to the fact the trees are in flower.

Initially green, hard, and with their high tannin content, extremely astringent, the fruits and their subtending calyces increase in size as the season progresses and gradually assume their mature color and texture. Depending on the cultivar, the fruits may ripen any time between July and December or even February, and contrary to some reports, frost apparently is not necessary to reduce astringency or to hasten ripening. As a matter of fact, some cultivars of the oriental persimmon or kaki are sweet and edible when still green and hard, looking like, and with the texture of, green apples.

Ripe persimmons may either contain seeds or, surprisingly, be totally free of seeds. Fruits containing seeds probably result from the normal sexual process whereby the egg cells contained in the ovules of the ovary of a carpellate flower are fertilized, and seeds and fruit develop. Seedless persimmons, on the other hand, develop without fertilization. The development of fruit without fertilization and hence without seeds is known as *parthenocarpy*. What factors are necessary to trigger parthenocarpic development in persimmons is not known to me and constitutes another aspect of the variable and complex reproductive mechanisms of the genus.

Moreover, circumstantial evidence involving a presumably totally carpellate tree of *Diospyros virginiana* in the Arnold Arboretum that regularly produces seed-filled fruits, yet is a considerable distance from the nearest staminate tree, suggests the possibility that some seeded fruits also may be produced without pollination and fertilization. The latter type of asexual seed production, termed *apomixis*, is known in some plant families, but has not been documented in *Diospyros* or the Ebenaceae. It might explain some of the variability of some species of *Diospyros*, including the kaki, and help in interpreting taxonomic complexities of the genus.

The species of *Diospyros* known to me to be cultivated in cool-temperate regions of eastern North America are discussed individually below. . . .

1. *Diospyros virginiana* Linnaeus, Sp. Pl. 2: 1057. 1753. The American persimmon, common persimmon, simmon, or possum wood, is native to a wide area of the eastern United States, from southern New England and Long Island south to southern Florida, and westward into eastern Iowa, Kansas, Oklahoma, and eastern Texas. Infrequent in southern New England, it reaches the northernmost limit of its natural distribution at Lighthouse Point in New Haven, Connecticut, but it is hardy further north and can be cultivated successfully throughout USDA Zones 5a and 5b. Common south of New England both east and west of the Allegheny Mountains, *Diospyros virginiana* is particularly plentiful in the southeastern states where it often invades fallow fields and forms dense thickets along roadsides, spreading by means of black, fleshy, stoloniferous roots. The trees usually grow in sandy, well-drained soils, but also occur in rich, wet soils of bottomland forests.

An extremely variable species over its wide range, the American persimmon occasionally develops a shrublike habit, but generally is a small tree to 10 or 15 meters, rarely to 35 meters, often with spreading and pendulous branches. The bark, hard and of a brownish

or blackish color, is irregularly and deeply fissured into small, blocklike plates, and resembles that of the flowering dogwood, *Cornus florida* L. . . .

The fruits of the American persimmon vary in size from that of a small cherry to that of a large plum about 4 centimeters in diameter, and in color from orangish to pinkish-yellow, often with a grayish bloom when ripe, to dark purple or bluish-black in f. *atra* Sargent. The fruits are an important food to many forms of wildlife, and opossums, raccoons, and squirrels often strip the trees of any fruits remaining on the branchlets during the winter months. The fruits also were important food items to the Indians of eastern North America as well as to the first European settlers and explorers. Easily grown from seed, American persimmons were sent back to England and established in English gardens some time before 1629.

The Spanish explorer Don Fernando de Soto learned of the food value of the persimmon from the Indians of Florida in 1539 and probably was the first European to write about the fruit. In the next century, Captain John Smith, among others, took an interest in the *putchamins* of the Indians, and likened them to medlars (*Mespilus germanica* L.), noting that "if it not be ripe it will drawe a mans mouth awrie with much torment; but when it is ripe, it is as delicious as an Apricock." The name *putchamin*, L. H. Bailey suggests, probably is a phonetic rendering of the Indian name for the plant.

Hedrick, in his *History of Horticulture in America to 1860*, states that "of the several plants used by the Indians, two, the persimmon and sassafras, were of importance to the [colonists] of Maryland and Virginia." European settlers in the southern states prepared a persimmon or simmon beer and used the fermented juice to distill an apparently very good brandy. In Pennsylvania, Isaac Bartram wrote a treatise on the preparation of persimmon wine. Persimmons also were eaten when ripe, or prepared in puddings, breads, or as preserves, while dried persimmons were



An old tree of *Diospyros lotus*, approximately 26 meters tall, growing at the base of Fei-Yueh-ling, Ching Chi Hsien, western Szechwan Province, China. Photo by E H Wilson, 1908. From the Archives of the Arnold Arboretum.

stored and eaten as we eat figs and dates. The wood of the common persimmon has been valued for its hardness and density and has been used locally for innumerable items; it once was preferred for shuttles over any other American wood.

During the 19th and early 20th centuries, considerable interest centered on the American persimmon as a potential orchard crop, and numerous cultivars, selected for fruit color, taste, size, and early maturation, were selected from wild populations and named. . . . While interest in cultivars of *Diospyros virginiana* has continued to the present day, primarily in the Midwest, to my knowledge American persimmons never have been grown successfully on a commercial scale. Undoubtedly, this in large part is due

to the fact that the American appetite for persimmons is limited, and the California-produced oriental persimmons satisfy the current market demand. Nonetheless, local native and occasional cultivated trees help to satisfy those of us who enjoy our native persimmon. . . .

2. *Diospyros lotus* Linnaeus. Sp. Pl. 2: 1057. 1753. The date plum, *Diospyros lotus*, is very similar to the American persimmon in its morphology and may be the closest living relative of our native species. . . . In the Old World, *D. lotus* is very widely distributed as a native, naturalized, or cultivated plant from southern Europe, the Caucasus, and Asia Minor eastward through the northwestern Himalayan region, and into China, Korea, and Japan. In cultivation since ancient times, the natural occurrence and original distribution of *D. lotus* no longer are possible to ascertain. In England and other areas of northern Europe, the date plum has been cultivated as an ornamental since the 16th century. In North America, the date plum is hardy at least as far north as the Boston area. It probably was introduced into North America when seeds were received at the Arnold Arboretum in 1884 from the Imperial Botanical Garden at St. Petersburg.

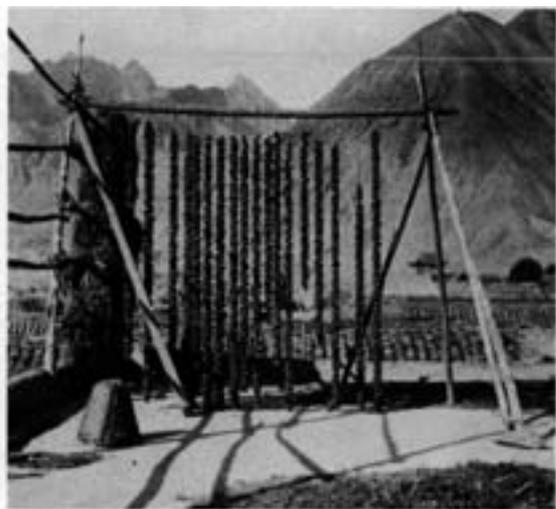
A small tree, usually with a rounded crown, that with age may attain 30 meters in height, *Diospyros lotus* is valued in Asia for its small, yellowish-brown to bluish-black fruits, which have a taste similar to dates and often are dried for winter consumption. The Chinese name for the species, *Ghae tsaio*, signifies black date. The fruits attain a diameter of about 2 centimeters, and those I have examined or eaten always have been almost completely filled with brown, oblong, and flattened seeds. F. N. Meyer, a plant collector for the USDA, reported a seedless type from China. The date plum is especially valued in eastern Asia as an understock onto which scions of the oriental persimmon are grafted.

Diospyros lotus grows, either as a native or naturalized plant, in rocky, protected ravines,

along mountain streams, and on rocky slopes. In Japan I saw a fruiting and healthy-appearing tree growing from a crevice in a rock outcrop on the Pacific Ocean beach at Matsushima. The date plum may prove of value as a small ornamental tree in coastal areas where salt spray limits the effective use of other ornamental species.

3. *Diospyros kaki* Linnaeus f., Suppl. Pl. 439. 1781. The kaki, Chinese persimmon, Japanese persimmon, or oriental persimmon, with fruits sometimes the size of large tomatoes, is the persimmon that occasionally appears in American markets and abounds in markets in Japan, Korea, and China during the late summer and fall and into winter. Like the date plum, kakis have been cultivated for such an extended period of time that the natural species range has become totally obliterated. Grubov, a Russian botanist, has suggested that the wild progenitor of the cultivated forms was native to northern China, while Rehder and Wilson in *Plantae Wilsonae* (1916) state that *Diospyros kaki* var. *sylvestris* Makino, the reputed wild form of the kaki, with smaller, yellow, and often hairy fruits, is "abundant in the mountains of central and western China up to 4000 feet altitude, where it forms a large tree 50 or 60 feet tall." . . .

That selection for differing fruit types has occurred is evidenced by the upwards of a thousand cultivars or forms of the kaki that are cultivated in Asia and maintained by ring-budding or grafting, primarily on date plum rootstock. Ranging in size from about 2 centimeters in diameter, the size of a small plum, to about 8 centimeters in diameter with a weight of over a pound, kakis can be astringent or sweet, seedless or seeded, and conical, round, flattened, or almost cubical in shape, and some cultivars have longitudinal or horizontal ridges or furrows. The 'Tamopan' or grindstone persimmon is one of the bizarre forms, with an equatorial to near basal furrow, while the more regular, oblong-conical fruits of 'Hachiya' with rounded apices terminating in small, black, stylar scars, are probably the



Cords of peeled persimmons (Diospyros kaki) hung up to dry in the village of Siku, Kansu Province, China, where the local name, Fang sze tze, signifies "square persimmon." Photo by F. N. Meyer, 1914. From the Archives of the Arnold Arboretum.

most common kaki in American produce markets.

As noted previously, the astringency of persimmons is a variable character caused by tannins that, depending upon the cultivar, may or may not be present when the fruits are green and hard. Some forms never lose their astringency, even when soft. The tannin-bearing cells are scattered in strands throughout the flesh of the fruit, and the tannin is associated with a mucilage-like carbohydrate that coagulates and "absorbs" the tannin during ripening. Oxidation of the absorbed tannin causes the tannin-filled cells to turn red in some cultivars; the strands of cells are then easily distinguished. Kaki fruits are also very high in vitamin C and sugar content (glucose ca. 18 percent), the latter a variable character, like astringency, but have relatively low percentages of protein and fat. In Japan, hard, astringent persimmons were sometimes placed in used sake casks or tubs to ripen, and these "tub persimmons," which absorbed the flavor and perfume of the sake, were considered a delicacy. However, the Japanese appar-

ently often ate the hard, unripened fruit, a fact that prompted Charles Sargent to observe that the kaki was "consumed in immense quantities by the Japanese, who eat it, as they do all their fruits, before it is ripe, and while it has the texture and consistency of a pavingstone."

Unlike Americans, who regard the kaki as a fresh fruit to be eaten when ripe or, more rarely, frozen for later use, the peoples of eastern Asia for centuries have dried the fruits for storage and use during the winter and early spring months. The persimmons, either whole or sliced, and occasionally skinned, are dried in the sun until their flesh attains the consistency of a dried fig. I have seen sliced persimmons drying on wooden platforms on rooftops in Korea, while a photograph taken by Frank N. Meyer, Agricultural Explorer in China for the U.S. Department of Agriculture early in this century, shows the fruits strung on stout cords and suspended from a simple scaffold to dry in the sun and wind. . . . Meyer's photographs also document another way in which the persimmon is used. In certain areas of China, the sugar, which collects on the cut surfaces of the dried kakis, is compacted into thin, round cakes or loaves and then pressed into molds to produce ornamented tablets. The Chinese characters on the surface of the tablets photographed by Meyer signify "double happiness"; couples engaged to be married often present these tablets to friends from whom they have received wedding gifts. The tablets of sugar also are served as one of the eight comestibles offered with tea during the first course of traditional Chinese banquets.

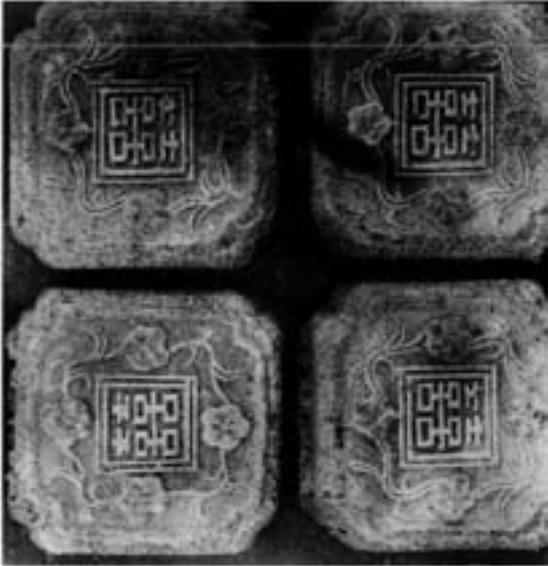
The kaki is grown in Asia for more than its edible fruits. Numerous medicinal properties have been attributed to different parts of the plants. The green unripe fruits of what in China is known as the oil persimmon, *Diospyros kaki* var. *sylvestris*, the reputed wild form of the domesticated kakis, are used to make a varnish oil that renders hats and umbrellas waterproof. In Japan, Shibu, a highly astringent, milky, light or dark gray fluid rich in tannin, is prepared from unripe

kakis and date plums during the summer and is used to toughen paper, wood, and fishnets. It also is required in one stage of the complicated process of making fine Japanese lacquer work and in the preparation of sake and certain dyes.

Sir Joseph Banks, botanist on Captain James Cook's first voyage around the world, is credited with the introduction of *Diospyros kaki* into Europe, while the first trees of the kaki in North America probably were grown from seeds obtained in Japan by Commodore Perry in 1856. Likened by some to an apple or pear tree in size and shape, but with larger, lustrous green leaves that turn scarlet in the fall, when it is particularly handsome with its brilliant fruits, the kaki was considered by Sargent to be the most beautiful of any fruit tree of cold temperate climates. Knowing that the kaki is hardy in Peking, Sargent speculated that it would be hardy in New England "if plants of a northern race can be obtained." Unfortunately, kakis, even some grown from seed obtained near Peking, never have survived in the Arnold Arboretum for longer than a few growing seasons. . . .

4. *Diospyros texana* Scheele, *Linnaea* 22:145. 1849. Unlike the carpellate flowers of the American persimmon, the date plum, and the kaki, carpellate flowers of the chapote, black persimmon, or Mexican persimmon lack sterile stamens or staminodia. Moreover, the flowers appear on the branchlets of the previous year's growth, and the anthers of the staminate flowers open by short, apical slits, while those of the other species dehisce by longitudinal slits that continue down the entire length of the anther. These differences help to distinguish *Diospyros texana* from the other species of the genus and were considered by John K. Small of enough significance to merit placing *D. texana* in a separate, monotypic genus, *Brayodendron*. However, most botanists have continued to regard the chapote as a unique species of *Diospyros*.

The chapote further differs from the other species discussed in this article in its shrubby,



Square tablets of persimmon sugar obtained from the dried fruits of a variety of *Diospyros kaki* with the Chinese name Pen sze sse. The Chinese characters signify "double happiness." Photo by F. N. Meyer, 1914. From the Archives of the Arnold Arboretum

often many-stemmed habit, although it may develop into a single-stemmed twiggy tree that occasionally reaches 25 meters in height. The bark of the chapote also is distinctive; it is smooth, light reddish-gray or reddish-brown,

and the outer layers exfoliate in irregular sheets, exposing the smooth, gray, inner bark. In appearance, it is reminiscent of the mottled bark of the crape-myrtle (*Lagerstroemia indica* L.) and is one of the characters that recommend the chapote as an ornamental plant.

Native to the United States, the chapote is distributed in central and western Texas and ranges southward into the Mexican states of Coahuila, Nuevo León, and Tamaulipas. Over its range it grows in rich moist soils of bottomlands as well as on dry rocky mesas and in isolated canyons. The small, hairy, black fruits mature to 2.5 centimeters in diameter. When mature, they are sweet but rather insipid. According to Paul Standley, they leave an "indelible black stain upon everything with which [they] come in contact" and have been used by Mexicans of the Rio Grande Valley to dye sheepskins.

Sargent notes that this species should prove valuable as a cultivated ornamental for its attractive, lustrous foliage, the interesting black fruits of the carpellate plants, and its mottled bark. It is recorded as cultivated in Virginia and in Pennsylvania, and although it has not yet proven hardy at the Arnold Arboretum, it may be hardy as far north as southern New England.