

Mesquite and Palo Verde Trees for the Urban Landscape

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Mesquite

Mesquite trees are members of the genus *Prosopis* and the *Fabaceae* (legume or bean) family. Because of their attractiveness and drought tolerance, they are one of the "backbone" plants of many xeriscape plantings. They tolerate most soils with good drainage and grow well in full to reflected sun as well as in partial shade. They range in size from shrubs to large trees that grow to over 30 feet (10 meters) in height. They are native to North America, South America, Africa, India, and the Middle East.

In Arizona, native mesquites grow along dry stream beds, in washes, flood plains, along rivers, on plains and hillsides, and in grasslands. Where water is not a limiting growth factor, the trees reach their true majestic size. At elevations above 5000 feet (1525 meters) their growth is retarded due to cold and plants may appear as low growing shrubs. All mesquites are heat tolerant and grow rapidly during hot weather provided there is adequate water available. Mesquites are deciduous, and foliage is shed in response to cold temperatures and prolonged drought conditions.

The different species of mesquite can be distinguished by tree form, size, shape, and bark characteristics, but foliage is particularly useful in determining the species. Line drawings of leaves for the mesquite species discussed accompany the descriptions of the plants (Fig. 1 – 6, and 8). Leaves are bipinnate, meaning that leaflets are arranged along a central axis (pinna) similar to a feather, and each leaf has one or several pairs of pinnae. Flowers of all mesquites are catkin-like and develop into seed pods of various shapes and sizes.

Historically, mesquite wood has been used by early peoples as a source of food, building materials and firewood. A nutritious meal is made from ground mesquite seed pods which helped sustain early Native Americans. Owing to the high protein content of the seeds, shoots and pods, it is an important food for range cattle. Currently there is a resurgence in the manufacture of mesquite furniture and flooring due to the natural beauty of the wood, its intricate grain, coloration and durability. Many trees are converted into charcoal and are sold as a favorite barbecue wood that

is renowned for its unique southwestern flavor. This has taken its toll on some of the oldest and largest trees in the wild. Bees produce a fine quality honey from the mesquite flowers.

Mesquite Species and Hybrids

Prosopis alba (Argentine mesquite)

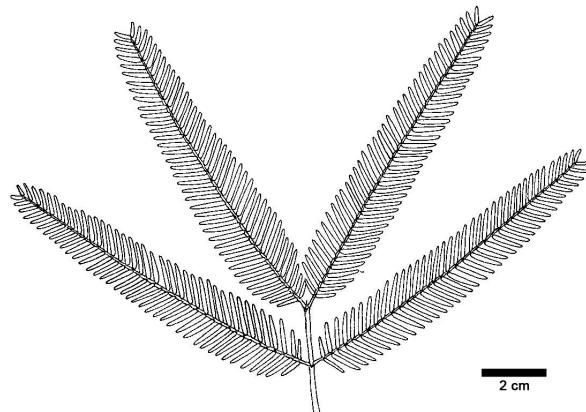


Figure 1: Leaf of *Prosopis alba*

The mature height and spread of this species may be 20 – 50 feet (6 – 16 meters). Argentine mesquite has been misidentified as Chilean mesquite for many years. Argentine mesquite is characterized by airy blue-green foliage on sometimes spiny stems (Fig. 1). The tree may have thorns or may be thornless. It becomes leafless after the first hard freeze of winter and is typically dormant for 6 – 8 weeks. When planted at elevations below 2500 feet (762 meters), it may remain semi-evergreen through the winter. If the winter is exceptionally mild, leaf drop may not occur until March which coincides with the first flush of new growth. Leaves of Argentine mesquite have 1 – 3 pairs of pinnae each with 25 – 50 pairs of leaflets. Flowers are catkin-like 2 – 3 inches (5 – 8 cm) long and pale yellow, followed by 3 – 5 inch (8 – 12 cm) long seed pods which ripen in July and August.

Prosopis chilensis (Chilean mesquite)

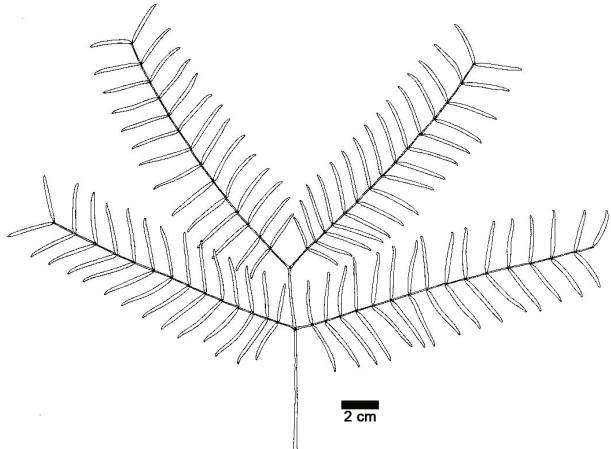


Figure 2: Leaf of *Prosopis chilensis*

This mesquite is characterized by a lacy crown of blue-green foliage on spiny stems (Fig. 2). Spines may be up to 2 inches (5 cm) in length which may limit its use in residential or high traffic areas. The trunk is typically dark brown and fissured. In the low and mid-desert, below 2,500 feet (762 meters), the tree will lose most of its foliage except in years of mild winter temperatures when foliage may remain on the tree until March. Old leaves do not fall from the tree until new growth is well underway. During cold winters the tree will be dormant and leafless for 6 – 8 weeks during winter. New foliage will appear in late March or early April and is fern-like and a beautiful light green. Leaves are characterized by 1 – 3 pairs of pinnae each with 10 – 29 pairs of widely spaced leaflets. Flowers are 1 – 3 inches (2.5 - 7.6 cm) in length and light yellow. Flowers are followed by 2 – 5 inch (5 – 13 cm) bean pods that ripen in July.

Prosopis glandulosa var. *glandulosa* (Texas honey mesquite)

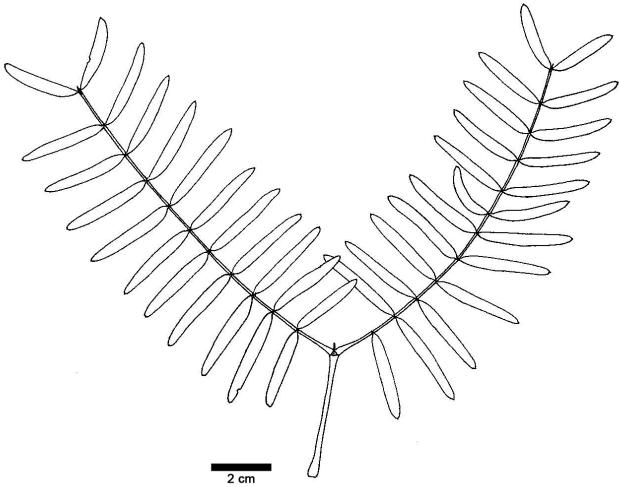


Figure 3: Leaf of *Prosopis glandulosa* var. *glandulosa*

This attractive ornamental tree grows to a mature height of 15 – 30 feet (5 – 10 meters) and is characterized by its weeping habit and shiny foliage which resembles *Schinus molle* (California pepper tree). It has small reddish thorns and creamy white flowers. Leaves have 1 – 2 pairs of pinnae with 6 – 17 pairs of secondary leaflets per pinna (Fig. 3). The

trunk is tan and smooth when young but becomes rougher and darker as the tree matures. Texas honey mesquite is native to the southwestern U.S. including Texas, Oklahoma, Kansas and into northern Mexico.

Due to its ornamental popularity, several selections have been made for foliage, form and thornlessness. These cultivars are vegetatively propagated to insure the integrity of the clone. Texas honey mesquites require well drained soil and tolerate full sun or partial sun. Once established, plants irrigated monthly develop into larger trees with a dense canopy.

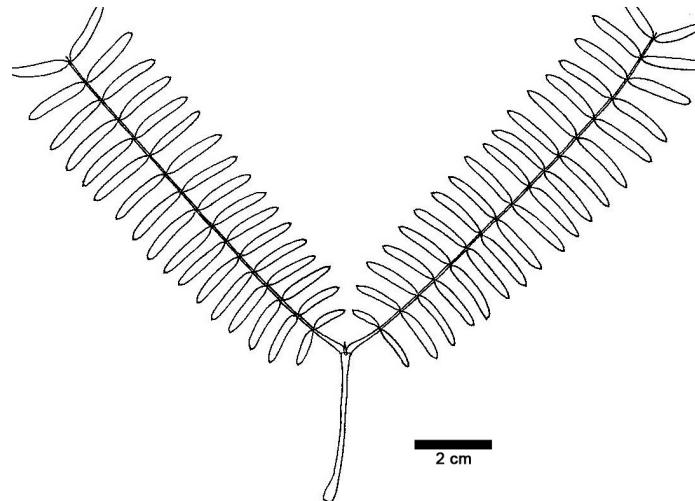


Figure 4: Leaf of *Prosopis glandulosa* var. *torreyana*

P. glandulosa var. *torreyana* is similar in character to Texas honey mesquite, but has smaller leaves with one pair of pinnae and 8 – 24 pairs of leaflets per pinna (Fig. 4). It is native to west Texas, California, New Mexico and parts of Arizona and Mexico. This variety can sometimes be found in nurseries.

Prosopis nigra (Black mesquite, Algarrobo negro)

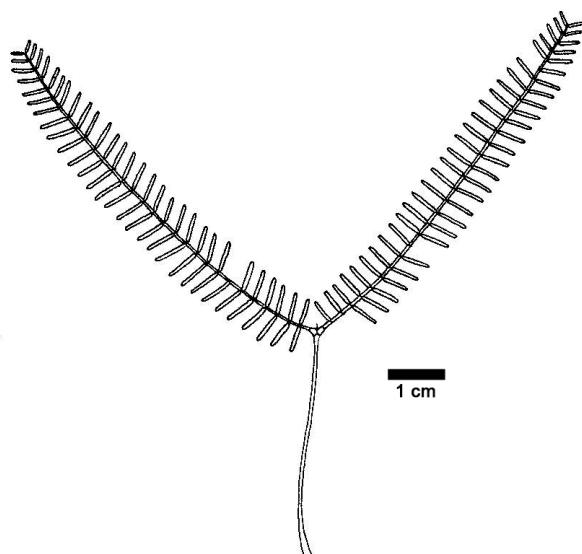


Figure 5: Leaf of *Prosopis nigra*

P. nigra is native to Argentina, Paraguay and parts of Uruguay. It resembles *P. alba* in many respects and has very similar form and foliage (Fig. 5). The leaflets of *P. nigra* are closely packed in dark green compound leaves. Leaves have 1 – 3 pairs of pinnae with 20 – 30 pairs of leaflets per pinna. Trunk color is dark brown to black. Unlike many members of the *Prosopis* genus, black mesquite is evergreen under most conditions. The plant form is quite variable and may be heavily thorned. With deep soil and adequate moisture the tree may grow to 30 feet (10 meters) in height and width. It will tolerate being grown in irrigated turf areas and full-sun exposure. The wood is prized because of its beautiful brown streaking and is used to make furniture and barrels. Flowers are typical catkin-like up to 2.5 inches (6 cm) long and yellow, and are followed by seed pods that are 4 – 6 inches (10 – 15 cm) long and are often streaked with pink. *P. nigra* is currently underused as it is not commonly available in the trade, although it is an excellent tree for the low and mid-elevation desert.

Prosopis pubescens (Screwbean mesquite, Tornillo)

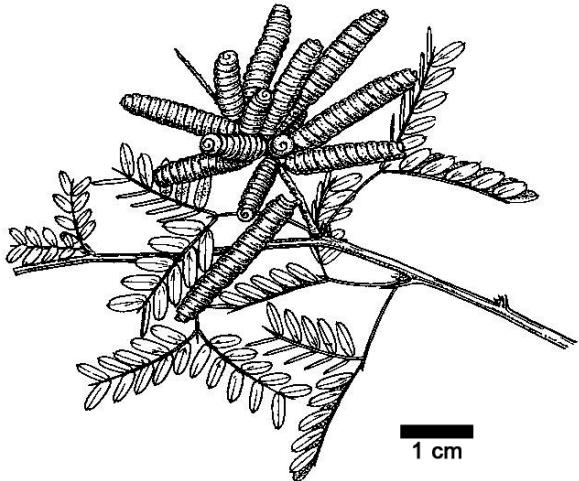


Figure 6: Leaf and seed pod of *Prosopis pubescens*

Screwbean mesquite grows to about 25 feet (7.6 meters) with an equal spread. *P. pubescens* is native to the Sonoran and Chihuahuan deserts in parts of southern Arizona, Texas, and New Mexico. The tree is characterized by unique seed pods that appear as a tightly wound spring or a screw, hence the common name (Fig. 6). “Tornillo” means screw in Spanish. The tree is typically multi-stemmed and the bark on older branches is shaggy, flaky and easily peels from the tree. Typical form of the tree is vase-like, very open and spreading. The leaves are smaller than the other mesquites described above and are characterized by one pair of pinnae with 5 – 9 pairs of leaflets per pinna. Each leaflet is approximately $\frac{3}{8}$ to 1 inch (1 – 2.5 cm) in length (Fig. 6). The small $\frac{3}{4}$ inch (2 cm) spines are whitish, slender and appear as pairs along the branches. Catkin-like flowers are bright yellow. This tree grows very slowly without irrigation.

Prosopis velutina (Velvet mesquite)



Figure 7: *Prosopis velutina* in winter (above) and spring (below)

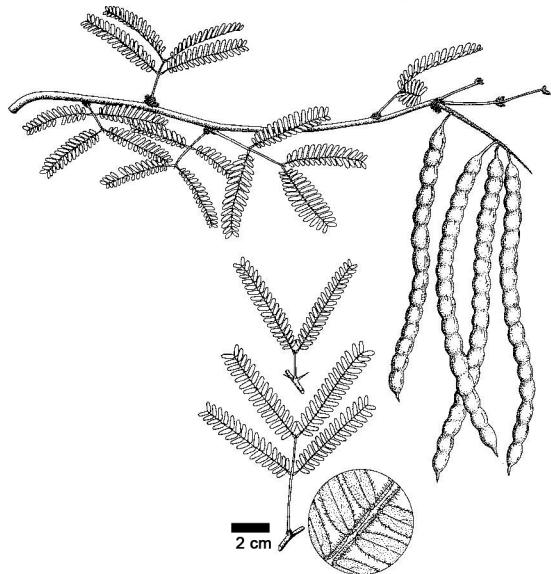


Figure 8: Leaf and seed pod of *Prosopis velutina*

Mature size of velvet mesquite is 30 – 50 feet (9 – 15 meters) height and spread (Fig. 7) when grown with adequate water and in deep soils. Growth rate is slow to moderate but moderate to rapid under irrigation. Velvet mesquite is

native from central and southern Arizona into Mexico. It grows as a shrub on dry rocky upland sites but will grow much larger under ideal conditions. This tree may be found as a single-stemmed tree in bosques (thickets) or as a multi-stemmed tree in open areas. The bark is fissured, dark brown and rough. The wood is prized for furniture because of its unique coloration and intricate grain. Trees may grow up to 4 feet (1.2 meters) in trunk diameter and live for several hundred years. Velvet mesquite foliage is covered with dense short gray hairs that cover most parts of a younger plant (Fig. 8).

Filtered shade from velvet mesquites is light and often serves as a nurse tree for other slower growing plants such as cactus and shrubs. Leaves have one or two pairs of pinnae (Fig. 8) with 12 – 30 pairs of leaflets each. In late fall or early winter after the first hard freeze, the gray-green, fine textured leaflets turn light green or tan and fall from the tree revealing a beautifully sculptured trunk and scaffold branches. In spring two to three inch (5 – 7.5 cm) long cream-colored flowers adorn the tree followed by tan seed pods which ripen in mid to late summer. Young velvet mesquites have small thorns which become less problematic as the tree matures. Velvet mesquite trees are drought tolerant yet will flourish with moderate irrigation. They may become unstable due to rapid crown growth and a limited root system in lawn conditions.

Hybrid mesquites

Mesquites cross-pollinate quite readily and as a result there are a group of plants that are simply called "hybrid mesquites". They are often the result of natural hybridization of *Prosopis alba* (Argentine mesquite), *P. chilensis* (Chilean mesquite) and native *P. velutina*. Because of this hybridization, it is almost impossible to obtain pure species seed. Most hybrids are typically fast-growing, attractive, thorny or thornless, may have delicate blue green or green foliage or may have small leaves and have intermediate characteristics of the above described species. Many of the hybrid mesquite leaves persist until the new growth begins in spring, giving the tree an almost evergreen appearance. These hybrids are often sold in the trade as "Chilean" mesquite or "South American Hybrids".

Hybrid mesquites are noted for their rapid growth and can attain a mature height of 9 – 40 feet (3 – 13 meters) with a spread of up to 30 feet (9 meters). They make an excellent large shade tree but given their size, are often unsuited for the smaller yards found in newer subdivisions. Many homeowners seek out the thornless hybrids and as a result, selections of trees having no thorns and superior structural and aesthetic characteristics have been made. To preserve these characteristics, trees either are grown from cuttings, are air layered, or are grafted. Thorns, which are modified leaves, often disappear as the tree matures. In situations where thorns (which can be up to 2 inches (5 cm) long) are objectionable, they may be pruned off young trees and will not re-grow from this location again.

Culture

All mesquites are very tolerant of hot south and west-facing walls, are valuable trees in parks or large public areas, and are an asset in low water-use landscapes. They may be planted in groups or as solitary specimens and add a lush appearance to the landscape. Mesquites are well suited to heat, low humidity, alkaline and poor soils. Mesquite trees are not well suited as street trees due to their multi-trunk character. The cold tolerance of many species has been established but this tolerance is quite variable owing to the condition of the plant at the onset of winter. Heavily fertilized and irrigated trees will not tolerate the cold as well as those that have been conditioned with less water and no fertilizer late in the summer. Honey mesquite (*Prosopis glandulosa*) and screwbean mesquite (*P. pubescens*) can survive temperatures to 0 °F (-18 °C); velvet mesquite (*P. velutina*) is reliably cold hardy to at least 10 °F (-12 °C); Chilean mesquite (*P. chilensis*) and black mesquite (*P. nigra*) are hardy to at least 15 °F (-9 °C); Argentine mesquite (*P. alba*) and many South American hybrids suffer damage and dieback when temperatures fall below 15 – 20 °F (-9 to -7 °C). Where there is abundant water present, mesquite specimens will be largest when grown in deep, uniform, sandy soils in and along streambeds, and alluvial plains. With proper irrigation, these trees will grow satisfactorily on any well drained soil.

Problems



Figure 9. True mistletoe aerial shoots with berries.

There are few problems of mesquites. **Mistletoe** (*Phoradendron californicum*) can be a nuisance or develop into a more serious problem for heavily infested trees. True mistletoe contains chlorophyll and carries on photosynthesis, but being a parasite it also lives off the nutrients of the host plant (Fig. 9). It can develop into plants that are several feet in diameter. Mistletoes may be a problem if left unmanaged and while it generally does not kill a tree, it can cause significant decline over time. If not pruned out, the weight of the mistletoe can become great enough that the branch may break off. Manual removal

of mistletoe is the only practical control however, removal does not kill the mistletoe as it continues to grow inside the wood. Since mistletoe is a part of the desert ecology, it is an aesthetic decision whether to remove it or not on lightly infested trees. Mistletoe berries are a primary food source of desert birds and only in few situations the mistletoe becomes large enough to warrant removal.



Figure 10: Slime flux on *Prosopis* sp.

Slime flux is caused by the infection of sapwood by several bacteria and is a problem with mature mesquites. The disease causing microorganisms are found in the soil and probably gain entry through above or below the soil line wounds or pruning cuts. After several years, affected areas will exhibit a water-soaked appearance (wet wood). Gas is produced by the bacteria (and possibly yeasts) which force out a foul smelling liquid from cracks and wounds. The liquid is dark brown to black in color (Fig. 10). Infected trees live many years and slime flux is more of a nuisance that requires periodically a strong, hard stream of water to prevent staining of patios and cars. Seriously infected branches may need removal if they present a safety hazard. The old remedy of placing drainage tubes into the infected areas is not recommended and may in fact, present more entry sites for the disease.



Figure 11: A shelf-shaped mushroom of a wood decay fungus (*Ganoderma* sp.).

Ganoderma root rot (*Ganoderma*) is caused by a soil-borne fungus and enters mesquite roots primarily through wound sites. Root rot causes slow decline and eventually death of mature trees. There is no recommended treatment for infected trees. Fruiting bodies at the base of the tree are most common during the summer rainy season. They start as white structures at the base of the tree and develop into light brown, shelf like fruiting bodies (Fig. 11).



Figure 12: Nymph of giant mesquite bug (*Thasus neocalifornicus*)

During the summer months, the **giant mesquite bug** (*Thasus gigas*) makes its appearance. Although it looks threatening because of its size and dramatic markings, it is just another insect that is part of the desert ecology. No control is recommended for these insects as their damage is minimal. The adults are up to two inches (5 cm) long and have brown and yellow markings on their forewings and red and black banding on their legs. What makes these insects interesting is that the immature insects (nymphs) are banded an attractive red and white and may appear in large numbers in early April (Fig. 12). Although menacing looking, they are not considered a damaging pest of mesquites.

Another minor pest of mesquite is the **mesquite twig girdler** (*Oncideres rhodosticta*) which may appear in early to mid-summer. The adult cuts a channel around the stem and deposits her eggs in now girdled portions. The resulting damage is "flagging" or browning of the girdled stems. Since the damage is cosmetic, no control is recommended. Miscellaneous wood borers may appear from time to time in older, neglected or stressed trees. These beetles are typically drawn to trees that are under severe stress and are considered secondary pests.

Irrigation related issues can cause problems for mesquite trees or surrounding vegetation. Infrequent shallow watering for turf will encourage surface rooting rather than the deep root development that proper irrigation of trees will provide. Mesquite trees can become unstable with excess irrigation, such as in lawns, due to rapid crown growth and limited root system development.

Another irrigation related problem is improper placement of drip emitters. By placing emitters close to the trunk, roots primarily develop in these areas. Placing the emitters further out (at the dripline of the tree and beyond) will help establish a root system which gives stability to the tree and reduces the occurrence of tree toppling and possible tree loss.

Root binding can be a problem of mesquite and palo verde trees when purchased in containers. Most mesquite but also some of the palo verde species grow very fast under cultivation. If not transplanted to larger containers in a timely manner, roots start circling around the outside of the root ball and in some cases close around the trunk. If not corrected by pruning circling roots at transplanting, this condition can lead to problems of tree failure.

Palo Verde Species and Cultivars



Figure 13: Profuse bloom on *Parkinsonia florida*

Palo verdes are popular, drought tolerant landscape trees in the genus *Parkinsonia* (formerly *Cercidium*) and the family *Fabaceae*. Palo verdes range from large shrubs to medium sized trees and are native in the Sonoran Desert except for *P. praecox* which is native from Mexico to South America. Along with saguaro cactus, they are a staple of the Sonoran Desert and are used in many xeriscape plantings. *Parkinsonia florida*, blue palo verde, and *P. microphylla*, the Foothill palo verde, share the title of Arizona's official state tree.

Palo verde trees prefer full sun and well drained soil in cultivated landscapes. Growth rates vary depending on supplemental irrigation and species. Conspicuous green, smooth bark dominates the plant's appearance during periods of drought and cold when trees are leafless and gives them their common name "palo verde" which in Spanish means "green stick". Shoots are armed with small thorns at the nodes or the end and leaves are small, bipinnate. The green bark allows photosynthesis and with age turns from smooth with yellowish green color to rough with gray color. Besides the striking green bark, a profuse show of yellow flowers in spring makes palo verdes popular landscape trees. Line drawings of leaves, flowers and seed pods are

presented with each species to aid in identification (Fig. 14, 15, 17 – 19).

Palo verde plays an important role in the desert ecosystem providing habitat for wildlife and serving as a nurse plant for small cacti. Flowers produce much nectar for honey. Pods are sought by wildlife and livestock and provided a staple for indigenous people in the Southwest. Pods can create heavy litter.

Parkinsonia aculeata (Mexican palo verde) is found in older landscapes, but is no longer considered a desirable landscape tree. Although a showy blooming tree, it is well armed, short-lived, produces heavy leaf litter, and reseeds freely on road sides, vacant lots, and in washes.

Parkinsonia florida (Blue palo verde)

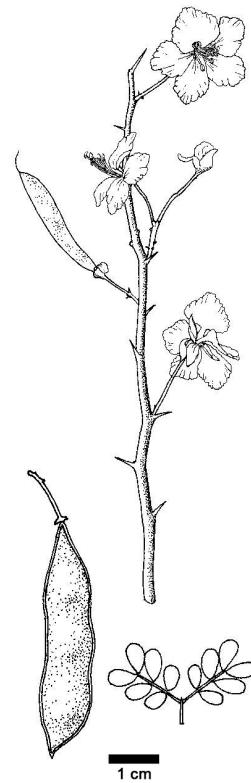


Figure 14: Leaf, flower and seed pod of *Parkinsonia florida*

The blue-green color of stems, branches, and densely growing twigs and the prolific bright yellow flowers in spring (Fig. 13) have made it one of the most popular palo verde species. Foliage is fine textured and consists of one pair of pinnae with 2 – 4 pairs of leaflets (Fig. 14). Blue palo verde flowers in mid-spring, about three weeks earlier than *P. microphylla* (Foothill palo verde). Blue palo verde has a moderate growth rate. It is adapted to desert soils, but can also tolerate lawn conditions. Native to washes and plains with deep soil, trees benefit from additional irrigation once or twice during the hot, dry season. This plant is native to the Sonoran Desert, northern Sinaloa and Baja California, Mexico, and can be found at elevations from sea level to 4,000 feet (1,220 meters). Cold hardiness is reported to 10 °F (-12 °C).

The profuse amount of flowers and seed pods can create heavy litter under the tree canopy. Short thorns on twigs can be a problem near walkways. Blue palo verde generally require more pruning than other cultivated palo verdes, because they tend to spread more and have more secondary branches. Blue palo verde is susceptible to the palo verde borer, mistletoe, and witches' broom (*see under problems*).

Parkinsonia microphylla (Foothill palo verde, littleleaf palo verde)

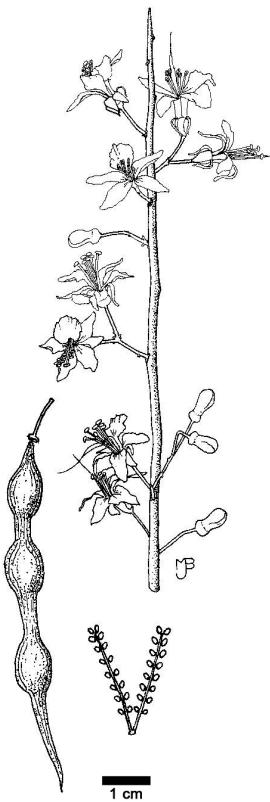


Figure 15: Leaf, flower and seed pod of *Parkinsonia microphylla*



Figure 16 : *Parkinsonia microphylla* in full bloom

Foothill palo verde trees grow 10 to 20 feet (3 to 6 meters) tall with equal spread. They are the slowest growing species among the *Parkinsonia* in cultivation. The canopy is dense with spiny branches and bark color is yellowish green. Leaflets are smallest among the species described here; leaves have one pair of pinnae with 4–8 pairs of leaflets each and appear on the tree only for a short time after summer or winter moisture in natural settings (Fig. 15). Flowers appear briefly and are pale yellow in color. Intensity of flowering varies by year and is generally heavier after a wet winter (Fig. 16).

P. florida and *P. microphylla* can be differentiated by their flower colors. *P. florida* has five deep yellow petals whereas *P. microphylla* has four yellow and one whitish petal which give the plant an overall pale yellow color while in bloom. Seed pods of *P. microphylla* are 1.2 – 5 inches (3 – 13 cm), oblong, and are constricted between seeds (Fig. 15). They can create heavy litter.

P. microphylla is native to the Sonoran Desert including Baja California in Mexico. This species requires well drained soil and does not tolerate lawn or well-watered conditions. Although extremely drought tolerant, trees might shed branches during prolonged drought. *P. microphylla* is tolerant of temperatures to 15 °F (-9 °C). Maintenance in the landscape generally includes pruning of dead branches, mistletoe, witches' broom or to expose lower stems.

Similar to blue palo verde, *P. microphylla* trees are also susceptible to the palo verde borer. Foothill palo verde trees are available in cultivation and large specimens are successfully moved from the wild to developed areas.

Parkinsonia praecox subsp. *glaуca* (Argentine palo brea)

This tree grows up to 20 feet (6 meters) tall and originated in Argentina. It has the characteristic green bark, yellow flowers, and tan pods of the genus. It looks very similar to the Sonoran palo brea (*P. praecox* subsp. *praecox*) but has smaller leaflets. The subspecies *glaуca* is considered to have greater drought tolerance than the Sonoran palo brea, because it is native in areas that receive as little as 4 inches (80 – 100 mm) of annual rainfall. Supplemental irrigation will increase growth. Argentine palo brea is also thought to have greater cold hardiness to 10 °F (-12 °C) based on observations where the Sonoran palo brea suffered greater cold damage after frost than the Argentine palo brea. This open shrub is often trained to a small tree by removing lower limbs and can be used in areas such as medians and patios where space may be limited. No problems have been observed on trees in the landscape.

"Brea" is the Spanish word for tar or pitch and refers to the waxy coating of the bark that can be scraped off and used as glue. The exudates from the bark are sweet and edible and have been used to make soap. Medicinal use of bark has been reported.

Parkinsonia praecox subsp. *praecox* (Sonoran palo brea, Brea)

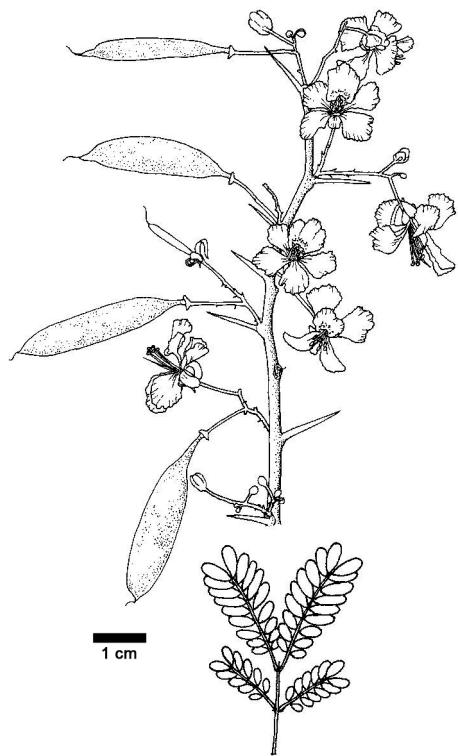


Figure 17: Leaf, flower and seed pod of *Parkinsonia praecox* subsp. *praecox*

This small tree grows 15 to 30 feet (4.5 – 9 meters) tall with almost equal spread. This subspecies has the largest leaves of the genus (Fig. 17). Flowers are golden yellow, the bark is bright green to lime green with foliage of blue green color. Seed pods are tan colored, oblong and 1.2 – 2.5 inches (3 – 6) cm in length and can create heavy litter. Growth rate is moderate to rapid and increases with supplemental irrigation. Plants tolerate a wide range of soil conditions.

Subspecies *praecox* is native to the widest range of the genus and occurs from northwest Mexico in disjunct populations as far south as Argentina, and from near sea level to 6,560 feet (2000 meters) elevation. This subspecies is considered less tolerant to drought and cold temperatures than the subspecies *glaucia*. Hardiness of plants from Sonora has been reported at 20 °F (-7 °C). Hybrids of *P. praecox* with *P. microphylla* or *P. florida* have been observed.

Parkinsonia hybrids and cultivars

Parkinsonia x 'Desert Museum' is the most popular hybrid of the genus and is a natural three-way cross of (*P. aculeata* x *P. microphylla*) x *P. florida*. Desirable horticultural characteristics of this tree include its upright growth habit, no thorns, fast growth with irrigation, smooth light green bark, and large masses of yellow flowers produced from March to May. Leaf size is intermediate between the parent taxa. *P. x 'Desert Museum'* has one or two pairs of pinnae

that are 2 – 4 inches (5 – 10 cm) in length and have 9 – 19 pairs of leaflets per pinna. Trees reach a height of 21 to 25 feet (7 – 8.3 meters) and grow as wide in canopy. The plant is hardy to 15 °F (-9 °C). Plants need to be propagated vegetatively to retain the characteristics of the parent tree.

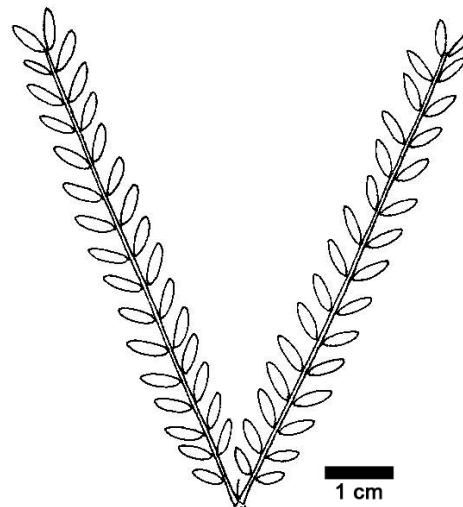


Figure 18: Leaf of *Parkinsonia x 'Desert Museum'*

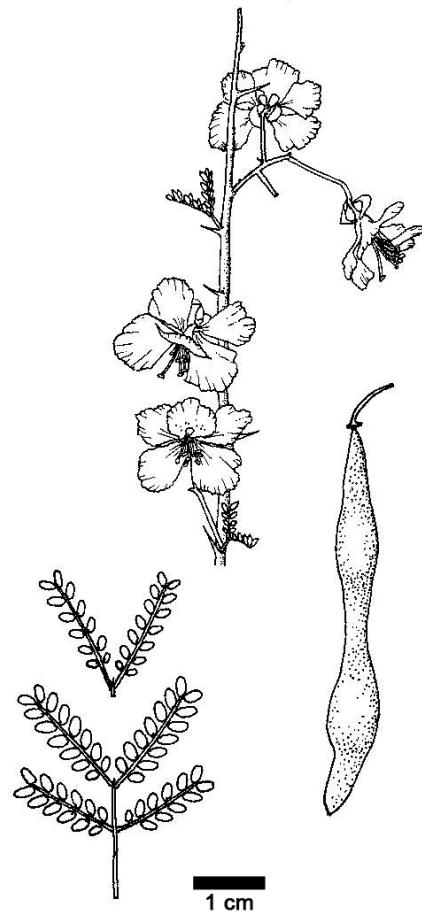


Figure 19: Leaf, flower and seed pod of *Parkinsonia x sonorae*

Another palo verde hybrid, *Parkinsonia x sonorae* (Sonoran palo verde) is a cross of *P. microphylla* x *P. praecox*. This small tree grows 10 to 20 feet (3.3 to 6.3 meters) high and as wide, but is not widely available in the trade.

A few other cultivars available in the trade have been selected by nurseries for desirable aesthetic appearance or improved cold hardiness.

Culture

Palo verde trees are extremely drought tolerant once established, but vary in their tolerance to irrigation. *P. florida* is most tolerant of the genus of frequently irrigated conditions such as lawns, while *P. microphylla* does not tolerate frequent irrigation. Even when tolerant of turf conditions, desert trees including palo verde are not recommended in turf. The shallow frequent irrigations to maintain turf can lead to possible tree toppling and loss. In addition, sun-loving grass species such as bermuda grass do not grow well in the shade below the tree.

P. microphylla is extremely susceptible to deep planting or having the base of the trunk covered with soil. Prolonged exposure to soil at the trunk base predisposes the tree to rot and tree failure.

Problems



Figure 20: Witches' broom on palo verde

Witches' broom causes a proliferation of dense twig growth, but the cause of the problem is unclear at this time (Fig. 20). Removal of affected branches is the only management method to date, but the broom regrows soon after removal. *P. florida* (blue palo verde) is the primary species affected by this disorder.

True mistletoe can affect all *Parkinsonia* species. Description and control methods are the same as described under the mesquite problem section.

Palo verde root borer (*Derobrachus geminatus*) is the larval grub stage of the 3 – 3.5 inch (8 – 9 cm) palo verde beetle. The adult beetle is dark brown to black and has prominent antennae approximately half the overall length of the insect. The larval stage is up to 5 inches (12.7 cm) in length and attacks the roots of many desert trees including palo verdes. Adult insects emerge from 1 inch (2.5 cm) wide holes in the soil during summer rains. Upon the removal of dead palo verde trees, the grub is usually present in the roots, hence the name. No control measures are recommended.

Palo verde webbers (*Bryotropha inaequalis*) emerge in spring and become apparent because of the silken tubes in which they live. The fine webbing appears soon after leaves emerge after winter rains on *P. microphylla*. Small caterpillars are up to $\frac{1}{2}$ inch long and slender. Palo verde webbers appear only seasonally and are not a pest warranting control measures.

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