UNIVERSITY OF GEORGIA
Warnell School of Forestry & Natural Resources

Publication WSFNR-24-09C

January 2024

Osage-orange – *Maclura pomifera*
A Traveling Tree

Dr. Kim D. Coder, Professor of Tree Biology & Health Care / University Hill Fellow
University of Georgia Warnell School of Forestry & Natural Resources

Osage-orange (Maclura pomifera) is a small tree in which people have found great value. Once discovered by early European American settlers, it was haphazardly carried and tended across the continent. Between 1855 and 1875 there was an agricultural hedge program to plant the species. Because of its attributes, it was prized anywhere agriculture, teamsters, and grazing animals were found. It is now considered escaped from cultivation and has naturalized in many areas. Solitary trees or small family groups can be found around old home sites, in alleys, and along roadways.

Names & Relatives

Osage-orange is not a citrus or an orange tree, and so its name is hyphenated. Osage-orange is known by many common names in all the places where it grows. Many names represent specific uses for the tree which included wood for long bows and linear plantings for field hedges. Common names include bois-d'arc, bodark, bodock, bowwood, fence shrub, hedge, hedge-apple, hedge-orange, horse-apple, mockorange, naranjo chino, postwood, and yellowwood. The common name most often used is Osage-orange, named after the Osage native American nation, and as such, should always be capitalized.

The scientific name (Maclura pomifera) is derived from a combination of a dedication to William Maclure, an American geologist working around 1800, and the Latin term for an apple or fruit bearing tree. Other scientific names in the past have been Ioxylon pomiferum and Toxylon pomiferum.

Osage-orange is one of two species in its genus. It is a member of the mulberry family (Moraceae), which contains mulberries and figs. The mulberry family has 73 genera and more than 1500 species, most of them tropical. All family members, including Osage-orange, produce a bitter, milky sap which contains latex. The most closely related genera to Osage-orange is Chlorophora from tropical America and Africa. The most closely related species is Maclura tinctoria — fustictree of Puerto Rico and the Virgin Islands.

History of Use

The first uses recorded for Osage-orange were from Native Americans. The Comanche, Kiowa, Omaha, Osage, Pawnee, Pima, Ponca, Seminole, and Tewa tribes were cited for using the tree primarily for making bows and for a yellow dye. The Osage used Osage-orange for bows, tool handles, and war clubs. Early trappers, frontiersmen, and explorers recognized the tough, dense wood as ideal for their own archery bows and handles. Historic use of Osage-orange followed the paths of European settlement on this continent, and the rise of traditional agriculture and trade.

The first planted uses were for animal corrals, and field hedges for wind breaks, shelterbelts, and living fences. The dense, shrubby growth, tough wood, and short, sharp nodal spines altogether proved effective in controlling domestic grazing animals before barbed wire. It has been suggested barbed wire was inspired by the spiny Osage-orange shoots. Except in times of poor grazing, animals would not graze the spiny, bitter-tasting, tough twigs and foliage. The rubbery fruits are poorly digestible and bitter tasting.

The extremely durable and decay resistant heartwood was used for wheel hubs, fence posts, and railroad ties. The wood was so hard and dense it was difficult to cut and work. With difficulty, the wood could be gathered for firewood. With its high density, it burned more like coal than other lighter woods, requiring a coal grate inside a stove. Periderm (bark) could be used for leather tanning and for extracting (principally from root bark) a yellow tannin (hot water soluble) dye for clothes and baskets. The fruit and sap were used as a pesticide. Gifford Pinchot, the father of modern forestry wrote about this tree in 1907 (USDA-Circular 90).

Native Range

One botanical mystery of this continent is identifying the native growing range of Osage-orange. The historic native range is unclear because is was moved and planted extensively before detailed botanical surveys were conducted. Its large fruit conceals many seeds in a pest protected wrapping. Even as the fruit rots, dormancy of seeds are maintained. Fruit size and novelty allowed for long range transport. Osage-orange quickly escaped cultivation and started to reproduce and thrive (naturalized) in many new locations across the continent.

The commonly accepted native range for Osage-orange is centered in the three state area of southwest Arkansas, southeast Oklahoma, and northeast and east Texas, with one outlier in West Texas. It seems to have reached the height of it reproductive success ecologically in open, rich bottom-land forests centered around the Red River valley of Oklahoma. Newly revealed or deposited mineral soil, plenty of water, full sun, and few competitors made for good germination and growth. Figure 1.

Today, Osage-orange can be found naturalized south of the Great Lakes and north of Florida, across the whole of eastern North America into the great plains states almost to the Rocky Mountains. Figure 2. Additional naturalized populations are present along Western settlement trails, forts, and settler locations as far West as California and the Pacific Northwest. Osage-orange has been bundled and dragged across the nation — east to west — north to south — because of its uniqueness and utility.

Description

Osage-orange is a small, deciduous, and dioecious (each individual is either male or female) tree or large shrub with low, crooked branches and a coarse-textured appearance. Usually Osage-orange is a large multi-stemmed shrub if grown in full sun without any competition. Neighboring competition from the side, as well as pruning and grazing, can generate a single-stemmed tree. The stem is usually short with many thick branches producing a rounded crown. With age, the tree and branch connections can develop a thick, gnarled appearance.

Average height is around 30-35 feet (65 feet maximum). Average spread is 25 feet (60 feet maximum). Stem diameter averages 1.5 feet diameter at 4.5 feet above the ground (6 feet diameter maximum). Osage-orange is a surprising rapid growing tree on the best sites, and has a relatively long life-span (approaching 130 years). It has reached its maximum size and age characteristics outside its

native home range on fertile, moist soils. It grows and reproduces on many sites and soils, including soil too alkaline for other trees. It has been found to be ideal for many stressful sites, such as along city streets and in parking lots, although it is damaged by soil compaction. Osage-orange is resistant to many types of stressful conditions, although it is slow growing under these conditions.

Leaves

Leaves of Osage-orange are simple in form, alternating along twigs, with smooth / entire margins, thick, waxy, and shiny. Leaves tend to be clustered on stubby, spur-like twigs. Figure 3. Leaves are 3-6 inches long with a long tapering and pointed tip, 2-3 inches wide with a rounded leaf base, and a 1.5 inch long, milky-sap-oozing, slender petiole connecting leaves to twigs. Leaf color is a dark shiny green on top and a light green color on the underside. Figure 4. In Fall, Osage-orange is known for its bright yellow senescence coloration.

Crown & Twigs

When viewed as a whole tree, Osage-orange has an open, rounded crown composed of thick, spreading, curved branches. Any sprouts present are long and slender. Marginal branches do not self-prune well and add to the coarseness and untidiness of the crown. Upon close inspection, twigs have a zig-zag form with straight internodes between lateral buds and an aborted terminal bud. Twigs contain a milky liquid (latex), and are thick, stiff, smooth and orange-brown in color.

There is a sharp, straight, unbranched nodal spines, ½ to 1 inch in length present in most leaf axils (petiole / leaf connection) on one year old twigs. Spine length decreases toward twig tips. Marginal branches (for example — in heavy shade) may not produce spines at all. There are small, brown, round, lateral buds which appear partially embedded (sunken) in periderm to the side of each spine.

One natural spineless variety (Malclura pomifera var. inermis), and a number of spineless cultivars (i.e. Wichita and White Shield) are available in the nursery trade. Cultivars are usually male selections to eliminate fruit problems. Osage-orange has a tetraploid genetic system. It has been found to hybridize with Cudrania tricuspidata.

Bark

Mature Osage-orange periderm is 3/4 inches thick, with deep, irregular furrows between rounded ridges. Periderm has an orange-brown color with brighter colors in furrow bottoms. Inner root periderm is an orange color, while inner stem periderm is a yellow-orange color. Periderm peels in thin strips.

Roots

Osage-orange has a wide-spreading, opportunistic root system. Fibrous absorbing areas can be generated quickly to take advantage of resource availability. Root growth is fast. A well developed juvenile tap-root is present. Many large, woody transport roots spread from the root crown. A high concentration of several protective materials (allelochems) are concentrated in root bark.

Flowers

Flowering of Osage-orange is dependent upon photoperiod and other environmental conditions. Osage-orange is a dioecious tree — having male and female flowers on different trees. Flowers of both genders are small, green, and inconspicuous. Flowers appear from April to May after leaves have

expanded. Female flowers are wind pollinated. Some people are specifically allergic to Osage-orange pollen.

Fruit

Probably the most noticeable feature of Osage-orange is fruit produced by female trees. Fruit is round, 3-5 inches in diameter, and yellow-green in color. Figure 5. It resembles a large orange or a giant round mulberry. Fruit is a dense round aggregate (cluster) of many one-seeded drupelets (average 300 seeds per fruit). Fruit is produced every year, ripens in September and falls to the ground. Fruit weight prevents natural dissemination beyond parent trees except where animals move and cache fruits, or where flood waters wash fruits downstream.

Osage-orange trees are usually sexually mature by 8-12 years of age and fully productive as fruit-bearers by 25 years of age. Maximum fruiting age is around 70 years. Female trees will produce fruit without the presence of a male tree, but no viable seeds will be present.

Fruits are pulpy, dense, and heavy with a high moisture content concentrated in a milky, bitter, latex-containing juice (sap). Young green-colored fruit ripen and mature to a yellowish-colored mature fruit with a rubbery, bumpy rind. The rind is composed of exterior ends of individual seed sacks. Figure 6.

The fruit has little ecological value as a food source until it has aged and broken apart. Few animals consume fruit or seeds. The latex-containing milky sap acts as a digestive irritant to domestic animals, with fruit not eaten unless nothing else is available. Seed eating birds and squirrels do tear open fruit for seeds. Note, humans should not ingest fruits or juice!

Wood

Wood of Osage-orange is as unique as the rest of the tree. Heartwood is extremely decay resistant, dense, tough, and bright orange. Osage-orange is the densest and most decay resistant wood in North America. Osage-orange is ring-porous. Osage-orange wood characteristics have provided for many local / folk uses. It is principally known for long effective-life fence posts when the bark is removed. Fence posts were traditionally cut from a hedge row or stand on a 15 year rotation, with sprouts regenerating the site. Any fruit generated were planted along fence rows every year to lengthen any living fence. Fence posts cut and immediately installed without bark removal can occasionally sprout and regenerate a root system.

Osage-orange is most visible as components of, or sole-species in, windbreaks and shelterbelts. It generates dense living barrier plantings and security fences, if maintained. Wood is still prized for specialty products such as hand-crafted archery bows, knife handles, and craft dyes extracted from the heartwood and root bark. Locally, wood is “chunked” for seasonal burning in coal-burning stoves. Wood density, toughness, and drying problems prevent most traditional lumber uses.

Growing Trees

To successfully collect seeds and grow seedlings, it is critical to locate fruiting females with several neighboring males. Fruit can be collected from the ground anytime after they fall until just before Spring. The milky juice in fruit serves as a dormant season pesticide protecting seeds from damage. Seeds should be removed from the pulp by aging in a cool moist location and/or mechanically cleaning. The more aging that occurs, the easier cleaning becomes. Do not ferment fruits to assist in seed removal. Avoid prolonged skin contact with the milky juice.

Osage-orange seeds have a short-duration dormancy factor which is removed by a moist, cool period (30 days), or soaking in cool water for 48 hours. Expected germination is 50% of seeds within 30 days. Sow seeds 3/8 inch deep and then firm soil over them. For Fall sowing, sow cleaned but otherwise untreated seeds in mineral soil and then use a light organic mulch over the top. For Spring sowing, spread cool-treated seeds in mineral soil without mulch. Seeds require mineral soil contact, full sunlight, and moist conditions. Seeds can be stored for several years if cleaned and kept under dry, cool conditions.

Stress Concerns

Osage-orange has few pests and, once established, can handle a variety of site / soil constraints. On resource-rich sites in full sun, Osage-orange can grow fast. A major concern in growing young trees is elimination of both herbaceous and woody competition. Osage-orange is considered hardy in non-fluctuating winter temperatures found up to hardiness zone 5. Winter cold kills Osage-orange across the Northern boundary of its range especially in the Midwest. Within its native range, Osage-orange is attacked by Phymatotrichum omnivoum – cotton root rot. In addition, Osage-orange has been attacked by leafy mistletoe, verticillium wilt, assorted leaf spots, Pythium root rot, stem borers, scales, mites, leaf-roller, fall webworm, and rodents. Osage-orange is not attacked by subterranean termites.

New Uses

Osage-orange has a wide variety of novel and potentially valuable chemical compounds. Some have potential for biodiesel, food production enzymes, and antioxidants. One antioxidants (i.e. pomiferin) was cited as being similar to vitamins C and E. It does seem to have antimicrobial and pesticide components in various parts.

Conclusions

Osage-orange is an unique tree found in abandoned areas and unexpected places. It represents a long American story of planting, transport, use and survival in new locations. Osage-orange is a stress-tolerant tree almost unknown and unused in communities, but readily found in many locations. Osage-orange could function as an effective shade and street tree, if spines and large fruit are not problems.

Citation:

Coder, Kim D. 2024. Osage-orange – *Maclura pomifera*: A Traveling Tree. University of Georgia, Warnell School of Forestry & Natural Resources Outreach Publication WSFNR-24-09C. Pp.13.

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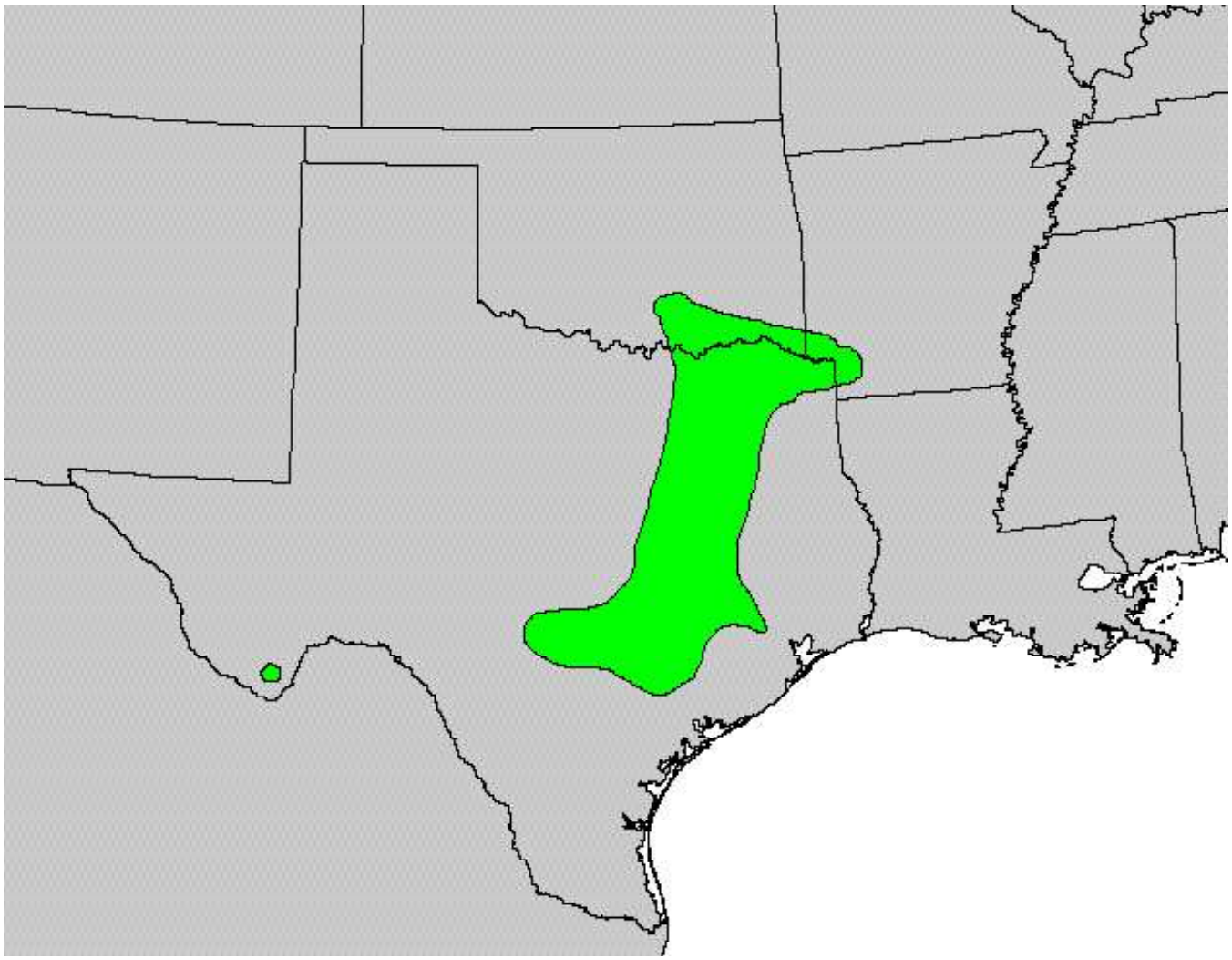

Figure 1: Estimated original ecological range of Maclura pomifera -- Osage-orange.
(USGS-GECSC Tree Range Maps)

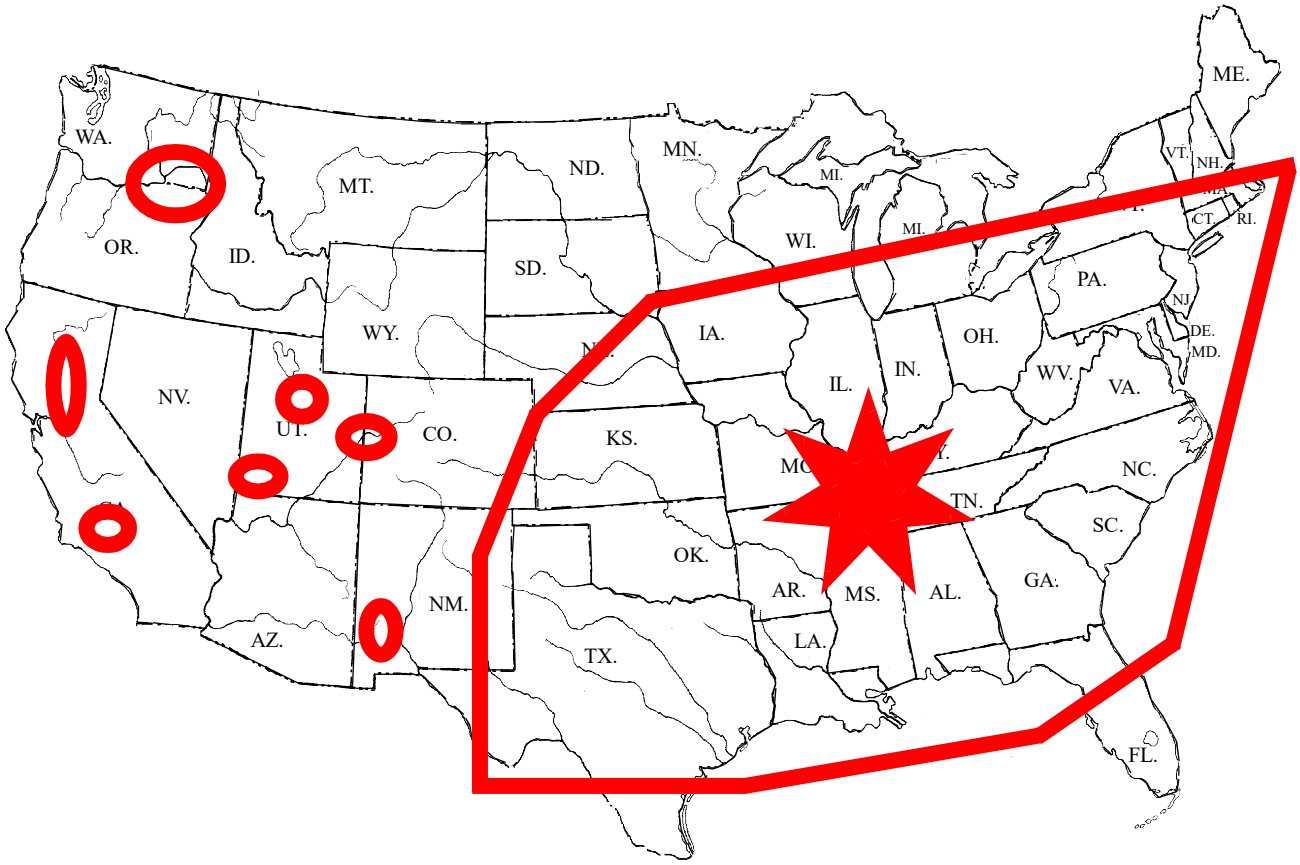

Figure 2: Naturalized range and pockets of Maclura pomifera - Osage-orange in ~38 states and one province.
(USDA-NRSC PLANTS database)

Figure 3: Osage-orange leaves.
(photo credit Dr. Kim D. Coder)

Figure 4: Osage-orange leaves, zig-zag twig form, and thorns.
(photo credit Dr. Kim D. Coder)

Figure 5: Osage-orange fruit showing shape and size variation. Fruit taken from area with both male and female trees.

(photo credit Dr. Kim D. Coder)

4 inches

Figure 6: Osage-orange fruit cut in half showing seeds. Fruit taken from area with both male and female trees.

(photo credit Dr. Kim D. Coder)