Prosopis glandulosa, Honey Mesquite

Cora Estelle Mosher

Plant Press Arizona

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Arizona's Remarkable Native Food Plants

Plus

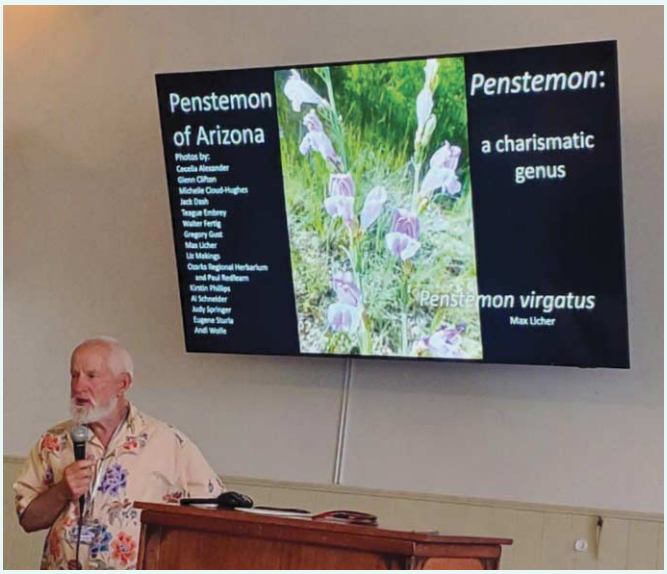
With Regular Features

Clockwise from left: Magdalena Big Cheese Squash, Chapalote corn, and white tepary beans from the O'odham Garden at Mission Garden. *Credits: Dena Cowan*

Arizona's Remarkable Native Food Plants

by J. Douglas Ripley, President, Arizona Native Plant Society

As any member of the Arizona Native Plant Society can attest, plants provide boundless benefits to all the other forms of life on earth. From providing the most essential function for life by combining carbon dioxide and water to produce oxygen and sugars through the process of photosynthesis, providing a wide array of environmental benefits to other plants and animals, to producing fiber for fabrics, cordage, and paper, and wood for fuel and construction, and to serving as a source of endless pleasure to humans through their incredible beauty and diversity. But certainly one of the most important contributions by members of the Plant Kingdom is that they are the sole source of food, either directly or indirectly, for members of the Animal Kingdom. In Arizona, many native plants have been used as essential food sources for centuries, originally by Indigenous peoples and eventually by early explorers, and settlers. In this issue of *Plant Press Arizona* we provide a brief introduction to some of the most iconic native Arizona food plants to include the history of their use cultivation and their continued uses to this day.



Above, from left:

Figure 1. Glenn Rink speaking at the American Penstemon Session. Figure 2. Carrie Cannon, Peach Springs Chapter President, speaking at AZNPS session. *Credits: Doug Ripley*

Below:

Figure 3. Field Trip to Seth Watkins' Penstemon Garden, Flagstaff. *Credit: Kirstin Phillips*

President's Note

by J. Douglas Ripley jdougripley@gmail.com

I extend summer greetings to all members of the Arizona Native Plant Society. Unlike last year at this time, the famous monsoon season is back on tract and we have been enjoying the arrival of rainfall in many parts of the state. We will continue to hold good thoughts for the monsoon to continue to the end of the season and provide its wonderful moisture to stimulate the type of summer wildflower displays that Arizona Native Plant Society members love.

Notwithstanding the vicissitudes of the weather, the Arizona Native Plant Society has continued to work to fulfill its mission of promoting knowledge, appreciation, conservation, and restoration of Arizona native plants and their habitats.

On a practical level, the Society membership continues to hold steady at approximately 700 members and our financial situation is very sound. Most of our chapters hold interesting monthly meetings and engage in various conservation projects such as invasive species control efforts.

The most significant effort in support of our mission was the Society's sponsorship of the 2026 Botany Conference which was held in Flagstaff in mid-June and consisted of formal presentations as well as numerous field trips. This year's conference was unique in that it was held over two days in conjunction with the American Penstemon Society's annual conference. That arrangement allowed for each society to gain new ideas and perspectives on various aspect of our native flora. We will share a lot of interesting details about the joint meeting in the Fall issue of *Plant Press Arizona* which we plan to devote to the results of the conference.

I wish all members best wishes for an enjoyable summer and gratitude to the many hard-working chapter officers and Board of Director members who continue to make such an important contribution to the success of the Society.

Figure 1. Chapalote corn and cushaw squash in the Early Agriculture plot at Mission Garden, Tucson, August 2014. *Credit: Dena Cowan*

The Three Sisters and Their Cousins, or Simply, *La Milpa* *by Dena Cowan*[1]

The cooperative sisters in this story are corn, beans and squash. Elder sister corn offers her tall sturdy stalk for beans to climb up on. Middle sister bean tenderly embraces corn and holds her up in strong winds. Little sister squash grows large leaves low to the ground, spreading, outcompeting weeds and protecting the surrounding soil and soil micro-organisms from the harsh summer sun, helping it retain moisture. Corn's roots are superficial, keeping the soil safe from erosion by wind and water. Bean's roots are a little deeper, containing many micro-organisms, fostering microbial activity, mineralization, improved soil texture, and nitrogen fixation. When beans and corn are grown together, their root exudates increase, giving rise to more diverse microbial activity that protects the plants from pathogens. Corn attracts microflora into the soil, which, in turn, attracts rhizobia that connect to the beans so they may fix more nitrogen —this symbiotic loop makes all the plants more productive. Squash's root system penetrates the deepest, aerating the soil and helping to prevent compaction.

Growing together side by side, the sisters are far more self-reliant than they would be if grown separately, left to fend for themselves. They protect each other and their home ground from wind and rain, and they are not dependent on fertilizers, herbicides, or pesticides.

Inspired by traditional farming practices of Indigenous communities throughout the Americas, the 'three sisters garden' is now universally popular among enlightened agroecologists, especially small-scale urban gardeners. By growing, together in one place, plants with different soil nutrient, spatial requirements, growth habits that are mutually beneficial, and whose fruits provide complementary dietary value, gardeners can make the most of available space to improve the fertility and water-holding capacity of their soil. Benefits also include reaping healthy harvests and creating a delightful aesthetic of wild symmetry, not to mention feeling grateful for the wisdom of countless generations of Indigenous farmers who have stewarded the land, water, seeds, and knowledge that made all this possible for us.

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[1]Mission Garden, Tucson, Arizona. **https://www.missiongarden.org/**

Figure 2. Some of our O'odham friends who helped us learn to plant the traditional crops. Clifford Pablo is on the left, and Bernard Siquieros is on the right. Figure 3. Tohono O'odham 60-day corn harvest at Mission Garden. *Credits: Dena Cowan*

The Three Sisters and Their Cousins, or Simply, *La Milpa* *continued*

I work at Mission Garden in Tucson, Arizona. Mission Garden is a living agricultural heritage and ethnobotanical museum featuring a timeline of garden plots representing the cultural and agricultural history of the Tucson Basin. The first time we planted the Early Agriculture, Hohokam, and O'odham gardens here in 2013, O'odham elder Clifford Pablo came to support us and give us guidance. Clifford is the Student Learning Farm Manager for the Tohono O'odham Community College. He helped us prepare the compacted soil, shape the broad flat planting basins, and plant the seeds. He showed us how O'odham plant their *hu:ñ* (60-day corn), *ha:l* (cushaw squash), *bab:wĭ* (tepary beans), and other summer crops — the sisters' cousins, such as *wako* (dipper gourds), *ke:li ba:so* (muskmelon), and *toki* (cotton), each in its own plot, separate from each other. I noticed that even the *hu:ñ*, *ha:l*, *and bab:wĭ* were grown separately, and on flat ground rather than up on mounds, as I had expected. Planting crops in mounds works well in moist, soggy soils that tend to become anaerobic, but here in the arid desert, flat planting grounds surrounded by berms to retain water are usually better. I asked Clifford why he planted the crops separately. He said they would all get mixed up if they grew up together. Indeed, I learned in my own garden at home, after trying to plant the three species as companion plants, that the local drought-adapted Tohono O'odham tepary bean plants will grow lush foliage if given the same water required by corn, but produce very few beans. They need much less water than corn. With tepary beans, instead of practicing the typical three sister garden technique, local traditional farmers practice crop rotation, planting the different sisters, and their cousins, in different plots in successive seasons. Often *i:wakĭ* (wild greens), such as *cual* (lamb's quarters, *Chenopodium berlandieri)*, *onk i:wakĭ* (Wright's saltbush, *Atriplex wrightii*), *cuhukia* (pig weed, *Amaranthus palmeri*), *ku'ukpalk* (purslane, *Portulaca oleracea)* and (false purslane, *Trianthema portulacastrum*), will also appear here and there voluntarily. These highly prized wild greens are also harvested and eaten, rather than weeded out and discarded.

With the help of our O'odham friends and elders, we planted all the seeds in late summer, and since they were grown separately, we planted them all in one day (Figure 2). It was already mid-August by the time we were ready to plant, but Clifford was not concerned because there was still plenty of time for the *hu:ñ*, *bab:wĭ*, *ha:l*, *ke:li ba:so, wako*, and *toki t*o mature before the first frost. After planting all the seeds, he signaled that it was time for us to pack up and go home. I asked him if we should water the plots first. In a gentle voice and with a smile, he said it was better to let them nestle in and sleep in dry ground overnight, to let them get used to their new home. They will be ready to get watered tomorrow.

Although these crop varieties had been grown on this ancient farming site for at least 4,000 years, urbanization and water scarcity had led to the demise of farming here in the late 19th and early 20th centuries. These were the first seeds sown in this soil for nearly a hundred years. We weren't sure how they would do.

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Figure 4 . Three varieties of tepary beans. *Credit: Dena Cowan*

Figure 5. Squash harvest at Mission Garden. *Credit: Roger Pfeuffer*

The Three Sisters and Their Cousins, or Simply, *La Milpa* *continued*

Three sister gardens are known as *milpas* throughout the Americas. *Milpas* are traditional small-scale family plots cultivated by hand or with animal traction—as opposed to mechanized conventional (post 'green revolution') agricultural systems. *Milpa* is a Spanish modification of the Nahuatl *milpan*, derived from *milli* (farm field) and *pan* (what is planted on it). *Milpas* are polyculture systems that replicate natural ecosystems, like forests. They are diverse and multilayered, above and belowground, rather than monocultures of single species. In addition to corn, squash, and beans — all first domesticated more than 10,000 years ago in the Mesoamerican fertile crescent which emanated from Guerrero, Tehuacán, and Oaxaca, Mexico — *milpas* contain other crops and edible wild greens that are adapted to the particular environment and culinary culture of the region, further enhancing soil health, and dietary nutritional value. Although the three sisters are warm season crops that can be eaten fresh, dried beans, corn, and squash seeds and dehydrated squash flesh can all be stored for consumption throughout the year as well. Of course, enough of the highest quality seeds are typically selected and set aside for planting in subsequent seasons.

By choosing locally adapted heirloom seeds to start with, farmers are not only choosing varieties that are most likely to thrive in their given climatological and ecological conditions, they are also preserving the precious legacy of seed lineages, or landraces, that have been carefully selected, grown, and tended for generations, centuries, and even millennia. Moreover, organic seeds not treated with fungicides or insecticides carry beneficial microbial diversity, including soil bacteria that are vital for nitrogen cycling. In fact, the Haudenosaunee, who are known to have developed the three-sister concept, employed a technique they called 'corn medicine', wherein they soaked and germinated their corn seeds in a tea of the roots of common reed, bottlebrush, and other grasses to introduce beneficial bacterial endophytes to give the seedlings a good start. I think of it as a sort of colostrum for plants.

The three sisters generally need about four months of sunny days, at least six hours of sun every day, for them to reach maturity. Planting can begin as soon as the danger of frost has passed. In a typical three-sister system, elder sister corn is planted first and left to grow alone for around three weeks, so she can get a head start. A stand consisting of a minimum of ten corn plants planted about a foot apart, in at least three rows, will enable effective pollination—male pollen moving from tassels to female silks. Middle sister bean can be planted roughly three weeks later, when corn is about a foot tall. Choose climbing types of beans: common, lima, and runner beans work well. Four bean plants can be sown around the corn on all sides, two or three inches from the corn, since their roots do not compete. About a week later, little sister squash can be planted on the sunniest edges, about two feet away from the other sisters, and apart from other sibling squashes, where they will all have plenty of space to sprawl.

For the whole nutrient cycling process to work, it is essential to give the biomass of the stems and foliage back to the

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Figure 5. Squash harvest in truck at Mission Garden. *Credit: Roger Pfeuffer*

The Three Sisters and Their Cousins, or Simply, *La Milpa* *continued*

ground after harvest in the fall, returning the organic matter into the soil as it breaks down. This practice is known by contemporary permaculture enthusiasts as "chop and drop." In other words, cut the stems at ground level, leaving roots and their fertile rhizosphere to decompose underground, chop stems and leaves and leave them *in situ* (as the saying goes, "Leave the leaves; that's why they're called leaves") rather than hauling them away to compost elsewhere. Just as the soil is nourished by diverse crop associations, so are the farmers. Although they are sisters, they each belong to a different plant family, each bringing something different to the potluck. Corn (*Zea mays*) is a grass, in the Poaceae family; it provides carbohydrates and amino acids (Figure 3). Beans (*Phaseolus* spp.) are legumes, in the Fabaceae family; they are high in protein, fiber and minerals (Figure 4). The amino acids of corn and beans complement each other: beans have a lot of lysine, which corn does not have, whereas corn provides the methionine, which is low in beans. Together, when the corn has gone through the ancient process of nixtamalization, again developed in Mesoamerica, they provide all nine essential amino acids, in addition to niacin and complete proteins. Squash is a gourd, from the Cucurbitaceae family; it complements the others with fiber, minerals, and vitamins, especially vitamin A and beta-carotene (Figures 4 and 5).

That summer in Mission Garden, our first growing of these traditional O'odham crops, we were pleased and grateful to discover that the advice of our generous O'odham friend was sage advice indeed. Even though the sisters grew up separately, left to fend for themselves, they must have sensed each other's presence nearby, for they thrived, providing us with an abundant harvest, whose seeds are still spreading, farther and wider every day.

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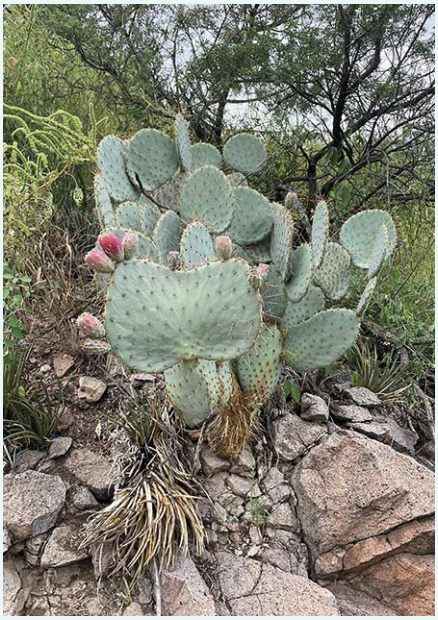
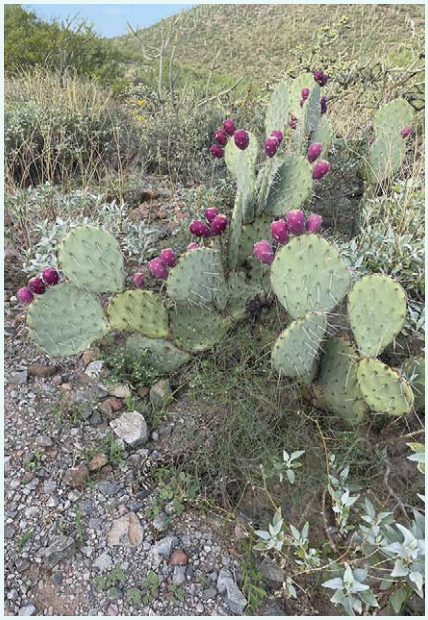

Opuntia engelmannii . From left: Figure 1. Flowers. Figure 2. A fused pad. Figure 3. In fruit.

SPOTLIGHT ON A NATIVE PLANT *by Jack Dash*[1] *Photos credit the author.*

Opuntia engelmannii

Naw (Tohono O'odham) | *Iibhai* (Akimel O'odham) | *Nopal* (Spanish) | *Engelmann Prickly Pear* (English)

Engelmann prickly pear is one of the most abundant cactus species in Arizona, growing in a variety of habitats from 1,500 feet in the Sonoran Desert to nearly 7,500 feet in the wooded mountain ranges running like a sash from northwest to southeast across the state. Despite being so prominent in the flora of the area, identifying Engelmann prickly pear can be trickier than you'd think. From the moment taxonomists got their (gloved) hands on the first botanical specimen of this plant, collected in 1846 near El Paso, there has been debate about the proper nomenclature for this species. The matter isn't helped by the diverse forms Engelmann prickly pear takes in response to environmental conditions. In colder areas, plants may be just two or three feet tall with a few scraggly pads growing in frost-protected locations. In prime semidesert grassland habitat, the plant might be six feet high and even wider around, with dozens of robust disk-shaped pads growing in populations that stretch on for miles.

Writing about the "typical" Engelmann prickly pear can be difficult. Thornber and Bonker in "The Fantastic Clan" describe its pads as "pancake-like...about the size of a medium meat platter." Unfortunately, I don't keep a medium meat platter handy, so I haven't had occasion to confirm this measurement. They also equivocate on the hue of the pads, writing only that "the general color is greenish." In general, you can expect a cactus with round, flattened pads fringed with a mantle of hair-like brown glochids, the tiny, hard-to-remove spines that make close encounters with this species particularly painful. Somewhere between one and seven stalactite-like white spines point out in all directions to ward off browsers. The flowers are usually fluorescent yellow and satellite dish-shaped, with a green pistil column emerging from a disheveled mass of pollen-covered stamens. As the day wears on, the flowers transition from pure yellow to a rich apricot color, like the pink over the horizon during an Arizona sunset, which may signal to pollinators that the blooms have already been visited.

To make accurate identification even more confusing, these plants are notoriously promiscuous, hybridizing with just about any other prickly pear they come in contact with, creating swarms of hybrids intermixed with the true species. Engelmann prickly pear is truly a kaleidoscope

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that becomes more disorienting the closer you look. In his 1984 work "*Cacti of Texas and Neighboring States*" Del Webb describes 10 different varieties of Engelmann prickly pear, and Inaturalist recognizes 15 separate species in an "*Opuntia engelmannii* complex." This confusion of hybrids, varieties, species, and forms is enough to keep the cactologists arguing for decades to come.

Pads and fruits of this species are an important food source for all manner of life in Arizona. Mammals like javelina, mule deer, bighorn sheep, rodents, and rabbits all relish the fruits, and in dry seasons, the pads become an important source of stored moisture, despite the spines, glochids, and stomach-churning oxalic acids inside. Numerous insects visit Engelmann prickly pear, from pad-munching longhorn beetles to busy digger bees, flitting out of the blossoms covered in sticky pollen.

This species and its relatives have had a rich and interwoven history with humanity. People across the Americas recognized the value of these plants and have been harvesting them for food, medicine, and dye for millennia.

In the early 1500s, a shipwrecked Spaniard named Alvar Nunez Cabeza De Vaca described the lifeways of the Texas tribes he was living among saying, "Those Indians would go to another land to eat prickly pears. These are fruits the size of an egg, red and black in color with a very good flavor. They eat them three months out of the year, when they eat nothing else."

In an arid land, the plump purple fruits of prickly pear are a refreshing treat, though Akimel O'odham and Yoeme knowledge-keepers differentiate between plants that produce fruits that can give you fever-like symptoms and those that can be eaten without concern.

The most historically important use of prickly pear is in the cultivation of cochineal insects. When Europeans arrived in the Americas the Aztecs and Incas were cultivating prickly pears and harvesting the dye-producing cochineal insects in huge quantities. The evocative Nahuatl word for the beautiful red dye was Nocheztli meaning "blood of the nopal." Before the advent of synthetic dyes in the 19th century this dye, called carmine, was the most brilliant and long-lasting red dye known to humans.

The Aztecs had cultivated both prickly pear and cochineal insects so thoroughly that they created distinct cultivars, the tree-like *Opuntia ficus-indica* and the dye cochineal *Dactylopius coccus.* After the fall of the Aztec Empire, the Spaniards monopolized the trade in carmine, jealously guarding the secret of its production as it became the most important export item from the Americas after silver and gold.

The female cochineal bug is a relentless eater, sucking at the juices of *Opuntias.* Because they are fairly stationary, they need a defense against reptiles, mammals, and birds. This comes in the form of carminic acid, distasteful to potential predators, and astoundingly beautiful to the human eye. There are six species in the genus *Dactylopius.* In Arizona, we see maybe three of those. *Dactylopius coccus*, the cochineal cultivated by people in the Americas, is the species still used commercially. Small dye producers in Mexico today preserve their distinctive local cultivars, protecting whatever biodiversity remains in these insects after the bottom fell out on their production with the advent of synthetic red dyes. Because of the limited genetic diversity and the increasing dominance of a single South American lineage at large commercial operations, this insect and the beautiful dye it produces may be vulnerable to disease outbreaks. Developing and preserving site-adapted lineages will be one way to preserve the practice of cultivating cochineal into the future.

Opuntia engelmannii is easily grown; a single cutting of a pad is all that is needed to start this plant in a garden. The value of the plant to wildlife and its resilience in various horticultural settings make it a fantastic choice for native plant gardens. Plant cuttings in unwatered parts of the yard, along a fenceline, or under a window and just give them time to grow.

Inset — Figure 4. Illustration of Cochineal Collection in José Antonio de Alzate y Ramírez, 1777. *Credit: Newberry Digital Collections for the Classroom*

Arizona Native Plant Society Honors University of Arizona's Dr. Michelle McManon

Associate Professor of Practice in the College of Agriculture, Life, and Environmental Sciences, and Director and Curator of Plants at the UA Herbarium

by Joey Charboneau, Ries Lindley, Lyn Loveless, and Douglas Ripley, Arizona Native Plant Society

Above: Shelley in the stacks. *Credit: Doug Ripley*
Inset: Dr. Michelle McMahon. *Credit: UA College of Agriculture, Life, and Environmental Sciences*

In May 2026, Dr. Michelle (Shelley) McMahon, the longtime Senior Curatorial Specialist at the University of Arizona Herbarium and associate professor in UA's College of Agriculture, Life, and Environmental Sciences, retired from her academic career.

Shelley joined the UA faculty in 2006 and became the director of the University of Arizona Herbarium, taking over from Steve McLaughlin. During her UA tenure, she guided hundreds of students through classes, projects, and science degrees (both undergraduate and graduate), many of them using the resources the herbarium has to offer. But it was through her remarkable leadership at the UA Herbarium that she has had the most significant and lasting impact upon the Arizona Native Plant Society and its members.

The UA Herbarium was started in 1890, and today it houses about a half million specimens including a stellar collection of plants from the Southwest and northern Mexico. Unfortunately, none of those mounted specimens organize themselves, change their names when science demands it, loan themselves out to other herbaria or researchers, database themselves if they are new, image themselves, find themselves when they are lost, or go to bat for themselves and their herbarium home when the budget takes a haircut. Someone has to direct an overworked staff and a whole bunch of volunteers (including many AZNPS members) to do all that and more. Those were responsibilities that Shelley consistently performed with the utmost skill, cheerfulness, and dedication.

During Shelley's tenure, she also made many especially important contributions to our understanding of the Arizona flora. For example, on the countertop inside the Herbarium's main door is a book titled *Legumes of Arizona: An Illustrated Flora and Reference*. Shelley was one of the lead authors for this very thorough treatment of Arizona's extremely important pea family. The effort took years and the hard work of many people (as well as devotion from the lead authors, all of them weaving their legume work into their other full-time responsibilities. This lovely book compiles the most up-to-date information about each of the almost 300 native species of legumes that make up one of Arizona's largest plant families. It also includes a new and easy-to-use dichotomous key which allows users to efficiently name a plant they are seeking to identify.

Under Shelley's direction, the Herbarium was relentlessly focused on outreach and education. For the Arizona Native Plant Society, this resulted in joint sponsorship of numerous highly popular Plant Atlas Program Arizona (PAPAZ) projects, as well as rigorous (but non-academic) introductory plant identification classes and specialized classes in the Poaceae and Asteraceae. The weekly botanical lunch seminars, open to all, and usually supplied personally with refreshments by Shelley, are a regular source of education and enjoyment for students, faculty, and the plant-loving public.

Thanks to Shelley the Herbarium stands open to plant lovers of all backgrounds , as a library, a place to meet, a museum, a resource for plant research, and the oldest plant-science legacy institution in Arizona. The Arizona Native Plant Society and its members extend gratitude and best wishes to Shelley in her well-deserved retirement.

Mesquite *by Jack Dash*[1]

algarroba (Spanish) | Hu'upa (Yoeme) | kui (Tohono O'odham)

Screwbean mesquite. Figure 1. Flower. Figure 2. Pods.
Credits: Jack Dash

When the arid foresummer arrives in the Sonoran Desert, the heat wraps you in an inescapable embrace, stifling and repressive. Counterintuitively this is also the time when the full beauty of the desert reveals itself. Brilliant torches of scarlet flame are held aloft at the end of scraggly ocotillo branches. Palo verdes droop under the weight of their own fluorescent golden blossoms. From the barren soils where their roots find purchase, prickly pears, cholla, and hedgehog cacti, unveil blooms in shades of red, pink, orange, and yellow, colors that rival the flowers of the most diligently tended rose gardens. The desert punishes you for going abroad at midday, but consoles you with scenes of beauty like a last gasp before the final dregs of moisture evaporate from the soil into the cloudless azure sky.

Against the backdrop of these gaudy floral displays, the blossoms of the mesquite trees, resembling small, pale, corn cobs, may go unnoticed. Yet more than almost any other plant in the landscape, this species is integral to the biocultural past, and future, of the Borderlands. A vital source of nutrients for humans and wildlife and a keystone species in this arid environment, mesquite trees have a tumultuous history with humans who have viewed them alternately as a tree of life, or an ungodly nuisance.

Globally, the mesquites are represented by around 56 species in the legume family. These trees are native to arid regions in the Americas, Asia, and Africa, but they have been introduced to Australia, India, and the Middle East where they can become invasive. The advent of large-scale cattle ranching with its accompanying fire suppression efforts and impact on grass populations, along with cow's affinity for mesquite pods, has led to a massive increase in the number of exquisite trees that can be found on rangeland today. This increase leads some to consider them invasive even in areas where they occur naturally. While cattle are a direct cause of this buildup, it is often ranchers who bemoan it, as the mesquites can suppress growth of grasses. Over the years, land managers and ranchers have turned to mechanical removal, burning, and herbicide applications to try to suppress these trees, meeting with little success against this resilient plant. Even as mesquites have become more common on rangelands, the massive mesquite forests that characterized desert riparian areas like the San Pedro, Santa Cruz, and Rillito rivers in southern Arizona were rapidly denuded as settlers cut mesquites for firewood or turned them to fuel in the ore smelters that sprang up around the increasing number of mines in the region.

Describing the massive mesquite bosque around the San Xavier mission south of Tucson in the early 1900s, Ornithologist Harry Swarth wrote;

> *"The river…rises to the surface at this point, and the bottom lands on either side are covered, miles in extent, with a thick growth of giant mesquite trees, literally giants…many of them sixty feet high and over…This magnificent grove is included in the Papago Indian (San Xavier) reservation, which is the only reason for the trees surviving as long as they have, since elsewhere every mesquite large enough to be used as firewood has been ruthlessly cut down, to grow up again as a straggly bush…In the early morning the medley of bird songs was absolutely confusing, and the number of individuals of the many species found in this region went far beyond what is usually the case in the lowlands of Arizona."*

Recent phylogenetic work has led to the division of the mesquite genus (*Prosopis*) into three genera, of which two occur in our region. The genus Strombocarpa contains the screwbean mesquite (*Strombocarpa pubescens*, Figures 1 and 2) while the genus Neltuma contains the honey mesquite (*Neltuma glandulosa*, Figure 3) and the velvet mesquite (*Neltuma velutina*, Figure 4).

The screwbean mesquite with its more vividly colored blossoms and unusual dowel-like seed pods is a species of wash bottoms and river valleys where it benefits from seasonal moisture and higher water tables. This species is found along the Rio Grande in Texas and New Mexico, around the Salton Ssea in California, and along the Colorado and Salt Rivers in Arizona.

The honey mesquite thrives in plains and open valleys where it can be the dominant shrub or tree. There are distinct western and eastern populations of this plant, and some taxonomists advocate for dividing it into distinct species.

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Mesquite *continued*

The velvet Mesquite is the most common of the Arizona species in the Sonoran Desert where it grows in desert scrub, grassland, and oak-juniper woodland habitats.

All of these mesquites have similar ethnobotanical uses. Because of their dense wood, these trees are excellent for making fence posts, ramada supports, and sawed boards. The roots or trunks can be carved into decorative bowls, plates, and utensils, and selling these products is a thriving cottage industry in the southwest. Perhaps the most well-known use for mesquite wood is as a fuel source for grilling. The aroma of the woodsmoke imparts an instantly recognizable flavor to barbequed meat. While this use has probably led to over-harvesting in certain parts of its range, mesquites are so widespread and abundant that our three Arizona species are considered to be of "least concern" by the IUCN, which rates the conservation status of plants around the world.

According to Amadeo Rea, the Akimel O'odham recognize at least three distinctive types of mesquite sap. The first, called *kui eldag* is very viscous and dark, notorious for staining any car parked underneath. The dark sap is the result of a bacterial infection in the tree, often introduced these days by the uninformed attentions of so-called arborists who fail to make clean cuts or to sanitize their tools. This dark sap can be used to color dark locks and prevent hair loss. It can still be found for sale in parts of northern Mexico. Mesquite trees also produce a light colored, golden sap called *kui ushab* that can be used as an adhesive or chewed like gum. The third type is almost white and sweeter tasting than the other two. Called *si'al hikbin,* this exudate is the result of wounds caused by the mesquite girdler beetle (*Oncideres rodosticta*) which chews into the bark of young twigs.

One of the traits that has made mesquite so important ethnobotanically, and which makes them one of the most promising plants for the future of regional cuisine, is their beans which have a sugary pulp between the pod and the seed known as a mesocarp. This sweet pod is thought to have evolved as a means of tempting megafauna such as ground sloths and mammoths to eat the beans. Inside the digestive tract of these animals, the hard seat coat was worn down by mastication and stomach acid and then deposited into a fertile pile of manure, ready to imbibe water from the next rainfall or flood. Though these large mammals have been extinct for thousands of years, cattle and other livestock have taken their place in the ecosystem, eating, digesting, and spreading mesquite.

Humans also have made extensive use of these sweet beans. The skeptical Jesuit friar Ignaz Pfefferkorn wrote about how Indigenous people in the 1700s processed this food resource:

Figure 3. Honey mesquite. Figure 4. Velvet mesquite.
Credits: Luke Takata

> "*The Indians relish the fruit greatly because of its sweetness… They use them in two ways. They roast the pods, grind them between two stones, and mix this powder with water and drink it…Or they pulverise the unroasted pods in a wooden mortar, add water to it, and cook a very sweet porridge, which they deem unsurpassed.*"

The flour is quite sweet, with a sugar content approaching 30–50% of the dry weight of the flour. However, the pods also contain fiber and protein and mesquite flour has a low glycemic index, meaning that the sugars are processed slowly by the body, preventing blood sugar spikes and acting as a longer-lasting energy source.

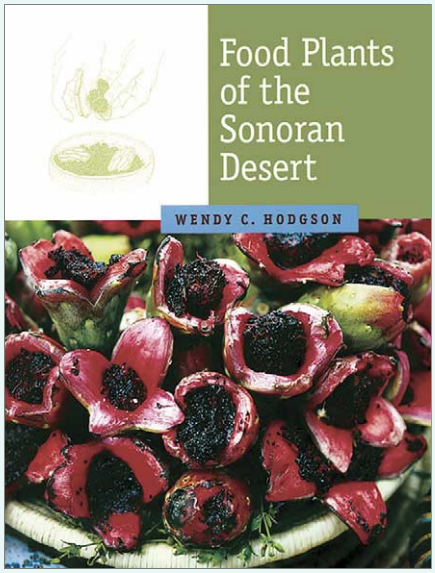
Mesquites are a true tree of life in the arid regions of North and South America — a critical part of desert ecosystems supporting a web of life extending from bacteria and fungi to birds and mammals. These trees are not only of ecological and historical significance, but also represent an important drought-tolerant food source in a drying region. For thousands of years, humans recognized these trees as a critical resource central to their lives. Within the last few decades, the ancient mesquite forests lining our waterways have been devastated by wood-cutting and groundwater pumping. Ranchers and land managers have spent millions of dollars attempting to remove mesquites from rangeland where they have spread because of grazing and fire suppression, pulling water from the soil and altering the species demographics of these landscapes. Poor land management has led to this incredible asset becoming an economic and ecological liability. A rapprochement between humans and mesquites is one vital step on the road to forging a sustainable future, where humans are benefitting from the abundant products of these trees while protecting them for their ecological, cultural, and aesthetic values.

BOOK REVIEW *by Micah Lindley, Arizona Native Plant Society*

Food Plants of the Sonoran Desert

by Wendy C. Hodgson, The University of Arizona Press, 2001. ISBN-13: 978-0-8165-3283-4 (paper). Available from uapress.arizona.edu ($47.00) and Amazon.com.

As someone who cooked in professional kitchens (once upon a time in a former life in a galaxy far, far away…), ethnobotany, especially with a focus on edible plants, has always been a subject I find deeply fascinating and perpetually inspiring. While food writers routinely gush about surging trends in the Michelin-starred echelon of fine dining restaurants such as foraging for wild ingredients, returning to more "primal" preparation techniques such as "live fire" cooking and fermentation, or celebrating "unsung, exotic" cuisines, too often these notions are primarily marketing vehicles to distinguish one sumptuous dining experience from the others and the bold claims and fervent declarations could be described in less flowery language such as "We collect edible weeds for garnish next to the parking lot," or "We grill food over hot embers," and "We cook with ingredients and techniques from cuisines we are all-too-often woefully simplifying into limp tropes and mushy clichés due to our lack of deep knowledge and genuine appreciation."



Alas, perhaps educating an entire elite cadre of restauranteurs, chefs, and cooks remains a Sisyphean task, but tools to push the proverbial rock up the hill do indeed exist. One such example is the fascinating and encyclopedic book, *Food Plants of the Sonoran Desert* by Wendy C. Hodgson. The book's organization makes *Food Plants of the Sonoran Desert* an excellent resource for reference, as each entry is located by family, then genus, and finally species. Synonyms for the scientific namse are included, as well as several common names (whenever available) in a variety of languages including English, Spanish, and a variety of Indigenous languages found throughout the Sonoran desert, helping the reader to ensure accuracy when researching a particular plant. Common names for plant families and genera are also provided, allowing the reader to draw connections between the rigorous scientific knowledge of academia with the more grounded, everyday experiential knowledge gained through hands-on effort and discussion with other serious practitioners.

This combination of two different fields of study, ethnobotany and botany, while sharing many overlapping subjects of study, often approach said subjects from very different perspectives. Botany investigates plants in their natural environments and absent human intervention, while ethnobotany focuses on the uses of plants for human needs such as food, medicine, materials for building and clothing, fuel, religious ceremonies, and intoxication, as well as how these plants were gathered, harvested, cultivated, and bred for desirable traits. (I recall being completely bewildered as to what plant I was looking at the first time I worked on a student-run farm in college only to be told in the flattest of responses: "That's a potato plant." Despite a formal culinary education and over fifteen years in the hospitality industry, I realized I had likely never even seen an image of a potato plant before that day.) *Food Plants of the Sonoran Desert* bridges these two disciplines smoothly, while still primarily focusing on the ethnobotanical aspects of included plants.

One excellent example of this connection between the two disciplines is the entry for *Hordeum pusillum*, commonly known as little barley. Ethnobotanists suspect that little barley was domesticated by the Hohokam, as the little barley seeds found at numerous sites in the southwest and central portions of the United States which were "naked," or lacking adhering bracts. Wild barley varieties have bracts which help the seeds stay attached to the planting case which helps shield seeds from the elements until they can germinate. Domesticated "naked" barley, because it is planted by humans, has no need for the bracts but makes threshing the grain much easier once harvested.

Food Plants of the Sonoran Desert is organized by plant families alphabetically in each of the three main sections,

continued next page

Food Plants of the Sonoran Desert *continued*

Gymnosperms, Angiosperms (Monocots), and Angiosperms: (Dicots). Within each entry, the genus and common name are provided first, followed by individual species names, the author of the plant's scientific name, and finally common names in English, Spanish, and a variety of Indigenous languages. Synonyms for scientific names are also provided, where applicable. Interestingly, plant descriptions are omitted as the author Wendy C. Hodgson notes in the introduction, because "The majority of texts on edible include descriptions that are far too brief." The author helpfully provides a list of nine texts authored by botanical experts of plants of the Sonoran desert as resources to find detailed descriptions of the plants included in *Food Plants of the Sonoran Desert*. When possible, photographs of plants in their natural habitats and approximate location data are provided, as well as excellent illustrations specifically highlighting the edible portions of the plant, such as fruits, seeds, tubers, and tender shoots.

The real meat and potatoes of *Food Plants of the Sonoran Desert* (pun very much intended), are the detailed descriptions of where and how plants were collected or planted, how the plants were harvested and processed, cooking methods used to prepare the foods, and what dishes and preparations the food was used in. As there are no universal methods in ethnobotany, a variety of methods are described from communities living throughout the vast expanse of the Sonoran Desert and curious differences reveal themselves. For example, neighboring communities may have diametrically opposed views on a given plant, where one community may consume the plant throughout the year and relish the food's flavor while a nearby community may only eat the food during months where food stores are diminished, such as late spring and early summer before the (North American) monsoon rains arrive. Wild onions are an excellent example of this phenomenon as the entry for *Allium* (onion, garlic, wild leek, cebolla, ajo) describes many Indigenous communities in the Sonoran Desert that consumed alliums regularly, whether "raw, cooked, or used as seasoning" but also notes "However, the Havasupai experienced headaches after eating wild onions and thus only ate them when very hungry." Or sometimes neighboring communities may have diametrically opposed views on a food plant that grows in abundance in both locales but only one community may consume the plant as food and the other may not view that plant as food at all or have a strong taboo against eating the plant in question. The entry for *Hesperocallis* (desert-lily) indicates many Sonoran communities "ate the bulbs raw, roasted, or boiled" but the Gila River Pima did not view the plant as a source of food.

Food Plants of the Sonoran Desert is chock full of fascinating details about edible plant's uses. The entry for *Cucurbita* (gourd, calabaza) highlights a variety of ways desert people would use these plants including eating the seeds, making oil from the seeds, eating the flesh of mildly bitter varieties, using parts of the plant for medicine or to clean, and using the roots of certain varieties as a source of starch. But one other use for gourds and calabaza I found to be a very clever is women utilizing the bitter cucurbitacin (a triterpenoid glycoside) by cutting slits in the fruit and then rubbing the bitter compound on their breast to wean young children from breast milk. Another example of the captivating details included in the book is the description of the flavor of sandfood, a parasitic plant that grows in sand dunes in the western portion of the Sonoran desert: "The taste has been described as similar to that of a delicate sweet potato, a cross between celery and a pear, and ranging from bland to moderately sweet."

Additional information is provided with four appendices, a literature cited section, and a very thorough index in *Food Plants of the Sonoran Desert*. Appendices II and III provide fruiting periods for plants with edible fruits and seeds respectively, Appendix IV features common names used for edible plants in the Sonoran Desert, primarily in Spanish or Indigenous languages, next to the plant's scientific name in Latin. And last but certainly not least, Appendix I provides a chart that indicates which portions of edible plants are eaten such as fruits, leaves, roots, and flowers. Typically, there are only one or two portions of an edible plant considered edible, but some exceptions exist such as the Santa Rita Mountain and Mexican yellowshows, where every major portion of the plant was consumed, including flowers, fruits, seeds, leaves, and roots.

Food Plants of the Sonoran Desert was written with archaeologists, botanists, and ethnobotanists in mind per the Introduction section, and it certainly achieves its aim as an easily searchable resource with an extensive Literature Cited section for further reading and research. But this book is also so well written that it is easily and enjoyably consumed by simply reading it from cover-to-cover, no matter how little formal botanical education the reader has. Whether the book lives in a public library, a university herbarium, or on the nightstand at home, *Food Plants of the Sonoran Desert* makes for a truly delicious read.

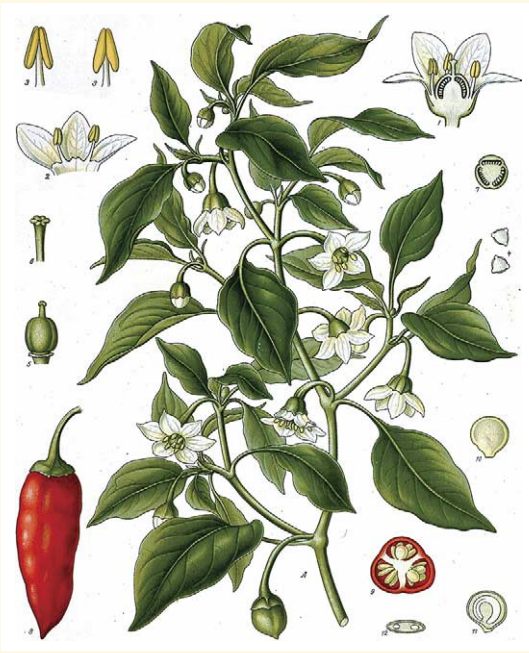


Figure 1. *Capsicum annuum. Illustration: Franz Eugen Kohler*

Figure 2. A chiltepin in cultivation. *Credit: Luke Takata*

The Chile Pepper *by Jack Dash*[1]

The cultivated chile pepper is an exceptional blend of steady evolution and frenetic human selection. It all started with a small fruit. A bright red bead held upright on a thin stalk. An offering to passing birds who lack the pain receptor that causes a burning sensation on the taste buds of mammals. The pain caused by the chemical capsaicin causes a rush of endorphins in humans. It's a pupil-dilating thrill that can leave you aching and still wanting more.

So, over the past few centuries humans have taken over for birds as the primary dispersal vector for peppers. We have carried them throughout the warmer parts of North and South America and spread them across oceans to gardens and farms all over the globe. It's an evolutionary outcome that would have been impossible to predict. The exact compound produced by this plant to repel browsers has become an addiction to the one mammal species that has the capacity to transport it around the world, giving it a global distribution, and breeding thousands of different cultivars. It's an ecological rags-to-riches story like few others.

It's even more astonishing when you realize that all those thousands of pepper cultivars can be traced back to just five wild species. Of those five, one, the chiltepin, accounts for around 95% of all the cultivated peppers that we eat. Sweet, watery bell peppers, and fiery serranos, all descended from the same peppers that can be found in the boulder-strewn draws of the Tumacacori Mountains, where they are growing at the extreme northern limit of their natural range.

There are two types of locations where chiltepins can be found in the Sky Islands of southern Arizona. The first is sites with evidence of human activity. Indigenous harvesting grounds, modern gardens, and migrant layup spots are all prime sites to search for chiltepins. The other type of habitat is near the top of steep side canyons and cliffs, where you can only find them by stumbling up hills, kicking down rocks that clatter and bounce as they pick up speed, becoming potentially lethal to anyone unfortunate enough to be standing below you. These plants are often hidden under the canopies of oaks (*Quercus* spp.) or mesquites (*Neltuma velutina*). These are the rookeries of the birds who devour the berries in ignorant bliss of their intoxicating burn and deposit their seeds in nutrient rich piles of feces where they germinate and thrive.

These wild peppers are more than a culinary oddity. These plants, growing at the limit of their range, may hold the genetic key to improving the resilience of their cultivated progeny. Human cultivation over time tends to encourage plants that are more productive, but weaker, than their wild

continued next page

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Figure 3. A chiltepin fruiting in the mountains of southern Arizona. *Credit: Luke Takata*

The Chile Pepper *continued*

ancestors. The occasional reintroduction of wild genes into agricultural crop plants can render them more resistant to harsh conditions and climatic extremes.

Unique variants in the DNA molecule (alleles) that have developed in chiltepins as a response to heat, drought, and poor soil can be crossed into cultivated chiles to improve their hardiness and ensure the survival of the peppers that enliven our meals with their palate-scorching payloads of red-hot capsaicin. The urgent need to preserve the wild relatives of our cultivated crops adds impetus to habitat conservation efforts in the Tumacacori Highlands. The wellbeing of natural areas and the plants they contain is intimately connected with the resilience of the agricultural systems that we all rely on.

In October 2025, botanists, agronomists, horticulturists, Indigenous knowledge keepers, and ethnoecologists gathered together at Tohono Chul Botanic Garden to discuss the status of chiltepin, its conservation needs, and how to celebrate its cultural importance to the region. The outcome of this session is a report, written by researcher Erin Riordan, soon to be published by the Arizona-Sonoran Desert Museum, which lays out six key focus areas for further research and action. The goal of this report is to help stimulate an appreciation for the importance of chiltepin to the cultural identity of the region, and to build a broad base of support for the *in-situ* and *ex-situ* conservation of this iconic plant.

Parts of this paper are excerpts from "Atascosa Borderlands", see Atascosaborderlands.com for more information

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