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Daily Bread and Healing Balm: A Deep History of Native Plant Use in the Trans-Pecos of Texas

by Phil Dering

For thousands of years, people living in arid lands have relied on plants to provide most of their food, medicine, clothing, and building materials. Agave and prickly pear were unquestionably the most important plants for the ancient hunter-gatherers of the region, providing food, medicine, and the implements needed to hunt and fish. The Native Americans of the Trans-Pecos understood the chemical and mechanical properties of these two plants at a very practical level. Some of this knowledge, especially the medicinal or dietary knowledge gained from these studies, can have important applications in today's society.

There are three primary avenues for learning the history of plant utilization. The first is through historical and ethnographic records. The second is through the excavation and analysis of material remains from archeological sites. The third is by means of replication experiments that are guided by the historical and archeological records. Many archeologists utilize all three of these information sources to study the history of plant use.

How do we know that agave and prickly pear were the most important plants to the prehistoric populations that lived in an area? First, archeologists identify the remains of plants at ancient settlements and campgrounds. Where and what parts of plants are discarded tells us a lot about how they were used and how often they were harvested. They study coprolites (dried human feces) from rockshelter sites. Remember, much of what goes in, must come out! Measuring carbon-isotope ratios in human bone also tell us what kinds of foods people ate. In the Trans-Pecos and Lower Pecos regions, analysis of human bone has demonstrated that plants using a C-4 or Crassulacean acid

metabolic (CAM) pathway for photosynthesis contributed up to 50% of the diet (Heubner 1991). Both agave and prickly pear are CAM plants. Add that piece of information to the overwhelming abundance of agave and prickly pear in the trash heaps and coprolites found at archeological sites, and the importance of these two plants emerges.

Agave: Food in the stomach is essential; in the absence of food such basics as clothing, shelter, and physical security mean nothing (Oswalt 1976). For the dwellers of the southwestern deserts, agaves played a vital role as both a food source and as a material from which food-procuring tools were fashioned.

The word agave comes from the Greek word *agavos*, which means noble, or illustrious. The two agaves most often utilized by the hunters and gatherers of the Trans-Pecos region were lechuguilla (*Agave lechuguilla*) Torr., (see

photos of plants and flower stock), and Havard agave (*Agave havardiana*) Trel. They grow in the form of an evergreen rosette; the well-armed leaves are arranged in spiral ranks around a thick, shortened, central stem. The plant stores most of its carbohydrates in the fleshy but fibrous stem, which also contains saponins, a combination of steroids and sugars that foam when water is added to the sap and agitated (Nobel 1994). Because of these added chemicals and the high fiber content of the stem and leaves, agaves present some obstacles for human consumption.

Most of my work has been with lechuguilla, but this smaller agave has been recovered from archeological deposits throughout the lower elevations of the Trans-Pecos. One of the saponins found in agave has been identified as smilogenin, and lechuguilla contains more of it than any other agave (Gentry 1982). The detergent property of saponins makes lechuguilla sap an effective soap (Pennington 1963), but when taken internally, the same property damages animal cells, hence the plant is considered toxic. The Tarahumara Indians of Chihuahua, Mexico understood this property and would pound the central stems and leaves of the plants and throw them into water holes of small streams. The sap shocked the fish, bringing them to the surface at distances of a few hundred yards (Pennington 1963). Agaves also store food in very long-chain carbohydrates that must be converted to sugar before humans can effectively access the calories they contain.

Native Americans devised an ingenious appliance to overcome these chemical obstacles, the earth oven. Both the carbohydrates and the saponins can be broken down into smaller compounds and the sugars released, by exposure to high temperatures for a period of 36 to 48 hours. The only way to expose food to high temperatures for such a long time without burning it is to place the food in an anaerobic environment. Long ago people all over the world discovered that the most expedient way to cook foods at high temperatures in an oxygen-free environment is to use an earth oven, which consists of a pit dug into the ground and a heating element of hot rocks onto which the food is placed and then covered with earth.

The agave plants are harvested and the leaves trimmed, leaving the central stem or heart. Wood and rock is stacked into the pit, and the wood is ignited. Once the fire has burned down completely, the hot rocks, which reach temperatures of 700 degrees F, are covered with a moist packing material of grasses, greens such as goosefoot or pigweed, or even prickly pear pads. The agave plants are placed on top of the packing material. Once the food is in place the pit is sealed with dirt, and care is taken to see that no air holes develop in the earthen lid, otherwise the earth oven turns into an earth furnace. The hot rock heating element acting on the packing material generates steam which triggers hydrolysis, the chemical means by which the saponins and long-chain carbohydrates are broken down into sugars.

By measuring how much agave can be baked in a pit, and determining how many food calories are generated by a single oven firing, one can get an impression of the return the natives received for their investment in the agave harvest. Repeated measurements of earth oven cooking experiments with lechuguilla have determined that the average earth oven yields about 7,600 Kcal or enough calories to feed a family of five. Because baking agave requires about 10 hours of work to harvest the agave, dig the pit, and collect 250 pounds of rock and 250 pounds of wood to heat the rock, earth ovens have a very low return for the time and energy required to use them (Dering 1999). By comparison, a small white-tailed deer yields conservatively about 28,000 Kcal of venison and meat can be eaten raw or lightly roasted, with little or no processing time. The advantage of agave to the Native Americans, however, is that gathering wild plants is a low-risk investment compared to hunting wild animals. The hunter-gatherers living in the region knew the location of agave stands, and they only had to harvest and process them. On the other hand deer in the desert were both scarce and elusive, and much time could be wasted on a hunt that ended in failure. Although Native Americans most likely did not think like a western economist, these hunter-gatherers were intuitively balancing risk against return in their quest for food.

Agave has a long history of use, having been reported from 9,000 year-old cave deposits in Oaxaca, and 8,000 year-old deposits in Hinds Cave near the lower Pecos River (Shafer and Bryant 1977). Agave of course has many other uses; the long fibers from the leaves were fashioned into cordage with which nets, ropes, fishing line, snares, and baskets were made. These were food-getting and collecting implements critical for survival. Sandals made from agave leaves have been recovered by the hundreds from just one rockshelter. Thus the agave was perhaps the most important single plant resource to the hunters and gatherers of the region.

Prickly pear: Prickly pear is a bane to many ranchers, but it was both a seasonal staple and a source of medicine to the hunter-gatherers of the Trans-Pecos. Prickly pear is a cactus that consists of succulent, green, flattened stem segments commonly called "pads" or "*nopales*". The spines (the prickly part of the name) are actually modified leaves. Although there are well over a dozen species in the Trans-Pecos, the most common and fruitful of the lot is *Opuntia engelmannii* Salm-Dyck, which can grow into dense, shrubby clumps covering large tracts of land. The fruit (also known as a tuna or pear) ripens to a deep red color and produces a very sweet, insipid, purple-red juice. The fruit ripens in midsummer, and is harvested by many animals as well as people.

Each prickly pear fruit contains over 50 seeds, and it is the hard and durable seed that is found most commonly at archeological sites. It not only survives the fruit processing activities, it will pass through the human gut unscathed (Williams-Dean 1978). Because prickly pear seed was present in some Hinds Cave deposits (Area F) at densities exceeding 90 seeds/liter, we know that the tuna, was a common plant food for the people who lived in the shelter (Dering 1999). We also have more direct evidence that prickly pear was consumed in large quantities by the inhabitants, because the seeds or fragments of the seeds were found in 74% of the coprolites in one study, and 82% of the coprolites in another study! These coprolites ranged in age from 8,300 to 5,700 years-old, demonstrating the time depth of prickly pear use in the region (Stock 1983; Williams-Dean 1978) .

Prickly pear fruit is harvested by knocking or twisting the fruits off the pads into a basket. The stiff hairs that cover the fruits need to be removed before they are consumed, and this can be accomplished by parching the fruit in hot coals or rubbing off the hairs using a rock. The fruits can be eaten raw, or they can be pounded in a mortar and pestle. A wooden mortar and pestle discovered in a cave in northern Val Verde County had prickly pear seeds in the cracks (Collins and Hester 1968). These seeds were probably wedged into the cracks when the user was pounding prickly pear fruits into juice and pulp. The juice is separated and consumed, and the remaining pulp can be sun-dried.

There are very few ethnohistoric descriptions for the use of prickly pear from Texas. The most famous is the great prickly pear harvest recorded by Cabeza de Vaca, the first European to cross Texas and northern Mexico. He noted that the harvest was so important that the Indians would talk about it months before the fruit was ripe. The Indians with Cabeza de Vaca journeyed several miles to an area where large stands were

were ripening. Many other groups would converge on the area, dining on fresh fruit for weeks. They would also squeeze the juice out of the fruit and dry the pulp skin for future consumption (Cabeza de Vaca 1983).

Some of the more detailed ethnographic records of tuna processing come from western groups that were not heavily invested in plant production. Typical preparation of the fruit includes drying and pressing fruits into a large flatcake, practiced by the Yavapai. The Cahuilla pick the fleshy young fruit of *Opuntia basilaris* in early summer and steam or bake it (Bean and Saubel 1972). *Opuntia engelmannii* fruit is very juicy and needs only to be pounded and sun-dried. Although there are no ethnographic references to pit-baking green or partially ripened *Opuntia engelmannii*, I have pit-baked the green or partially ripe fruit and found it to be palatable. Thus there are many avenues by which the charred prickly pear seeds might have entered the archeological record.

Early explorers learned the hard way that prickly pear tunas have to be processed carefully. The following is an account of a historic prickly pear accident that occurred on Matagorda Island, as related by Henri Joutel, a survivor of La Salle's expedition to Texas in the late 17th century (this also contains good tuna processing advice):

> One must strip the fruit before eating it because, although the quills are quite small and almost imperceptible, without fail they make one sick once they lodge in the throat and on the roof of the mouth. One of our soldiers even died from having eaten the fig greedily without wiping it. All these quills caused tremendous inflammation of the throat and eventually suffocated him (Foster, 1998).

Since the officers on the ship hoarded all the good food and drink, the poor man was probably not greedy, just starving — and pretty clueless to boot.

The fruit is not the only useful part of the plant; the pads (green fleshy stems) were edible, and even used as containers. Based on coprolite evidence, both the immature pad (nopalito) and the mature pad (nopal) was consumed by the foragers of the past. Although the immature pad can be eaten raw, the mature pad most likely was baked first. As the French explorers learned, the spines must be removed. Today we can buy the spineless cultivated variety at the grocery store. Prickly pear fibers are difficult to identify in coprolites. However, we know that epidermis, the outer skin of the *nopal*, was present in between 8% and 28% of the coprolites in one study, and 70% of the coprolites in another study from Hinds Cave (Stock 1983). We can infer from this that the pads were consumed.

Although it is 55-85% water by weight, prickly pear fruit is rich in Vitamin C and calcium and is a good source of carbohydrates. The pads contain fewer carbohydrates but are rich in Vitamin A. Mature pads probably were baked in an earth oven before consumption, because they contain oxalic acid and calcium oxalate crystals that impart a bitter taste. On the other hand, the immature pads or nopalitos, available in most grocery stores, can be consumed raw and are rich in calcium and digestible fibers. These cultivated nopalitos are grown from a spineless prickly pear variety originally developed by the famous plant breeder Luther Burbank.

Native American and folk ethnobotanies have reported many medicinal applications:

- Infusion of pads used to treat urinary tract infections
- Mature pads as poultice an antiseptic for wounds
- Mature pads to treat burns
- Tea made from pads for treating tuberculosis scar tissue
- Mucilage from mature pads kills bacteria in cultures, so it has antibiotic properties
- Hot poultice of prickly pear pad skin applied to boils
- Split pads used as a hemostat
- Infusion of pads used to treat swollen prostate

Many public health experts are beginning to emphasize the potential importance of prickly pear in our diet today. The pads are high in calcium, both insoluble calcium oxalate and soluble mucilage. They have a hypoglycemic effect, significantly lowering cholesterol and preventing glycemia, reducing insulin shock. Soluble fibers, including viscous mucilage, inhibit the absorption of simple carbohydrates and thus help to control Type-2 diabetes. Pads also contain high levels of amylose, a starch that breaks down into simple sugars more slowly than amylopectin, the starch in bread and potatoes. Therefore the plants of the ancients

may continue to prove useful to modern populations that cope with too much of the wrong kinds of food, and too little of the foods which benefit us.

This brief review demonstrates how the Native Americans utilized the chemical and mechanical properties of two common Trans-Pecos plants. The ancients knew plants in an experiential manner that is difficult for members of an urban society to grasp. Although we continue to depend upon plants for survival, we are many-times removed from the source of our sustenance. Hopefully we can impress on our children the importance of maintaining an active knowledge of the land and its resources.

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Agave lechuguilla plant in bloom

Opuntia engelmannii with ripened tunas or pears (right). Whole plant with flowers and non-ripe tunas (below).

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Nature Happenings in the Lower Rio Grande Valley, Texas

McAllen Great Outdoors Nature Series, McAllen Chamber of Commerce— The great outdoors nature series at 6:00 pm continues in March. March 7, Keith Hackland, Nature Tourism in South Texas; March 14, Roy Rodriquez, Birds of NE Mexico, Tamaulipas, El Cielo; March 21, Collen Hooks, History & Wildlife of the Quinta Mazatlan; March 28, Janis Lentz, Monarch Migration.

Texas State Park Tours/ World Birding Center, Mission, Texas— Lomitas Ranch Tours and other natural area tours 7:30 a.m. – 5 p.m. every Tuesday and Friday from Benson Rio Grande State Park/World Birding Center in Mission, TX. Outings focus on native plants and their uses. Fees: $25 per person, reservations required - call 956-519-6448. Or go to www.worldbirdingcenter.org

Sabal Palm Grove Sanctuary— Native plant presentation and tour by Joseph Krause – every weekday at 10 a.m. Pre-registration required – call 956-541-8034.

Laguna Atascosa NWR— Nature BIKE RIDES on Saturdays from 8 a.m. - 10:30 a.m. and Nature WALKS, Sundays from 8 a.m. - 10 a.m. Call for details: 956-748-3607.

Santa Ana NWR— Tram Tours of the park. Fees: $3 for adults and $1 for 12 years-old and under. Guided Nature WALKS are available. Call for details: 956-787-3079.

The Sabal is the Newsletter of the Native Plant Project and conveys information on the native habitats, and environment of the Lower Rio Grande Valley Texas. Co-editors: Gene Lester and Eleanor Mosimann. **You are invited to submit articles for *The Sabal*.** They can be brief or long. Articles may be edited for length and clarity. Black and white line drawings -- and colored photos or drawings -- with or without accompanying text are encouraged. We will acknowledge all submissions. Please send them, preferable in electronic form - either Word or WordPerfect, to: Native Plant Project, P.O. Box 2742, San Juan, TX 78589 or contact Gene Lester @ 956-425-4005, or g_lester48@msn.com. See *The Sabal* and our 5 handbooks on the website:

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Native Plant Project Meetings – January 24, 2006. **Board meeting** at 6:30 pm; G**eneral meeting** at 7:30pm featuring:: Ann Vacek and Eleanor Mosimann will present NPP's new handbook "Butterfly Gardening with Native Plants of the Lower Rio Grande Valley, TX".

Board and General Meeting 2006:

January 24
February 28
March 28
April 25
May 23
September 26
October 24
November 28

Board Meeting Only 2006:

June 27 July 25 August 22

Summary of the Minutes of the NPP Board Meeting on NOV. 22, 2005. Bert Wessling and Martin Hagne will update the agreement between the NPP and the Valley Nature Center for sales of NPP handbooks. Eleanor Mosimann agreed to stand for election as Vice President. The terms of the following Directors end in January 2006: Mike Heep, Kathy Sheldon, Sue Sill, Benito Trevino, and Ann Vacek.

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