

# A Tale of Two Cacti –The Complex Relationship between Peyote (*Lophophora williamsii*) and Endangered Star Cactus (*Astrophytum asterias*).

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**ABSTRACT** *Astrophytum asterias*, commonly called star cactus, is a federally listed endangered cactus endemic to the Tamaulipan thornscrub ecoregion of extreme southern Texas, USA, and Tamaulipas and Nuevo Leon, Mexico. Only three metapopulations totaling less than 4000 plants are presently known in Texas. Star cactus, known locally as “star peyote”, is highly sought by collectors. This small, dome-shaped, spineless, eight-ribbed cactus is sometimes mistaken for peyote (*Lophophora williamsii*), which grows in the same or adjacent habitats. Peyote is harvested from native thornscrub habitats in Texas by local Hispanic people and sold to *peyoteros*, licensed distributors who sell the peyote to Native American Church members. Annual peyote harvests in Texas approach 2,000,000 “buttons” (crowns). Although the *peyoteros* do not buy star cactus from harvesters, they cultivate star cactus in peyote gardens at their places of business and give star cacti to their customers as lagniappe. If even 0.1% of harvested “peyote” is actually star cactus, the annual take of this endangered cactus approaches the total number of wild specimens known in the U.S. This real but unquantifiable take, together with information from interviews with local residents, suggests the existence of many more star cactus populations than have been documented.

## ASTROPHYTUM AND LOPHOPHORA – SIMILARITIES AND DIFFERENCES

*Astrophytum asterias* (Zuccarini) Lemaire (star cactus) is a small, spineless cactus. Each plant usually has a single low, dome-shaped stem that becomes flat or depressed during dry conditions. In the wild, star cactus grows to 7 cm tall and 15 cm in diameter. Plants are green to grayish-green or goldish-brown, patterned with whitish to yellowish circular scales. Each normally has 8 triangular ribs separated by narrow grooves. The areoles follow a central line down each rib, bearing tufts of short, whitish hairs. The pale yellow flowers with orange-red bases appear in mid-March through May (Fig. 1) (Benson 1982; Damude and

Poole 1990). Star cactus was listed as Endangered by the US Fish and Wildlife Service (USFWS) in 1993 due to its few populations and high degree of threat from collecting. It is also listed in the Convention on International Trade in

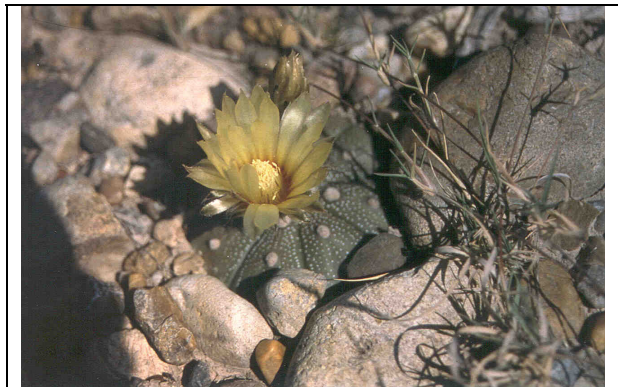


FIGURE 1. Endangered *Astrophytum asterias* (Star cactus), Starr County, Texas

Endangered Species (CITES) Appendix I. Star cactus is an extremely popular collector's item. Even though it is easily grown from seed, plants continue to be taken from the wild.

*Lophophora williamsii* (Lem. ex Salm-Dyck) Coult. (peyote) resembles star cactus in its size, shape and lack of spines. However, peyote is bluish-green and lacks the tiny whitish scales found on star cactus. Peyote has 5-13 (most often exactly 5, 8 or 13) ribs, the number increasing with age. Star cactus, in contrast, generally has 8 ribs throughout life. Peyote's ribs may extend toward the base in a spiral conformation not seen in star cactus. Mature specimens of *L. williamsii* may have pronounced tubercles, which may (particularly in spiral-ribbed individuals) give the ribs an irregular appearance not observed in *A. asterias* (Fig. 2). The flowers of peyote appear pale pink in color (Fig. 3). The outer tepals are white with a green stripe down the midline, but only the inner tepals, which are white with a pink stripe down the midline, are visible from above when the flowers are fully open. Peyote has a large (diameter ca. 70-90% of the diameter of the base of the stem),



FIGURE 2. *Lophophora williamsii* (Peyote), Starr County, Texas. Grandmother and younger plants showing variation in number of ribs.



FIGURE 3. Peyote in flower, Starr County, Texas

slowly tapering taproot with few lateral roots, while star cactus has a diminutive taproot (diameter ca. 10% of the diameter of the aerial portion of the stem) that branches into many slender roots suggestive of a fibrous root system (Fig. 4).

## II. RANGE AND HABITAT OF *ASTROPHYTUM* AND *LOPHOPHORA*

The range of *Lophophora williamsii* includes both the Tamaulipan thornscrub and the Chihuahuan desert (Anderson 1996), while *Astrophytum asterias* has a much more restricted range in the Tamaulipan thornscrub only (Damude and Poole 1990; Martinez Avalos 2002; Sanchez-Mejorada et al. 1986). The ranges



FIGURE 4. Taproot of Peyote (left) and star cactus fibrous roots (right). Star cactus has a fibrous root system with at most a diminutive taproot and cannot regenerate if the top is removed.

of the two species overlap in the Lower Rio Grande Valley of southern Texas, USA, and in northern Tamaulipas and Nuevo Leon, Mexico (Fig. 5).

Within the Tamaulipan thornscrub, star cactus grows in gravelly clays or loams, on gentle slopes in sparsely vegetated openings between shrub thickets within mesquite-blackbrush thorn shrublands (Fig. 6). Associates of both *Astrophytum* and *Lophophora* in Texas include the shrubs mesquite (*Prosopis glandulosa*), amargosa (*Castela erecta*), blackbrush (*Acacia rigidula*), lotebush (*Ziziphus obtusifolia*), allthorn (*Koeberlinia spinosa*), desert olive (*Forestiera*

*angustifolia*), guayacan (*Guaiacum angustifolium*), coyotillo (*Karwinskia humboldtiana*), saladillo (*Varilla texana*); native short grasses (*Bouteloua trifida*, *Monanthochloë littoralis*, *Aristida* spp., *Hilaria belangeri*), and numerous other cacti (including *Opuntia leptocaulis*, *Echinocactus texensis*, and *Mammillaria heyderi*) (Damude and Poole 1990; Texas Parks and Wildlife Department and The Nature Conservancy of Texas unpublished field data).

*Astrophytum* and *Lophophora* may be found in close proximity within these habitats, sometimes growing together under the same nurse shrub (Fig. 7). More

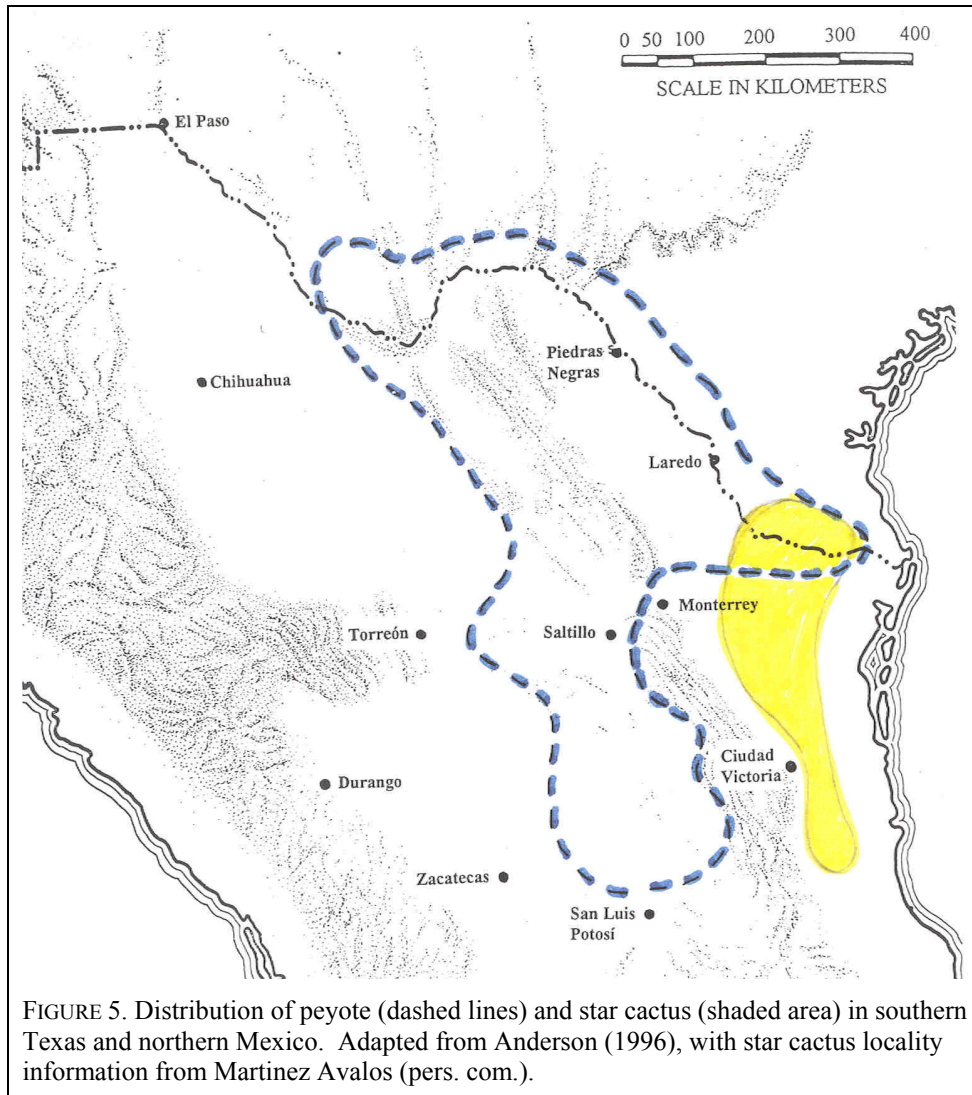


FIGURE 5. Distribution of peyote (dashed lines) and star cactus (shaded area) in southern Texas and northern Mexico. Adapted from Anderson (1996), with star cactus locality information from Martinez Avalos (pers. com.).



often, however, the two species appear to use slightly different microhabitats. For example, we have more often observed *Lophophora* near the base of shrubs while *Astrophytum* may grow farther out under the edge of the shrub's canopy or even in the open. The two cacti appear to show preferences (though not absolute requirements) for different soil types, as well. Further investigation is needed to determine whether and how these two cacti partition the habitat.

*Castela erecta* and *Opuntia leptocaulis* have been documented as important nurse shrubs for star cactus (Martinez Avalos, 2002).

### III. COMMERCIAL PEYOTE HARVEST – HOW IT WORKS

Federal law provides protection for the use of peyote for bona fide religious ceremonial purposes by members of the Native American Church (NAC). The supply of peyote for such purposes is regulated by the Drug Enforcement

Administration (DEA) and the Texas Department of Public Safety (2003). The regulated commerce in peyote begins with the harvest of peyote from wild populations by licensed peyote distributors or their agents. Commercial quantities of peyote occur in the U.S. only in Starr, Zapata, Webb and Jim Hogg Counties in South Texas, so all four currently licensed peyote distributors (*peyoteros*) are based in those counties, within 50 miles of the Rio Grande. Historically the *peyoteros* have gained access to harvestable populations of peyote through peyote-specific lease agreements with private landowners. Distributors normally tend to stay close to their places of business, where they can take orders from NAC members over the phone. Therefore, most of the actual harvesting of peyote is done by contract laborers who are paid by the number and size of freshly cut crowns (“buttons”) of peyote they deliver to the licensed peyotero.

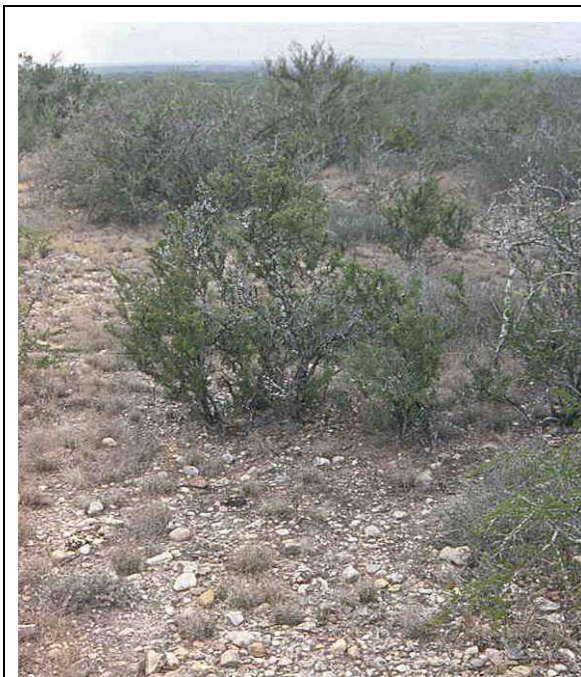


FIGURE 6. Area of Tamaulipan thornscrub, habitat for peyote and star cactus.



FIGURE 7. Star cactus and peyote growing under canopy of *Krameria ramosissima*

The proper technique for harvesting peyote is that the crown (i.e., the aerial stem) of the peyote cactus is cut off at the top of the root. Such harvesting of the commercially valuable crown of the cactus may be accomplished by cutting through the plant in cross section, parallel to the surface of the ground, at or near the interface of the green stem and the brown root, using a machete, a long-handled cutting tool with a broad flat blade (such as a hand edger), or virtually any kind of knife (Fig. 8).

When such traditional harvesting technique is adhered to, the decapitated taproot of the cactus (Fig. 9) remains intact in the ground, where it will normally begin to regenerate one or more new crowns within a few weeks after loss of the apical meristem (Fig. 10). These new crowns may themselves be harvested after they reach maturity in a few years (Fig. 11).



FIGURE 8. Cut peyote crown (“button”), showing proper harvesting technique.



FIGURE 10. Peyote “pups” (new stems) regenerating from cut crown



FIGURE 9. Harvested peyote taproot capable of regenerating.



FIGURE 11. Repeated harvest of peyote. Plant on left bears notches from having been harvested three times in the past; plant on right has never been harvested.



#### IV. INCIDENTAL HARVEST OF STAR CACTUS WITH PEYOTE: PROBLEM OR OPPORTUNITY?

Peyoteros maintain peyote gardens at their places of business, offering their Native American Church customers the opportunity to visit and pray. These gardens include specimens of both peyote and star cactus (Fig. 12). On rare occasions the NAC members take a specimen of star cactus back to their homes as a presumably nonconsumable souvenir from the “peyote gardens” of South Texas. Though the intention is to maintain these star cacti indefinitely in cultivation, damage to the root system that occurs in the collection process assures that most of these exiled plants will die in a few months. In any event, the act of removing such a plant from the population of which it was an element, renders it effectively dead in terms of its potential contribution to the genetics of the wild population.

Recent reports (Janssen 2004) from interviews with peyoteros indicate that the use of star cactus by some NAC members may not be of an exclusively nonconsumptive nature. NAC members are reported to ask the peyoteros specifically for “hard peyote” (*Astrophytum*), which they claim to be “stronger medicine” than “soft peyote” (*Lophophora*). This suggests that the desired effects of the “stronger medicine” are obtained by ingestion of the star cactus, as is the case with peyote, which is also called “medicine” by NAC members. However, whether the star cactus is being ingested to obtain the benefits of its “stronger” medicinal properties, or whether the effects can be perceived by NAC members without ingesting the plant (through its use as a religious amulet, for example), the

detrimental effect of the loss of these plants at the population level is the same.

Star cactus is currently known from only three metapopulations in Texas and six in Mexico (Martinez Avalos 2002). The largest known Texas population was estimated to total 2,000 individuals (Damude and Poole 1990). Peyoteros are familiar with star cactus and report that harvesters rarely bring it in; one distributor estimated that one plant in a thousand might be star cactus. In recent years, harvest of peyote in Texas has fluctuated around 2,000,000 buttons (Fig. 13). Although rare, incidental harvest of star cactus at a rate of 0.1% of



FIGURE 12. Star cactus growing in a *peyotero*'s peyote garden.

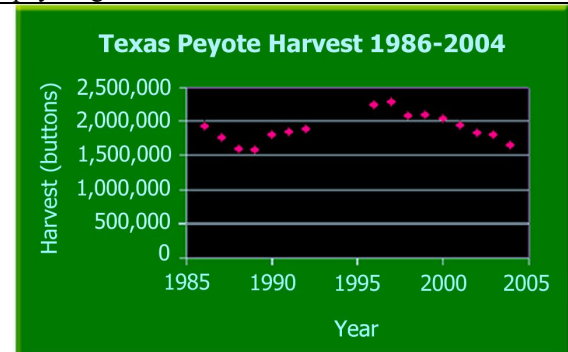


FIGURE 13. Total peyote harvests reported by licensed distributors. (Source: Texas Department of Public Safety, 2003.)

peyote harvests would result in “take” of nearly 2,000 individuals, approaching the size of the known population.

Local people in the Lower Rio Grande Valley of Texas view star cactus or “star peyote” as a curiosity. On rare occasions botanists have encountered star cactus specimens being cultivated as potted plants or in home cactus gardens. These star cacti were collected locally from undisclosed private lands. Rumors of additional star cactus populations abound, yet in a landscape where over 90% of the land is privately owned (Anderson 1995), opportunities for botanists to survey are limited. Further, star cactus is extremely cryptic and easily overlooked during the long dry periods that are prevalent in South Texas.

We believe that peyote harvesters could significantly add to the number of known populations of star cactus, probably expanding the known extent of its distribution. Historically, there has been no incentive for them to do so. As we continue our fieldwork with these two species, we envision establishing working relationships with peyote harvesters. Collaboration with such important sources of local botanical knowledge will be crucial to the effective management of the endangered star cactus.

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