ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PDCAC0J0E1
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Echinomastus erectocentrus* var. *acuñensis* (W.T. Marshall) Bravo
COMMON NAME: Acuña cactus, redspine fishhook cactus, red pineapple cactus
SYNONYMS: *Echinomastus erectocentrus* subsp. *acuñensis* (W.T. Marshall) U. Guzman, *Echinomastus acuñensis* W.T. Marshall, *Neolloydia erectocentra* var. *acuñensis* (W.T. Marshall) L. Benson, *Sclerocactus erectocentrus* var. *acuñensis* (Coulter) Taylor
FAMILY: Cactaceae

AUTHOR, PLACE OF PUBLICATION: *Echinomastus acunensis* W.T. Marshall, Saguaroland Bulletin. 7: 33. 1953.

TYPE LOCALITY: Organ Pipe Cactus National Monument, Pima County, Arizona.

TYPE SPECIMEN: Lectotype: DES. William Supernaugh, 02 Jan 1951.

TAXONOMIC UNIQUENESS: *Echinomastus* has a complex taxonomic history. The genus currently contains five species (Zimmerman and Parfitt 2003). Two varieties occur in the species, *E. erectocentrus* var. *acuñensis* and *E. erectocentrus* var. *erectocentrus.*

The USFWS and the *Flora of North America* (Zimmerman and Parfitt 2003) recognize this taxon as *Echinomastus erectocentrus* var. *acuñensis*. The HDMS follows this convention. According to Tropicos (2020), the accepted taxonomic treatment is *Echinomastus erectocentrus* subsp. *acuñensis* (W.T. Marshall) U. Guzman.

Summary of bibliographic citation and taxon history: W.T. Marshall partially described the species in his first edition of Arizona's Cactuses (1950). Marshall validly published the species in 1953 as *Echinomastus acunensis*. Lyman Benson (1969) placed the species in the genus *Neolloydia*, making it a variety of *Neolloydia erectocentra*. Hubert Earle (1980) raised the variety to a specific level, incorrectly assigning L. Benson (1969) as the authority. H. Bravo (1980) transferred the taxon back to *Echinomastus* and left it as a variety *of E. erectocentrus*. The consensus of the International Organization of Succulents (1990) is to place all of Lyman Benson's (1982) *Neolloydia* taxa into the genus *Sclerocactus* except for *N. conoidea.* Recently, Baker and Porter (2016) have suggested treating *E. erectocentrus* var. *acuñensis, E. erectocentrus* var. *erectocentrus* and *E. johnsonii* as a single species with three varieties, based upon molecular phylogenetic work. However, Fehlberg and Willis (2019) concluded three distinct groups of populations corresponding to *E. erectocentrus* var. *acunensis, E. erectocentrus* var. *erectocentrus*, and *E. johnsonii* can be recognized, based upon DNA analysis. Genetic analysis suggests that the Box-O Canyon and Kearny

populations of *E erectocentrus* var. *acuñensis* are genetically similar to and may be experiencing hybridization with *E. erectocentrus* var. *erectocentrus* (Willis 2020). Although there is room for interpretation, J. Mark Porter, Marc Baker, Shannon Fehlberg, and Alison Willis all agree that the entity *E. erectocentrus* var. *acunensis* is supported by morphological and genetic analysis and is a valid taxon (USFWS 2022).

DESCRIPTION: small, spherical cactus, usually single-stemmed, reaching up to 40 centimeters (16 in) tall and 9 cm (3.5 in) wide. Areoles bear 11-15 radial spines up to 2.5 cm (1 in) long, and 3-4 up-turned central spines up to 3.5 cm (1.4 in) long. All spines are similarly colored, purplish pink or nearly white with brownish purple tips (Zimmerman and Parfitt 2003). Flowers 3.6-6.0 x 4.0-9.0 cm (1.4-2.4 x 1.6-3.5 in); inner tepals pale to bright rose-pink or lavender, proximally blotched orangish brown, chestnut, maroon, or greenish brown (petaloid perianth parts coral pink to mallow per Benson (1982), or pink to purple per Rutman (1994)). Stigma lobes red to brownish red, papillae red to green. Fruits are pale green, drying to tan with several membranous scales, 1.25 cm (0.5 in.) long; opening along a dorsal slit. Small, nearly black seeds are rigose (Felger 2000).

AIDS TO IDENTIFICATION: In Arizona, due to morphological and geographic overlap, *E. erectocentrus* var. *acuñensis* is very similar to *E. erectocentrus* var. *erectocentrus* and *E. johnsonii*. Morphological analyses show only slight differences or overlap between characteristics such as length and number of spines, stems, and floral characteristics, and suggest a geographical cline exists among these three taxa from the northern Mojave Desert to the northern Sonoran Desert. The most significant characteristics for distinguishing taxa are floral characteristics and the length and thickness of the guard spines (Baker 2007, Porter et al. 2012, Baker and Porter 2016).

ILLUSTRATIONS:

B&W photo showing tubercles and spines (Benson 1982: 795)
Color photo and line drawing (Falk, Jenkins et al. 2001)
Color photo (Felger 2000)
Color photos (USFWS 2022)

TOTAL RANGE: Sonoran Desert in southern Arizona and northern Sonora, Mexico (USFWS 2022). May occur or have occurred in northern Chihuahua, Mexico, as well, though no records exist (USFWS 2022).

RANGE WITHIN ARIZONA: Maricopa, Pima, and Pinal Counties. Potential habitats exist in Sand Tank Mountains of the Barry M. Goldwater Air Force Range and the Tohono O'odham tribal lands.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Succulent perennial.

PHENOLOGY: Flowering occurs early March to mid-April; flowering correlated with plant size, and flower production is positively associated with winter rainfall. Fruiting April to May (Zimmmerman and Parfitt 2003). Cacti must reach adult size (> 24 mm tall, generally about 5 years of age) before producing flowers, fruits, and seeds, and generally produce flowers annually, if winter rainfall is adequate (USFWS 2022).

BIOLOGY: The taxon is self-incompatible, and does not reproduce vegetatively, thus requiring insect vectors for pollination (Johnson and Nagy 1999, USFWS 2022). Acuña cacti are pollinated by a suite of bees from the Andrenidae, Anthophoridae, Anthophorinae, Halictidae, and Megachilidae families; however, the leafcutter bee (*Megachile palmensis*) and cactus bee (*Diadasia rinconis*) are thought to be the primary pollinators (Johnson 1992). These primary pollinators are believed to have a maximum travel distance of 900 m (2,950 feet). Cacti growth is positively correlated with annual precipitation, while flower, fruit, and seed production are correlated with winter precipitation (Rutman 2001). Seedling survival is associated with summer and early fall precipitation (Johnson et al. 1992). Larger individuals are better able to withstand drought conditions than smaller individuals (Johnson et al. 1992). Establishment is the most critical limiting phase of the acuña cactus life cycle (USFWS 2022). The lifespan is not known, though the two oldest known plants were 38 and 42 years old at time of death or last monitoring (USFWS 2022).

Like most cacti, the acuña cacti are susceptible to attacks from insects. Four native insects have been documented to impact the acuña, with the cactus longhorn beetle or the opuntia borer (*Moneilema gigas*) and the cactus weevil (*Gerstaeckeria spp*) being the most responsible for the observed population decline. Seed predation by the pyralith moth larvae (*Yosemitia graciella*) and unknown ant species also occurs. While no specific diseases have been documented as detrimental to the cactus, the plants are exceptionally susceptible to bacterial rot after minor stem damage. A variety of small mammals and birds can severely damage or kill both mature and young cacti during times of drought (USFWS 2012). Seedlings are particularly vulnerable to desiccation (USFWS 2022). Reproduction decreases under drought conditions (USFWS 2022).

HABITAT: Patchy populations on open, rounded small hills, benches and flats (Holm 1997-2005). Low gravelly hills, valleys bajadas and rocky hilltops (eFloras 2011). Restricted range occurring on well-drained knolls and gravel ridges between major washes (A. Phillips, B. Phillips and N. Brian 1982). Open soil and wood components are necessary for pollinator nesting (USFWS 2022).

ELEVATION: 350 – 1,150 m (1,150 – 3,773 ft) (USFWS 2022).

EXPOSURE: Open, but up to 30% slope.

SUBSTRATE: This species grows on soil overlying various bedrock types including extrusive felsic volcanic rocks of rhyolite, andesite, and tuff, and intrusive igneous rocks composed of granite, granodiorite, diorite, and Cornelia Quartz Monzonite. Soil texture varies between bedrock and both coarse and fine textured substrates (Rutman 2007).

PLANT COMMUNITY: Palo-Verde/Saguaro Association of the Arizona Upland subdivision of Sonoran Desert Scrub. Dominant associated species include: *Larrea tridentata* (creosote bush), *Olneya tesota* (ironwood), *Parkinsonia microphylla (*palo verde), *Fouquieria splendens* (Ocotillo), *Ambrosia deltoidea* (triangle bur ragweed), *Cylindropuntia acanthocarpa* (Buckhorn cholla), *Echinocereus engelmannii* (Engelmann's hedgehog cactus), *Carnegiea gigantea* (saguaro), *Senegalia greggii* (catclaw acacia), *Encelia farinosa* (White brittlebush), and *Ephedra* spp. (Mormon tea) (A. Phillips et al 1982, USFWS 2022). The acuña cactus is often found growing under the protective canopy of these and other species (USFWS 2022).

POPULATION TRENDS: Monitoring plots at OPCNM and Coffeepot Mountain, along with occasional surveys of all populations, indicate major population declines have occurred across the entire range of the acuña cactus in the past 30 years (USFWS 2022).

SPECIES PROTECTION AND PRESERVATION

ENDANGERED SPECIES ACT STATUS: LE (USDI, FWS 2013)
With CH (USDI, FWS 2016)
[PE with CH, USDI, FWS 2012]
[C USDI, FWS 1996]
[C USDI, FWS 2002, 2004-2011]
[C USDI, FWS 1997, 1999]
[C1 USDI, FWS 1985, 1990, 1993]
[LT USDI, FWS 1975]

STATE LIST STATUS: Highly Safeguarded (ARS, ANPL 1999, 2008)

OTHER STATUS: Determined Endangered (Norma Oficial Mexicana PROY-NOM-059-ECOL-2000)

MANAGEMENT FACTORS: Known threats to acuña cactus include drought and climate change, nonnative plant invasion and alteration of the fire regime, border activities, mining, urban development, and livestock activity. Small populations are also threatened by individual effects such as uprooting, herbivory, predation, and illegal collection. Drought and change are likely to impact all populations of acuña cactus. Climatic predictions suggest less frequent summer precipitation, reduced winter precipitation, and increasing temperatures are likely in the Sonoran Desert (USFWS 2022). Drought and heat stress increase mortality of adult plants and reduce or halt reproduction and recruitment. Many nonnative plant species have been identified in or near acuna populations, but the most threatening are buffelgrass (*Pennisetum ciliare*), red brome (*Bromus rubens*), fountain grass (*Pennisetum setaceum*), and Sahara mustard (*Brassica tournefortii*) (USFWS 2022). These species alter the fire regime, reduce native biodiversity, alter ecosystem dynamics, and outcompete native plants for resources (Albuquerque et al. 2019, Franklin and Molina-Freaner 2010, Brooks and Pyke 2001). Nonnative plant invasion is likely to impact all populations. Border activities may result in mortality of individual cacti and are likely to degrade habitat by disturbing soils, introducing or spreading nonnative plants, and altering hydrology. Border activities are likely to have the

most impact on the OPCNM and Sonoyta populations, and may also affect the Ajo South, Coffeepot Mountain, and Sand Tank Mountain populations. Mining and urban development may cause loss of individual cacti, loss or degradation of habitat, and impacts to pollinator habitat. It is likely the two Ajo population were once large population which was fragmented by the New Cornelia copper mine. The Box-O Wash, Mineral Mountains, Ajo South, Ajo North, Coffeepot Mountain, and Sonoyta populations are believed to be most at risk from mining and/or development. Although herbivory of acuña cactus by livestock has not been reported, livestock grazing can change vegetation composition, cause soil erosion and compaction, reduce water infiltration and increase runoff, and cause crushing and uprooting of individuals (Loftin et al. 2000, Abbate 2017). The Sand Tank Mountains and OPCNM populations are protected from livestock grazing. Where livestock grazing is permitted, habitat and individual plants may be impacted, but grazing is unlikely to threaten larger populations. Four extant populations of acuna cactus are comprised of fewer than 50 individuals (USFWS 2022). These populations are at greater risk of extirpation and reduction in resilience from threats with individual effects such as uprooting, predation, herbivory, and illegal collection.

Resiliency of acuña cactus populations depends on the presence of native plant dominated habitat, availability of precipitation, presence of nurse plants, rocks, or mosses, presence of appropriate substrate, and presence of pollinators. Preservation of acuña cactus necessarily also requires preservation of pollinator habitat and pollination corridors. The leafcutter bee nests in holes in wood or soil, while the cactus bee nests in dense aggregation in open ground. *Diadasia* spp. move nesting sites yearly to shed parasites, therefore requiring the continued availability of sandy, well-drained bare ground avilabe to create nests (USFWS 2022)

CONSERVATION MEASURES TAKEN: Listed as Endangered with Critical Habitat designated which includes a total of 21,740 ha (53,720 acres) divided into six separate units on federal (55%), State (26%), Tribal (10%) and private (8%) lands as of August 18, 2016 (USFWS 2016). The populations (OPCNM, Sand Tank Mountains) within Organ Pipe Cactus National Monument and the Sonoran Desert National Monument are protected from grazing, mining, and development. The taxon is also offered protection under the Arizona Native Plant Law and is listed as endangered in Mexico.

SUGGESTED PROJECTS: All known populations should be monitored. Further research is needed, focusing on reproduction, demography, and limitations on the geographic distribution of all known populations. Additional information on the effect of seed predation by the pyralid moth larvae and the opuntia borer (*Moneilema gigas*) should be gathered. Potential association with spikemoss (*Selaginella arizonica*) should be examined, especially concerning germination. Efforts are needed to locate additional populations, especially on habitats existing in the Sand Tank Mountains and on the Tohono O'odham tribal lands.

The conservation measures that could address threats include nonnative plant control, reduction in livestock activity, reduction in illegal cross border activities and illegal collection, no new urban developments or mines occur near acuña cactus populations, intensive habitat improvement, and augmentation of existing populations and introduction of populations into appropriate habitat (USFWS 2022).

LAND MANAGEMENT/OWNERSHIP BLM - Phoenix and Tucson Field Offices; NPS - Organ Pipe Cactus National Monument and Sonoran Desert National Monument; DOD - Barry M. Goldwater Range; Tribal - Tohono O'odham Nation; State Land Department; Private.

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ADDITIONAL INFORMATION:

Revised: 1989-12-27 (SST)
1994-11-28 (DBI)
1997-11-12 (SMS)
1999-12-20 (DJG)
2004-07-30 (AMS)
2004-08-19 (SMS)
2011-11-01 (SMS)
2013-10-17 (BDT)
2020-12-29 (KSL)
2022-02-24 (KSL)

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