

*CANOTIA HOLACANTHA* ON ISLA TIBURÓN, GULF OF CALIFORNIA, MEXICO

Benjamin T. Wilder

Desert Laboratory  
University of Arizona  
1675 W. Anklam Rd, Building 801  
Tucson, Arizona 85745  
(bwilder@email.arizona.edu)

Richard S. Felger

University of Arizona Herbarium (ARIZ)  
P.O. Box 210036  
Tucson, Arizona 85721  
(rfelger@ag.arizona.edu)

Thomas R. Van Devender

Arizona-Sonora Desert Museum,  
2021 N. Kinney Rd.  
Tucson, Arizona 85743

Humberto Romero-Morales

Comunidad Seri, Punta Chueca, Sonora, Mexico

**ABSTRACT**

*Canotia holacantha* Torrey is reported from the Gulf of California, Mexico on Isla Tiburón. This population is isolated from its closest conspecifics in northern Sonora by 230 km and is best explained as a Pleistocene relict. Previous reports of this species on Tiburón and differences between other “crucifixion thorns” are explained.

**INTRODUCTION**

We report *Canotia holacantha* Torrey (crucifixion thorn, *corona de cristo, junco*; Celastraceae) from the heart of the Sonoran Desert on the high peaks of Isla Tiburón. Previously, Turner et al. in *Sonoran Desert Plants: An Ecological Atlas* (1995: 145) reported *Canotia* on Isla Tiburón based on collections of *Castela polyandra* Moran & Felger made by Richard Felger (9359, 10135, ARIZ). In recent conversations and data checking with Ray Turner it became clear that these collections were incorrectly ascribed to *Canotia holacantha* in the Atlas. It is with pleasure that we now report, with vouchers, the intriguing occurrence of *C. holacantha* on the island:

**Mexico. Sonora, Isla Tiburón:** exposed upper ridges of the Sierra Kunkaak, 825 m, to 1.3 m tall and wide, 28°57'49.08"N, 112°19'40.37"W, *B. Wilder 07-549* with Brad Boyle, Richard Felger, and José Ramón Torres (ARIZ, SD, MEXU); east-facing slope just below high ridge, 800 m, ca. 1/2 m tall, population of ca. 10 individuals, 28°57'57.27"N, 112°19'47.75"W, *B. Wilder 07-528* with Brad Boyle, Richard Felger, and José Ramón Torres (ARIZ, USON).

## DISCUSSION

Two local subpopulations of *C. holacantha* were encountered at the highest elevations on the island, each with several shrubs, mostly ca. 1 m tall. These individuals are notably smaller than those that are encountered throughout the primary range of the species in central and northern Arizona, where it is often a thick-trunked "shrub or small tree 2–6 (occasionally 10) m tall" (Turner et al. 1995: 145). Browsing by the large population of bighorn sheep, introduced on the island in 1975, might be responsible for the relatively dwarfed stature of these plants, or it is very likely caused by the harsh conditions that the plants are subjected to in this locality with windswept rock ridges and minimal soil (Figs. 1, 2).

*Canotia holacantha* has a distribution that is transitional into higher, more northern vegetation types in and to the north of the Sonoran Desert. This discovery is the southernmost locality for the species, and extends its range 230 km to the southwest. The nearest populations are on the mainland in northern Sonora, where it is known from a few small populations, such as those in the foothills southeast of Magdalena de Kino, the nearby Sierra Babiso, and the Altar-Tubutama area (Turner et al. 1995, Felger et al. 2001). It has also recently been collected in the Sierra Madera near Imuris in northern Sonora (Fig. 3, *A.L. Reina-G. 2005-654*, ARIZ, USON).

The presence of *C. holacantha* on an island in the Gulf of California is best explained as a Pleistocene relict (Turner et al. 1995) that is indicative of a historic vegetation much different than the current suite of desert species found there. Reconstruction of Pleistocene vegetation through much of what is now the Sonoran Desert, by analysis of fossil packrat middens, confirms that in the late Wisconsin (the last glacial period prior to 11,000 yr B.P.) a relatively mesic woodland vegetation and flora was present in the low desert regions (Betancourt et al. 1990). Ice age dominants included *Pinus monophylla* Torrey & Frémont (singleleaf pinyon; Pinaceae), *Juniperus osteosperma* (Torrey) Little (Utah juniper; Cupressaceae), *Quercus turbinella* Greene (shrub live oak; Fagaceae), and *Yucca brevifolia* Engelm (Joshua tree; Agavaceae). The early Holocene from 11,000 to about 9,000 yr B.P. was a transitional period with some mesic species, including *Juniperus californica* Carrière (California juniper) and *Y. brevifolia* in the Tinajas Altas Mountains in southwestern Arizona. The only published packrat midden records from Sonora are 10,000 year Holocene sequences from the Hornaday Mountains in

the Gran Desierto in northwestern Sonora, and the Sierra Bacha on the coast of the Gulf of California (Van Devender 1990, Van Devender et al. 1994). Ice age climates with greater winter rainfall and cooler summers favored the expansion of northern and higher elevation species southward and into what are now desert lowlands. No paleovegetation analysis, however, has been conducted for any island in the Gulf of California, a prospect made even more intriguing via this discovery.

The flora of Isla Tiburón, especially the extensive and rugged Sierra Kunkaak (ca. 1,000 m elevation), has biogeographical connections to the entirety of the Sonoran Desert, including the central and southern Baja California peninsula and the northern and southern edges of the desert. Examples of disjunct Sierra Kunkaak populations are: species with nearest populations to the south in the more “tropical” parts of the Guaymas region (e.g., *Lantana velutina* M. Martens & Galeotti; Verbenaceae); species at a higher elevation than the desert in northeastern Sonora (e.g., *Fraxinus gooddingii* Little; Oleaceae); species primarily in Baja California Norte with populations on Tiburón and a few other Midriff islands, and extremely limited localities in Sonora (e.g., *Sideroxylon leucophyllum* S. Watson; Sapotaceae); species with wide distribution in Baja California Sur and isolated Sonoran populations (e.g., *Tetramerium fruticosum* Brandegee; Acanthaceae); and species in Baja California Sur in the Cape Region and Isla Cerralvo (e.g., *Diospyros intricata* (A. Gray) Standley; Ebenaceae). This biogeographically heterogeneous flora of a “sky island” within an island shows evidence of a high degree of connectivity at the center of the Sonoran Desert. The presence of the northerly-distributed *Canotia holacantha*, among the most recent of botanical discoveries on Tiburón (Wilder et al. 2007), adds a Pleistocene temporal dimension to these enigmatic “sky island” populations.

The only fossil record for *Canotia holacantha* is from an 11,100 yr B.P. midden from Picacho Peak, Pinal County, Arizona (Van Devender et al. 1991), reflecting a southeastward expansion of this species in the late Wisconsin woodlands. Subsequently a relict population of *Canotia holacantha* was discovered in the Waterman Mountains in Pima County about 50 km southeast of Picacho Peak (Van Devender 2002-1152, ARIZ).

The isolated populations near Tubutama and Magdalena de Kino, and the newly-discovered population in the Sierra de la Madera suggest that during the winter rainfall Pleistocene glacial periods, *Canotia holacantha* and other more cold-tolerant scrub, chaparral, and woodland species were present throughout the modern Arizona Upland subdivision of the Sonoran Desert. The record of *C. holacantha* on Isla Tiburón is a remarkable range extension from the north into a zone that, as has been reported, was more like Baja California during the Pleistocene (Van Devender et al. 1994). Modern desert communities were present for only about five percent of the 2.4 million years of the Pleistocene, while ice age woodlands in the desert lowlands persisted for about ninety percent of this period (Van Devender 2000). Considering this, isolated populations of *C. holacantha* and other ice age expanders are relicts of an era when woodlands were the predominant vegetation in Sonoran Desert area, and the Arizona Upland was greatly contracted.

*Canotia holacantha* is one of three unrelated “crucifixion thorn” shrubs on Isla Tiburón, each with a distinctive growth-form. *Canotia holacantha* occurs at

peak elevations and has terete stems, bisexual flowers, and persistent woody capsules, 1.5–2 cm long, with 5 carpels that split apically into awned valves. *Koeberlinia spinosa* Zuccarini and *Castela polyandra* occur only at lower elevations. *Koeberlinia* has slender, terete twigs, bisexual flowers, and non-persistent, rounded fruits 3–3.5 mm in diameter that dry capsule-like. It is common on the Agua Dulce Valley floor (southward from Tecomate) where it often becomes a small tree ca. 4 m tall (Felger & Moser 1985). It is an infrequent low shrub in the Valle de Aguila at the northeast part of the island and in Arroyo Sauzal at the south end of the island. *Castela polyandra* occurs on the eastern bajada of the island in a narrow band parallel to the shore, just inland from the *Frankenia* zone and extending into the lower mixed desertscrub vegetation (Felger & Lowe 1976). It is a low, spreading shrub, reaching up to ca. 1 m in height, that has laterally compressed stems, a sparse foliage of leaves, often 0.5–2.5 cm long, that quickly become deciduous, male and female flowers are on separate plants, and the fruits are 1–1.5 cm long, fleshy and not persistent (Moran & Felger 1968).

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#### LITERATURE CITED

- BETANCOURT, J.L., T.R. VAN DEVENDER and P.S. MARTIN. 1990. *Packrat Middens: The last 40,000 years of biotic change*. University of Arizona Press, Tucson.
- FELGER, R.S., M.B. JOHNSON and M.F. WILSON. 2001. *Trees of Sonora, Mexico*. Oxford University Press, New York.
- FELGER, R.S. and C.H. LOWE. 1976. *The Island and Coastal Vegetation and Flora of the Gulf of California, Mexico*. Natural History Museum of Los Angeles County, Contributions in Science No. 285.
- FELGER, R.S. and M.B. MOSER. 1985. *People of the Desert and Sea: Ethnobotany of the Seri Indians*. University of Arizona Press, Tucson (Reprinted 1991).

MORAN, R. and R.S. FELGER. 1968. *Castela polyandra*, a new species in a new section; union of *Holocantha* with *Castela* (Simaroubaceae). *Transactions of the San Diego Society of Natural History* 15(4): 31–40.

TURNER, R.M., J.E. BOWERS and T.L. BURGESS. 1995. *Sonoran Desert Plants: An Ecological Atlas*. University of Arizona Press, Tucson.

VAN DEVENDER, T.R. 1990. Late Quaternary vegetation and climate of the Sonoran Desert, United States and Mexico. Pp. 134–165. In: J.L. Betancourt, T.R. Van Devender and P.S. Martin (eds.). *Packrat Middens: The Last 40,000 Years of Biotic Change*. University of Arizona Press, Tucson.

VAN DEVENDER, T.R. 2000. The deep history of the Sonoran Desert. Pp. 61–69. In S.J. Phillips and P.W. Comus (eds.). *A Natural History of the Sonoran Desert*. Arizona-Sonora Desert Museum Press, Tucson and University of California Press, Berkeley.

VAN DEVENDER, T.R., T.L. BURGESS, J.C. PIPER and R.M. TURNER. 1994. Paleoclimatic implications of Holocene plant remains from the Sierra Bacha, Sonora, Mexico. *Quaternary Research* 4: 99–108.

VAN DEVENDER, T.R., J.I. MEAD and A.M. REA. 1991. Late Quaternary plants and vertebrates from Picacho Peak, Arizona, with emphasis on *Scaphiopus hammondi* (western spadefoot). *Southwestern Naturalist* 36: 302–314.

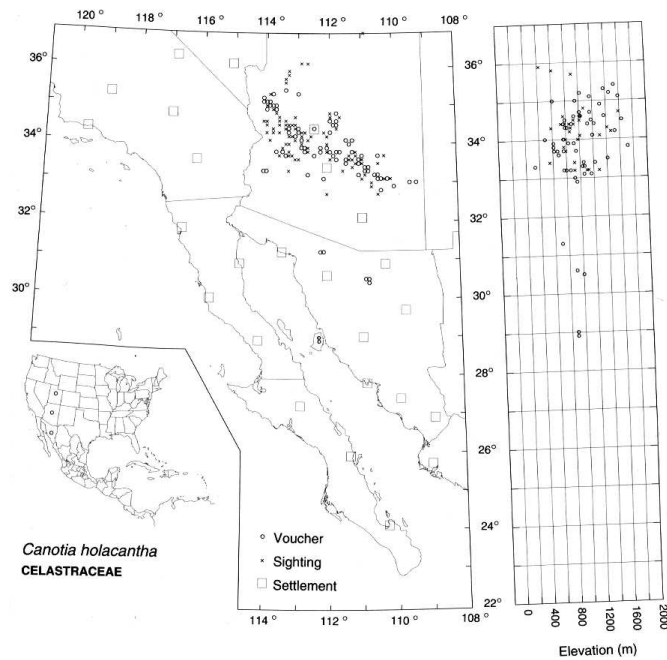
WILDER, B.T., R.S. FELGER, H. ROMERO-MORALES and A. QUIJADA-MASCAREÑAS. 2007. New plant discoveries for the Sonoran Islands, Gulf of California, Mexico. *Journal of the Botanical Research Institute of Texas* 1: 1203–1227.



***Canotia holacantha* on Isla Tiburón** Figure 1. *Canotia holacantha* on the exposed upper ridges of Isla Tiburón (image by Benjamin Wilder 26 October 2007).



*Canotia holocantha* on Isla Tiburón Figure 2. This plant (Wilder 07-549) is 1.3 m tall and was the largest individual of *Canotia holocantha* seen on the island (image by Benjamin Wilder 26 October 2007).



*Canotia holocantha* on Isla Tiburón Figure 3. Distribution of: *Canotia holocantha* (modified from Turner et al. 1995 and used with permission of Raymond M. Turner).