

New Plant Records From the Sonoran Desert¹

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The vegetation and flora of the Sonoran Desert are among the most thoroughly documented of the arid portions of North America. The climate and relative accessibility of the area have attracted many botanists and the landmark studies resulting from their efforts, too numerous to list here (see Shreve and Wiggins 1964, and Kearney and Peebles 1960 for partial bibliographies) are a testament to their achievements. In an area covering over 310,000 square km (Shreve 1951) it is not, however, surprising that some less-known localities should exist, which might harbor plant species not previously known to exist there. For example, H.S. Gentry (1972) described two very distinctive Sonoran Desert species of *Agave* (*A. zebra* and *A. pelona*) from localities in the mountains near the Gulf of California. The plant records reported here were encountered during visits to observe these endemic century plants in a small range of mountains, the Sierra del Viejo.

Introduction.

The Gulf Coast mountains form an interrupted band of low pediments along the length of western Sonora. The geology of the coastal area between Puerto Lobos and Bahia Kino has been studied and mapped (Gastil and Krummenacher 1976, Gastil et al. 1977), but the remaining region is still poorly known. Gentry (1972) suggested that most of the coastal ranges were islands or maritime headlands during portions of the Upper Tertiary (2-20 million years ago). He summarized the probable physiographic development of the area and mapped a probable Miocene shoreline of the Gulf of California.

The Sierra del Viejo is located at about 30°20'N latitude and 112°20'W longitude, about 40 km southwest of Caborca, Sonora. It is a narrow north-south trending range a little over 30 km long. Elevation of the coastal plain at the base of the mountains is about 300 m and the highest point is 1020 m, at the summit of Cerro del Viejo. Climatic records are available from La Union, at the southern end of the range (Hastings 1964). Average temperature was 21.6°C, with extremes of 31.1°C in August and 11.6°C in January (1958-1962). Annual rainfall averaged about 200 mm, with the highest monthly means in August (72.5mm) and January (38.1 mm). The mountains lack any permanent surface water.

The Sierra del Viejo is distinguished from most other mountain ranges in the low desert of western Sonora by its relatively large areas of Late Precambrian or Cambrian limestone (cf. Gastil and Krummenacher 1976, Gastil et al. 1977). The range is at the northeastern boundary of the areas included in the above-cited paper and map and the remaining geologic features have not been thoroughly studied. We observed that the remainder of the range is primarily granite, with smaller areas of basalt and metamorphic formations at the southern end. The endemic *Agave* species mentioned above grow only on the limestone, as do many of the plants reported in this article.

The vegetation of the Sierra del Viejo has been included in the Lower Colorado Valley Subdivision of the Sonoran Desert (sensu Shreve 1951) by Brown and Lowe (1980), but includes many elements more typical of the Central Gulf Coast Subdivision. The igneous and sedimentary slopes have the same dominant plants; *Cercidium microphyllum* (Foothills Paloverde), *Mimosa laxiflora*, *Larrea tridentata* (Creosotebush), *Simmondsia chinensis* (Jojoba), and *Fouquieria splendens* (Ocotillo). The granitic slopes are sparsely covered with a greater variety of arborescent species, including *Eysenhardtia orthocarpa* (Kidneywood) and *Prosopis velutina* (Velvet Mesquite). The limestone slopes effect more of an open appearance, with scattered patches of *Bursera microphylla* (Elephant Tree) and *Jatropha cuneata* (Limberbush) interspersed with open areas dominated by *Opuntia bigelovii* (Teddy-bear Cholla), *Echinocereus engelmannii* (Engelmann Hedgehog), and *Tiquilia canescens* (Oreja del Perro). The limestone summits and ridges are a patchwork of scrubby areas dominated by such plants as *Dodonea viscosa* (Hopbush), *Lycium berlandieri* (Wolfberry), and *Calliandra eriophylla* (Fairy-duster) and very open "pavement-like" areas with only occasional bunchgrasses and small cacti. The minor elements of the flora are diverse and more distinct for each substrate type.

The Sierra del Viejo is not well known botanically. It was apparently overlooked by most early collectors and few specimens have reached herbaria. Gentry and associates

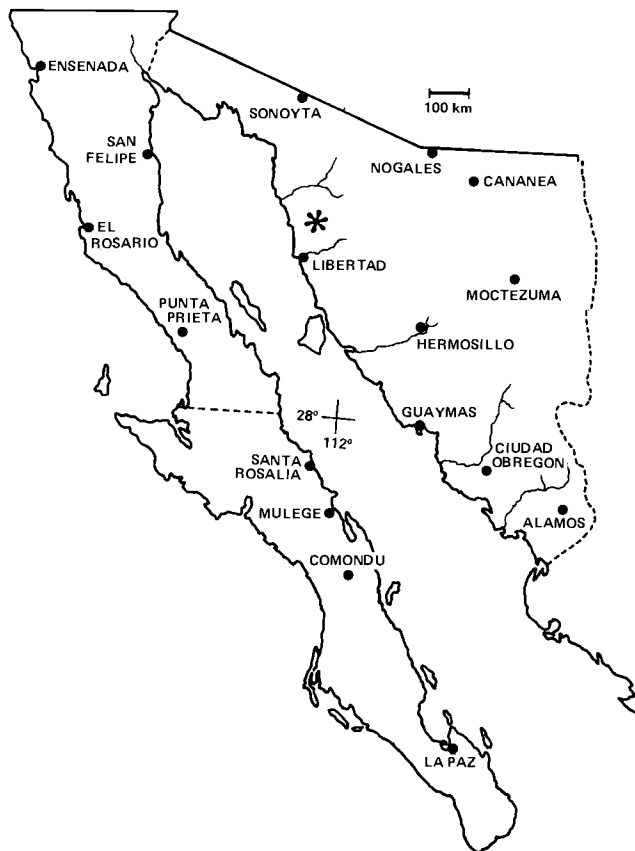
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*A limestone hillside in the Sierra del Viejo, Sonora. Prominent plants are Ocotillo (*Fouquieria splendens*), Elephant Tree (*Bursera microphylla*), Limber Bush (*Jatropha cuneata*) and *Agave zebra*.*



View northward from the Sierra del Viejo. The coastal plain is periodically broken by low mountains.



Map of northwestern Mexico showing Sonora and Baja California. The location of the Sierra del Viejo is indicated by a large asterisk.

visited the range several times between 1951 and 1966. In 1980 and 1983 R. M. Turner and coworkers made collections in the area. M. Dimmitt and associates collected in the Sierra del Viejo in early 1983.

We visited the Sierra del Viejo in 1981 and 1982. Because the range is almost entirely privately owned (it is riddled with numerous old gold, silver, and lead mines) our access has thus far been limited to the northern half. Further exploration in other portions and in nearby mountains may yield further discoveries.

The purpose of this paper is to detail nine new distributional records for the Sonoran Desert from collections made by Turner et al., and by us in the Sierra del Viejo. Within the mountain range, specific localities for each species are not given here to protect particularly the cacti from possible overcollection. Voucher specimens cited are accessioned in the herbarium at the University of Arizona (ARIZ). Plants are listed alphabetically, by family.

ANACARDIACEAE

Rhus kearneyi Barkley ssp. **kearneyi**. Turner 80-10. This collection from the Sierra del Viejo represents the first mainland Sonoran record for this rare xerophytic shrub, previously known from the low hot mountains of southwestern Arizona and eastern Baja California (Moran 1969). It is to be looked for in other mountains of northwestern Sonora. In the Sierra del Viejo, the plants are uncommon in limestone ravines.

CACTACEAE

Ancistrocactus uncinatus (Galeotti) L. Benson. *Yatskievych & Fischer 82-20*. This is a westward range extension of over 400 km from the closest known populations in southern New Mexico and Chihuahua (Benson 1982). It represents the first record for Sonora and for the Sonoran Desert for this limestone-dwelling cactus, which is widespread in the Chihuahuan Desert. The plants are tentatively assigned to var. *uncinatus* on the basis of their generally fewer radial spines and the shape of the petaloids. This and var. *wrightii* (Engelmann) L. Benson do not appear to be well separable and the Sonoran plants are somewhat intermediate between the two. The species is relatively rare in the Sierra del Viejo, occurring on steep limestone slopes.

Echinocactus horizontalonius Lemaire var. **nicholii** L. Benson. *Yatskievych & Fischer 82-21*. This species has not previously been reported from Sonora. The type variety is restricted to the Chihuahuan Desert in New Mexico, Texas, and northeastern Mexico, while *E. horizontalonius* var. *nicholii* has previously been reported in the Sonoran Desert from the Waterman and Vekol Mountains of southern Arizona (Benson 1982, and T. R. Van Devender, pers. comm.). Our collection consists of a single immature plant assigned to var. *nicholii* on the basis of its consistently five radial spines. Additional specimens need to be collected to determine if var. *horizontalonius* (with 6-7 radial spines) is also present in the Sierra del Viejo. The species is very uncommon in the mountains and is restricted to a few limestone ridgetops.

Echinocereus scopulorum Britton & Rose. *Yatskievych & Fischer 82-17*. A duplicate of this collection was determined by Allan D. Zimmerman, University of Texas at Austin. The species is part of a confusing group of rainbow cacti that includes *E. pectinatus* (Schweidweiler) Engelmann and its varieties. Our collection represents a northward range extension of about 350 km for the species, which was previously known from Guaymas southward along the coast to northern Sinaloa (Shreve and Wiggins 1964). In the Sierra del Viejo the plants are scattered in crevices on steep limestone slopes and can be locally common on some south-facing exposures.

Mammillaria lasiacantha Engelmann. *Yatskievych & Fischer 82-16*. The population in the Sierra del Viejo represents the first record for Sonora and for the Sonoran Desert. The remaining range of the species is in the Chihuahuan Desert and adjacent grasslands, in New Mexico, Texas, and northeastern Mexico, with an unconfirmed report from a grassland locale in southeastern Arizona (see Benson 1982, for discussion). At our station, this cactus is nearly restricted to flat open limestone ridgetops with gravelly pavement-like substrate. It can be locally common, but is easily overlooked because the small white nearly flat-topped plants blend very well with the surrounding rocks.

LEGUMINOSAE

Cassia goldmannii Rose. Turner 80-1; Burgess 5751, 5764; Bowers & McLaughlin 1935. The Sierra del Viejo populations represent the only mainland Sonoran records for this shrub, which is otherwise confined to mountains of Baja California Sur. In the Sierra del Viejo the plants occur on both limestone



Ancistrocactus uncinatus in the Sierra del Viejo.

and granite slopes and form widely scattered stands. Within a stand they can become locally common.

LOASACEAE

Eucnide cordata (Kellogg) Kellogg ex Curan. *Felger & Gentry* 7906; *Burgess* 5754, 5766. This species is common in Baja California and on several of the Gulf islands, but the only previous reports from mainland Sonora are from the vicinity of Guaymas (Waterfall 1959, Thompson and Ernst 1967). Plants from the mountains adjacent to the Sonoran Desert, in eastern

Sonora, are usually referable to *E. hypomalaca* Standley, rather than *E. cordata*. In the Sierra del Viejo, the species is uncommon and widely scattered on lower slopes and in washes.

POLYPODIACEAE (sensu lato)

Notholaena jonesii Maxon. *Burgess* 5759; *Yatskievych & Fischer* 82-12, 82-23. These specimens represent the first records of this species from Mexico, a range extension of about 300 km to the southwest from the closest known population,



Mammillaria lasiacantha in the Sierra del Viejo.

in the Waterman Mountains of southern Arizona. The diminutive plants are very uncommon in crevices of steep limestone slopes and are generally confined to the relative shelter of narrow ravines and talus.

SCROPHULARIACEAE

Galvezia juncea (Bentham) Ball. *Burgess 5753*. This species ranges nearly the length of Baja California, but has not previously been reported from mainland Sonora. In the Sierra del Viejo, plants are uncommon on both granite and limestone substrates, on upper slopes and ridgetops. Plants from the Sierra del Viejo are var. *juncea*. Previously unreported Sonoran collections from Sierra Bacha, Punta Cirio, south of Libertad (*Burgess 5715*; *Phillips 7517*; *Van Devender & Kearns s.n.*) and from nearby Cerro Tepoca (*Fise s.n.*) are apparently var. *pubescens* (Brandege) I. M. Johnston.

Discussion.

The distributional records detailed above illustrate several disjunctive patterns and provide circumstantial evidence for the expansion and contraction of distributional limits for plant species over time. While some of the species, such as *Notholaena jonesii*, are apparently adapted for long range dispersal, it seems more probable that particularly the cacti arrived in the Sierra del Viejo by more gradual migration along an expanding distributional boundary and were isolated there when a changing climate caused all nearby populations to become extinct.

In the absence of more direct evidence, such as from plant remains in ancient pack rat middens (numerous studies, e.g.,

Van Devender and Spaulding 1979), theories concerning species migrations cannot be thoroughly substantiated. Examination of the present-day ranges of plant species can, however, provide insight into the phytogeographic processes which account for these distributions and is thus important for both the formation and the support of theories concerning the different patterns of species migrations.

Ancistrocactus uncinatus, *Echinocactus horionthalonius*, and *Mammillaria lasiacantha* represent species that are widespread in the Chihuahuan Desert, but are uncommon in the Sonoran Desert, present there in a very few, apparently relictual populations. Formation of this type of disjunction must have followed migration either across the Sierra Madre Occidental (which separates the two deserts in Mexico) or around its northern edge (in southern Arizona and New Mexico). In either case, judging from the climates at present-day localities, this probably occurred during a previous interglacial period, when temperatures in the intervening areas were relatively high and rainfall was relatively depressed. Fragmentation of the distribution would have followed with the onset of the next glaciation, as much of the area became too cool and wet for the plants to survive.

The repeated advance and retreat of Pleistocene glaciers also influenced the north-south migrations of plant species (as summarized by Benson 1982). *Echinocereus scopulorum*, which grows primarily in southern Sonora and Sinaloa, undoubtedly migrated northward into the Sierra del Viejo during an interglacial thermal maximum. By contrast, *Notholaena jonesii*, whose primary distribution is in the southwestern United States, may have migrated southward into Mexico



An excavated flowering specimen of Mammillaria lasiacantha.

during a more pluvial glacial time. North-south migration also accounts for the presence of *Echinocactus horzonthalonius* in both Arizona and Sonora. The fact that all of these western populations are apparently var. *nicholii* suggests that the species migrated from the Chihuahuan Desert region westward and differentiated into var. *nicholii*, with subsequent formation of the present-day latitudinal disjunction.

The occurrence in mainland Sonora of plants primarily restricted to Baja California has long been recognized. Shreve (1961) documented the similarity between the vegetation of the two sides of the Gulf of California in the Central Gulf Coast Subdivision of the Sonoran Desert, but also pointed out the distinctness of the plant associations along each shore. *Galvezia juncea*, *Cassia goldmannii*, and *Eucnide cordata* represent species showing trans-Gulf disjunctions. *Eucnide cordata* differs from the others in its presence on many of the islands in the Gulf of California. It seems reasonable to suggest that this species crossed the Gulf via a pattern of "island-hopping". This pattern of migration does not, however, explain disjunctions involving the other two species. *Galvezia juncea* and *Cassia goldmannii* are not commonly found on any of the Gulf islands. These plants probably followed a pattern of migration around the head of the Gulf of California during a previous period of glaciation, when rainfall (particularly in winter) was higher and temperatures were cooler in areas that are currently reckoned as among the hottest and driest in North America. The present-day distribution of *Rhus kearneyi* is probably also due to this type of migrational pattern, but the rarity of this species makes it unwise to theorize on the direction of migration involved.

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