THE FLORA OF CAÑÓN DE NACAPULE: A DESERT-BOUNDED TROPICAL CANYON NEAR GUAYMAS, SONORA, MEXICO

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The Flora of Cañón de Nacapule: A Desert-Bounded Tropical Canyon near Guaymas, Sonora, Mexico

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ABSTRACT.—Cañón de Nacapule, located at the southeastern flank of the Sierra El Aguaje, is about 20 km northwest of Guaymas, Sonora, Mexico, in the Sonoran segment of the Gulf Coast subdivision of the Sonoran Desert. The climate is arid with highly variable biseasonal rainfall (winter, summer). Many plants of tropical origin reach their northern limits in this region or do not extend farther north into the arid coastal Sonoran Desert. The vegetation in the canyon is tropical thornscrub and approaches the character of tropical deciduous forest in the wettest areas. The Nacapule flora, species found in the canyon and within 500 m of the canyon mouth, includes 285 species of vascular plants in 215 genera and 65 families. The most diverse families are the Asteraceae, Fabaceae, Poaceae, and Euphorbiaceae. Regional endemics limited to the Sierra El Aguaje and nearby mountains include *Telosiphonia nacapulensis* and *Verbesina felgeri*. Geographically isolated populations of tropical genera such as *Aphanosperma*, *Briquetia*, *Coccoloba*, *Ficus*, and *Zanthoxylum* also occur in the canyon. Plants not native to the Guaymas region, mostly Old World weeds, are represented by 17 species. There is habitat degradation at Nacapule but much original vegetation remains. This unique canyon is worthy of vigorous protection.

RESUMEN.— El Cañón de Nacapule, localizado en el lado Sureste de la Sierra El Aguaje, aproximadamente 20 km al Noreste de Guaymas en el Estado de Sonora, México, se encuentra incluido en la parte sonorense de la subdivisión de la Costa del Golfo del Desierto Sonorense. El clima es árido con precipitación altamente variable distribuida en dos temporadas (invierno y verano). Muchas plantas de origen tropical alcanzan sus límites norteños en esta región del Desierto Sonorense. La vegetación en el cañón está formada por matorral espinoso tropical, el cual muestra características de bosque tropical deciduo en las áreas más húmedas. La flora de Nacapule, desde 500 m de la boca del cañón hasta el fondo del mismo, incluye 285 especies de plantas vasculares en 215 géneros y 65 familias. Las familias más diversas son Asteraceae, Fabaceae, Poaceae, y Euphorbiaceae. Entre las endémicas limitadas a las cañones de la Sierra El Aguaje se incluyen *Verbesina felgeri* y *Telosiphonia nacapulensis*. También se encuentran en el cañón poblaciones geográficamente aisladas de especies pertenecientes a géneros tropicales, como *Aphanosperma*, *Briquetia*, *Coccoloba*, *Ficus*, y *Zanthoxylum*. Las plantas no nativas a la región de Guaymas, la mayoría hierbas del Viejo Mundo, se encuentran representadas por 17 especies. Aunque existe degradación del ambiente en Nacapule, mucha de la vegetación original todavía permanece. Este singular cañón es digno de protección efectiva.

INTRODUCTION

Cañón de Nacapule has a rich flora and a history of botanical collections spanning more than a century. This desert-bounded tropical canyon is 6 km north of the burgeoning beach resorts of San Carlos, or 20 km northwest of Guaymas (Fig. 1). The canyon entrance is at 28° 00′ 56″ N, 111° 02′ 58″ W and an elevation of approximately 150 m. From one end to the other the canyon floor probably rises less than 25 m (Fig. 2). Only about 1.2 km long, Nacapule Canyon slices into the southeastern flank of the Sierra El Aguaje [the region called the Guaymas Monadnoc by Gentry (1949)]. Ragged red and yellow rhyolite slopes rise steeply from the bajada plain to a peak elevation of ca. 860 m. This study includes the canyon bottom, the immediate slopes, and the adjacent open desert within about 500 m of the canyon entrance, as well as adjacent Nacapule Spring. *Nacapul* is the term in the Cahitan (Yaqui and Mayo) language for earlobe (*naca* = ear) and one of the native figs, *Ficus pertusa*.

On my first trip to the area in the early 1960s I camped beneath a lone *Sabal* palm on the cobble beach by the yet undeveloped Bahía San Carlos. Jesús Ortega, a cowboy from a nearby ranchito, took me by horse to see the cool, green canyon. He said it was named for the huge *nacapule* tree at the spring just north of the canyon mouth. We drank from the water and found two boa constrictors mating among the dry, crackling fig leaves. Cattle had muddied the ground around the wooden water trough. We rode into the deep canyon, green like the tropics, shaded in the late afternoon of a hot summer day. Palms overtopped the trees and marched up rugged rhyolite walls; fig trees hung from cliff faces. We stopped to roll cigarettes. Jesús was proud of the mystic gorge turning purple in the hazy dusk.

Since that time substantial changes have been wrought on the region and the canyon, but much of the original vegetation remains. The uppermost reaches of the canyon and the rough slopes, difficult to climb and inaccessible to cattle, are in pristine condition.

The canyon cuts into Tertiary volcanic rock of the Cerro Algodones group, of which most of the Sierra El Aguaje is composed (Wilson 1978). The Cerro Algodones group consists of silica-rich lavas and tuffs of rhyolite to rhyodacite. The tuff may be more permeable than lava and has commonly been altered by the circulation of hot water. As a result the tuff weathers to yellowish colors, contrasting with the reddish brown lavas. The lava is massive, flow-banded, and glassy. The Sierra El Aguaje is part of a much larger volcanic field in which gigantic eruptions resulted in the collapse of

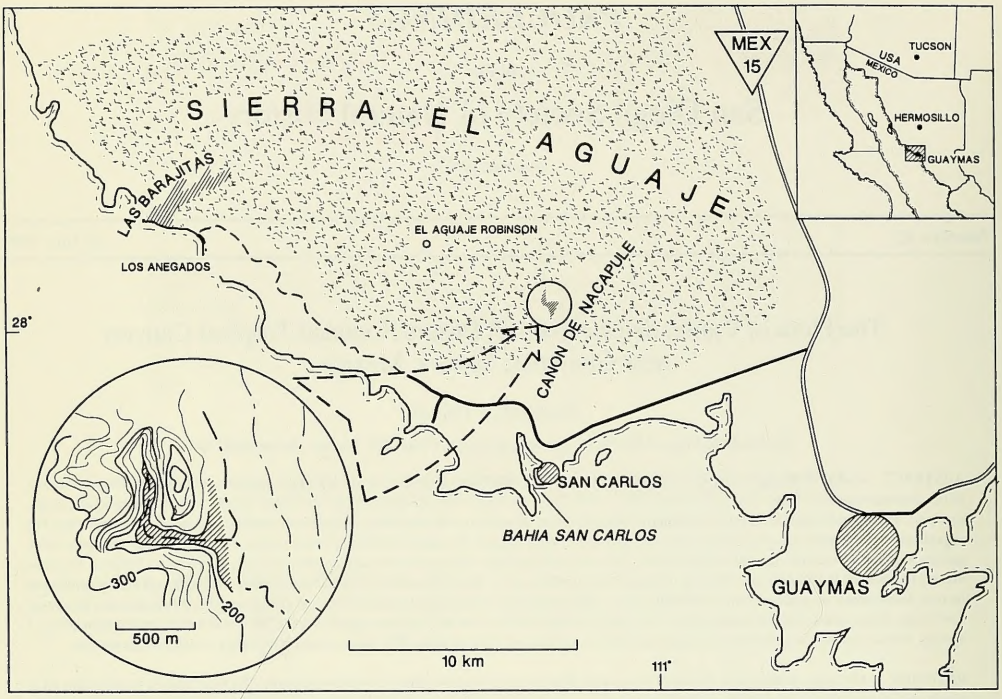

Figure 1. Cañón de Nacapule and surrounding region. Map by Jim Abbott, SciGraphics.

calderas tens of kilometers across. The north–south segment of the canyon is cut into a post-collapse rhyolitic volcanic vent on a caldera margin. At the canyon mouth, the drainage passes from volcanic rock into Quaternary alluvium consisting of unconsolidated sand and gravel derived from the mountains.

The climate is arid. Rainfall is biseasonal and highly variable. Winter–spring rains, derived from Pacific frontal storms, can deliver light rains or drizzle over many hours. Summer rains result from an abbreviated monsoon of tropical origin and often bring violent, local thunderstorms with dramatic lightning and heavy if brief rainfall. These sporadic rains may commence about one or two months after summer solstice and continue into September. In some years either the summer or winter rains may be very scant or fail entirely. Tropical storms or *chubascos* sometimes bring large amounts of rain in late summer or early fall. These occasional hurricane-fringe storms may induce spectacular growth of many perennials. Winters are mild and warm, most of the region, and presumably the canyon, being nearly frost free. Coconuts and other tropical plants are grown in nearby San Carlos. The hot weather and seasonal drought of late spring and early summer is severely limiting to the plant life. The summers are long and very hot.

Shreve (1951) designated the vegetation of the region as the Sonoran segment of the Gulf Coast subdivision of the Sonoran Desert. The higher elevations of the Sierra El Aguaje, especially on north-facing slopes, and many of the riparian habitats support vegetation that can be classified as foothills thornscrub, sometimes approaching tropical deciduous forest in character (Felger 1966; Felger and Lowe 1976; Búrquez et al.).

Nacapule is among the several large canyons in the Sierra El Aguaje that support a rich, subtropical flora and vegetation. High, rugged desert mountains separate two nearby canyons that are comparable to Nacapule. Cañón Las Barajitas, approximately 15 km northwest of Nacapule, is more than 8 km long and drains from the western side of the Sierra El Aguaje to the Gulf of California. Its flora includes more than 225 species of vascular plants (pers. obs.). The long Cañón Los Anegados drains eastward from near the center of the Sierra El Aguaje through the ranch and waterhole known as Aguaje Robinson. Although only 6 airline km to the northwest, Robinson is inaccessible by trail or road from Nacapule. Anegados appears to have a species richness comparable to that of Nacapule but remains scarcely explored botanically. Among the special plants occurring at some or all of these canyons are *Coccoloba goldmanii*, *Vallesia laciniata*, *Verbesina felgeri*, and *Zanthoxylum mazatlanum*. Some of the unusual plants also should be sought in similar habitats at higher elevations in the Sierra El Aguaje and the Sierra Libre [ca. 60 km to the northeast, east of the highway (Mexico 15) to Hermosillo; see Yetman and Búrquez (1996)]. Despite more than one century of extensive botanical collections in the Guaymas region, the higher elevations of the Sierra El Aguaje and Sierra Libre remain botanically unexplored.

Many plants of tropical origin reach their northern limits in this region, or they do not extend farther north into the arid, coastal Sonoran Desert, e.g., *Citharexylum*, *Coccoloba*, *Coursetia caribaea*, *Dalechampia*, *Desmodium*, *Ficus insipida*, *F. pertusa*, *Hintonia*, *Ludwigia octovalvis*, *Randia sonorensis*, and *Sida hyalina*. Sonoran Desert plants reaching their southern limits in this region include

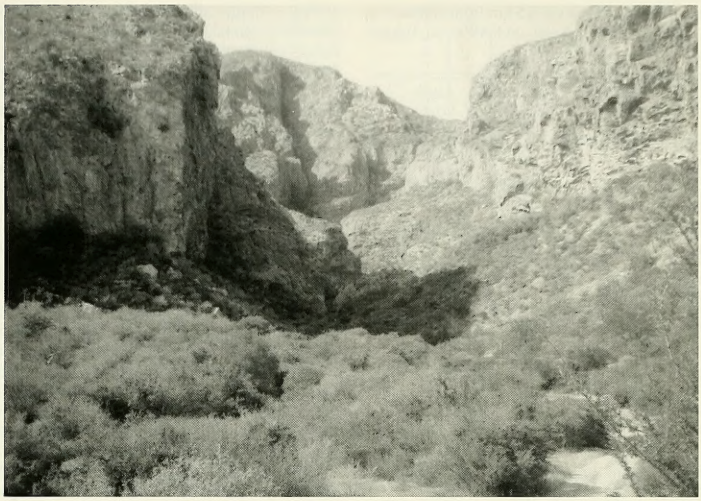

Figure 2. Cañón de Nacapule, looking westward from near the mouth of the canyon.

Abutilon parishii, *Colubrina californica*, *Fouquieria splendens*, and *Perityle emoryi*. Among species with geographically isolated populations are *Aphanosperma sinaloensis*, *Briquetia sonorae*, *Coccoloba goldmanii*, *Ficus insipida*, *Psilotum nudum*, and *Zanthoxylum mazatlanum*. Others occur primarily on the Baja California peninsula and are otherwise found only in the Sierra El Aguaje, e.g., *Euphorbia ceroderma*, *Pluchea salicifolia*, and *Washingtonia robusta*. Regional endemics include *Brickellia rhomboidea*, *Echinocereus engelmannii* subsp. *llanurensis*, *Euphorbia pediculifera* var. *linearifolia*, *Perityle leptoglossa* subsp. *palmeri*, *Physalis purpurea*, *Telosiphonia nacapulensis*, and *Verbesina felgeri*.

A stream flows all year in the upper part of Cañón de Nacapule (Fig. 3) or in drought dries to scattered seep-filled pools. In the 1960s the stream flowed intermittently through the lower part of the canyon but today flows only with rainy weather or seasons. Destruction of portions of the wetland vegetation and understory vegetation, mostly due to decades of cattle grazing, seems to have contributed to reduction of the stream flow. Exposed roots of some of the larger *Washingtonia* palms indicate that the canyon floor has eroded approximately 1.5 m during the lifetime of these palms. The lower part of the canyon runs more or less east–west for nearly 1 km, and the high, north-facing canyon wall and mountain slope shade much of the lower canyon during the winter. The Sierra El Aguaje endemics and geographically isolated populations of tropical species such as *Aphanosperma sinaloensis*, *Briquetia sonorae*, *Coccoloba goldmanii*, *Verbesina felgeri*, and *Zanthoxylum mazatlanum* occur in this shaded habitat.

In 1965 I recorded the plants in a 5 × 50 m quadrat in this unusual habitat, finding 41 species (Table 1). The quadrat could not be made larger because of constraints of the topography. A road now virtually obliterates the quadrat site. An additional 14 species occurred on the canyon floor within 5 m of the quadrat, and more species were quickly encountered as one walked through the canyon. I estimated plant coverage here at 98%. Large shrubs and small trees produced a closed canopy with crown heights generally at 4 to 6 m. The vegetation was weakly stratified into tree, shrub, and ground-herb layers and interlaced by vines and scandent shrubs. Coverage consisted

Figure 3. *Washingtonia robusta* along streambed in the upper portion of the canyon. The exposed root masses indicate the soil has eroded more than 1.5 m. January 1996.

TABLE 1. Plants in a 5 × 50-m quadrat ca. 0.5 km from entrance to Cañón de Nacapule, January, 1965., on canyon bottom, ca. 0.5 km from canyon entrance[a].

Species[b]	Number of plants	Maximum height (ft)	Mean height (ft)
Non-herbaceous plants			
Brahea elegans	3	25.3	19.3
Sapindus saponaria	3	24.6	20.0
Celtis reticulata	1	21.0	—
Lysiloma divaricatum[c]	—	20.0	—
Forchhammeria watsonii	1	18.2	—
Cordia sonorae	2	16.1	14.3
Passiflora mexicana	1	14.9	—
Sebastiania bilocularis	4	13.9	11.5
Sideroxylon occidentale[c]	—	13.9	—
Celtis pallida[c]	—	13.4	—
Hintonia latiflora	1	13.2	—
Haematoxylum brasiletto	1	12.9	—
Prosopis glandulosa[c]	—	12.8	—
Coccoloba goldmanii	3	12.0	10.1
Coursetia glandulosa	19	12.4	11.2
Gouania rosei[c]	—	11.7	—
Guaiacum coulteri	2	11.2	10.1
Vallesia laciniata	13	11.1	9.9
Antigonon leptopus	33	10.8	—
Justicia californica	2	10.8	—
Nissolia schottii	1	10.6	—
Phaulothamnus spinescens	7	10.3	8.3
Acacia willardiana	3	9.8	—
Jacquinia macrocarpa	2	9.6	8.9
Marsdenia edulis	2	9.0	7.9
Randia sonorensis	2	9.0	8.1
Cardiospermum corindum	3	7.3	—
Cocculus diversifolius[c]	—	7.1	—
Randia thurberi	1	6.4	—
Zapoteca formosa	8	6.3	5.5
Ibervillea sonorae	1	6.2	—
Mimosa distachya[c]	—	6.2	—
Ambrosia ambrosioides[c]	—	4.9	—
Acalypha californica	2	4.7	4.5
Justicia candicans	16	4.6	3.8
Trixis californica[c]	—	4.5	—
Brickellia coulteri	20	4.1	3.6
Ditaxis lanceolata[c]	—	4.1	—
Bursera laxiflora	2	4.0	—
Dodonaea viscosa[c]	—	4.0	—
Coursetia caribaea	5	3.9	—
Tragia jonesii	1	3.2	—
Ambrosia cordifolia	1	3.1	—
Vaseyanthus insularis	—	2.8	—
Abutilon incanum	1	2.2	—
Callaeum macropterum[c]	1	1.3	—
Elytraria imbricata	2	1.1	—
Hofmeisteria crassifolia[c]	—	1.0	—
Plumbago scandens	1	0.5	—
Total	168		
Herbaceous plants			
Dryopetalum runcinatum			
Euphorbia setiloba			
Perityle californica			
P. leptoglossa			
unidentified perennial forb			

[a]Deep rocky and gravelly soil, much leaf litter, and limited cattle grazing; plant coverage ca. 98%.
[b]Total species in 0.25-ha quadrat: 41. Total species in stand (canyon floor within 5 m of quadrat): 55
[c]Canyon-floor plant within 5 m of quadrat.

mostly of large, spreading shrubs, e.g., *Coccoloba goldmanii*, *Coursetia glandulosa*, and *Vallesia laciniata*. The 11 species of vining plants included *Antigonon leptopus*, *Gouania rosei*, and *Passiflora mexicana*. Arborescent species along the canyon floor are generally scattered in small groves or groups of several adult individuals. The vegetation cannot be characterized by any one or several species.

The Nacapule flora includes 285 species of vascular plants in 215 genera and 65 families. The most diverse families are the Asteraceae, Fabaceae, Poaceae, and Euphorbiaceae (Table 2). Fourteen genera have three species each, and only *Euphorbia*, with six species, is more diverse.

The Nacapule flora contains about half the number of species in the entire flora of the coastal +85 km from the vicinity of Tastiota to Las Guasimas—a region of more than 3000 km^2 with Guaymas and San Carlos at its center (Felger 1966; unpublished notes). The Nacapule flora represents approximately 11.8% of the total flora (ca. 2500 species) of the 300,000-km^2 Sonoran Desert (Shreve 1951, Wiggins 1964). The topography is complex, and although there are also other topographically complex riparian canyons in the region they apparently do not support so many species in such a small area. I know of no other place in the Sonoran Desert where the species richness is so great as in Cañón de Nacapule.

The upper part of the canyon turns sharply northward so that its axis is north–south. At this bend there is a narrow side canyon extending up the east face of the mountain, providing substantial drainage into the lower canyon. There are many small, permanent shallow pools and hidden, trickling seeps along the shaded bottom of the upper canyon. Plants more or less restricted to this part of the canyon include the tall fan palm *Washingtonia robusta*, the large fig *Ficus insipida*, and a number of herbaceous wetland species such as *Eleocharis geniculata*, *Fuirena simplex*, *Ludwigia octovalvis*, and *Mimulus floribundus*.

In contrast to the verdant canyon floor, the canyon walls are, in places, partially barren. Hesper palms (*Brahea elegans*) grow from crevices in sheer cliffs and rock slopes above the canyon floor. Other common rock-adapted plants clinging to cliffs and rocky slopes include *Agave chrysoglossa*, *Asclepias leptopus*, *Ficus palmeri*, *Hofmeisteria crassifolia*, *Perityle leptoglossa*, and *Pleurocoronis laphamioides*. On the slopes of more gentle gradients with a soil profile there are dense stands of shrubby vegetation ranging to near 100% cover. Vegetation on north- and east-facing slopes is relatively dense and verdant, resembling foothills thornscrub or tropical deciduous forest vegetation found to the east and south of the Sonoran Desert. Vegetation on the more arid, south-facing canyon slope supports Sonoran Desert elements such as palo blanco (*Acacia willardiana*), foothills palo verde (*Parkinsonia microphylla*), and desert ironwood (*Olneya tesota*). Vegetation on desert slopes away from the canyon generally resembles that of the south-facing canyon side.

The open desert on the bajada adjacent to the canyon supports a perennial vegetation cover of about 50%, although summer–fall

TABLE 2. Seven largest families of the flora of Cañón de Nacapule.

Family	Genera	Species
Asteraceae	26	31
Fabaceae	26	31
Poaceae	15	19
Euphorbiaceae	9	16
Cactaceae	9	13
Malvaceae	8	11
Acanthaceae	7	10

ephemerals may carpet the ground with essentially 100% cover. Winter–spring ephemerals are concentrated near the larger perennials such as desert ironwood (*Olneya tesota*). These larger desert shrubs and small trees provide shade, perhaps extra nutrients, and protection from grazers, producing "island patches" (Búrquez and Quintana 1994).

Many of the large, xerophytic shrubs and small trees on the open desert and canyon floor near the entrance tend to be set well apart from each other, while smaller and seemingly shorter-lived and quicker-growing shrubs have aggregated patterns of distribution. This pattern seems at least in part to be the result of cattle grazing. Among the most common and conspicuous larger xerophytic perennials are *Bursera microphylla*, *Fouquieria diguetii*, *F. macdougalii*, *Colubrina glabra*, *Forchhammeria watsonii*, *Jatropha cuneata*, *Mimosa distachya*, *Olneya tesota*, and *Ruellia californica*.

Arroyo Nacapule leads southeastward from the canyon entrance and courses through the bajada desert plain for several kilometers. Cut about 8+ m deep with steep walls, it supports some of the unusual Nacapule plants, e.g., *Serjania palmeri*, *Zanthoxylum fagara*, scattered palms (*Brahea elegans* and *Sabal uresana*), and a few fairly large trees of *Ficus palmeri*.

The flora of the Nacapule region is dynamic, with immigrations and departures. My observations indicate that most changes are anthropogenic. Plants not native to the Guaymas region, mostly Old World weeds, are represented by 16 species, e.g., *Malva parviflora*, *Sisymbrium irio*, and *Pennisetum ciliare*. Nonnative plants are identified by an asterisk (*). Others, such as *Acacia cochliacantha*, *Opuntia fulgida*, and *Vallesia glabra* are native to the Guaymas–San Carlos region but are apparently not part of the original Nacapule flora. Seventeen species, or 6% of the total flora, seem to have spread to the canyon and spring area, or at least have substantially increased in population size, within the past two decades as a result of the activities of cattle and other habitat disturbances such as roads, collecting of decorative rock, and trampling by too many visitors:

Acacia cochliacantha
A. farnesiana
Ambrosia confertiflora
Baccharis sarothroides
**Chenopodium murale*
**Conyza canadensis*
**Dactyloctenium aegyptium*
**Digitaria ciliaris*
Gymnosperma glutinosum
**Lactuca serriola*
**Malva parviflora*
Opuntia fulgida
**Pennisetum ciliare*
Prosopis glandulosa
**Rhynchelytrum repens*
**Sisymbrium irio*
Vallesia glabra

The changes attributed to cattle grazing are based on my numerous visits and observations, including comparing grazed areas with adjacent areas inaccessible to cattle. Although subjective, I noted "new" plants and changes whenever possible. *Amaranthus watsonii* seems to have increased along the canyon floor in areas of cattle grazing. A few wetland plants that are probably bird-dispersed seem to be transient and not fully established, e.g., *Echinodorus berteroi*, *Limnocharis flava*, and *Typha domingensis*. Four species, *Cyperus squarrosus*, *Fimbristylis annua*, *Heliotropium procumbens*, and *Psilotum nudum*, are apparently no longer present in the canyon. *Fimbristylis* may have been eliminated by cattle grazing. *Psilotum*, stunted at the time of discovery, may have succumbed to drought. The other two were probably not well established in the canyon.

The growth-form spectrum of the Nacapule flora is shown in Fig. 4. Trees are represented by 18 species (6% of the flora), larger shrubs or vines by 36 species (13%). In comparison, tree species

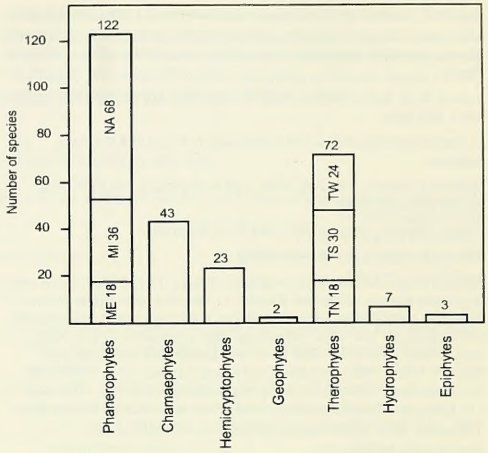

Figure 4. Growth-form spectrum of the Nacapule flora. Phanerophyte: Trees, shrubs, or vines with growth buds well above ground. ME, mega–phanerophytes (trees >5 m tall); MI, microphanerophytes (larger shrubs or vines, usually 2–5 m tall); NA, nanophanerophytes (shrubs, vines, or shrub-sized perennials, usually 0.2–2 m tall). Chamaephyte: Perennials with meristem above ground but below 0.5 m. Hemicryptophyte: Perennials with meristem at or near ground level. Geophyte: Meristem below the ground. Therophyte: Annuals or ephemerals. TN, nonseasonal therophytes; TS, seasonal summer–fall therophytes; TW, seasonal winter–spring therophytes. Hydrophyte: Meristem in water. Epiphyte: Plants entirely above ground.

likewise represent 6% of the flora of the northern Sierra Madre Occidental as well as that of the state of Sonora (Felger and Johnson 1995; unpublished data). The largest groups are shrub-sized perennials (68 species, 24%) and annuals (72 species, 25%). Only two species are geophytes, i.e., *Aristolochia watsonii* and *Commelina erecta*. The three species of epiphytes are parasitic plants in the Loranthaceae and Viscaceae. The growth-form spectrum for the Nacapule flora is characteristic of regions intermediate between the dry tropics (e.g., tropical deciduous forest) and warm deserts (Búrquez et al. 1999).

Vining plants, usually relatively few in desert regions, are represented by 26 species (9%). Plants with succulent stems and/or leaves include 25 species (9%). These range from small annuals such as *Portulaca* to giant cacti such as cardón (*Pachycereus pringlei*). Succulents are especially prominent on exposed rock slopes and hilltops with very shallow or no soil.

Wetland plants of tropical as well as temperate origin occur along the permanent stream. Tropical vines grow through the shrubs and small trees, lacing into gallery groves of tall palms. Three species of fig (*Ficus*) and three genera of native palms make up part of the riparian streambed flora. One of these figs, *Ficus insipida*, forms buttress roots, a growth habit unique for the Sonoran Desert.

The collection history of Cañón de Nacapule spans more than one century and includes a number of prominent western botanists (Table 3). Four species have been described from specimens from the canyon: *Erythea clara* (*Brahea elegans*), *Telosiphonia nacapulensis*, *Vallesia baileyana* (*V. laciniata*), and *Verbesina felgeri*.

CONSERVATION

Bahía San Carlos is a major resort area with hotels, vacation homes, golf courses, and marinas. Most of the original vegetation is destroyed,

TABLE 3. Collectors of botanical specimens from Cañón de Nacapule.

Martha Ames [Martha Burgess, Martha Wiseman], 12 Mar 1977, with Bonnie Fine.

Liberty Hyde Bailey, 30 Mar 1934, 14 Apr 1934, and 14 Apr 1936 (Bailey 1937, BH, MO).

C. David Bertelsen, 6 Nov 1992, with John F. Wiens and Kristen J. Johnson

Fredrick C. Boutin, Jan–Feb, 1970, with Fred Brandt; Feb 1970, with Myron Kimnach (HNT).

Tony L. Burgess, 24 Aug 1984, with Peter Warshall.

Thomas F. Daniel, 12 Jan 1982 (ASU).

Richard Felger, 18 June 1960, with Jesús Ortega; 13 Oct 1960; 1963, with Alexander Russell and Robert Russell; 11 Jan 1965, with Robin Thomas; 7 Sep 1980, with Robert Schmalzel; 19 Oct 1984, with James Aronson and Avi Shmida; 19 Nov 1984, with Diego Valdez Zamudio; 25 Feb 1985, with Robert S. Devine; 9 Mar 1985, with Goodman Larson and Jean Russell; 11 Aug 1985, with Mark A. Dimmitt; 10 Oct 1985, with Frank Reichenbacher; 13 Dec 1992, with Alberto Búrquez; 26 Nov 1994 and 3–4 Jan 1995, with Silke Schneider; 15 Feb 1995, with Michael Wilson; 6 Jan 1995, with Silke Schneider, Gil Gillenwater, and Esther Tittle.

Bonnie Fine, 12 Mar 1977.

Margaret (Peg) Gallagher, 17 Oct 1981 (ASU); 15 May 1982, see entry for Parfitt.

Howard S. Gentry, 29 Mar 1963, Cerro 4–5 mi N of Bahía San Carlos, arid palm canyon with volcanic rocks, with Juan Arguelles; 17 Jun 1975, ca. 5 mi N of Bahía San Carlos, with Rodney Engard.

Paul S. Martin, 24 Dec 1970; 12 Mar 1977.

Edward Palmer, 12 Oct 1897. Some of his specimens merely labeled "Guaymas" are actually from the canyon, although a few say "Nacapuly, 15 miles west of Guaymas" (see *Asclepias leptopus* and *Passiflora mexicana*). McVaugh (1956) reports that nos. 255–260 in 1897 are from "Nacapuly." Palmer's often relatively detailed notes rarely accompanied his specimens into the the herbaria to which they were distributed (McVaugh 1956:vii). Also see species account for *Abutilon abutiloides*.

Bruce Parfitt, 15 May 1982 (ASU), with Martha Burgess, Sylvia Forbes, Margaret L. Gallagher, Carol Starr, Gregg Starr, and George Yatskievych.

Arthur M. Phillips, III, and Barbara G. Phillips, 9 Mar 1975, with Fred M. Wiseman; 26 Oct 1975, with Lee Karpiscak, Martin Karpiscak, Raymond M. Turner, Fred M. Wiseman, Martha Ames Wiseman, and Wally Woolfenden.

Ana Lilia Reina-Guererro, 18 Feb 1995, with Jesús Sanchez-Escalante, Oscar Gutierrez, Telma S. Fuentes, and L. Morales.

Gregg Starr, 17 Oct 1981, with Martha Ames Burgess, Margaret Gallagher, Robert Perrill, and Vicki Phelps; 15 May 1982, see entry for Parfitt; 28 Dec 1982, with Carol Starr, Tom Van Devender, and Florence H. Nishida; 1 Jan 1984, with Carol Starr and Laurence J. Toolin.

Victor Steinmann, 13 Mar 1992, with Cele Smith and Jenny Davidson; 15 Aug 1992, with Cele Smith.

Laurence J. Toolin, 1 Jan 1984, see entry for Starr.

Raymond M. Turner, 4 Oct 1979, with Paul S. Martin.

Thomas Van Devender, 28 Apr 1982 and 28 Dec 1982, see entry for Starr; 23 Apr 1984, with Robert Perrill, Jacqueline Soule, and Rebecca K. Van Devender.

Peter Warren, 18 Aug 1975, with D. E. Goldberg.

John F. Weins, 17 Jan 1993, with S. Horley.

Martha Ames Wiseman, see Martha Ames.

George Yatskievych, 15 May 1982, see entry for Parfitt.

but natural habitats in nearby rugged mountains remain virtually intact. Even in the 1960s cattle grazing, wanton burning, and woodcutting in the canyon had taken their toll (Felger 1966). Until the late 1980s, however, the canyon remained only minimally altered from my first visit on that hot summer afternoon in the 1960s when the population of the entire state of Sonora was less than half of what it is today. The road from San Carlos to Nacapule was a rough, rock-filled dirt track until the 1990s. At that time a road had been pushed up the canyon, parts of the canyon floor's forest cleared, decorative rock extracted from the slopes by use of dynamite, and some of the trees smashed. Substantial portions of the understory vegetation in the lower canyon has disappeared. Increased tourism is also affecting the vegetation, resulting in trash, minor vandalism, and trampling of fragile wetland vegetation.

The Nacapule region is at the southern margin of a 50,000-ha reserve known as Cajón del Diablo, established "on paper" in 1937 as a hunting reserve. This "reserve" is not strictly delimited and has not received formal management, although there are efforts to turn it into an actual managed reserve, called Cajón del Diablo y Cañón de Nacapule (Búrquez and Martínez-Yrízar 1997).

Cañón de Nacapule is a small and vulnerable place. Enough of the canyon biota remains that its recovery could be rapid if protected. The land is owned cooperatively by an *ejido* and is a popular place for hiking and ecotourism. I suggest that a nongovernmental conservation organization in Mexico make arrangements with the ejido to eliminate mining, the road, vehicles, and cattle in the canyon, and to limit general access to the one major established trail. Modest entrance fees from a controlled number of visitors would generate higher income than is presently being earned. The canyon and the rugged surrounding mountain areas are not suitable for other development. Access to the canyon is from only one easily controlled place, so effective management is feasible. This special place deserves vigorous protection.

ANNOTATED CATALOG OF THE VASCULAR FLORA

The flora is presented alphabetically by family, genus, and species with the ferns and fern relatives listed first, followed by the dicotyledons and then the monocotyledons. Plants not native to the region are indicated with an asterisk (*). Nomenclature used here results from my studies of the regional flora. Selected synonyms are given in brackets. Some common names are provided, with the local Spanish name(s) first, followed by the English name, and in a few cases Yoeme (Yaqui) names (the last are from a manuscript Felipe Molina and I are preparing). Measurements for length or height precede those for width, and the terms length, long, or height are omitted unless needed to avoid confusion. Flowering times are expressed by the season or months of probable or known flowering. In many cases flowering times or seasons vary greatly from year to year, and one can expect variation greater than what is presented here. Flower color refers to the dominant or most conspicuous color of the flower.

Three general kinds of ephemerals (desert annuals that complete their life cycle within a single season) are distinguished: (1) Winter–spring ephemerals grow during the cooler seasons and may flower during late fall, winter, and/or spring. (2) Hot-weather or summer ephemerals usually germinate with the first substantial summer thunderstorms. Some may also grow with early fall rains (such as hurricane-fringe storms) while the soil and air temperatures are still high, allowing quick maturity. (3) Nonseasonal ephemerals grow with sufficient soil moisture at any time of the year.

Specimens cited are deposited at the University of Arizona, Tucson (ARIZ), unless otherwise indicated. When more than one collector is listed on a label, usually only the first collector is given. My specimens are identified by "F" plus the collection number. When no collection number is given on the label, the specimen is identified by the date of collection. I have seen all specimens unless otherwise

noted. Only selected specimens are cited, and in many cases there are additional specimens, especially at ARIZ. At least in the case of my collections an additional set is at the Instituto de Biología, Universidad Autónoma de México, Mexico City (MEXU) or, for many of my earlier collections, the Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, Mexico City (ENCB), with duplicates variously distributed primarily to the California Academy of Sciences, San Francisco (CAS), Rancho Santa Ana Botanic Garden, Claremont, California (RSA), the San Diego Natural History Museum (SD), the University of Texas, Austin (TEX), and the University of California, Berkeley (UC).

KEY TO THE MAJOR PLANT GROUPS AND FAMILIES

1. Plants spore-bearing, without flowers or seeds; leaves those of typical ferns, or nearly leafless and stems dichotomously branched, seldom >30 cm ..... PTERIDOPHYTES
1′ Plants with flowers and seeds; leaves various or none ..... FLOWERING PLANTS:
  2. Agaves, aquatic plants, cattails, grasses, sedges, sedgelike plants, or palms ..... MONOCOTYLEDONS (page 38)
  2′ All other plants, not as above ..... DICOTYLEDONS

PTERIDOPHYTES—FERNS AND FERN RELATIVES

1. Plants not fernlike, with erect, dichotomously branched green leafless stems ..... Psilotaceae
1′ Ferns; stemless but with brown to blackish rhizomes, the leaves well developed ..... Pteridaceae

PSILOTACEAE—Whisk-fern Family

Psilotum nudum P. Beauv. A single colony "with about a dozen stems two to three inches high . . . at an alga-covered seep on the canyon wall in the shade of palms" (Boutin 1971). Spring, 1970, *Boutin 3814* (Huntington Botanical Garden); propagations from this collection cultivated at the Huntington Botanical Garden (HNT no. 25061) and specimen of a portion of "plant cultivated at Huntington Library Botanic Garden" (ARIZ 260328).

Although the plants were small, apparently stunted by the relatively dry conditions, in cultivation they reached 15–17 cm, within the usual size range for the species. The *Psilotum* colony was found in the upper part of the canyon. I could not relocate it in spite of precise information provided by Myron Kimnach, one of the original collectors. Perhaps this stunted colony succumbed to drought. There are no other records for this moisture-loving plant within the Sonoran Desert. The nearest known populations are in oak woodland in Sycamore Canyon in Santa Cruz County, southern Arizona (Toolin et al. 1979), and in pine forest on the Sierra Saguaribo in southeastern Sonora (Gentry 1942).

PTERIDACEAE—Brake Fern Family

The four ferns have leaves that curl up tightly during dry periods and expand during moist conditions to reveal green surfaces.

1. Leaves once-pinnate, the upper surfaces of leaf segments with often deciduous stellate-pectinate scales (star-shaped and comblike) ..... *Astrolepis sinuata*
1′ Leaves 2- or 3-times pinnate, without stellate or pectinate scales, the upper surfaces of leaf segments mostly glabrous.
  2. Leaf segments green on both surfaces, edged with a nearly continuous margin of sori ..... *Cheilanthes lozanii*
  2′ Leaf segments brownish or whitish below, green above, the sori not forming a continuous margin.
    3. Leaves <12 cm, divided into numerous minute segments, the lower surfaces green with brown sori ..... *Cheilanthes pringlei*
    3′ Leaves 20+ cm, the segments not numerous and minute, the lower surfaces white ..... *Notholaena lemmonii*

Astrolepis sinuata (Lag. ex Sw.) D.M. Benham & M.D. Windham subsp. **sinuata** [*Notholaena sinuata* (Lag. ex Sw.) Kaulf.]. Wavy star-fern. Crevices in rock ledge on north-facing canyon wall; rare. *F 92-1030.*

Cheilanthes lozanii (Maxon) R. Tryon var. ***seemannii*** (Hook.) Mickel & Beitel. [*Pellaea seemannii* Hook.]. Leaves mostly 20-30 cm, pale green, the sori golden-brown. Among rocks in canyon bottom and on north-facing slopes. *F 84-136.*

Cheilanthes pringlei Davenp. Diminutive ferns with creeping rhizomes. Shaded north-facing rock slopes; rhizomes often in moss and humus overlying rock surfaces. *F 84-135, 85-1186.*

Notholaena lemmonii D.C. Eaton. Leaves at least twice as long as wide. Among rocks on north-facing slopes. *F 84-100; Gallagher 275.*

FLOWERING PLANTS
DICOTYLEDONS

1. Plants parasitic: KEY 1.
1′ Plants not parasitic.
  2. Plants succulent but not parasitic: KEY 2
  2′ Plants not succulent.
    3. Vines: KEY 3.
    3′ Not vines.
      4. Composites: individual flowers small and borne in a head often resembling a single large flower, the head surrounded by a series of somewhat sepal-like bracts forming an involucre, the heads often sunflower- or daisylike, with a central group of tubular disk flowers often surrounded by a ring of ray flowers, or the heads of disk flowers only, or dandelionlike and all flowers with a strap-shaped corolla; ovary inferior, the fruit a cypsela ("achene"), topped by scales or bristles forming the pappus, or the pappus sometimes none. ..... Asteraceae
      4′ Not composites.
        5. Leaves compound. KEY 4
        5′ Leaves simple.

6. Leaves whorled or appearing whorled: KEY 5
6′ Leaves alternate or opposite.
7. Leaves opposite: KEY 6
7′ Leaves alternate: KEY 7

KEY 1. PARASITIC PLANTS

1. Stems vining, threadlike, and orange; flowers white, the perianth consisting of a well-defined calyx and corolla ..... Convolvulaceae (*Cuscuta*)
1′ Stems not vining, not threadlike, and not orange; flowers cream-colored, yellow, or red, the perianth of calyx only (corolla none).
2. Leaves more than twice as long as wide; flowers cream-colored or red ..... Loranthaceae
2′ Leaves about as half to fully as wide as long; flowers small, yellow ..... Viscaceae

KEY 2. SUCCULENT PLANTS

1. Cacti; stems with "areoles" bearing a cluster of spines ..... Cactaceae
1′ Not cacti; without areoles, without spines, or the stem tips spinescent.
2. Plants herbaceous, mostly <50 cm; sap not milky; stems leafy.
3. Leaves deeply dissected or lobed, often somewhat glaucous; flowers pale pink, in dense, many-flowered heads on long peduncles ..... Asteraceae (*Hofmeisteria*)
3′ Leaves not dissected or lobed, the margins entire, not glaucous; flowers yellow, orange, or deep pink to purple, in open, loose panicles or solitary and sessile or short-pediceled in leaf axils ..... Portulacaceae
2′ Plants shrubby or semi-shrubby, mostly >50 cm; sap milky; leaves few and reduced, filiform or narrowly linear.
4. Stems waxy, grayish white, wandlike, quite flexible, not spinescent-tipped. Asclepiadaceae (in part)
4′ Stems green, rather firm, spinescent-tipped. ..... Euphorbiaceae (*Euphorbia ceroderma*)

KEY 3. VINES

1. Plants with stinging hairs; leaves 1.5-4 cm; flowers unisexual, small and inconspicuous. ..... Euphorbiaceae (*Tragia*)
1′ Plants glabrous with nonstinging hairs; flowers bisexual (except *Dalechampia*)
2. Plants with tendrils.
3. Leaves pinnately or bipinnately compound ..... Sapindaceae (*Cardiospermum*, *Serjania*)
3′ Leaves simple although sometimes deeply lobed.
4. Flowers and their bracts pink; tendrils at ends of flowering branches ..... Polygonaceae (*Antigonon*)
4′ Flowers white or white with blue or purple; tendrils at bases of inflorescences or leaves.
5. Tendrils on inflorescence peduncles; leaves shallowly toothed but not lobed; flowers <0.5 cm in diameter; fruits dry, three-winged ..... Rhamnaceae (*Gouania*)
5′ Tendrils at leaf bases; leaves shallowly to deeply lobed and toothed or not; flowers at least 1 cm in diameter; fruits fleshy, not winged.
6. Stipules none; flowers unisexual ..... Cucurbitaceae
6′ Stipules present; flowers bisexual ..... Passifloraceae
2′ Plants without tendrils.
7. Ovary inferior; perianth 3.5-5 cm, consisting of a single, bilateral segment, toothlike above and funnel-like below; leaves arrow-shaped; the sap not milky ..... Aristolochiaceae
7′ Ovary superior or inferior; perianth not as above, with sepals and petals; leaves not arrow-shaped, or if so then the sap milky.
8. Leaves compound or divided nearly to the base.
9. Flowers bilaterally symmetric, pealike, pink, purplish, or yellow. Fabaceae (*Nissolia*, *Phaseolus*, *Macroptilium*, *Rhynchosia*)
9′ Flowers radial, not pealike, various colors.
10. Leaves palmately parted, the leaf segments with entire margins; flowers bisexual. Convolvulaceae (*Ipomoea leptotoma*)
10′ Leaves pinnately parted or divided, the leaf segments with toothed margins; flowers unisexual ..... Euphorbiaceae (*Dalechampia*)
8′ Leaves simple.
11. Annuals ..... Convolvulaceae (*Ipomoea* in part)
11′ Perennials.
12. Leaves alternate ..... Menispermaceae
12′ Leaves opposite.
13. Sap milky; petals white, cream, greenish, or white and maroon; fruits not winged ..... Asclepiadaceae (*Marsdenia*, *Matelea*, *Metastelma*, *Sarcostemma*)
13′ Sap not milky; petals bright yellow; fruits winged ..... Malpighiaceae (*Callaeum*, *Janusia*)

KEY 4. LEAVES COMPOUND

1. Leaves opposite; summer ephemerals or hardwood shrubs and small trees ..... Zygophyllaceae
1′ Leaves alternate; herbs to trees.
2. Small annual herbs; leaves palmately compound ..... Capparaceae (*Cleome*)
2′ Herbs to trees; leaves pinnately or bipinnately compound.
3. Leaflet margins crenate to toothed; leaves glandular punctate, with a citruslike odor when crushed ..... Rutaceae (*Zanthoxylum*)
3′ Leaflet margins entire or sometimes shallowly toothed; leaves not glandular punctate, not smelling like citrus.

4. Plants armed or unarmed; leaves with pulvini at bases of petioles and/or leaflet stalks (pulvini are swollen, often dark areas that swell or contract to move the leaves and/or leaflets); stipules often well developed and persistent; leafstalks often with prominent nectary gland(s); fruits one- to many-seeded ..... Fabaceae
4′ Plants not armed; leaves without pulvini or leafstalk glands; stipules none; fruits one-seeded
5. Leaflets ≤1 cm wide; fruits dehiscent with a red or yellow aril, 8 mm ..... Burseraceae (*Bursera*)
5′ Leaflets 2–5 cm wide; fruits indehiscent, without an aril, at least 12 mm ..... Sapindaceae (*Sapindus*)

KEY 5. LEAVES WHORLED OR APPEARING WHORLED

1. Trees and shrubs.
2. Stems unarmed and flexible; flowers unisexual ..... Euphorbiaceae (*Jatropha cuneata*)
2′ Stems armed and rigid; flowers bisexual.
3. Leaf clusters (short shoots) often subtended by a rigid spine; flowers at least 1.5 cm, tubular, and red ..... Fouquieriaceae
3′ Twigs spinescent only at tips; flowers <1 cm long or wide, saucer shaped, and yellow-green ..... Rhamnaceae
1′ Plants herbaceous.
4. Flowers sessile in dense spikes, the peduncles and spikes clothed in firm, overlapping bracts with pointed tips .... Acanthaceae (*Elytraria*)
4′ Flowers pediceled, in small clusters or dense to elongated racemes, without bracts as above.
5. Perianth radial, with sepals but no petals ..... Molluginaceae
5′ Perianth bilateral, with sepals and petals ..... Scrophulariaceae (*Antirrhinum*, *Linaria*, *Stemodia*)

KEY 6. LEAVES SIMPLE AND OPPOSITE

1. Stems square in cross section; leaf margins serrated to toothed.
2. Leaves often whitish; plants with branched white hairs ..... Lamiaceae
2′ Leaves greenish; plants with simple hairs ..... Verbenaceae
1′ Stems terete; leaves entire.
3. Trees or woody shrubs usually >1 m.
4. Plants armed with 2–4 spines near twig tips ..... Rubiaceae (*Randia*)
4′ Plants unarmed.
5. Leaves opposite or fascicled, linear-oblong to narrowly elliptic, <1 cm wide, markedly glandular-punctate .... Oleaceae (*Forestiera*)
5′ Leaves all opposite, broadly elliptic to ovate, >1 cm wide, not glandular-punctate.
6. Small trees or treelike shrubs usually taller than wide, mostly with a single, well-formed trunk and corky-ridged bark; leaves relatively thin and not at all leathery; flowers bisexual; capsules many-seeded ..... Rubiaceae (*Hintonia*)
6′ Much-branched, trunkless shrubs as wide or wider than tall, the bark smooth; leaves leathery; flowers unisexual; capsules one- or two-seeded ..... Simmondsiaceae
3′ Plants herbaceous, if somewhat woody then mostly <1 m and generally woody only near the base.
7. Herbage or fruits glandular-sticky; flowers pink, white, or dull greenish yellow ..... Nyctaginaceae
7′ Plants glandular or not but not sticky; flowers of various colors.
8. Herbage woolly-pubescent, at least when young; flowers small and inconspicuous. Amaranthaceae (*Froelichia*, *Tidestromia*)
8′ Herbage glabrous or pubescent but not woolly; flowers conspicuous.
9. Corollas bilateral.
10. Perennials; fruits several-seeded, elastically dehiscent capsules ..... Acanthaceae (except *Elytraria*)
10′ Annuals; fruits many-seeded capsules, not elastically dehiscent ..... Scrophulariaceae (*Antirrhinum*, *Linaria*)
9′ Corollas radial.
11. Pubescence of simple hairs or plants nearly glabrous; fruits dehiscent, paired, and slender. Apocynaceae (*Haplophyton*)
11′ Pubescence of two-armed hairs or plants nearly glabrous; fruits indehiscent, not paired, and not slender .... Malpighiaceae (*Callaeum*, *Galphimia*)

KEY 7. LEAVES SIMPLE AND ALTERNATE

1. Woody shrubs and trees, usually >1 m.
2. Leaves or stems armed.
3. Leaves spine-tipped; plant otherwise unarmed ..... Theophrastaceae
3′ Leaves not spine-tipped; the twigs, nodes, and/or leaves variously armed.
4. Flowers bilateral; fruit a spiny bur ..... Krameriaceae
4′ Flowers radial; fruit not a spiny bur.
5. Leaf veins not readily evident.
6. Trees or large shrubs with a well-formed trunk, the bark light-colored, checkered to furrowed; leaves not fleshy. ..... Sapotaceae
6′ Shrubs lacking a well-formed trunk, the bark mostly smooth; leaves often semi-fleshy.
7. Sepals 4, petals none; fruits whitish, drying blackish, one-seeded ..... Phytolaccaceae (*Phaulothamnus*)
7′ Calyx and corolla present, each 4- or 5-lobed; fruits orange or red-orange, multiple-seeded ..... Solanaceae (*Lycium*)
5′ Leaves with prominent veins (at least the midrib prominent).
8. Plants with stellate hairs ..... Solanaceae (*Solanum*)
8′ Plants glabrous or the hairs not stellate.

9. Leaves scabrous ..... Ulmaceae
9′ Leaves not scabrous.
10. Long-shoot branches with a rigid spine at many or all nodes; flowers tubular, red, at least 1.5 cm. Fouquieriaceae
10′ Twigs spinescent only at tips; flowers saucer-shaped, yellow-green, <1.0 cm ..... Rhamnaceae
2′ Plants unarmed.
11. Sap milky.
12. Leaf margins toothed ..... Euphorbiaceae (*Sebastiania*)
12′ Leaf margins entire.
13. Stipules minute or not apparent, not enclosing terminal growth buds; flowers small but conspicuous, fragrant, and white, with calyx and corolla ..... Apocynaceae (*Vallesia*)
13′ Stipules conspicuous, the growth bud enclosed by a pair of elongated bractlike stipules falling away as the new leaf expands, the fallen stipules leaving a ringlike scar on the twig; flowers not fragrant, inconspicuous and minute, enclosed in a fig, the perianth not evident ..... Moraceae
11′ Sap not milky.
14. Leaf blades narrow, more than twice as long as wide.
15. Trees with a thick, single trunk; leaf margins conspicuously inrolled ..... Capparaceae (*Forchhammeria*)
15′ Shrubs; leaf margins not inrolled.
16. Flowers bilateral; fruit a spiny bur ..... Krameriaceae
16′ Flowers radial; fruit not a bur.
17. Herbage not sticky-viscid; stems thick and semi-succulent ..... Euphorbiaceae (*Jatropha cuneata*)
17′ Herbage, especially when young, sticky-viscid; stems slender, not succulent ..... Sapindaceae (*Dodonaea*)
14′ Leaf blades broader, less than twice as long as wide to wider than long.
18. Flowers unisexual, generally inconspicuous.
19. Shrubs; leaves not scabrous; flowers all unisexual; fruits of two- or three-seeded capsules ..... Euphorbiaceae (*Acalypha*, *Adelia*, *Croton*, *Jatropha*)
19′ Trees with a well-formed trunk; leaves scabrous; flowers both unisexual and bisexual, often on the same branch; fruits one-seeded drupes ..... Ulmaceae (*Celtis reticulata*)
18′ Flowers bisexual, small and inconspicuous to large and showy.
20. Leaves serrate-toothed.
21. Hairs stellate; flowers maroon or rose-lavender ..... Sterculiaceae (*Ayenia*, *Melochia*)
21′ Hairs simple; flowers yellow-green or white.
22. Hairs coarse, firm; flowers >2 cm wide, white ..... Boraginaceae (*Cordia parvifolia*)
22′ Hairs slender, soft; flowers <1 cm wide, yellow-green ..... Rhamnaceae (*Colubrina californica*)
20′ Leaves entire.
23. Leaf blades nearly orbicular with a rounded or blunt apex; stipules forming a tubular cap enclosing the developing bud and later clasping and encircling the stem ..... Polygonaceae (*Coccoloba*)
23′ Leaf blades longer than wide, or if nearly as wide as long then the apex pointed; stipules none or not as above, not sheathing the stem.
24. Plants glabrous (including new growth).
25. Twigs brittle, the wood not hard; leaves somewhat fleshy and semi-succulent; flowers white; fruits red ..... Phytolaccaceae (*Stegnosperma*)
25′ Twigs of flexible, nonbrittle hardwood; leaves thin, not at all succulent; flowers yellow-green; fruits brown ..... Rhamnaceae (*Colubrina glabra*)
24′ Plants pubescent, at least the new growth, inflorescences, and/or calyces.
26. Plants scabrous or with two-armed hairs.
27. Shrubs; pubescence of two-armed hairs, not scabrous; flowers bright yellow, showy, >10 mm wide ..... Malpighiaceae (*Echinopterys*)
27′ Trees; leaves scabrous, the hairs simple (not two-armed); flowers yellow-green or green, inconspicuous, <6 mm wide ..... Ulmaceae (*Celtis reticulata*)
26′ Pubescence of simple soft hairs.
28. Leaves mostly <5 cm, the blades soft, not firm; individual flowers <1 cm wide or long, inconspicuous, the flowers and fruits enveloped in tufts of white hairs ..... Amaranthaceae (*Iresine*)
28′ Leaves mostly >5 cm, the blades rather firm; flowers at least 3 cm wide, showy, not enveloped in hairs ..... Boraginaceae (*Cordia sonorae*)
1′ Annual or perennial herbs, not woody or scarcely woody below, or if somewhat woody then generally <1 m.
29. Herbage and/or fruits spiny.
30. Herbage and fruits spiny; stamens numerous ..... Papaveraceae
30′ Herbage unarmed, the fruits spiny; stamens 5.
31. Shrubs; fruits ca. 1–1.5 cm in diameter ..... Krameriaceae
31′ Annual herbs; fruits >3 cm in diameter ..... Solanaceae (*Datura*)
29′ Herbage and fruits unarmed.
32. Flowers unisexual; fruits three-seeded capsules ..... Euphorbiaceae (*Ditaxis*, *Euphorbia*)
32′ Flowers unisexual or bisexual; fruits various but not three-seeded capsules.
33. Pubescence of stellate or dendritic hairs.
34. Hairs dendritic, the herbage, calyces and fruits sticking like Velcro; stamens separate ..... Loasaceae
34′ Hairs stellate, the herbage, etc., not sticking; stamen filaments united, at least basally.

35. Fertile stamens many, the filaments united for at least half their length. ..... Malvaceae
35′ Fertile stamens 5 (*Ayenia* also has 5 staminodes), the filaments united only at base. ..... Sterculiaceae
33′ Pubescence of simple hairs or plants glabrous.
36. Perianth 4-merous (calyx 4-lobed, or sepals 4; corolla, if present, 4-lobed or petals 4).
37. Calyx present, the corolla absent; stamens 4; fruits one-seeded.
38. Bushy summer-flowering perennials; flowers bisexual, small but conspicuous, white, in slender terminal and axillary racemes; fruits red, fleshy ..... Phytolaccaceae (*Rivina*)
38′ Winter–spring annuals; flowers bisexual and unisexual in same cluster, inconspicuous, dull green or brown, in dense axillary clusters; fruits brown, dry. ..... Urticaceae
37′ Calyx and corolla present; stamens 6 or 8; fruits multiple-seeded.
39. Cool-season annuals; ovary superior; stamens 6. ..... Brassicaceae
39′ Warm-weather annuals or perennials; ovary inferior; stamens 8. ..... Onagraceae
36′ Perianth various but not 4-merous, often 5-merous.
40. Annuals; flowers small and inconspicuous; sepals green or straw-colored, the petals none; fruits one-seeded.
41. Flowers unisexual; fruit a circumscissile capsule. ..... Amaranthaceae (*Amaranthus*)
41′ Flowers bisexual; petals none, fruit an achene. ..... Chenopodiaceae (*Chenopodium*)
40′ Annuals or perennials; flowers small or not, with sepals and petals, variously colored; fruits one- to many-seeded.
42. Flowers bilateral.
43. Leaves all alternate, the margins sparsely toothed; flowers whitish; fruits 3-seeded ..... Violaceae
43′ Leaves alternate and some sometimes also whorled or opposite, the margins entire; flowers pink, blue, or purple; fruits with 4 or more seeds.
44. Flowers sessile in dense spikes, the peduncles and spikes clothed in overlapping bracts with pointed tips .... Acanthaceae (*Elytraria*)
44′ Flowers pediceled in dense to elongated racemes, without overlapping bracts .... Scrophulariaceae (*Antirrhinum*, *Linaria*)
42′ Flowers radial.
45. Inflorescences and calyx with sticky, stalked glands; flowers white, small but showy; seeds 1 .... Plumbaginaceae
45′ Plants glandular or not, but not sticky; flowers white or variously colored; seeds more than 2, generally 4 or more.
46. Flowers bright yellow; fruits 7-10 cm, paired, very slender ..... Apocynaceae (*Haplophyton*)
46′ Flowers yellow or not; fruits to ca. 1 cm, not paired and not slender.
47. Inflorescence branches helicoid.
48. Leaves entire ..... Boraginaceae
48′ Leaves pinnately lobed or toothed ..... Hydrophyllaceae (*Phacelia*)
47′ Inflorescence branches straight, not helicoid.
49. Stamens many, the filaments united into a column or tube; style branches more than 5 ..... Malvaceae
49′ Stamens 5, the filaments separate from each other; style branches 4 or fewer.
50. Style undivided, the stigma 3-cleft ..... Polemoniaceae
50′ Styles and stigmas unbranched, or styles 2 and each two-branched.
51. Styles 2, each with a two-lobed stigma; seeds 4 or fewer ..... Convolvulaceae (*Evolvulus*)
51′ Styles and stigmas unbranched; seeds many per fruit ..... Solanaceae (*Nicotiana*, *Physalis*, *Solanum*)

ACANTHACEAE—Acanthus Family

1. Leaves alternate or whorled; flower clusters on long scaly stems. ..... *Elytraria*
1′ Leaves opposite; inflorescences not on scaly stems.
2. Shrubs or dense mound-shaped bushes.
3. Leaves conspicuously glandular-sticky; corollas lavender, large and showy, about as wide as long. ..... *Ruellia*
3′ Leaves not glandular-sticky; corollas not lavender, longer than wide.
4. Corollas rose-pink; fertile stamens 4. ..... *Holographis*
4′ Corollas red-orange or red; fertile stamens 2. .... *Justicia* (*J. californica*, *J. candicans*)
2′ Perennial herbs.
5. Floral bracts large, 4-ranked, the flowers in dense spikes; calyx 4-lobed. ..... *Tetramerium*
5′ Floral bracts not noticeably large, not 4-ranked, the flowers not in dense spikes; calyx 4- or 5-lobed.
6. Calyx 4-lobed; flowers lavender; capsules glandular. ..... *Justicia* (*J. sonorae*)
6′ Calyx 5-lobed; flowers white or yellow with purplish markings; capsules not glandular.
7. Capsules narrowly club-shaped, gradually tapered below; corollas <1 cm wide ..... *Aphanosperma*
7′ Capsules broadly club-shaped, abruptly narrowed below to a claw; corollas ca. 1.5 cm wide. ..... *Carlowrightia*

Aphanosperma sinaloensis (Leonard & Gentry) T. F. Daniel [*Carlowrightia sinaloensis* Leonard & Gentry]. Herbaceous perennial, the herbage and flowers appearing with summer rains and sometimes with spring rains. Leaves thin, relative large, and falling with the first dry conditions. Corollas white, quickly falling with daytime heat. Restricted to ca. 0.5 km of shaded canyon bottom beneath *Coccoloba* shrubs. *F 85-1194*, *85-1316*. The nearest known populations are in Cañón las Barajitas and the Sierra Libre. The unusual clavate or T-shaped capsules set *Aphanosperma* apart from *Carlowrightia*.

Carlowrightia
1. Leaves lanceolate to ovate. ..... *C. arizonica*
1′ Leaves linear. ..... *C. pectinata*

Carlowrightia arizonica A. Gray [*C. californica* Brandegee; *C. cordifolia* A. Gray]. *Lemilla*. Suffrutescent perennial with drought-deciduous leaves. Growing and flowering primarily during late

spring and the summer rainy season. Corollas white with yellow and purple on the upper lip. The flowers snap open at about sunrise, then the corollas fall in the daytime heat, usually by mid- to late morning. Canyon bottom, slopes, and nearby desert. *F 84-614, 85-556.*

Carlowrightia pectinata Brandegee. Herbaceous perennial with slender stems to ca. 1 m. Leaves thin and quickly drought deciduous. Corollas white with a yellow "eye" and lavender nectar-guides. Grows and flowers primarily during the summer rainy season. Canyon bottom and lower north-facing slopes; not common. *F 84-603; Starr 216.*

Elytraria imbricata (Vahl) Pers. *Cordoncillo.* Dwarf perennial herb; growing and flowering primarily during summer rainy season. Leaves tardily drought deciduous. Flowers blue. Widespread, common understory plant; shaded canyon bottom, mostly north-facing slopes, and in nearby desert habitats. *F 84-120, 85-862.*

Holographis virgata (Benth. & Hook.) T.F. Daniel subsp. ***virgata*** [*Berginia virgata* Benth. & Hook. var. *virgata*]. Scarcely woody dense mound-shaped shrub often 1 m. Tardily drought deciduous. Flowers bright rose-pink; flowering response nonseasonal. Widespread and common, mostly in open, xeric habitats; canyon bottom and slopes and nearby open desert. Heavily browsed by cattle, deer, and rabbits, as evidenced by observations and scat at the bases of browsed plants. *F 4082, 85-565.*

Justicia

1. Herbaceous perennials; corollas lavender; capsules glandular. ..... *J. sonorae*

1′ Shrubs; corollas red-orange to red; capsules not glandular.
  2. Twigs pale, densely covered with microscopic hairs (0.05–0.10 mm); corollas uniformly red-orange ..... *J. californica*
  2′ Twigs not noticeably pale, the hairs not especially minute (0.2–1.0 mm); corollas red with white markings ..... *J. candicans*

Justicia californica (Benth.) D. N. Gibson [*Beloperone californica* Benth.]. *Chuparosa*; desert hummingbird-bush; *sewalulukut* "hummingbird flower" (Yaqui). Sprawling shrub to 2+ m, nearly leafless during drier times of the year; leaf blades often thickish. Flowering response nonseasonal but often flowers massively in March. Dry watercourses, especially in the lower canyon and nearby desert. *F 85-580; Starr 204.*

Justicia candicans (Nees) L.D. Benson [*Jacobinia ovata* A. Gray; *J. ovata* var. *subglabrata* S. Watson]. Understory shrub 1–1.5 m with slender stems. Leaves drought deciduous, the leaf blades thin. Flowering various seasons, especially late fall and early winter. Most common in the canyon bottom and on north-facing slopes; absent from the surrounding desert. *F 84-92; Starr 205.*

Variety *subglabrata*, described from "near Guaymas," is of doubtful significance (Tom Daniel, personal communication, 1985).

Justicia sonorae Wassh. Herbaceous perennial 0.5–1.2 m with wiry stems. Flowers showy, the corollas lavender with white nectar-guide streaks on the lip; mass flowering in March. One small colony in the canyon bottom. *F 85-366, 85-1301.*

Occurs also on Cerro Tetas de Cabra at nearby Bahía San Carlos. Previously known only from southern Arizona and northernmost Sonora in riparian oak woodland and the upper margins of the desert (Daniel 1984). It thrives under cultivation in southern Arizona, and although attractive it tends to become weedy. In cultivation it flowers profusely in spring and mid-fall, sometimes through the winter in warm, protected habitats. The winter–fall flowers are often cleistogamous.

Ruellia californica (Rose) I. M. Johnst. *Rama parda*; *hupa chumi* "skunk ass" (Yaqui). Scarcely woody shrub 1–1.5 m. Leaves strong-smelling, noticeably glandular-sticky, tardily drought deciduous. Corollas lavender, rarely white; various seasons. Mostly in open, exposed habitats and dryer areas on canyon slopes and near the canyon bottom; locally abundant. *F 11954; Gallagher 273* (ASU); *Starr 713.*

Tetramerium nervosum Nees [*T. hispidum* Nees]. Herbaceous perennial. Corollas cream and lavender, falling with mid-morning heat; generally flowers during hot weather, especially after rains. Often beneath shrubs; canyon bottom and north-facing slopes. *F 84-90, 85-1222.*

AMARANTHACEAE—Amaranth Family

1. Annuals.
  2. Leaves alternate, green or red-green, glabrous or with short simple hairs, the surfaces clearly visible; flowers unisexual. ..... *Amaranthus*
  2′ Leaves mostly opposite, densely white-woolly with branched hairs usually obscuring the surfaces; flowers bisexual ..... *Tidestromia*

1′ Perennials.
  3. Herbaceous; perianth firm and tubular ..... *Froelichia*
  3′ Shrubs; perianth soft, not tubular, the segments separate. ..... *Iresine*

Amaranthus

1. Monoecious; herbage glabrous; inflorescences "soft," the bracts not prickly; pistillate sepals fringed; stamens 3 ..... *A. fimbriatus*

1′ Dioecious; herbage glandular pubescent; inflorescence bracts rigid, often sharp and prickly; pistillate sepals not fringed; stamens 5 ..... *A. watsonii*

Amaranthus fimbriatus (Torr.) Benth. *Bledo*, *quelitillo*; fringed amaranth; *wee'e* (Yaqui). Hot-weather ephemeral, sometimes persisting until December or even spring. Flowers green and white. Canyon bottom, mostly in open habitats, sometimes on slopes and open nearby desert. *F 95-60.*

Amaranthus watsonii Standl. *Bledo*, *quelite*; careless weed, pigweed; *wee'e* (Yaqui). Nonseasonal ephemeral. Flowers green. Canyon bottom and lower slopes, mostly in areas grazed by cattle, and often abundant in the nearby open desert. Honeybees collect the pollen. *F 84-146, 94-861.*

Froelichia interrupta (L.) Moq. [*F. gracilis* (Hook.) Moq.]. Herbaceous perennial, probably short-lived, mostly growing and flowering with summer rains. Flowers inconspicuous, nearly hidden in woolly bracts. Not common; rock crevices and ledges on north-facing slopes and rarely along the canyon bottom. *Bertelsen 92-155; F 85-1320.*

Froelichia gracilis is distinguished only by its annual habit. Distinctions of the related taxa are based on minor and apparently unreliable characters (James Henrickson, personal communication, 1994).

Iresine

1. Leaves mostly alternate; sepals glabrous or sparsely pubescent ..... *I. alternifolia*

1′ Leaves opposite; sepals usually woolly ..... *I. calea*

Iresine alternifolia S. Watson [*Dicraurus alternifolius* (S. Watson) Uline & A. Gray]. Shrub 1.5–2 m with slender stems. Leaves tardily drought deciduous, turning orange before falling.

Figure 5. *Vallesia laciniata*. Cultivated in Tucson, grown from seed from Cañón de Nacapule. Drawing by Kristen Jakobs.

Inflorescences and flowers white. Canyon bottom and north-facing slopes. *F 84-94*; *Starr 28*.

Alternate leaves usually distinguish this species from *I. calea*; however, *I. alternifolia* may have opposite as well as alternate leaves, even on the upper branches. The leaves of *I. alternifolia* are usually smaller and with rounded tips, while those of *I. calea* are larger and pointed. *I. alternifolia* in the Guaymas region tends to have more elongated and more slender inflorescences and larger leaves than in Baja California Sur.

Iresine calea (Ibañez) Standl. Shrub 1.5–2 m. Inflorescence and flowers white. Canyon bottom and north-facing slopes; not rare but not as common as *I. alternifolia*. *F 84-172*; *Steinmann 13 Mar 1992*.

Iresine calea cannot always be readily separated from *I. hartmanii* Uline of northwestern Mexico, and they might not be worthy of differentiation at the species level.

Tidestromia lanuginosa (Nutt.) Standl. *Hierba ceniza*; honeysweet. Hot-weather ephemeral. Flowers minute, yellow. Seasonally abundant in open, xeric habitats such as the arroyo bed near the canyon entrance, south-facing slopes, and nearby open desert. *F 85-1123*.

APOCYNACEAE—Dogbane Family

1. Shrubs usually >1 m; fruits fleshy, indehiscent ..... *Vallesia*
1′ Suffrutescent perennials or shrubs generally <1 m; fruits dry, dehiscent.
  2. Suffrutescent perennials; leaves often alternate, the blades thin; flowers bright yellow, the floral tube ca. 1 cm; capsules 2.0–2.5 mm in width; seeds with a tuft of hair at both ends ..... *Haplophyton*
  2′ Small woody shrubs; leaves opposite, the blades rather thick; flowers white, the floral tube 6.5–12 cm; capsules >5 mm in width; seeds with a tuft of hair at one end only ..... *Telosiphonia*

Haplophyton cimicidum A. DC. var. ***cimicidum***. *Hierba de la cucaŕacha*; cockroach plant. Herbaceous perennial. Leaves drought deciduous. Flowering mostly during warmer months. Canyon bottom, slopes, and floodplain and hills near the canyon entrance. *F 84-122*; *Starr 25*.

Telosiphonia nacapulensis Felger & Henrickson, Aliso 14:194, 1996. Shrub to 1 m, the branches divaricate, rigid, and woody. Leaves tardily drought deciduous. Flowers white and showy, often 3–5 cm wide, fragrant, mostly opening in the late afternoon and fading the following morning; flowering more or less throughout the summer rainy season. Fairly common on open rocky slopes, ledges, and cliffs at various exposures. *F 85-830* (holotype, ARIZ; isotypes, GH, MEXU, NY, TEX), *F 85-869*, *92-1034*.

Occurs in the Sierra El Aguaje, from the vicinity of Bahía San Carlos and Nacapule northward to Bahía San Pedro, and in the Sierra Libre. Its closest relative seems to be *T. brachysiphon* (Torr.) Henrickson [*Macrosiphonia brachysiphon* (Torr.) A. Gray], a herbaceous perennial of northern Sonora, Chihuahua, Arizona, and New Mexico (Henrickson 1996).

Vallesia
1. Leaves 3.3–8 cm; stipules 1.3–1.5 mm, the margins nearly entire; corolla tube 3.6–4.3 mm ..... *V. glabra*
1′ Leaves 5-12 cm; stipules 1.5–3.0 mm, the margins laciniate; corolla tube 9.5–10.5 mm ..... *V. laciniata*

Vallesia glabra Cav. *Citabaro*, *huevito*; *sita'avao* (Yaqui). Shrub to 2.5 m, essentially evergreen. Flowers white; various seasons. Rare, with several widely scattered young plants in areas of cattle grazing in the arroyo below the canyon entrance and at the spring. It has spread into the canyon area within about the last decade, apparently as a result of cattle grazing. Common in nearby areas of San Carlos and Guaymas. *F 95-43*, *95-60*.

Vallesia glabra can be distinguished from *V. laciniata* by its smaller and shinier leaves and smaller flowers. The two species do not grow intermixed.

Vallesia laciniata Brandegee [*V. baileyana* Woodson, Ann. Mo. Bot. Gard. 24: 14, 1937]. Fig. 5. Nacapule jasmine. Shrub to 3–4 m, with multiple stems, the branches flexible, with age becoming woody especially near the base. Leaves essentially evergreen, alternate, the blades 4.4–11.3 × 1.3–2.7 cm, lanceolate, the upper surfaces glabrous or minutely puberulent, especially along the midrib, the lower surfaces short-pubescent, the petioles 5–10 mm, relatively thick; stipules triangular, laciniate, yellowish, soon becoming brown.

Inflorescences subumbellate, often of two short dichotomous branches, the clusters often 4–6 cm across, each with 10–25 flowers. Peduncles 12.5–23.5 mm, erect, firm, with minute scales. Flowers with strong gardenia-like fragrance day and night, the nectar sweet-tasting. Each flower subtended by scales resembling the stipules. Calyx green, the tube swollen, 0.8–1.0 mm, the lobes triangular-acute, 0.8–1.2 mm. Corolla tube at first green, becoming white during or just after anthesis, 10.0–10.5 mm, narrowed to 0.8–1.5 mm wide below, conspicuously swollen above to 2.5–2.7 mm wide, the tube wall thickened here to 0.3 mm thick, the tube constricted to 2.0 mm in width at apex of throat. Corollas otherwise pure white, fading yellowish when dried, with a star-shaped slightly thickened callus of white glistening and erect hairs surrounding the throat orifice, the lobes spreading, each 7–7.5 mm, the margins inrolled above. Anthers yellow, 1.4–1.6 mm, tapered above, the filaments shorter than anthers, the stamens inserted on throat of corolla tube. Style 6 mm, whitish below, the stigma green, 1.3–1.4 mm, cylindrical and thick, enveloped in a clear jellylike substance, notched above. Flowering any time of year, often profusely March–April. Fruits paired or one fails to develop, one-seeded drupes 10–13 mm, the pericarp fleshy, translucent whitish to whitish pink. Seeds (9) 10–12 mm, oblanceolate, white, and bony, the surfaces with a raised dendritic–reticulate pattern.

Locally dense along the canyon bottom and in pockets of dense brushy vegetation on the lower north-facing slopes; essentially restricted to the winter-shaded portion of the canyon. *Bailey s.n.*, 30 Mar 1934 (type of *V. baileyana*, MO, not seen); *F 84-110*; *Gentry 19880*; *Van Devender 84-255*.

The fruits are eaten by coyotes and other animals, and the seeds seen in their scat along the canyon-bottom trail and trails leading out of the canyon. Seed-grown plants are cultivated to a limited extent in Tucson gardens but are sensitive to freezing temperatures. *Vallesia laciniata* can also be propagated by cuttings in a greenhouse mist-bench with bottom heat. The luxuriant foliage and spectacularly sweet-scented flowers make it worthy of extensive cultivation in Sonora and other arid and semi-arid tropical regions.

Vallesia laciniata was previously known only from Cañón de Nacapule, but recently I found scattered plants in Cañón las Barajitas and at Los Anegados on the seaward side of the Sierra El Aguaje. Apparently it also occurs in the Sierra Libre (Alberto Búrquez, personal communication, 1996). Williams (1996) suggested that *V. baileyana* may be a synonym of *V. laciniata*, described from Baja California Sur. I agree, although *V. laciniata* tends to have more conspicuously pubescent herbage. Williams also suggested that *V. conzattii* Standl. might be another synonym of *V. laciniata*, thus giving it a rather wide distribution in mainland Mexico. Woodson (1937) mentioned affinities with *V. flexuosa* Woodson of Costa Rica and *V. montana* Urban of Hispaniola.

ARISTOLOCHIACEAE—Birthwort Family

Aristolochia watsonii Woot. & Standl. [*A. brevipes* Benth. var. *acuminata* S. Watson; *A. porphyrophylla* Pfeifer]. *Hierba del indio*; Indian root; *bwasubwila* (Yaqui). Drought-deciduous herbaceous perennial from a thickened tuberous root. Stems sprawling or short-vining. Flowering with warm weather. Canyon bottom and slopes and rock crevices on north-facing canyon wall. *F 85-239*; *Starr 213*.

ASCLEPIADACEAE—Milkweed Family

1. Stems not vining ..... *Asclepias*
1′ Vines with the stems twining, at least at the tips.
  2. Leaves linear to lanceolate, more than twice as long as wide, the margins often revolute.
    3. Stems with a longitudinal line of usually curved hairs; flowers 4 mm, the inner petal surfaces obscured by hairs. ..... *Metastelma*
    3′ Stems essentially glabrous or sparsely pubescent with scattered straight hairs; flowers >5 mm, the petal surfaces readily visible ..... *Sarcostemma*
  2′ Leaf blades broadly ovate to cordate, less than twice as long as wide, the margins not revolute.
    4. Herbage essentially glabrous; leaves cordate at base;

fruits at least 2 cm in diameter, tough and leathery to hard-shelled ..... *Marsdenia*

4′ Herbage conspicuously pubescent; leaves rounded to obtuse at base; fruits to 1.5 cm in diameter, soft-walled. ..... *Matelea*

Asclepias—Milkweed

1. Flowers 8-10 mm ..... *A. leptopus*
1′ Flowers >15 mm ..... *A. subulata*

Asclepias leptopus I. M. Johnst. Cliff milkweed. Suffrutescent perennial, much smaller than *A. subulata*. Stems very slender, ascending to upright and drooping during drought. Leaves few, filiform, and quickly deciduous. Flowers white and green; various seasons. Rock crevices, mostly on north-facing canyon walls but also on arid, exposed rock faces. Larvae of *Danaus gillipus strigosus* feed on the herbage, and the butterflies visit the flowers. *F 84-147*; 12 Oct 1897, *Palmer 256* [ARIZ, DS, UC, US; the labels on the DS and UC specimens read "Guaymas," while the ARIZ and US specimens are labeled "near Nacapuly, 15 miles west of Guaymas." Also see Johnston (1924:1127) and McVaugh (1956)].

Asclepias subulata Decne. *Mata candelilla*, *yamate*; reed-stem milkweed. Perennial with many semi-succulent erect stems. Leaves few, filiform, and quickly deciduous. Flowers cream-white; various seasons; visited by large orange-winged tarantula-hawk wasps (*Pepsis*). Widely scattered on open desert near canyon mouth. *F 94-858*.

Marsdenia edulis S. Watson. *Talayote*. Large perennial vine, the base often woody with winged corky bark; leaves tardily drought deciduous. Flowers white with pale pink; at least following summer rains. Fruits 8–10 cm, ellipsoid and green. Canyon bottom and mostly north-facing slopes. *F 85-866*.

Matelea cordifolia (A. Gray) Woodson. *Talayote*. Perennial, often growing through shrubs and trees with drought-deciduous broadly ovate pale green leaves, foul smelling when bruised or crushed. Flowers cream color with a green corona. Herbage, flowers, and fruits produced at various seasons following rainy periods. Mainly canyon bottom and north-facing slopes; less common on south-facing slopes. *F 84-621*; *Phillips 75-142*.

Metastelma arizonicum A. Gray [*Cynanchum arizonicum* (A. Gray) Shinners; *Metastelma watsonianum* Standl.; *M. albiflorum* S. Watson, 1889, not *M. albiflorum* Griseb., 1861]. Small perennial vine growing in shrubs; leaves tardily drought deciduous, narrow and dark green with revolute margins. Flowers 3–4 mm, green except densely white villous on the inner surface of the corolla lobes. The hairs point downward and toward the center of the flower. A small insect attracted to the flower is thus directed toward the center, and the downward-pointing hairs prevent its access elsewhere. Flowering during warmer months. Scattered on canyon slopes. *F 85-560*.

Sarcostemma cynanchoides Decne. subsp. ***hartwegii*** (Vail) R. W. Holm. *Guirote*; climbing milkweed; *maso pipi* (Yaqui). Perennial vine. Flowers maroon-purple and white; any season. Canyon bottom and arroyos in nearby open desert. *F 84-123*.

ASTERACEAE (COMPOSITAE)—Composite or Daisy Family

1. Perennials; stems semi-succulent, the leaves succulent ..... *Hofmeisteria*

1′ Annuals or perennials; not succulent.

2. Annuals; sap milky; florets all conspicuous and similar in shape (inner florets often smaller), ligulate (ligules 5-lobed, strap-shaped), and bisexual.

3. Achenes (cypselas) beaked, the beak slender like a wire and about as long as or longer than the achene body ..... *Lactuca*

3′ Achenes not beaked (sometimes narrowed to a neck but the neck not slender like a wire and much shorter than the achene body ..... *Sonchus*

2′ Annuals or perennials; sap not milky; florets not all ligulate, the heads with (1) both ray florets (with a strap-shaped, 3-lobed corolla, and pistillate or sterile) and disk florets (with a tubular, 5-toothed corolla, and usually bisexual), or (2) only disk or disklike florets, the corollas showy to reduced or lacking, or (3) bilabiate (two-lipped) florets only.

4. Leaf bases persistent on stems as short, blunt projections; heads of bilabiate florets only; achenes expanded at apex into a disk bearing numerous pappus bristles. ..... *Trixis*

4′ Leaf bases not persistent as above; heads with ray and disk florets, or only disk or disklike florets, these not bilabiate; achenes various.

5. Heads with both ray and disk florets, the rays usually obvious (taxa with small, inconspicuous, or early-deciduous rays will key out in either choice; if in doubt, best to go to 5′).

6. Pappus none.

7. Leaves alternate.

8. Plants annuals or short-lived herbaceous perennials; leaves dissected; rays white with dark longitudinal lines ..... *Coreocarpus*

8′ Plants shrubby or subshrubby; leaves entire; rays yellow.

9. Herbage not viscid; leaves ovate; rays >10 mm ..... *Encelia*

9′ Herbage viscid-sticky; leaves linear; rays <3 mm ..... *Gymnosperma*

7′ Leaves opposite.

10. Rays white, minute, and not persistent ..... *Eclipta*

10′ Ray yellow, fading greenish, showy, and persistent ..... *Heliopsis*

6′ Pappus present, at least on disk achenes.

11. Plants glabrous and dotted with prominent oil glands, pungently aromatic.

12. Leaves deeply divided; rays white ..... *Thymophylla*

12′ Leaves entire but some with basal bristles; all flowers yellow.

13. Annuals; leaves with prominent bristles at base ..... *Pectis*

13′ Perennials; leaves without bristles ..... *Porophyllum*

11′ Plants pubescent or nearly glabrous, not dotted with oil glands and not pungently aromatic.

14. Plants glabrous except woolly tufts at leaf bases and axils; pappus of many long soft white hairs ..... *Senecio lemmonii*

14′ Herbage pubescent throughout; pappus of scales and sometimes also bearing 1 or 2 awns or bristles.

15. Annual or perennial herbs; leaves palmately lobed and coarsely toothed; florets without chaffy bracts ..... *Perityle*

15′ Perennials, herbaceous or shrubby; leaves entire to minutely toothed; disk florets subtended by chaffy bracts, these enclosing the achenes and falling with them ..... *Viguiera*

5′ Heads of disk florets only, outer florets without an

obvious ligule or ray, or if ray florets present then inconspicuous or reduced, or lacking a well-developed ligule (if in doubt about presence of rays then take this choice).
16. Heads unisexual, the pistillate florets in a bur ..... *Ambrosia*
16′ Heads not unisexual; none of the florets in burs.
17. Annuals; leaves sessile or nearly so, the margins entire or nearly so; florets minute, inconspicuous, and dull-colored (rarely reddish on tips); achenes 1 mm or less.
18. Majority of bracts of head partially or completely enclosing a floret; outer several florets without pappus ..... *Filago*
18′ Majority of bracts of head not directly associated with florets; all florets with pappus.
19. Plants sparsely pubescent, not at all woolly; leaves with a few shallow teeth. ..... *Conyza*
19′ Plants densely white-woolly; leaves entire ..... *Gnaphalium*
17′ Annuals and perennials; leaves sessile or not, the margins entire or not; florets small or medium-sized, often colorful, greenish, yellow, white, or pink; achenes 2 mm or more, or if smaller then perennials.
20. Annuals or perennials; pappus none.
21. Herbs, mostly annuals, not viscid-sticky; leaves opposite; outer florets white, the central ones yellow ..... *Eclipta*
21′ Perennials, shrubs or subshrubs with viscid-sticky herbage; leaves alternate; all florets yellow ..... *Gymnosperma*
20′ Perennials, pappus present.
22. Stems conspicuously winged.
23. Leaves alternate, soft-pubescent and glandular, the margins finely toothed; flowers pink ..... *Pluchea*
23′ Leaves opposite, densely scabrous-hispid, the margins coarsely lobed and toothed; flowers yellow ..... *Verbesina*
22′ Stems not winged.
24. Heads unisexual; vegetative parts (herbage and phyllaries) resinous-glutinous and aromatic; flowers dull white ..... *Baccharis*
24′ Heads bisexual; herbage and phyllaries not resinous-glutinous.
25. Many-stemmed perennial bushes; pappus of plumose bristles ..... *Bebbia*
25′ Annuals or perennials; pappus not plumose.
26. Pappus of uniform, slender, capillary bristles.
27. Heads clearly multiple-flowered and on separate peduncles; dull flowers yellow-green ..... *Brickellia*
27′ "Heads" actually a globose collection of small single-flowered heads; flowers bright yellow ..... *Lagascea*
26′ Pappus with scales or broad bristles in addition to slender bristles.
28. Leaves entire or nearly so, the petioles shorter than the leaf blades; heads 4 mm. *Eupatorium*
28′ Leaf margins crenate to toothed, the petioles mostly longer than the leaf blades; heads 8–10 mm ..... *Pleurocoronis*

Ambrosia
1. Herbaceous perennials, the stems dying back to the ground after fruiting; leaves 1- to 3-times pinnately divided ..... *A. confertiflora*
1′ Bushy or shrubby, the stems more or less perennial; leaves crenate to shallowly lobed.
2. Leaf blades elongate-triangular, longer than wide ..... *A. ambrosioides*
2′ Leaf blades ovate-cordate, about as wide or wider than long. ..... *A. cordifolia*

Ambrosia ambrosioides (Cav.) W. W. Payne [*Franseria ambrosioides* Cav.]. *Chicura*; canyon ragweed; *hiowe* (Yaqui). Shrub 1.5–2 m with many slender stems. Leaves partially evergreen but reduced in size and number during drought, the blades usually with insect damage and studded with insect galls. Flowers in spring. Infrequent along the canyon floor and the open desert; more numerous in nearby arroyos. *F 94-861*; *Gentry 19879*.

Ambrosia confertiflora DC. *Estafiate*; slim-leaf ragweed; *chichivo* (Yaqui). One colony ca. 1 m across, adjacent to *Coccoloba goldmanii* and *Vallesia laciniata* in disturbed areas at edge of road; not seen elsewhere in the canyon. This weedy plant was first found in the canyon in 1992. *F 92-1021*.

Ambrosia cordifolia (A. Gray) W. W. Payne [*Franseria cordifolia* A. Gray]. Bushy perennial ca. 1 m. Growing and flowering with cool-season rains, and essentially leafless during the summer. Canyon floor and north-facing slopes; not common. *F 11990*, *95-7*.

Baccharis sarothroides A. Gray. *Romerillo*; desert broom; *heeko*, *heko* (Yaqui). Broomlike shrub, several plants to 2 m, mostly much smaller; flowers cream-white. Scattered along the canyon bottom in open, grazed, and disturbed areas. First seen in the canyon in 1985. *F 92-1038*, *94-873*.

Bebbia juncea (Benth.) Greene var. ***aspera*** Greene. *Hierba ceniza*; sweetbush; *maso kuta* (Yaqui). Suffrutescent bushy perennial, often 1–1.5 m. Leaves usually sparse and quickly drought deciduous. Flowers yellow, fragrant; almost any time of the year. South-facing slopes and the nearby open desert. *F 85-569*.

Brickellia
1. Leaf margins coarsely toothed; outer phyllaries ca. 1.0 mm wide; achenes (3.0) 3.5–4.0 mm ..... *B. coulteri*
1′ Leaf margins blunt-toothed to scalloped; outer phyllaries 1.2–1.4 mm wide; achenes 2.2–2.9 mm ..... *B. rhomboidea*

Brickellia coulteri A. Gray var. ***coulteri***. Shrub 1–2 m with slender brittle stems. Leaves gradually drought deciduous. Flowers rather inconspicuous, yellow-green and purple; nonseasonal. Canyon bottom and slopes and nearby open desert. *F 84-151*; *Van Devender 28 Dec 1982*.

Brickellia rhomboidea Greene, 1890 [*B. floribunda* A. Gray]. Sprawling shrub 1.5-2+ m across, scarcely woody at the base and with whitish stems. Leaves nearly evergreen or perhaps deciduous in extreme drought, highly variable in size and shape. Phyllaries green, the flowers yellow-green; flowering at various seasons. Distinguished from *B. coulteri* by its thicker stems and larger, broader, thicker, generally more obtuse leaves with smaller, shallower, and blunter marginal teeth, less glandular, broader (espe-

cially the outer) phyllaries, and smaller achenes with denser and longer hairs.

Several colonies along the canyon bottom and at a shaded seep on a north-facing rock face near the upper end of the canyon. Known from the Guaymas region. *F 84-151, 84-582, 85-1307.*

Brickellia macromera B. L. Rob., 1917, of the eastern side of Baja California Sur is perhaps not distinct from *B. rhomboidea*. The differences in leaf character given by Wiggins (1964) do not hold up. However, there are differences in achene size: *B. macromera* achenes are ca. 3.6 mm, while those of *B. rhomboidea* are ca. 3.0 mm. *B. rhomboidea* also seems very closely related to and perhaps conspecific with *B. brandegei* B. L. Rob., 1917, from Baja California Sur, southwestern Sonora, and northwestern Sinaloa. *B. rhomboidea* is distinguished from *B. brandegei* by its smaller heads and achenes.

Conyza canadensis** (L.) Cronquist var. ***glabrata (A. Gray) Cronquist. *Cola de caballo*; horseweed. Warm-weather annual. Flowers white, inconspicuous; fall. First found in the canyon in 1985 as one colony in wet soil in the bottom of the upper part of the canyon in an area heavily grazed by cattle. *F 85-1300.*

Coreocarpus sonoranus Sherff. Ephemeral to short-lived perennial. Leaves drought deciduous, thin to sometimes semi-succulent. Rays white with dark purple lines, the disk yellow; apparently nonseasonal depending on soil moisture. Canyon bottom, often in shade. *F 84-604, 92-1037.*

***Eclipta prostrata** (L.) L. [*E. alba* (L.) Hassk.]. *Chile de agua*; false daisy. Nonseasonal ephemeral. Flowers white; more or less continuously during warm weather. Wet soil in the canyon floor in the vicinity of *Ficus insipida* and *Washingtonia*. *F 84-153*; *Phillips 75-172.*

Encelia farinosa A. Gray var. ***farinosa***. *Incienso, rama blanca*; brittlebush; *toroko huya, kopal ouwo* (Yaqui). Small shrub; rays and disk yellow; spring and with summer or fall rains. Abundant in the open desert and on drier exposed slopes. *F 95-106.*

Eupatorium solidaginifolium A. Gray. Suffrutescent perennial. Leaves nearly evergreen. Flowers whitish, inconspicuous. Shaded north-facing slopes near the canyon floor and occasionally among dense vegetation in shaded areas of the canyon floor. Widespread in western Mexico and southwestern United States. In the San Carlos–Guaymas region I have found it only at Nacapule and on Cerro Tetas de Cabra. *F 11996, 85-863.*

Filago californica Nutt. California fluffweed. Small slender white-woolly winter–spring ephemeral. Open desert habitats near the canyon mouth and open areas along the canyon bottom. *F 85-244A.*

Gnaphalium sphacilatum Kunth [*G. pedunculosum* I. M. Johnst.]. Small densely white-woolly winter–spring annual. Canyon bottom, especially near the entrance; apparently uncommon. *F 85-244B.*

Gymnosperma glutinosum (Spreng.) Less. [*Selloa glutinosa* Spreng.]. Annual or suffrutescent perennial; herbage sticky-glutinous, the flowers yellow. Locally rare; canyon bottom near *Washingtonia* and *Ficus insipida* trees in areas heavily grazed by cattle. First seen in the canyon in 1992. *F 92-1029.*

Heliopsis anomala (M. E. Jones) B. L. Turner [*H. rubra* T. R. Fisher; *H. parvifolia* A. Gray var. *rubra* (T. R. Fisher) B. L. Turner]. Winter–spring annual to short-lived perennial. Flower heads solitary on long peduncles, the flowers bright yellow; November–April. Scattered along the canyon floodplain; seldom common. *F 95-5.*

Hofmeisteria crassifolia S. Watson. Small globose perennial with succulent leaves and stems. Nearly evergreen but leaves reduced in size and number during drought. Flower heads solitary on long stalks, the rays lavender-pink, the disks white; at least February–April and October. Rock crevices, mostly on north-facing cliffs. *Burgess 6379*; *Van Devender 84-254.*

***Lactuca serriola** L. Prickly lettuce, compass plant. Annual, germinating in late winter or spring, flowering in late spring. Flowers pale yellow. Rare; first found in 1995, along the road in the canyon bottom. *F 95-119.*

Lagascea decipiens Hemsl. var. ***glandulosa*** (Fern.) Stuessy. Shrub 1.5–2.5 m. Leaves tardily drought deciduous. Flowers bright yellow; nonseasonal except in extreme drought. Mostly along the canyon bottom and north-facing slopes. *F 84-161, Phillips 75-167.*

Pectis rusbyi A. Gray [*P. palmeri* S. Watson]. *Manzanilla del campo*; *wo'i si'iya* (Yaqui). Summer–fall ephemeral with pungently aromatic herbage. Flowers bright yellow. Canyon floor near the entrance and the open desert. One of the most abundant summer wildflowers in the region. *Burgess 6530.*

Perityle

1. Rays white, the disk flowers yellow ..... *P. emoryi*
1′ Ray and disk flowers bright yellow.
  2. Annuals; rays <5 mm ..... *P. californica*
  2′ Perennials from a woody base and also flowering in first season; rays at least 7 mm ..... *P. leptoglossa*

Perityle californica Benth. *Mansaniata saila* (Yaqui). Cool-weather ephemeral. Canyon bottom, slopes, and open desert; often seasonally abundant. *F 84-111, 85-555.*

Perityle emoryi Torr. Desert rock daisy. Spring ephemeral. Canyon bottom near entrance. *F 85-584B.*

Perityle leptoglossa Harv. & A. Gray subsp. ***palmeri*** (S. Watson) Felger & Lowe [*P. palmeri* S. Watson]. Herbaceous perennial, also flowering in the first season. Flowering response apparently nonseasonal, at least during the cooler months, late spring, and fall. Steep rocky slopes, crevices on north- and east-facing cliffs, and on large rocks in the canyon bottom. *F 85-262.*

Pleurocoronis laphamioides (Rose) R. M. King & H. Rob. [*Hofmeisteria laphamioides* Rose]. Perennial subshrub, subglobose, ca. 80 cm across, the leaves semi-succulent, ultimately drought deciduous. Flowers white to pale yellow with purple stigmas; various seasons. North-facing rock walls of canyon. *F 92-1053, 94-856.*

Pluchea salicifolia (Mill.) S. F. Blake [*P. adnata* Willd.; *P. parvifolia* (A. Gray) Godfrey; *P. adnata* var. *parvifolia* (A. Gray) S. F. Blake; *P. salicifolia* var. *parvifolia* (A. Gray) S. F. Blake; *P. subdecurrens* Cass. var. *parvifolia* A. Gray; *P. subdecurrens* var. *canescens* A. Gray]. Sprawling shrub to 2 × 3 m. Stems brittle and winged from decurrent, sessile leaves, the leaves evergreen or nearly so and pungently aromatic. Flowers pink, the florets ca. 200+ per head; flowering in warmer months. A vigorous but highly localized population of several dozen shrubs in the upper reaches of the canyon at seeps and along the streambed beneath *Washingtonia* palms. *F 84-144, 84-583.* Not known elsewhere within the Sonoran Desert in Sonora. It occurs in subtropical regions of Baja California Sur and from southern Sonora to Guatemala.

Pluchea adnata var. *parvifolia* was previously considered endemic to Baja California Sur. Godfrey (1952) treated *P. parvifolia* as a species distinct from *P. salicifolia*. I cannot distinguish Nacapule specimens from those of Baja California Sur and believe them to be

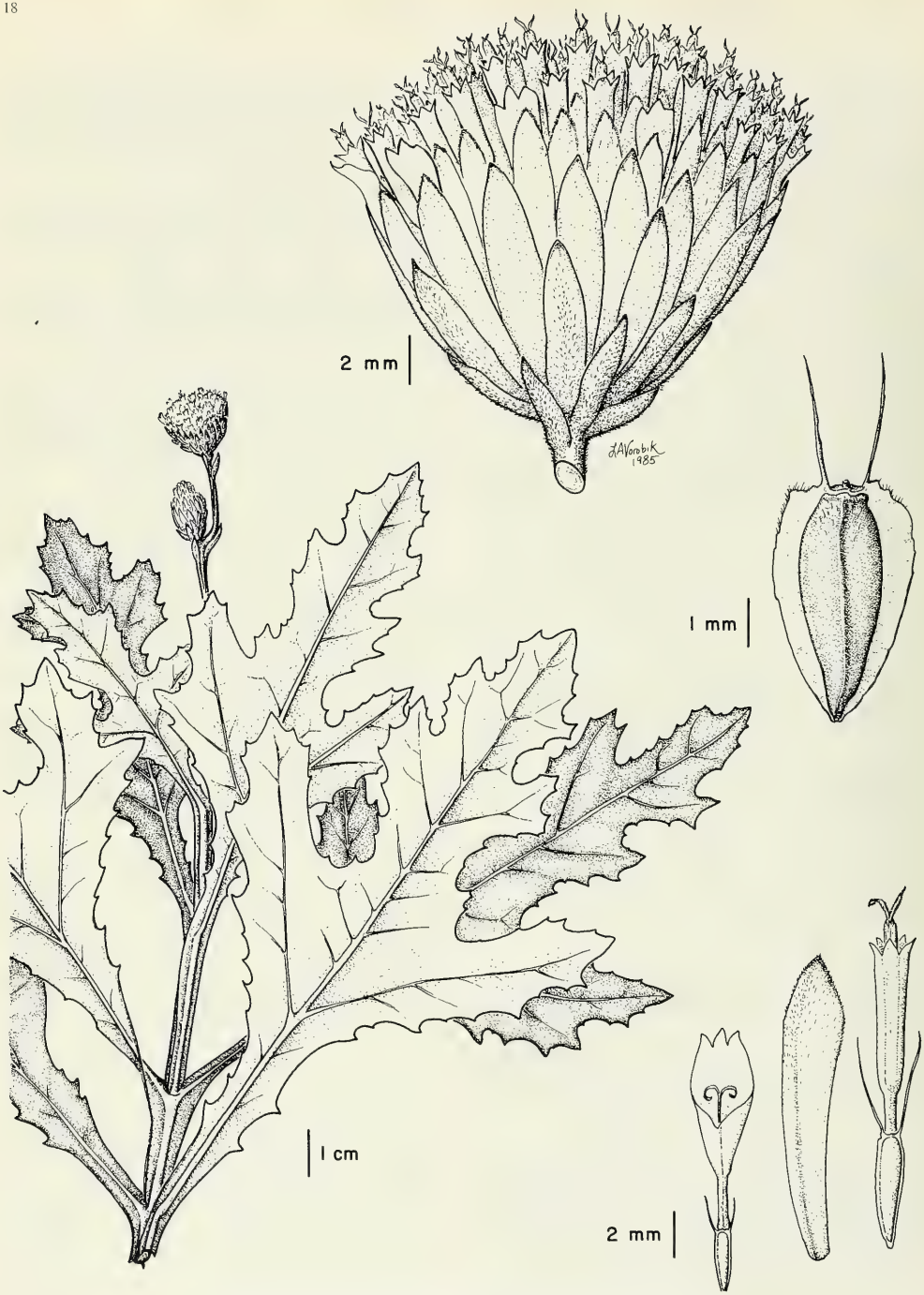

Figure 6. *Verbesina felgeri*. Drawing from holotype by Linda Vorobick (from Turner 1985).

conspecific with *P. salicifolia*. Reported differences, including size of the heads, did not hold up when I examined a suite of specimens larger than was available to Godfrey.

Porophyllum pausodynum B. L. Rob. & Greenm. [*P. brachypodum* B. L. Rob.]. *Maso kuta* (Yaqui). Short-lived perennial often ca. 1 m, with the pungent aroma characteristic of the genus. Leaves tardily drought deciduous. Flowers yellow; apparently nonseasonal. Rock crevices, often on north-facing slopes. *F 84-108*, *85-563*.

Senecio lemmonii A. Gray. Lemmon groundsel. Winter–spring ephemeral. Leaves thin. Flowers bright yellow. Rare, in the canyon bottom mostly in shade. *F 84-579*, *85-263*.

****Sonchus oleraceus*** L. *Chinita*; common sow-thistle; *korai* (Yaqui). Winter–spring ephemeral. Flowers pale yellow. Scattered along the canyon bottom. A common weed in the region. *F 85-253*, *Van Devender 84-242*.

Thymophylla concinna (A. Gray) Strother [*Dyssodia concinna* (A. Gray) B. L. Rob.]. *Manzanilla del coyote*; *wo'i si'iya* (Yaqui). Winter–spring ephemeral dotted with small oil glands and pungently aromatic. Rays white, the disk yellow. Mostly on sandy or gravelly soils; canyon entrance, nearby south-facing slopes, and the open desert.

Trixis californica Kellogg var. ***californica***. Scarcely woody bushy perennial. Flowers yellow; nonseasonal but especially in spring. Common and widespread, mostly on slopes and in the surrounding desert. *F 85-571*, *85-859*.

Verbesina felgeri B. L. Turner, Phytologia 57:127, 1985. Fig. 6. Suffrutescent to shrubby perennial, probably short-lived, to ca. 1 m; eventually drought deciduous or dying back to near ground level in extreme drought. Flowers bright yellow; apparently at various seasons depending on soil moisture. Known only from Cañón de Nacapule and a second population recently discovered in Cañón los Anegados near Aguaje de Robinson in the middle of the Sierra El Aguaje (Alberto Búrquez, personal communication, 1997).

In 1984 I found less than one half dozen plants in the shade beneath dense canyon-bottom vegetation adjacent to the north-facing wall in the lower part of the canyon. Subsequently, during a wetter year, approximately 65 plants were located in the same area. Several plants were grown from cuttings from the type collection, and these propagated in cultivation from cuttings and seed. The plants have been distributed to botanic gardens and plant nurseries in southern Arizona and Sonora. According to Turner (1985), *V. felgeri* "has no strikingly close relatives" and is in the section *Pterophyton*, which is centered mostly in Jalisco and surrounding areas. *F 84-97* (TEX, holotype; isotypes: ARIZ, MEXU, RSA), *85-1125*, *85-1327*.

Viguiera dentata (Cav.) Spreng. var. ***dentata***. Straggly annual to short-lived herbaceous perennial; tardily drought deciduous. Flowers yellow. Locally rare in the canyon bottom in shade beneath trees and shrubs. *F 84-101*, *85-1224*.

I have not seen *V. dentata* elsewhere in the Guaymas region. It usually occurs as a robust many-flowered perennial outside the desert, as in tropical deciduous forest in southeastern Sonora and oak woodland in Sonora and Arizona.

BORAGINACEAE—Borage Family

1. Woody shrubs or small trees ..... *Cordia*
1. Herbaceous annuals or perennials.
   2. Fruits broadest below middle; calyx tightly enclosing the nutlets, the calyx lobes obviously longer than the mature nutlets; nutlets muricate and glabrous ..... *Cryptantha*
   2′ Fruits broadest at about middle; calyx not tightly enclosing the nutlets, the calyx lobes obviously shorter than the mature nutlets; nutlets pubescent ..... *Heliotropium*

Cordia

1. Leaves mostly <3 cm, rough-pubescent, the margins toothed. ..... *C. parvifolia*
1′ Leaves mostly >6 cm, glabrous or nearly so except petioles, the margins entire ..... *C. sonorae*

Cordia parvifolia A. DC. *Vara prieta*; littleleaf cordia; *wotovo* (Yaqui). Shrub often 1.5–2+ m with hardwood stems and dark bark; drought deciduous. Flowers white, showy, opening an hour or so after dawn and falling with mid-day or afternoon heat; mass flowering following rains at almost any time of year except midwinter. Canyon entrance and nearby open desert. *F 85-837*.

Cordia sonorae Rose. *Palo de asta*; *pomahe* (Yaqui). Large shrub to small tree 3–6 m; tardily drought deciduous. Flowers white; March–April. The fruits, not described previously, are one-seeded nutlets (the pericarp very thin, quickly drying), ripening in early summer, 6.0–7.0 × 3.9–4.2 mm, broadly ellipsoid, mottled tan and brown or red-brown, essentially smooth to faintly ribbed, minutely papillate, the dried style base forming an oblique, persistent knob at the fruit apex; fruit tightly held in the persistent calyx and corolla to form a parachutelike dissemination unit. Lower north-facing slopes. *Burgess 6378*; *Van Devender 84-249*.

Cryptantha

1. Nutlets heteromorphic, the odd nutlet largest .... *C. angustifolia*
1′ Nutlets homomorphic, the nutlets all similar ..... *C. grayi*

Cryptantha angustifolia (Torr.) Greene. Narrowleaf cryptantha, desert cryptantha. Winter–spring ephemeral. Inflorescence branches coiled, the flowers white; nutlets 4. Canyon bottom near entrance and nearby open desert. *F 85-237B*.

Cryptantha grayi (Vasey & Rose) J. F. Macbr. var. ***cryptochaeta*** (J. F. Macbr.) I. M. Johnst. Winter–spring ephemeral, generally smaller and more delicate than *C. angustifolia*. Inflorescence branches moderately coiled, the flowers minute, white; nutlets 4. Canyon bottom near entrance and nearby open desert. *F 85-237A*.

Heliotropium procumbens Miller. Annual or perhaps short-lived perennial. Flowers white. Canyon bottom. Locally rare; small first-season plants fruiting in October (elsewhere perennial but often flowering in the first season). *F 84-162*.

BRASSICACEAE (CRUCIFERAE)—Mustard Family

1. Herbage with dendritic (branched) hairs; fruits 3.5–12 mm ..... *Descurainia*
1′ Herbage glabrous or with simple hairs; fruits at least 20 mm.
   2. Petals white to lavender, at least 6 mm, conspicuously lobed. ..... *Dryopetalum*
   2′ Petals yellow, 3–4 mm, not lobed ..... *Sisymbrium*

Descurainia pinnata (Walter) Britton. Tansy mustard; *aasam*, *huya aasam* (Yaqui). Winter–spring ephemerals. Flowers minute, pale yellow. Mostly along canyon bottom in open areas and nearby open desert. *F 85-249*.

Dryopetalum runcinatum A. Gray var. ***laxiflorum*** Rollins. Winter–spring ephemeral, sometimes germinating in mid-October. Herbage glabrous or essentially so when shaded and well watered, generally hirsute with simple white hairs in harsher conditions. Flowers attractive, white or suffused with pink-purple; December–March. Canyon bottom and north-facing slopes. *F 85-242*; *Reina 95-155*; *Starr 207*.

Plants in the Guaymas region have been referred to *D. palmeri* (S. Watson) O. E. Schulz (Rollins 1941). I am unable to disinguish these specimens from *D. runcinatum* var. *laxiflorum*.

****Sisymbrium irio*** L. *Pamita*; London rocket; *wikit woki* (Yaqui). Winter–spring ephemeral. Common along the canyon bottom, especially in areas of cattle grazing. *F 85-265*.

BURSERACEAE—Torchwood Family

1. Bark not exfoliating or peeling; fruits bivalvate with a thin fleshy orange aril covering one-half to two-thirds of the blackish seed; leaves usually bipinnate (occasionally pinnate or tripinnate) ..... *B. laxiflora*
1′ Bark exfoliating in papery flakes or sheets especially during dry seasons; fruits trivalvate with a thin papery aril covering the light-colored seed; leaves once pinnate.
  2. Bark of twigs brown; leaflets lanceolate to elliptic, 15–60 mm × 3–10 mm, the margins irregularly toothed or sometimes entire ..... *B. fagaroides*
  2′ Bark of twigs reddish; leaflets mostly linear, 5–25 × 1–2.5 mm, the margins entire or occasionally with a few small lobes ..... *B. microphylla*

Bursera fagaroides (Kunth) Engelm. var. ***elongata*** McVaugh & Rzed. *Torote*; *tooro*, *saa tooro* (Yaqui). Small tree. Leaves present during summer rainy season and quickly shed in September. Flowers white, minute; early summer. Canyon slopes and open desert. Distinguished from *B. microphylla* by its larger leaves with larger, broader, and fewer leaflets. *Starr 215.*

Bursera laxiflora S. Watson. *Torote prieto*; *chukui tooro* (Yaqui). Large shrub or small tree, the bark red-brown. Leaves drought deciduous and fernlike, produced following rainfall at any season. Flowers and fruits on long slender pendulous peduncles. Flowers white, minute; August. Canyon bottom near entrance, slopes, and open desert. *F 85-843.*

Bursera microphylla A. Gray. *Torote*; elephant tree; *tooro*, *saa tooro* (Yaqui). Small tree or large shrub with fat semi-succulent limbs and trunk; sap and leaves highly aromatic. Leaves appearing at various seasons following rainfall. Flowers yellow-white, minute; summer. Common in open desert and on rocky, arid (especially south-facing) slopes. *F 92-1060*; *11978.*

CACTACEAE—Cactus Family

1. Columnar cacti, the stems mostly >1.5 m and with conspicuous ribs.
  2. Stems and spines not conspicuously dimorphic, the spines similar on juvenile (lower or sterile portion) and adult (upper or fertile portion) stems; areoles bearing tufts of red-brown glandular hairs, with an exudate producing dark red to blackish encrustations on the spines ..... *Stenocereus*
  2′ Stems and spines markedly dimorphic, the juvenile and adult stems markedly different (e.g., stem diameter, rib numbers, distance between areoles, spine lengths and morphology); areoles not producing dark exudate.
    3. Stem ribs 6–8; sterile (juvenile) stem parts with short, thick spines, the fertile (adult) stems parts with long, slender, twisted and often flattened spines, the areoles producing multiple flowers ..... *Lophocereus*
    3′ Stem ribs 12–25; fertile (adult) stems spineless or spines shorter than those of sterile (juvenile) stems and not obscuring the stem surfaces, the areoles one-flowered.
      4. Upper (fertile) growth with 19–25 ribs; areoles of adult stems close but not coalesced and with bristly spines; fruits spineless or nearly so ..... *Carnegiea*
      4′ Upper (fertile) growth with 12–15 ribs; areoles of adult stems coalesced, lacking spines or with short, stout spines; fruits densely spiny or with dense feltlike hairs. ..... *Pachycereus*
1′ Not columnar cacti; stems <1.5 m, or if as long or longer then constricted into many joints and without stem ribs; stem ribs present or not.
  5. Barrel cacti; stem thick and unbranched, >20 cm in diameter; spines stout; flowers and fruits spineless and hairless ..... *Ferocactus*
  5′ Growth forms various, but not barrel cacti; stems <15 cm in diameter; spines not stout; flowers and fruits spiny and pubescent or not.
    6. Chollas and prickly pears; stems constricted into joints or pads; areoles with glochids (small spines deciduous at a touch) in addition to larger, persistent spines ..... *Opuntia*
    6′ Not chollas or prickly pears; stems not constricted into joints or pads; glochids none (if spines small, then not readily deciduous).
      7. Stems <2 cm in diameter, conspicuously grooved, more than 20 times longer than wide; spines inconspicuous, 1–8 mm ..... *Peniocereus*
      7′ Stems >3 cm in diameter, not grooved, <6 times as long as wide; spines conspicuous, mostly >8 mm.
        8. Stems with ribs rather than tubercles, the spines straight; floral tube and fruits spiny ..... *Echinocereus*
        8′ Stems with conspicuous tubercles rather than ribs, each tubercle with a terminal spine-bearing areole, the central spine(s) sometimes hooked or curved; flowers and fruits without spines ..... *Mammillaria*

Carnegiea gigantea (Engelm.) Britton & Rose [*Cereus giganteus* Engelm.]. *Sahuaro*; saguaro; *sauvo* (Yaqui). Giant columnar cactus. Flowers white; early summer. Sparse, on south-facing slopes.

Echinocereus—Hedgehog cactus
1. Spines at least 3 cm ..... *E. engelmannii*
1′ Spines 1.5 cm or shorter ..... *E. scopulorum*

Echinocereus engelmannii (Engelm.) Rümpler subsp. ***llanuraensis*** (J. Rutow) Felger, comb. nov. [*Echinocereus nicholii* (L. D. Benson) B. D. Parfitt subsp. *llanuraensis* J. Rutow, Der Echinocereenfreund 8(3):61–70, 1995]. Guaymas hedgehog cactus. Plants cespitose, the stems several to many, ca. 15–20 cm, ca. 5 cm in diameter, often from short rhizomes. Spines moderately dense, bicolored, dull yellow to brown, white, or gray, fading (or remaining) gray with age, the central spines 4, the longer (lower) central spine 3.0–5.8 cm, twisted or straight, flattened or terete, the other spines terete. Flowers showy, 9.5 × 5–6 cm, the inner tepals magenta; flowering spring and again in summer. Open, usually sparsely vegetated rock slopes with shallow soil or exposed and often nearly barren rock on various exposures. *F 85-545.*

The type locality for this subspecies is given as "Guaymas." This hedgehog cactus is widespread in the San Carlos region and through the Sierra El Aguaje, on Cerro el Vígia at Guaymas, and also occurs on Sierra Libre.

Allan Zimmerman (personal communication, 1996) counted the chromosomes of plants from the Nacapule population and found them tetraploid, aligning them with the *E. engelmannii* complex of the southwestern United States and northwestern Mexico rather than with *E. nicholii* (see Parfitt 1987). Subspecies *llanuraensis* further shows affinity with the *E. engelmannii* complex by having dull grayish, often bicolored spines becoming (or remaining) gray with age and large showy flowers with bright deep magenta inner tepals. In contrast, *E. nicholii* has uniformly yellow spines often turning blackish with age and smaller, less showy flowers with pale pink inner tepals. *Echinocereus nicholii* occurs in southern Arizona and western Sonora south to the Sierra Seri (opposite Isla Tiburón); I do not know of it in the Sierra El Aguaje or the Sierra Libre.

Echinocereus scopulorum Britton & Rose [*E. pectinatus* (Scheidw.) Engelm. var. *scopulorum* (Britton & Rose) L.D. Benson]. Sonoran rainbow cactus. Stems solitary, the spines dull-colored, mostly 10–15 mm. Flowers large and showy, the perianth

bright pink fading to magenta; April and July–August. Fairly common on steep mostly south-facing sparsely vegetated rock slopes. *F 95-63*.

Ferocactus emoryi (Engelm.) Orcutt [*F. covillei* Britton & Rose]. *Biznaga*; barrel cactus; *ono'e* (Yaqui). Occasionally reaching 2 m in height. Spine clusters with stout spines only. Flowers yellow; August. Common on rocky slopes with various exposures and the nearby open desert. The Nacapule–San Carlos population has yellow flowers as in those from the Guaymas region southward, rather than red flowers as found north of the Guaymas region.

Lophocereus schottii (Engelm.) Britton & Rose var. ***schottii***. *Sinita*; senita; *museo* (Yaqui). Small columnar cactus. Flowers whitish to dull pink; warmer times of the year. Scattered on steep canyon slopes, some even on shaded north-facing cliffs; common at the canyon mouth and on the desert plain. *Parfitt 3037* (ASU), *n* = 11 (Pinkava et al. 1985).

The San Carlos–Guaymas region population, with 6–8 stem ribs, is morphologically and geographically intermediate between the northern var. *schottii* with thicker stems and 5–8 ribs and the southern var. *australis* (K. Brandegee) Borg with thinner stems and 6–10 ribs (Felger and Lowe 1967, Lindsay 1963).

Mammillaria—Fishhook or pincushion cactus

1. Stems globose, as broad or broader than wide, the spines straight or curved but not hooked; sap milky. ..... *M. johnstonii*
1′ Stems globose to taller than wide, the central spines hooked or straight; sap watery. ..... *M. swinglei*

Mammillaria johnstonii (Britton & Rose) Orcutt [*M. johnstonii* var. *sancarlosensis* R. T. Craig; *M. johnstonii* var. *guaymensis* R. T. Craig]. San Carlos pincushion cactus; *chikul aaki*, *chikul hu'i* (Yaqui). Stems globose, often broader than tall, solitary or clustering, a few larger plants at least 30 × 50 cm with 16 or more stems. Inner tepals cream to pink; summer. Rocky slopes with shallow soil on various exposures. The spine lengths are highly variable.

Mammillaria swinglei (Britton & Rose) Boed. [*M. inaiae* R. T. Craig]. *Cabeza de viejo*; fishhook cactus; *chikul aaki*, *chikul hu'i* (Yaqui). Stems solitary or with a few branches, usually taller than wide; central spine(s) may be hooked or straight, even on the same plant. Some plants have straight spines only. Inner tepals white to cream with a broad pale pink midstripe; various seasons but mostly following rains during warmer weather. Rocky slopes with various exposures, mostly on shallow soils, and nearby open desert. *F 95-62*.

Opuntia—Chollas and prickly pears

1. Prickly pears, the stem segments ("pads") flattened or compressed; surfaces relatively flat, not tuberculate; spines not sheathed ..... *O. gosseliniana*
1′ Chollas, the stem segments ("joints") more or less rounded in cross-section (cylindroid), often tuberculate; spines with papery sheaths at least when young.
   2. Stems green all year; fruits proliferating in perennial pendent chains of 3 or more fruits ..... *O. fulgida*
   2′ Stems often purple-brown in winter and dry seasons; fruits single, annual, not proliferating in pendent chains .... *O. versicolor*

Opuntia fulgida Engelm. var. ***fulgida***. *Cholla*; jumping cholla; *seve'e choa* (Yaqui). Flowers rose-pink; summer. Fruits green and fleshy. Locally rare; several widely scattered plants, <1 m, first recorded in early 1995 on open desert between the spring and canyon entrance and in arroyo below the canyon entrance. These plants seem to have been brought into the area by cattle; the species is common in nearby heavily grazed disturbed habitats in the San Carlos–Guaymas region.

Opuntia gosseliniana F. A. C. Weber [*O. violacea* Engelm. var. *gosseliniana* (F. A. C. Weber) L. D. Benson]. *Duraznillo*; purple prickly pear; *nakkaim*, *naavo* (Yaqui). Cladodes (pads) turning purplish during winter and early spring, probably in response to relatively cool nights and drought; spines 5.5–8.0 cm. Flowers bright yellow; March–April. Seedlings and juvenile plants with long hairlike spines. Rocky slopes on both sides of the canyon and arid slopes near the canyon entrance.

Opuntia versicolor Engelm. *Siviri*; staghorn cholla; *sevii* (Yaqui). Often 1.5–2+ m with an upright trunk and main stems and spreading branches. Flowering March–early April. Fruits fleshy, greenish yellow even when ripe, usually persistent until the following year, often becoming enlarged and swollen, usually solitary. Rarely in chains of two or three fruits but these not pendent. Common in desert scrub near the canyon entrance. Plants in the Guaymas region have flowers with inner tepals that are greenish yellow with reddish brown tips. *F 85-546*.

Pachycereus pringlei (S. Watson) Britton & Rose. *Cardón*, *sahueso*. Giant columnar cactus, the juvenile portion of the stems with long stout spines, the adult or fertile (upper) portion of stems with coalesced areoles and spineless or with bristly spines only. Flowers white, nocturnal, remaining open in daytime; spring. Infrequent on south-facing slopes; more common elsewhere in the region in arid, coastal habitats.

Peniocereus striatus (Brandegee) Buxbaum [*Cereus striatus* Brandegee; *Neoevansia striata* (Brandegee) Sánchez-Mej.; *Wilcoxia striata* (Brandegee) Britton & Rose; *Cereus diguetii* K. Weber; *Wilcoxia diguetii* (K. Weber) Diguet & Guillaumin]. *Sacamatraca*; *noono* (Yaqui). Stems pencil thin, often 1–2 m, growing through shrubs such as *Citharexylum* or *Lycium* and seemingly mimicking their nurse-plant stems; plants with clusters of potatolike tuberous roots. Flowers nocturnal, white; summer. Fruits ripening in late summer or early fall. Fairly common near the canyon entrance and on the nearby open desert.

Stenocereus thurberi (Engelm.) Buxbaum [*Lemaireocereus thurberi* (Engelm.) Britton & Rose]. *Pitahaya dulce*; organ-pipe cactus; *aaki* (Yaqui). Multiple-stemmed columnar cactus. Flowers nocturnal, the interior white; hot weather, mostly in early summer. Fruits red, juicy, sweet, and edible, ripe during summer. Canyon slopes, most numerous on south-facing slopes, and also common in the nearby desert. *Parfitt 3035* (ASU), *n* = 11 (Pinkava et al. 1985).

CAPPARACEAE—Caper Family

1. Herbaceous annuals; leaves with 3–5 leaflets ..... *Cleome*
1′ Woody shrubs or trees; leaves simple ..... *Forchhammeria*

Cleome tenuis S. Watson. Hot-weather ephemeral with slender, upright stems; flowers inconspicuous. Canyon bottom and nearby open desert. *F 85-1203*.

Forchhammeria watsonii Rose. *Jito*; *hi'ito* (Yaqui). Unarmed tree 5–6 m with a single thick smooth trunk and dense essentially evergreen crown; leaves of young plants narrowly linear, those of the mature tree much broader. Dioecious. Flowers small, the male flowers yellow, the female flowers maroon; mass flowering mostly March–April. Scattered along the canyon bottom, more common in the nearby open desert. *Van Devender 84-243*; *Wiseman 77-64*.

CHENOPODIACEAE—Goosefoot Family

Chenopodium—Goosefoot

1. Herbage green or green with reddish tinges; seed margins acute ..... *C. murale*

1′ Herbage grayish (mealy); seed margins acute to obtuse .... *C. neomexicanum*

Chenopodium murale L. *Chual*; netleaf goosefoot; *chuuhi* (Yaqui). Winter–spring ephemeral. Heavily grazed area at Nacapule Spring; not seen prior to 1995. *F 95-105*.

Chenopodium neomexicanum Standl. *Choali* (Yaqui). Annual, germinating in spring and maturing during summer. The plants, especially when mature, stink like dead fish but the tender young herbage is eaten locally as greens ("*quelite, se come*"). Common along the canyon bottom, especially in areas frequented by cattle. *F 85-266, 85-1329*.

CONVOLVULACEAE—Morning-Glory Family

1. Parasites; stems vining, orange, and leafless ..... *Cuscuta*
1′ Not parasites; stems vining or not, not orange; leaves present although sometimes deciduous.
  2. Perennials; stems not vining; corollas pale blue, <1 cm wide ..... *Evolvulus*
  2′ Annuals; stems vining; corollas variously colored, not pale blue, at least 1 cm wide ..... *Ipomoea*

Cuscuta—Dodder
1. On shrubs; perianth segments obtuse ..... *C. americana*
1′ On herbaceous annuals or perennials; perianth segments acute.
  2. Calyx lobes lanceolate ..... *C. desmouliniana*
  2′ Calyx lobes deltoid to ovate ..... *C. umbellata*

Cuscuta americana L. Probably annual; on woody shrubs including *Colubrina viridis*, *Sebastiania bilocularis*, and *Vallesia laciniata*. Nonseasonal in growth and flowering response. Stems thicker than those of the ephemeral species. Flowers white. Canyon bottom. *F 4087, 84-618*.

Cuscuta desmouliniana Yunck. Warm-weather ephemeral on *Euphorbia polycarpa*. Flowers white. Terrace above arroyo at canyon mouth. *Burgess 6949*.

Cuscuta umbellata Kunth. Warm-weather ephemeral, sometimes persisting through winter, on various herbaceous plants, especially *Boerhavia* spp., *Bouteloua aristidoides*, *Euphorbia polycarpa*, and *Kallstroemia grandiflora*. Flowers white. Open habitats at canyon entrance and the open desert. *F 85-578*.

Evolvulus alsinoides (L.) L. var. ***angustifolia*** Torr. [*E. alsinoides* var. *acapulcensis* (Willd.) Ooststr.]. Small herbaceous perennial. Flowers open in the morning and fade with daytime heat; nonseasonal with sufficient soil moisture. Canyon bottom in open habitats, north- and south-facing canyon slopes, and nearby desert, especially along washes. *F 84-106, 85-1187*.

Ipomoea—Morning-glory
1. Leaves divided into narrow palmately arranged segments .... *I. leptotoma*
1′ Leaves simple, entire to broadly lobed.
  2. Sepals glabrous, the lobes linear-subulate; corollas salviform, bright red ..... *I. cristulata*
  2′ Sepals with large, coarse hairs, especially on the tube, the lobes attenuate-tipped; corollas rotate (opening wide), bluish or lavender, generally with a white base. *I. hederacea*

Ipomoea cristulata Hallier f. Warm-weather ephemeral; small vine, delicate to sometimes robust. Flowers often open all day. Occasional in the canyon bottom, usually near water in the vicinity of *Ficus insipida*. *F 4085, 85-1310*.

Ipomoea hederacea Jacq. *Trompillo*; morning-glory. Warm-weather annual vine, often rank. Flowers open in the early morning, fade with daytime heat. Infrequent along the canyon bottom. *F 4086, 85-1317*.

Ipomoea leptotoma Torr. Warm-weather ephemeral vine. Corollas lavender, open in the early morning, fade with daytime heat. Canyon bottom and open desert. *F 4086, 85-1185*.

CUCURBITACEAE—Gourd Family

1. Summer-growing perennials from a thick caudex; tendrils simple; fruits fleshy, ovoid or broadly ellipsoid, and smooth. ..... *Ibervillea*
1′ Cool-season annuals without a caudex; tendrils usually forked; fruits dry when mature, globose, mostly spiny (echinate) .... *Vaseyanthus*

Ibervillea sonorae (S. Watson) Greene [*Maximowiczia sonorae* S. Watson; *Ibervillea sonorae* var. *peninsulare* Brandegee; *I. insularis* (Brandegee) Wiggins]. *Güerequi*; cow-pie plant; *kau chaani* (Yaqui). Plant with a large swollen above-ground caudex often resembling a large cow dropping. Leafy stems appearing with summer rains and quickly deciduous at the end of the rainy season. Flowers dull yellow; summer. Fruits yellow to orange-red when fully ripe; late summer. Common in the open desert and scattered on canyon slopes. *F 84-132, 85-1322*.

Vaseyanthus insularis (S. Watson) Rose. Vine growing luxuriantly with fall to spring rains and dying in late spring, often carpeting otherwise barren rock slopes and festooning trees and shrubs in green curtains. Flowers small, white. *F 85-250*; *Daniel 1996* (ASU, *n* = 13); *Parfitt 3023* (ASU).

EUPHORBIACEAE—Spurge Family

1. Stems thick, succulent, terete, and green, without spur branches, the stem tips sharp-pointed; leaves few and quickly deciduous ..... *Euphorbia ceroderma*
1′ Stems not as above, not succulent or if so then with spur branches; leaves many.
  2. Plants usually scandent or vining, mostly herbaceous.
    3. Hairs on herbage not stinging; leaves often 5–8.5 cm, palmately 3-lobed ..... *Dalechampia*
    3′ Herbage with stinging hairs; leaves mostly 1.5–5 cm, ovate to elliptic, not lobed ..... *Tragia*
  2′ Plants not scandent or vining; herbaceous to shrubby.
    4. Sap milky; leaves opposite; flowers enclosed in a cuplike involucre (cyathium) of gland-bearing united bracts, the whole structure simulating a bisexual flower; perianth none, the staminate flower consisting of a single, pediceled stamen, the pistillate flower of a single pediceled ovary ..... *Euphorbia*
    4′ Sap milky or not; leaves alternate; flowers not enclosed in a cyathium; staminate flowers with a perianth.
      5. Annual and perennial herbs, often <1 m, with two-armed (Malpighian) hairs ..... *Ditaxis*
      5′ Shrubs; glabrous or pubescent but the hairs not two-armed.
        6. Older leaves turning orange before falling; pubescence of stellate hairs ..... *Croton*
        6′ Older leaves not turning orange; glabrous or pubescent with simple hairs.
          7. Sap of copious milky latex; glabrous. *Sebastiania*
          7′ Sap not milky; glabrous or pubescent.
            8. Plants with conspicuous glandular and nonglandular hairs ..... *Acalypha*
            8′ Glabrous or the hairs inconspicuous, not glandular.

9. Hardwood shrubs, not at all succulent, the stems rather rigid; sap not watery ..... *Adelia*
9′ Softwood shrubs, semi-succulent, the stems flexible; sap watery, clear, or colored .... *Jatropha*

Acalypha californica Benth. [*A. pringlei* S. Watson; *A. vagans* Cav. sensu Wiggins (1964) but not as to the type. See Levin (1994) and Steinmann and Felger (1997)]. Copperleaf. Shrub often 1.5–1.8 m; leaves gradually drought deciduous. Mostly along the canyon bottom and on north-facing slopes. Flowering at various seasons. *F 84-145*; *Starr 202*; *Van Devender 28 Dec 1982*.

Adelia virgata Brandegee. Shrub 2–3+ m. Leaves quickly drought deciduous. Flowers green, inconspicuous. Canyon bottom at entrance. *F 92-1032*.

Croton sonorae Torr. *Mariola*. Woody shrub 1.0–1.5 m; tardily drought deciduous, the leaves turning orange before falling. Staminate flowers white; August. Canyon bottom and slopes; widespread on nearby desert plains and rocky slopes. *F 84-611*; *Warren 18 Aug 1975*.

Dalechampia scandens L. Facultative ephemeral, in dry years as small as 10–30 cm, nonvining, and producing seeds; during wet years becoming a short-lived scandent perennial with a semi-woody base. Canyon bottom and mostly shaded north-facing slopes. *F 84-602*, *85-848*; *Yatskievych 82-151*.

Throughout its extensive range in the American tropics and subtropics this species is usually a large scandent shrub or vine, rarely a perennial herb. The ephemeral phase is unusual. This species enters the Sonoran Desert only in several riparian canyons in the Sierra El Aguaje and Sierra Libre.

Ditaxis

1. Plants subshrubby; stems mostly erect and straight; staminate petals united to the staminal column at base, appearing to arise above the glands; style branches sometimes dilated and flattened at the apex ..... *D. lanceolata*
1′ Plants herbaceous; stems mostly ascending to spreading, the main axis sometimes erect but the branches spreading and seldom straight; staminate petals free from the staminal column, appearing to arise between and alternating with the glands; style branches terete at the apex ..... *D. neomexicana*

Ditaxis lanceolata (Benth.) Pax & K. Hoffm. [*Argythamnia lanceolata* (Benth.) Müll. Arg.; *Ditaxis palmeri* (S. Watson) Pax & K. Hoffm.]. Suffrutescent perennial to 1+ m, sometimes flowering in the first season; leaves often silvery-pubescent, tardily drought deciduous; nonseasonal. Canyon bottom, slopes, and nearby desert. *F 84-134*, *85-567*.

Plants in well-watered shaded areas along the canyon bottom tend to have larger, broader, and green rather than silvery leaves. *Ditaxis palmeri*, described from Guaymas, is apparently based on such plants (Steinmann and Felger 1997).

Ditaxis neomexicana (Müll. Arg.) A. Heller [*Argythamnia neomexicana* Müll. Arg.; *A. gracilis* Brandegee; *Ditaxis gracilis* Rose & Standl.]. Nonseasonal ephemeral to short-lived perennial. Open slopes, canyon entrance, and adjacent desert. *Argythamnia gracilis* and *Ditaxis gracilis*, each independently based on separate collections, appear to be nothing more than robust plants growing under highly favorable conditions during the summer rainy season (Steinmann and Felger 1997). *F 85-836*, *85-575*.

Euphorbia

1. Shrubs.
   2. Stems succulent, with few, quickly deciduous leaves .... *E. ceroderma*
   2′ Stems leafy and not succulent ..... *E. tomentulosa*
1′ Annual or perennial herbs.
   3. Cyathia in dense subcapitate leafless cymose clusters .... *E. capitellata*
   3′ Cyathia solitary in the axils of leafy shoots.
      4. Herbage with appressed hairs only ..... *E. pediculifera*
      4′ Herbage glabrous or with at least some spreading hairs.
         5. Appendages rounded to broadly lobed or absent .... *E. polycarpa*
         5′ Appendages divided into triangular, pointed segments, the cyathia thus appearing "star-shaped." .... *E. setiloba*

Euphorbia capitellata Engelm. [*Chamaesyce capitellata* (Engelm.) Millsp.]. *Golondrina*; *koapa'im* (Yaqui). Herbaceous perennial, often flowering in the first season. Petaloid appendages white. Flowering nearly all year except during extended drought. Canyon bottom and near canyon entrance, mostly in gravelly washes, and dry rocky slopes and nearby arroyo beds. *F 84-569*.

Euphorbia ceroderma I. M. Johnst. Shrub 1.0–1.5 m, forming dense clumps, the stems green, rigid, and succulent, each with several or more spreading-ascending branches, the tips drying to form a rigid thorn. Leaves very sparse, very quickly deciduous, and seldom seen, often 9–11 mm, semi-succulent, sparsely puberulent with short appressed white hairs, essentially sessile with a thick petiole <1 mm, the blades narrowly linear-lanceolate, the apex acute. Reproductive with summer rains.

Exposed steep north and south canyon slopes and rugged slopes high above the canyon. *F 92-1048*, *94-859*. This is one of the few succulent "cactoid" euphorbias in the Sonoran Desert (see Steinmann and Felger 1997).

Euphorbia pediculifera Engelm. var. ***linearifolia*** S. Watson. *Golondrina*; louse spurge; *koapa'im* (Yaqui). Nonseasonal ephemeral or (mostly) short-lived perennial. Appendages white, fading pink. Widespread, especially in gravelly soil along the canyon bottom, rocky slopes, and the open desert. This subspecies is endemic to the Guaymas region. *Daniel 2003* (ASU); *F 85-1202*; *Van Devender 84-241*.

Euphorbia polycarpa Benth. [*Chamaesyce polycarpa* (Benth.) Millsp.]. *Golondrina*; desert spurge; *koapa'im* (Yaqui). Nonseasonal ephemeral to small perennial herb. Appendages white, in drought sometimes minute or essentially absent. Widespread; slopes, gravelly arroyo bed of canyon bottom, and especially common at the canyon entrance and on the open desert. *F 11975*, *85-1183A*.

Euphorbia setiloba Engelm. [*Chamaesyce setiloba* (Engelm.) Millsp.]. *Golondrina*; fringed spurge. Nonseasonal ephemeral. Appendages white to pink, divided into toothlike segments forming a starlike pattern. Gravelly soils of open areas along canyon bottom and in open desert. *F 11866*, *85-1330*

Euphorbia tomentulosa S. Watson [*Chamaesyce tomentulosa* (S. Watson) Millsp.]. Shrub 1–1.5 m; leaves tardily drought deciduous. Appendages white; nonseasonal. Canyon slopes, especially the more arid habitats, open rocky areas along the canyon bottom, and on nearby desert hills. *F 94-862*; *Steinmann 15 Aug 1992*.

Jatropha

1. Bark papery and peeling; leaves conspicuously petioled, the blades cordate, about as wide as long, mostly >4 cm .... *J. cordata*
1′ Bark not papery and peeling; leaves sessile to subsessile, or the long-shoot leaves petioled, the blades spatulate, about twice as long as wide, mostly <2 cm ..... *J. cuneata*

Jatropha cordata (Ortega) Müll. Arg. *Copalillo*, *torote papelillo*; *kau sapo* (Yaqui). Slender, erect, *Bursera*-like shrub 2–3 m; bark papery and peeling in dry seasons. Leaves present only during

summer rainy season and quickly deciduous after the rains cease in September. Flowers white to pink; July–August. Steep slopes on both sides of the canyon. Farther south and east in Sonora *J. cordata* is a small tree. *F 84-119, 85-858.*

Jatropha cuneata Wiggins & Rollins. *Sangrengado*; limberbush. Multiple-stemmed shrub 1.5–2.5 m; lower stems and roots oozing blood-like sap when cut (hence the common name); roots thick, almost tuberous. Short shoots producing leaves after rains at almost any time of the year, bearing smaller, sessile, entire, and quickly drought-deciduous leaves, the long shoots developing with summer–fall rains and bearing larger, petioled, and lobed leaves. Flowers white; summer rainy season. South-facing slopes, the canyon entrance, and nearby desert. *F 92-1041, 94-863.*

Sebastiania bilocularis S. Watson [*Sapium biloculare* (S. Watson) Pax]. *Hierba de la flecha*; Arizona jumping bean; *hoyo kuta* (Yaqui). Shrub 3–4 m. Staminate flowers yellow; various seasons including August. Nearly evergreen along the canyon floor, tardily drought deciduous on slopes and the open desert. *F 85-854*; *Starr 211.*

Tragia jonesii Radcl.-Sm. [*T. scandens* M.E. Jones, not *T. scandens* L.; *T. amblyodonta* (Müll. Arg.) Pax & K. Hoffm., sensu Wiggins 1964]. *Quemador*; noseburn; *nata'e* (Yaqui). Vining perennial with slender stems and mildly stinging hairs, the leaves drought deciduous. Usually beneath shrubs in the canyon bottom, on north-facing slopes, and in nearby desert habitats. *F 85-550, F 95-17.*

This species ranges from northwestern Sonora to southern Mexico and also occurs in Baja California Sur. It has been treated as *T. amblyodonta* (Mull. Arg.) Pax & K. Hoffm. but represents a quite different species (Steinmann and Felger 1997).

FABACEAE (LEGUMINOSAE)—Legume Family

1. Stems vining.
  2. Annuals; flowers pink ..... *Phaseolus*
  2′ Perennials; flowers yellow or red-brown.
    3. Leaves with 5 leaflets; pods indehiscent, one-seeded .... *Nissolia*
    3′ Leaves with 3 leaflets; pods dehiscent, multiple-seeded.
      4. Flowers dark red-brown; seeds brown .....*Macroptilium*
      4′ Flowers yellow; seeds red and black ..... *Rhynchosia*
1′ Stems not vining.
  5. Trees or woody shrubs, mostly >1 m (ambiguous cases key out in both places).
    6. Bark green, at least on upper limbs; flowers caesalpinioid. ..... *Parkinsonia*
    6′ Bark not green (except sometimes on first or second year's growth); flowers various.
      7. Leaves once pinnate; flowers caesalpinioid or papilionoid.
        8. Trunk and limbs fluted, the bark smooth; leaves even-pinnate; leaflets 4–8, broadest above middle, with conspicuous lateral veins; flowers caesalpinioid, yellow ..... *Haematoxylum*
        8′ Trunk and limbs not fluted, rounded in cross-section, the bark rough on the trunk and older limbs; leaves odd-pinnate or sometimes even-pinnate; leaflets 6–19, mostly broadest at or below the middle, the lateral veins inconspicuous; flower papilionoid, yellow or not.
          9. Pods papery and inflated; flowers bright yellow. ..... *Diphysa*
          9′ Pods not papery and inflated; flowers not yellow.
            10. Leaflet tips with a conspicuous mucronate projection; pods glandular .....*Coursetia glandulosa*
            10′ Leaflets not apiculate, the tips rounded, blunt, or notched; pods not glandular.
              11. Trees or large shrubs, with a well-developed thick trunk and shredding bark; branches with prominent spines at bases of at least some leaves ..... *Olneya*
              11′ Small shrubs, scarcely woody, the bark not shredding; unarmed.
                12. Pods one-seeded; corollas bright purple, about as long to scarcely longer than the calyx; midrib of calyx lobes extending into awnlike plumose bristles..... *Dalea*
                12′ Pods multiple-seeded; corollas salmon-orange, longer than the calyx; calyx lobe not awned .....*Indigofera*
      7′ Leaves twice pinnate; flowers caesalpinioid or mimosoid.
        13. Flowers caesalpinioid; leafstalk glands none.
          14. Unarmed; leaflets broadest at or below middle, not notched at tip..... *Caesalpinia*
          14′ Armed with stipular spines; leaflets broadest above middle, usually notched at the tip .... *Haematoxylum*
        13′ Flowers mimosoid; leafstalks often with craterform gland(s).
          15. Pods indehiscent.
            16. Leaves with 2–4 pairs of pinnae; flowers in dense rounded heads; stamens numerous .... *Acacia farnesiana*
            16′ Leaves with one pair of pinnae; flowers in cylindrical racemes; stamens 10 ..... *Prosopis*
          15′ Pods dehiscent.
            17. Plants unarmed.
              18. Leaves with one (sometimes two) pair(s) of pinnae .....*Acacia willardiana*
              18′ Leaves usually with three or more pairs of pinnae.
                19. Large shrubs or small trees; stipules leafy (often soon deciduous); valves of pods separating from a conspicuous rim .... *Lysiloma*
                19′ Small shrubs; stipules not leafy; valves of pods not separating from the rim.
                20. Stamens 10 or fewer; valves of pods partially to fully separating but not elastically and remaining straight ....*Desmanthus*
                20′ Stamens numerous; valves of pods separating elastically and curling back.
                21. Stipules subulate, firm; leaflets rather firm and thickish; flowers bright red ..... *Calliandra*
                21′ Stipules ovate, not firm; leaflets thin, not firm; flowers cream-white ....*Zapoteca*
            17′ At least some branches conspicuously armed.
              22. Spines straight, acicular to flattened or boat-shaped. *Acacia cochliacantha* and *A. pringlei*
              22′ Spines curved (with a slight hook).
                23. Shrubs; spines (prickles) internodal; flowers pink-purple; pods to 5 cm, breaking into one-seeded segments ....*Mimosa*
                23′ Small trees; spines nodal; flowers white; pods 5–10 cm, not separating into segments ..... *Havardia*
5′ Herbaceous annuals and perennials, not woody or scarcely so.
  24. Leaves simple (unifoliolate) ..... *Sphinctospermum*
  24′ Leaves with three or more leaflets.

25. Flowers caesalpinioid; leaves even-pinnate; anthers large, with terminal pores ..... *Senna*
25′ Flowers papilionoid; leaves odd-pinnate; anthers small, opening longitudinally, without pores.
26. Leaflets 9–23; herbage gland-dotted; pods 1.8–2.5 mm, indehiscent, one-seeded; flowers dark blue ..... *Marina*
26′ Leaflets three or five; herbage not gland-dotted; pods >8 mm, dehiscent or breaking into segments, with more than two seeds; flowers not dark blue.
27. Delicate hot-weather ephemerals with small curved "hold-fast" hairs; pods resembling a series of cut-outs, the segments triangular to four-cornered or rounded ..... *Desmodium*
27′ Winter–spring ephemerals, perennials, or robust annuals, the hairs straight; pods more or less entire (not "cut-out").
28. Delicate winter–spring ephemerals; pods to 1.5 cm ..... *Astragalus*
28′ Rather robust annuals or perennials; pods at least 3 cm.
29. Pods 5–8 cm, linear, conspicuously septate between seeds; leaflets broadly elliptic to ovate ..... *Coursetia caribaea*
29′ Pods 3–4.5 cm, linear-falcate, not septate; leaflets linear ..... *Tephrosia*

Acacia
1. Unarmed; bark papery and peeling; glabrous or essentially so; petioles long, slender, and straplike ..... *A. willardiana*
1′ Armed with stipular spines at least on some branches; bark not papery and peeling; variously pubescent; petioles not as above.
2. Leaves with 7 to many pairs of pinnae; spines flattened or the larger ones boat-shaped ..... *A. cochliacantha*
2′ Leaves with 1–6 pairs of pinnae; spines acicular.
3. Leaves with 2–4 pairs of pinnae, the leaflets 1–7 mm; pods pulpy (with mesocarp), indehiscent, dark brown to blackish, not constricted between seeds ..... *A. farnesiana*
3′ Leaves with one pair of pinnae, the larger leaflets 7–45 mm; pods dry, tardily dehiscent, red-brown, slender, constricted between seeds ..... *A. pringlei*

Acacia cochliacantha Willd. [*A. cymbispina* Sprague & Riley]. *Chirahui*; boat-spine acacia; *koowi tami* (Yaqui). Shrub 3+ m; drought deciduous. Flowers yellow-orange; June–September (–November). Occasional in the canyon bottom near the entrance and most common at the spring; apparently a recent invader associated with cattle grazing. *F 95-33*, *95-57*.

Acacia farnesiana (L.) Willd. [*A. minuta* (M. E. Jones) R. M. Beauch. subsp. *densiflora* (Small) R. M. Beauch.; *A. smallii* Isely]. *Huisache*, *vinorama*; sweet acacia; *kuka* (Yaqui). Shrub to 4 m; ultimately partially to fully winter deciduous. Flowers bright yellow-orange, sweet scented; December–March. Canyon entrance, not common, and rare elsewhere along the canyon bottom and at the spring. The Nacapule *huisaches* were seedlings and young plants when first observed. They occur in areas of heavy cattle grazing and disturbance, and seem to be recent invaders. In the San Carlos–Guaymas region the species thrives in disturbed habitats. *Daniel 1985* (ASU); *F 92-1044*.

Acacia pringlei Rose subsp. ***californica*** (Brandegee) Lee, Seigler & Ebinger [*A. californica* Brandegee]. *Chicorai* (Yaqui). Shrub 3-4 m; mostly evergreen. Flowers pale yellow; (March–) May–June. Canyon bottom and steep east-facing rock slope below cliffs at the southeast side of the canyon entrance. Recorded 28 December 1985 (observation). This acacia is distinctive owing to its striking, dark green foliage contrasting with the large white spines. The leaflets are the largest of the Sonoran acacias.

Acacia willardiana Rose. *Palo blanco*; *nawi'o* (Yaqui). Slender wispy tree 3–5+ m; bark white, exfoliating in sheets during dry seasons; leaflets and then the pinnae drought deciduous, leaving the leafstalk to function as a phyllode—unique among New World acacias. Flowers pale yellow; February–May and October. Arid canyon slopes, cliffs, and the nearby desert. *F 85-561*.

Astragalus nuttallianus DC. var. ***imperfectus*** (Rydb.) Barneby. Small-flowered milk-vetch. Delicate, winter–spring ephemeral. Flowers bluish, selfing and semi-cleistogamous. This is the smallest *Astragalus* species in the Sonoran Desert. Canyon entrance and open desert. *F 95-1*.

Caesalpinia
1. Leaflets elliptic to oblong, to 6 mm wide; pods explosively dehiscent ..... *C. palmeri*
1′ Leaflets nearly orbicular, ca. 5–20 mm wide; pods indehiscent. ..... *C. pumila*

Caesalpinia palmeri S. Watson. *Palo piojo*; *kume'a ouwo* (Yaqui). Shrub with conspicuous lenticels (said to resemble *piojos*, or lice, hence the common name); tardily drought deciduous. Flowers bright yellow, the sepals fading to red; warmer months except during severe drought. South-facing canyon slopes, dry habitats at the canyon entrance, and the open desert. *F 85-584*; *Martin 12 Mar 1977*.

Caesalpinia pumila (Britton & Rose) F. J. Herm. Small shrub; tardily drought deciduous. Flowers yellow; summer. Open desert near the canyon and occasionally on east-facing slopes near canyon mouth. *F 85-871B*.

Calliandra californica Benth. *Tabardillo*; Baja California fairy duster. Shrub 1.0–1.5 m; tardily drought deciduous. Flowers bright red and showy; at least March and August. North- and northeast-facing slopes and occasional in the nearby desert. *Burgess 6533*; *F 92-1039*.

Coursetia
1. Suffrutescent perennials ..... *C. caribaea*
1′ Woody shrubs ..... *C. glandulosa*

Coursetia caribaea (Jacq.) Lavin var. ***caribaea*** [*Cracca caribaea* (Jacq.) Benth.; *C. caribaea* var. *edwardsii* (A. Gray) Hassl.; *C. edwardsii* A. Gray; *C. brandegeei* Rydb.; *Benthamantha edwardsii* (A. Gray) Rose]. Stems to ca. 1 m; growing and flowering during hot-weather rains, the fruits ripen in October; plant leafless and dormant at other seasons. Flowers with a white keel and pink banner with red streaks on the back. Common understory plant in the canyon bottom and on densely vegetated north-facing slopes. *F 84-138*, *84-574*.

Coursetia glandulosa A. Gray. *Sámota*; *saamo* (Yaqui). Multiple-stemmed shrub to 4 m; leaves unfolding in spring after flowering except in severe drought, the foliage luxuriant with leaves and leaflets largest during the summer–fall rainy season, smaller and gradually deciduous during fall and winter. Flowers pale yellow and white with pink to red tinges; spring. Canyon bottom, north and south slopes, canyon entrance, and nearby desert slopes. Stems sometimes encrusted with orange lac produced by the ant-tended scale insect *Tachardiella*. *F 85-256*.

Dalea pulchra Gentry. Dense intricately branched shrub 0.5–1.3 m, the stems slender and rigid. Leaves silvery gray pubescent, tardily drought deciduous. Flowers dark magenta-purple with a large yellow spot on the banner, attracting large numbers of honeybees; spring. Mostly on west- and south-facing rock faces but also on other exposures. *F 85-543*. Also in the nearby hills and canyon at El Baviso (between Nacapule and San Carlos) and at

Las Barajitas. This species is absent across most of the Sonoran Desert but widepread in mountains to the east.

Desmanthus covillei (Britton & Rose) Wiggins & B. L. Turner [*D. subulatus* (Britton & Rose) B. L. Turner; *D. palmeri* (Britton & Rose) B. L. Turner]. *Site'epoa* (Yaqui). Slender shrub often 1.5 m, with delicate unarmed stems and filmy drought-deciduous foliage. Growing and flowering mostly with summer rains. Flowers white. Scattered along the canyon bottom, more common on mostly north-facing slopes high above the canyon. *F 4089, 84-133.*

Desmodium procumbens (Mill.) Hitchc. var. ***procumbens***. Tick clover. Summer–fall ephemeral with trifoliolate leaves. Flowers pink, minute. Pods slender, resembling a series of cut-outs, the segments triangular to four-cornered or rounded and with minute hooked hairs. Canyon bottom and north-facing slopes, mostly shaded beneath shrubs and trees. This species, widespread in the American tropics as well as in temperate and montane habitats, barely enters the Sonoran Desert; this is the northernmost population along the Sonora coast. *F 84-96, 85-1304.*

Some of the Nacapule specimens show characters of both this species and *D. scopulorum* S. Watson, which may be conspecific. Furthermore, *D. procumbens* var. *procumbens* and var. *exiguum* (A. Gray) Schubert are probably not distinct taxa.

Diphysa occidentalis Rose. *Güiloche*. Shrub or small tree to ca. 4 m; gradually drought deciduous. Flowers bright yellow; summer rainy season, November–April depending on rains. Pods inflated, thin-walled and papery. North- and south-facing canyon slopes. *F 85-851*; *Starr 201.*

Haematoxylum brasiletto H. Karst. *Brasil*; *huchahko* (Yaqui). Shrub with fluted hardwood stems and red heartwood, the nodes often with a single spine; gradually drought deciduous. Flowers bright yellow; nonseasonal. Canyon bottom, north and south slopes, and the open desert. *Starr 206.*

Havardia sonorae (S. Watson) Britton & Rose [*Pithecellobium sonorae* S. Watson]. *Jócono*; Sonoran ebony; *wokohna* (Yaqui). Multiple-trunked tree or large shrub to 6+ m; tardily drought deciduous. Flowers white; summer. Pods ripen in November. Along a small arroyo running northward from near the canyon entrance. *F 94-850.*

Indigofera jamaicensis Spreng. Suffrutescent perennial often 1 m; drought deciduous. Corollas dark salmon-pink; nonseasonal. Mostly on slopes, with various exposures. *F 85-558.*

Lysiloma divaricatum (Jacq.) J. F. Macbr. [*L. microphyllum* Benth.]. *Mauto*; *vamyo* (Yaqui). Large shrub or small tree 4–6 m. New growth in early summer; drought deciduous, the leaves shed mostly in early fall. Flowers cream-white; April–May. Pods ripening late summer–October. Canyon bottom and slopes, especially north-facing, and along arroyos in the nearby desert. *Phillips 75-145*; *Starr 24.*

Macroptilium atropurpureum (DC.) Urb. [*Phaseolus atropurpureus* DC.]. Perennial, growing and flowering mostly during summer rainy season. Flowers dark red-brown. North-facing slopes and shaded canyon bottom among boulders and leaf litter along the dry streambed. *F 92-1023.*

Marina parryi (Torr. & A. Gray *ex* A. Gray) Barneby [*Dalea parryi* Torr. & A. Gray *ex* A. Gray]. Nonseasonal ephemeral, mostly in spring; occasionally a short-lived perennial. Flowers blue. Open habitats: arroyo bed near the canyon mouth, open desert, and south-facing slopes. *F 95-109.*

Mimosa distachya Cav. var. ***laxiflora*** (Benth.) Barneby [*M. laxiflora* Benth.]. Shrub; drought deciduous. Flowers pink, fading to white; various seasons. Dry habitats, mostly near the canyon entrance, south-facing slopes, and the open desert. *F 84-610, 85-842.*

Nissolia schottii (Torr.) A. Gray. Vine climbing through shrubs; gradually drought deciduous. Flowers yellow; summer rainy season and sometimes at other seasons. Canyon bottom, north-facing slopes, and nearby open desert. *F 85-874, 95-21.*

Olneya tesota A. Gray. *Palo fierro*; desert ironwood; *ehea* (Yaqui). A grove of large shrubs and small trees on the steep south-facing slope in the mid-portion of the canyon; common on nearby slopes and the open desert. Flowers pink; late spring. Fruits ripening just before the onset of summer rains. *F 92-1026.*

Parkinsonia microphylla Torr. [*Cercidium microphyllum* (Torr.) Rose & I. M. Johnst.]. *Palo verde*; foothills palo verde; *wo'i voa'am* (Yaqui). Small tree or large shrub; drought deciduous. Flowers pale yellow and white; mass flowering in spring. Arid habitats, especially south-facing slopes and the open desert. *F 92-1054.*

Phaseolus filiformis Benth. Desert bean. Nonseasonal ephemeral vine. Flowers pink. Canyon bottom, slopes, and nearby open desert. *F 84-126.*

Prosopis glandulosa Torr. var. ***torreyana*** (L. D. Benson) M. C. Johnst. [*P. juliflora* (Sw.) DC. var. *torreyana* L. D. Benson]. *Mezquite*; western honey mesquite; *hu'upa* (Yaqui). Gradually winter deciduous, the new leaves and flower buds emerging in March. Flowers yellow, March–April and sporadically through the summer. Scattered shrubs and small trees to 5+ m along the canyon bottom; rare until the mid-1980s, the spread associated with increased cattle grazing and disturbance. Also several small trees and one ca. 14 m with a trunk 197 cm circumference at Nacapule Spring. Common on the nearby open desert and at the canyon entrance. *F 92-1052, 94-847.*

Rhynchosia precatoria DC. *Ojo de chanate*; *champuusi*, *santa puusim* (Yaqui). Perennial vine growing over shrubs; leaves velvety pubescent, the stems and leaves drought deciduous. Flowers dull yellow with red-brown markings. Seeds shiny red and black. Growing and flowering with summer–fall rains, the pods maturing in October. Canyon bottom and north-facing slopes. *F 84-116*; *Phillips 75-164.*

Senna covesii (A. Gray) H. S. Irwin & Barneby [*Cassia covesii* A. Gray]. *Hojasen*, *daisillo*; *kau ohasen* (Yaqui). Herbaceous or suffrutescent perennial, probably short-lived; stems and leaves drought deciduous. Flowers yellow; warmer months. Sandy soil at canyon entrance and scattered in nearby open desert. *F 94-852.*

Sphinctospermum constrictum (S. Watson) Rose. Hot-weather annual. Flowers inconspicuous, white with lavender. Mostly on rocky slopes and gravelly soil of the canyon bottom. *F 85-1120, 85-1332.*

Tephrosia vicioides Schltdh. [*T. tenella* A. Gray]. Nonseasonal ephemeral or annual, occasionally short-lived perennial. Petals pink-purple, drying wine-colored, <8 mm. *F 11964, 85-547.*

Wiggins (1964) listed *T. tenella* as a synonym of *T. purpurea* (L.) Pers. However, *T. purpurea* is an Old World species not present in Mexico (see McVaugh 1987).

Zapoteca formosa (Kunth) H. M. Hern. subsp. ***rosei*** (Wiggins) H. M. Hern. [*Calliandra rosei* Wiggins; *C. schottii* S. Watson subsp. *rosei* (Wiggins) Felger & Lowe]. Slender shrub 1.5–3 m; tardily drought deciduous in moist habitats, quickly deciduous in dry habitats. Stamens pink to pale lavender with whitish bases; summer. Mostly in shaded habitats; canyon bottom and on brushy north- and east-facing slopes of the canyon and nearby hills. *F 4083, 84-95.*

FOUQUIERIACEAE—Ocotillo Family

Fouquieria

1. Stems long, mostly straight and wandlike, ascending to erect, usually not branched above; trunk very short, usually appearing trunkless ..... *F. splendens*

1′ Stems and major limbs branched above; trunk(s) thick and well developed.

2. Inflorescences relatively compact, usually longer than wide; pedicels 2–6 (–13) mm ..... *F. diguetii*

2′ Inflorescences usually relatively loose and open and as wide or wider than long; pedicels (3–) 5–30 mm. *F. macdougalii*

Fouquieria diguetii (Tiegh.) I. M. Johnst. *Palo adán*; *mureo* (Yaqui). Shrub, often with rather thick limbs and a short trunk. Flowers red; various seasons. Rocky north-facing slopes but most common on south-facing slopes, nearby open mountain slopes, and the open desert. *F 92-1040.*

Three of the five Sonoran Desert species freely intermingle in the mountains from the vicinity of Nacapule to about 5 km east of Bahía San Pedro. In this region *F. diguetii* locally reaches maximum population density in more xeric habitats than does *F. macdougalii* (Felger 1966). In all three species the leaves are produced with sufficient rainfall at any time of year and are quickly drought deciduous. The flowers attract hummingbirds.

Fouquieria macdougalii Nash. *Ocotillo macho*; tree ocotillo; *mureo* (Yaqui). Large shrub or small tree to 4+ m with a thickened, twisted trunk and lower limbs, the bark often waxy yellow-brown and peeling in dry seasons. Flowers bright red; various seasons. Slopes on both sides of the canyon, apparently largest and best-developed on north-facing slopes; also common in the surrounding mountains and the nearby open desert. *F 11972, 92-1061.*

Fouquieria splendens Engelm. subsp. ***splendens***. Ocotillo; *mureo* (Yaqui). Shrub with multiple, slender stems. Flowers red-orange; February–March. Hot, exposed slopes, mostly near the canyon rim and on high south-facing slopes. This species, widespread in the deserts of southwestern North America, is here at its southernmost limit in Sonora. *F 85-542.*

HYDROPHYLLACEAE—Waterleaf Family

1. Leaves sessile or gradually tapering into the petiole, oblanceolate, the margins entire or inrolled; inflorescences not coiled or the flowers solitary ..... *Nama*

1′ At least the lower leaves petioled, the petiole and blade clearly differentiated, the blades pinnatifid or dissected; inflorescence coiled ..... *Phacelia*

Nama hispidum A. Gray var. ***sonorae*** C. L. Hitchc. Spring ephemeral. Corollas lavender with a yellow throat. Canyon bottom near entrance and open desert. *F 85-235.* Var. *sonorae* occurs along the coast from the vicinity of San Carlos and Guaymas southward, var. *hispidum* in the desert to the north.

Phacelia scariosa Brandegee. Spring ephemeral with unpleasant-smelling viscid herbage. Flowers pale lavender. Canyon bottom and slopes. *F 85-247, 95-116.*

KRAMERIACEAE—Ratany Family

Krameria

1. Branches rigid and knotty with many very short spur-branches; claws of the three upper petals fused basally, the blades lanceolate; spines of fruit with barbs along the upper part of shaft ..... *K. erecta*

1′ Branches mostly straight and without knotty spur-branches; the three upper petals separate, the blades nearly orbicular; spines of fruit with barbs in a terminal cluster ..... *K. sonorae*

Krameria erecta Willd. [*K. parvifolia* Benth.]. Range ratany. Spreading shrub ca. 80 cm or less in height. Flowers bright magenta-purple; nonseasonal. Rocky or gravelly soil near canyon entrance and on nearby open desert. *F 85-867A.*

Krameria sonorae Britton. *Cósagüi*; white ratany. Shrub often 1.5–2.5 m, the stems slender, spreading, and flexible. Leaves sparse, quickly drought deciduous. Sepals and lower petals nearly white inside, with red or red-lavender stripes and tinges, fading pink-lavender. Spines on the fruits bright red to red-brown and barbed only at the tip. Dry habitats, canyon mouth and nearby open desert. *Burgess 6527*; *F 94-867*; *Phillips 75-180.*

Simpson (1989) treated *K. sonorae* as a synonym of *K. grayi* Rose & Painter. However, they are distinct in the field and as herbarium specimens and should be maintained as distinct species. The southern limits of *K. grayi* in Sonora, in the vicinity of Bahía Kino and Hermosillo, closely approach the northern limits of *K. sonorae*. Their geographic ranges are apparently allopatric. I have not seen plants with intermediate characters. *K. sonorae* is distinguished from *K. grayi* by being conspicuously taller (often >2 m, versus usually <1 m for the latter), usually having more open branching, longer stems, greener, strigose leaves and young stems, conspicuously and consistently lighter-colored flowers, especially the lighter-colored lower petals, and differently shaped bracts.

LAMIACEAE (LABIATAE)—Mint Family

Hyptis emoryi Torr. [*H. emoryi* var. *amplifolia* I. M. Johnst.; *H. emoryi* var. *palmeri* (S. Watson) I. M. Johnst.]. *Salvia*; desert lavender; *vivino* (Yaqui). Shrub 1.5–2.5 m, the herbage densely white-pubescent with dendritic hairs, the leaves olive-green to whitish depending on moisture conditions and tardily drought deciduous. Flowers small, lavender blue and fragrant, visited by honeybees and hummingbirds; flowering nonseasonally, often profusely, especially in spring. Near the canyon entrance and on the nearby desert. *F 85-582*; *Starr 714.*

LOASACEAE—Loasa Family

1. Flowers white or green and yellow ..... *Eucnide*

1′ Flowers orange ..... *Mentzelia*

Eucnide

1. Perennials; flowers white ..... *E. cordata*

1′ Annuals; flowers green and yellow ..... *E. rupestris*

Eucnide cordata Kellogg. Bushy perennial with large drought-deciduous leaves. Flowering at least in spring. In the San Carlos–Guaymas region usually on cliffs, often with north-facing exposures, but the one record from Nacapule is from the canyon bottom along the trail among *Ficus insipida* trees. *Steinmann 412.*

Eucnide rupestris (Baill.) H. J. Thomps. & W. R. Ernst [*Sympetaleia rupestris* (Baill.) S. Watson]. Velcro plant. Nonseasonal ephemeral, the roots unusually small for the size of the plant. Pieces of the plants adhere like Velcro owing to their barbed hairs. Stems and petioles succulent, the leaf blades relatively thin and bright, shiny yellow-green. Most often in crevices on canyon-wall cliffs and rocks, occasionally in gravelly or sandy soil of the canyon bottom. *F 84-606.*

Mentzelia aspera L. Nonseasonal ephemeral, most often growing with summer–fall rains. Like *Eucnide rupestris*, pieces of the plants stick like Velcro. Canyon bottom, mostly in sandy or grav-

elly soil in open areas, on south-facing slopes, and on the nearby open desert. *F 85-1331.*

LORANTHACEAE—Mistletoe Family

1. Stems erect to spreading, straight; leaves terete, resembling the twigs; flowers bright red ..... *Psitticanthus*
1′ Stems pendent, often in loose spirals; leaves narrowly lanceolate, flattened, clearly distinct from the twigs; flowers cream-colored ..... *Struthanthus*

Psitticanthus sonorae (S. Watson) Kuijt [*Phrygilanthus sonorae* (S. Watson) Standl.]. Parasitic on *Bursera microphylla*. Flowers visited by hummingbirds; nonseasonal. Open desert adjacent to the canyon and south-facing slopes. *F 92-1061*; *Starr 715.*

Struthanthus palmeri Kuijt [*S. haenkei* (C. Presl) Engler *s. l.*, in part; *S. hankeanus* (C. Presl) Standl.; *S. hankeanus* var. *angustus* I. M. Johnst.]. *Toji*; *chichijam* (Yaqui). Parasitic on *Acacia willardiana*, elsewhere in the region also on other hosts, especially *Prosopis*. "*Struthanthus palmeri* is the most northerly of all Loranthaceae (excluding Viscaceae) in the New World" (Kuijt 1975:25). *F 95-45.*

MALPIGHIACEAE—Malpighia Family

1. Stems vining, semi-vining, arching, or trailing; fruits winged.
   2. Stems vining or not; leaves 2.5–11 cm; fruits with four large papery wings, wider than long, 2–3.5 cm ..... *Callaeum*
   2′ Stems all vining; leaves <5.5 cm; fruits with two or three samaras, each 6–13 mm, the wings longer than wide ..... *Janusia*
1′ Stems erect to spreading, not vining or as above; fruits not winged.
   3. Shrubs, usually 1.5 m or more; leaves alternate ..... *Echinopterys*
   3′ Subshrubs usually <1 m; leaves opposite ..... *Galphimia*

Callaeum macropterum (DC.) D. M. Johnson [*Mascagnia macroptera* (DC.) Nied.]. *Gallinita*. Bushy perennial in arid habitats, robust vine in better-watered habitats with denser vegetation. Flowers yellow; various seasons. The common name relates the unusual winged fruits to the wattles of a chicken. Canyon bottom, mostly in the more open, xeric habitats. *F 8046.*

Echinopterys eglandulosa (A. Juss.) Small. Shrub to 2 m. Leaves alternate, gradually drought deciduous. Flowers bright yellow and very showy; various seasons with moisture and warm weather. Near the canyon entrance and on north-facing slopes. *Starr 222.*

Galphimia angustifolia Benth. [*Thryallis angustifolia* (Benth.) Kuntze]. Suffrutescent perennial with mostly short erect stems. Flowers bright yellow; various seasons following rainfall. Canyon bottom. *F 84-159, 85-865.*

Herbarium specimens were annotated as *Galphimia brasiliensis* (L.) A. Juss. subsp. *angustifolia* (Benth.) by Bruce Macbryde in 1970. However, the combination has not been published. According to William R. Anderson (personal communication, 1994), Macbryde "is right that the North American plant is very close to the South American species, which is exceedingly variable. On the other hand, the northern one is probably sufficiently distinct that it can always be recognized, and it is disjunct. So until some brave taxonomist is willing to wade into this difficult genus, it is best to stick with *G. angustifolia*."

Janusia

1. Leaves usually larger, broadly elliptic, widest at middle ..... *J. californica*
1′ Leaves usually smaller, lanceolate, broadest below middle ..... *J. gracilis*

Janusia californica Benth. Perennial vine with wiry stems; leaves gradually drought deciduous. Flowers yellow; with warm weather and moisture. Common and widespread in the canyon bottom, on slopes, and on the open desert. *F 85-1184*; *Starr 210.*

Janusia gracilis A. Gray. Resembles *J. californica* but distinguished by leaf shape and size. Generally in more xeric habitats than *J. californica*. South-facing canyon slopes. *F 95-20.*

MALVACEAE—Mallow Family

1. Fruit a capsule, the segments (carpels) persistent and not falling away at maturity (opening through longitudinal splits between the carpels or along the inner seam of the carpels into the middle or "top" of the capsule) ..... *Hibiscus*
1′ Fruit a schizocarp, the segments (mericarps) separating and falling at maturity.
   2. Subshrubby perennials, the flowering branches long and very slender, the upper leaves sessile, cordate, or amplexicaul at the base and clasping.
      3. Fruits not globose, not readily breaking apart, the mericarps 8 ..... *Briquetia*
      3′ Fruits globose, like a tiny paper lantern, readily breaking apart, the mericarps 10–12 ..... *Herissantia*
   2′ Herbaceous to shrubby, the flowing branches not unusually long and slender, the upper leaves petioled.
      4. Mericarps sharp-beaked ..... *Sida*
      4′ Mericarps not sharp-beaked.
         5. Plants nearly glabrous or sparsely pubescent with soft white hairs mostly <1 mm; leaf blades as broad as long, orbicular to kidney-shaped; petals ca. 0.5 cm, white to pale lavender ..... *Malva*
         5′ Plants conspicuously pubescent; leaf blades mostly longer than wide, not orbicular or kidney-shaped; petals >1 cm, yellow to orange.
            6. Upper and lower halves of mericarps similar, not reticulate on sides, not winged ..... *Abutilon*
            6′ Upper and lower portion of mericarps markedly dissimilar, the mericarps reticulate on sides, with flared membranous wings above.
               7. Involucel (floral bracts subtending flower) absent. ..... *Horsfordia*
               7′ Involucel of three bractlets per flower. *Sphaeralcea*

Abutilon

1. Calyx lobes not overlapping, the fruiting calyx about 1/4 to 1/2 as long as the mericarps; petals with a maroon spot at base; fruits with 5 mericarps ..... *A. incanum*
1′ Calyx lobes overlapping basally, the fruiting calyx at least 3/4 as long as the mericarps; petals of a single color; fruits with 8–10 mericarps.
   2. Shrubby; herbage rough to the touch, the hairs often yellowish, the leaves about the same color on both sides; calyx about as long as mericarps; fruits 9–14 mm ..... *A. abutiloides*
   2′ Somewhat herbaceous perennials, dying back to ground in drought; herbage soft to the touch, the leaves markedly bicolored; calyx shorter than the mericarps; fruits 7–8 mm ..... *A. parishii*

Abutilon abutiloides Jacq. [*A. lignosum* (Cav.) G. Don; *A. scabrum* S. Watson, Proc. Amer. Acad. 24: 41, 1889]. Shrub often 1.5–2.5 (–3) m. Flowers orange; warm weather. Fruiting calyx about as long as the mericarps, the mericarps 10. Understory of canyon bottom and mostly on north-facing slopes. *F 84-619, 85-1189.*

This species is closely related to *A. californicum* Benth., a Gulf of California segregate of the more widespread *A. abutiloides* (Fryxell 1988, Strong 1977). With the exception of those from Nacapule, all

of the many twentieth-century collections of this species complex from the entire Guaymas region (from near the Río Yaqui north to Tastiota) are *A. californicum*. Palmer's late nineteenth-century type collection of *A. scabrum* is reported to be from Guaymas, probably San José de Guaymas, or "Old Guaymas," see McVaugh (1956).

Nacapule, *F 85-1189*; Guaymas, 1887, *Palmer 97* (type of *A. scabrum*, GH, not seen, cited by Fryxell 1988).

Abutilon incanum (Link) Sweet. *Tooko huya* (Yaqui). Slender-stemmed shrub. Petals pale orange with a maroon spot at base. Flowering and fruiting nonseasonally. Mostly along the canyon bottom and on north-facing slopes. *F 85-544A*; *Starr 718*.

Abutilon parishii S. Watson. *Riptia* (Yaqui). Suffrutescent perennial or subshrub, open and sparsely branched with slender stems. Leaves velvety with dense stellate hairs, darker above. Inflorescences of slender-stemmed sparsely branched terminal panicles rising to 1–1.8 m and well above the foliage; flowering also from leaf axils. Flowers yellow; warmer weather, opening between 5 and 6 PM. Mericarps about 10. Common in sandy soil and colluvium near mouth of canyon and scattered through the canyon bottom in open areas. At scattered localities northward to southern Arizona (Van Devender et al. 1995). *Bertelsen 92-154*; *F 92-1017*; *94-885*.

Briquetia sonorae Fryxell. Subshrub 1–1.5 m, open and sparsely branched with unusually slender stems; growing and flowering with hot, moist weather. Leaves widely spaced, the blades thin, darker green and glabrate above, lighter green with stellate hairs below, the margins toothed; vegetative leaves often 7–14 cm, their petioles slender and often about as long as the blades, the upper leaves (on flowering branches) smaller, sessile, and perfoliate. Panicles and racemes long and slender. Corollas orange. Fruits ca. 1 cm wide, readily breaking into eight mericarps, each two-celled and each cell one-seeded, the lower cell smaller and indehiscent, the upper cell larger, broader, and dehiscent. Seeds 1.9–2.2 mm; the seed of the lower cell mostly glabrous, the seed of the upper cell densely and minutely hispid with often slightly hooked hairs.

Densely shaded steep north-facing slopes near the canyon bottom and along the canyon bottom adjacent to the north-facing canyon wall. Endemic to west-central Sonora from near Hermosillo to mountains southeast of Cd. Obregón. *F 84-575*, *85-1325*.

Herissantia crispa (L.) Brizicky. Short-lived perennial with slender stems to ca. 1 m. Flowers pale yellow-orange; nonseasonal, mostly during warm, moist weather. Fruits resembling a miniature paper lantern, the mericarps separating at maturity. Canyon bottom in open, sunny habitats, slopes, and open desert. *F 92-1047*.

Hibiscus biseptus S. Watson. Slender subshrub 1–1.5 m. Stems with small stellate hairs in two vertical lines decurrent from the stipules, plus scattered larger simple and two- or three-rayed stellate hairs; drought deciduous. Flowers showy, bright yellow with a purplish center; warm, moist weather. Canyon bottom and north and south slopes. *F 85-557*, *85-1335*.

Horsfordia newberryi (S. Watson) A. Gray. Slender few-branched shrub, often 1.5–2 m. Petals bright yellow-orange; flowering and fruiting at least spring and fall. Mostly on south-facing slopes; a desert species reaching its southern limits in the Guaymas region. *F 85-562*; *Phillips 75-170*.

****Malva parviflora*** L. *Malva*; cheeseweed. Winter–spring ephemeral. Flowers white. Watercourse below Nacapule Spring in a heavily grazed area. Not seen in the canyon area until 1995. *F 95-55*.

Sida

1. Perennial herbs with weak, often procumbent stems; herbage and calyces with dense short stellate hairs and also larger simple spreading hairs; leaf blades to about 1.5 cm; mericarps 5 ..... *S. abutifolia*

1′ Slender, few-branched shrubs 1–1.4 m; herbage and calyces with dense short stellate hairs only; leaf blades often 2–3.5 cm; mericarps usually about 9 ..... *S. hyalina*

Sida abutifolia Mill. Flowers pale yellow-orange; warmer weather. Infrequent along the canyon bottom. Not known elsewhere in the Guaymas–Sierra El Aguaje region, although widespread elsewhere in Sonora and the Americas. *F 85-870A*.

Sida hyalina Fryxell. Flowers pale yellow-orange; warmer months. North-facing canyon slopes. *F 85-548*, *85-870*.

Coastal thorn scrub in southern Sonora and western Sinaloa, inland to the Alamos region in southern Sonora. The northernmost records are of isolated populations at Bahía San Pedro, Las Barajitas, and Cañón de Nacapule. *S. hyalina* appears to be closely related to *S. xanti* A. Gray of Baja California Sur and Sinaloa. *S. xanti* is glandular-viscid while *S. hyalina* is not.

Sphaeralcea—*Mal de ojo*; globe mallow

1. Perennials; mericarps two- or three-seeded, the dehiscent section more than half as long as the body ..... *S. ambigua*

1′ Annuals; mericarps one-seeded, the dehiscent section less than half as large as the body ..... *S. coulteri*

Sphaeralcea ambigua A. Gray. *Heoko kuta*, *ochoko kuta* (Yaqui). Subshrub; flowers orange. Locally rare on sandy soil of bench above arroyo floodplain near canyon entrance. *F 95-61*. This is a desert species, otherwise known only as far south as Bahía Kino.

Sphaeralcea coulteri (S. Watson) A. Gray. *Sevoa'ara*, *heoko kuta* (Yaqui). Annual globe mallow. Spring ephemeral. Flowers orange. Often locally abundant in the open desert and open areas in the canyon bottom. *F 85-234*.

MENISPERMACEAE—Moonseed Family

Cocculus diversifolius DC. Perennial vine, often woody at the base; nearly evergreen. Flowers small, yellow; at least March–April. Fruits dark purple. Canyon bottom. *F 84-152*; *Van Devender 84-251*.

MOLLUGINACEAE—Carpetweed Family

****Mollugo verticillata*** L. Carpetweed. Delicate hot-weather ephemeral. Flowers inconspicuous, green and white. Common on gravelly soil, mostly in open areas near canyon entrance and on open desert, less common on exposed, rocky slopes. In Sonora mostly in subtropical scrub south and east of the Sonoran Desert. *F 84-599*, *85-1210*.

MORACEAE—Mulberry Family

Ficus—*Higuera*; fig.

1. Leaf blades about as wide as long, oval or orbicular to ovate with a cordate base ..... *F. palmeri*

1′ Most leaf blades at least twice as long as wide, mostly lanceolate to elliptic, not cordate at base.

2. Leaves mostly 10–18 cm, broadly elliptic to ovate, often dull green, with both or only the lower surfaces usually rough-scabrous; sheathing stipules 4–8.5 cm; figs solitary at the nodes, 2.5–3 cm wide, subtended by three scales ..... *F. insipida*

2′ Leaves mostly 5.5–12 cm, lanceolate, shiny and smooth; sheathing stipules <2 cm; figs paired, 1 cm wide, subtended by two scales ..... *F. pertusa*

Ficus insipida Willd. subsp. ***insipida*** [*F. radulina* S. Watson]. *Chalate*; *kau chuuna* (Yaqui). Fig. 7. Tree 10–15 m with massive buttressed trunks and exposed spreading gnarled roots; evergreen or eventually deciduous in extreme drought. Figs mottled green and yellow-green; various seasons.

Figure 7. *Ficus insipida*, Cañón de Nacapule, January 1996. This tree shows extensive die-back and subsequent recovery. Cattle grazing has eliminated the former understory vegetation.

Canyon bottom among the *Washingtonia* palms; a few at the spring. Cattle have severely damaged young plants and the bark of the trees, especially at the spring. *F 84-117*; *Phillips 75-159*; *Yatskievych 82-147*. A tropical–subtropical species not known elsewhere in the Sonoran Desert except for a few immature plants in Las Barajitas canyon. Otherwise the nearest population is in the Sierra Bacatete where there are extensive groves of enormous trees along certain canyon streams. The buttressed trunks are unique among the trees of the Sonoran Desert region.

Ficus palmeri S. Watson [*F. petiolaris* subsp. *palmeri* (S. Watson) Felger & Lowe]. *Tescalama*; cliff fig. Shrub to tree 10+ m; canyon walls, cliffs, and rock. Seedlings germinate in rock crevices. The roots grasp the rock and cascade down over the surface, as if melted; if the roots reach the canyon floor or moist soil the plant develops into a tree. Root and stem bark yellowish white. Leaves often with pink veins. Figs edible, ca. 1.5 cm in diameter, paired (or one may fail to develop). *F 84-576*; *Phillips 75-178*.

Ficus palmeri is widespread in the Gulf of California region of the Sonoran Desert, and *F. petiolaris* Kunth is characteristic of subtropical and tropical regions from eastern Sonora to Oaxaca. They meet and apparently intergrade in the Guaymas region. In the more arid, exposed habitats surrounding the canyon the plants have the characteristics of *F. palmeri*, while in more favorable habitats, such as near the canyon bottom, they approach *F. petiolaris* in appearance.

Ficus pertusa L. [*F. padifolia* Kunth; *F. sonorae* S. Watson]. *Nacapule*; *naka'apuli*, *nakapuri* (Yaqui). Large spreading trees in the canyon bottom among the *Washingtonia* groves, smaller trees or large shrubs on cliffs and north- and east-facing canyon walls. An enormous *nacapule* tree shades Nacapule Spring, a few hundred meters north of the canyon entrance; it has been severely damaged by cattle. Evergreen at permanent water, facultatively and tardily drought deciduous in the more xeric habitats. Fruits edible, usually ripe in late summer and also in winter. This tropical–subtropical species reaches its northern limits in the surrounding mountain mass. *F 84-158*, *84-601*; *Phillips 75-85*.

NYCTAGINACEAE—Four O'Clock Family

1. Stems slender, weak, prostrate-trailing; flowers in clusters of three, the cluster resembling a single flower; "fruits" (anthocarps) with a deep cavity formed by a pair of inrolled wings ..... *Allionia*

1′ Stems erect to spreading, sometimes decumbent but not prostrate; flowers often clustered but each flower conspicuously separate; fruits not grooved or with four or five furrows.

2. Annuals or herbaceous perennials; stems mostly <1 m; herbage glandular-sticky; perianth pink or white to red-purple; fruits without peglike glands ..... *Boerhavia*

2′ Perennials, usually woody at base; stems usually 1 m or more; herbage glabrous; perianth yellow-green; fruits with large peglike sticky glands ..... *Commicarpus*

Allionia incarnata L. Trailing windmills. Short-lived herbaceous perennial with trailing stems. Flowers purple; warmer months. Arid habitats at canyon entrance and on the nearby open desert.

Boerhavia

1. Perennials; flowers dark purple-pink ..... *B. gracillima*

1′ Annuals; flowers whitish to pale pink.

2. Flowers in small umbellate or subumbellate clusters. *B. erecta*

2′ Flowers on elongated racemes ..... *B. spicata*

Boerhavia erecta L. var. ***intermedia*** (M. E. Jones) Kearney & Peebles [*B. intermedia* M. E. Jones; *B. maculata* Standl.; *B. triquetra* S. Watson]. *Mochis*; spiderling. Summer–fall ephemeral. Flowers fading with mid-morning heat. Seasonally abundant; canyon bottom and slopes, especially in open areas, and the open desert. *Burgess 6528*; *Starr 219*. I am taking a broad, "lumper's" view in the interpretation of this species and *B. spicata*.

Boerhavia gracillima Heimerl. Herbaceous perennial with hard knotty base. Leaves firm, semi-succulent, turning reddish in winter and spring. Flowering with warmer weather. North-facing slopes, less often in the canyon bottom. *F 84-149*, *84-617*.

Boerhavia spicata Choisy [*B. xanti* S. Watson]. Spiderling. Summer–fall ephemeral. Flowers fading with mid-morning heat. Canyon bottom and slopes, especially in open areas, and the open desert. *Phillips 75-78.*

Commicarpus scandens (L.) Standl. Perennial to 2 m, the stems slender and brittle with long internodes, often growing through other shrubs. Leaves semi-succulent, tardily drought deciduous. Flowers pale yellow-green; warmer months. Canyon bottom and mostly north- and east-facing slopes. *F 84-127*; *Phillips 75-154.*

OLEACEAE—Olive Family

Forestiera cf. ***angustifolia*** Torr. Desert olive. Much-branched shrub 2-3 m, with rigid branches. Leaves 15–25 mm, thickish, linear-oblong to elliptic, dark green above, lighter green below and markedly punctate-glandular; tardily drought deciduous. Fruits often 1 cm, fleshy, blue-black at maturity. Flowers recorded in January, fruits in March. Fairly common along the canyon bottom. *F 84-171, 85-856.*

Widely scattered in riparian canyons in the Sierra El Aguaje region. The leaves are generally larger than those of *F. angustifolia* from elsewhere.

ONAGRACEAE—Evening Primrose Family

Ludwigia octovalvis (Jacq.) P.H. Raven subsp. ***octovalvis*** [*Jussiaea suffruticosa* L. var. *octofila* (DC.) Munz]. Warm-weather annual to herbaceous perennial, 1 (–2.5) m. Stems slender, amazingly tough, the bark shredding. Petals pale yellow, falling at a touch. After the last fruits mature, often in December, most of the above-water portion of the plant perishes. Emergent from shallow water or in very wet soil in the upper part of the canyon beneath *Washingtonia* palms. *F 84-170, 85-1498.*

Wetlands in the warmer regions of the world, but not known elsewhere in the Sonoran Desert except at Las Barajitas. Otherwise the nearest population is along the lower Río Yaqui where the plants become 3 m tall.

PAPAVERACEAE—Poppy Family

Argemone—*Cardo*; prickly poppy
1. Petals white ..... *A. gracilenta*
1′ Petals yellow ..... *A. ochroleuca*

Argemone gracilenta Greene. Prickly poppy; *tatchi'ina* (Yaqui). Annual or perhaps short-lived perennial beset with sharp prickles. Petals large and white, the stamens yellow and very numerous; warmer months. Open areas of the gravelly to sandy wash in the lower part of the canyon, rare but common elsewhere in the region. *Starr 488.*

****Argemone ochroleuca*** Sweet subsp. ***ochroleuca***. *Cardo*; Mexican prickly poppy; *tatchi'ina* (Yaqui). Annual beset with sharp prickles. Petals and stamens yellow; warmer months. Open areas of the gravelly to sandy wash in the lower part of the canyon, rare but common elsewhere in disturbed habitats. *Ames 12 Mar 1977.*

PASSIFLORACEAE—Passion Vine Family

Passiflora—Passion vine
1. Herbage densely hairy; leaves three-lobed ..... *P. arida*
1′ Herbage glabrous; leaves two-lobed ..... *P. mexicana*

Passiflora arida (Mast. & Rose) Killip var. ***arida***. Desert passion vine; *mastaoka* (Yaqui). Perennial with semi-vining to vining stems 1–1.5 m often growing over shrubs. Herbage whitish woolly. Flowers white and lavender, ca. 3 cm wide; warmer months. Fruit globose, 2.5–3 cm in diameter, green, the pulp sweet and delicious. Scattered, mostly in dryer habitats in the canyon bottom, on south-facing slopes, and at the canyon entrance. *F 84-1211.*

Passiflora mexicana Juss. Perennial vine overtopping trees and shrubs; glabrous. Leaves deeply bilobed, variable in size and width depending on shade, season, age, and soil moisture. Flowers purple and white, ca. 2 cm wide; fruits globose, 1–1.5 cm in diameter, blackish when ripe; flowering and fruiting mostly with summer rains. Common in moist habitats along the canyon bottom. *F 85-845*; *Palmer 260*, [12 Oct] 1897 (the label reads "Guaymas," but according to McVaugh (1956) this collection is from "Nacapuly"); *Phillips 75-147.*

PHYTOLACCACEAE—Pokeweed Family

1. Herbaceous or scarcely woody at base, the stems very slender. ..... *Rivina*
1′ Woody shrubs, the stems not noticeably slender.
  2. Leaves narrowly spatulate to oblanceolate; fruits translucent white and fleshy ..... *Phaulothamnus*
  2′ Leaves broadly elliptic to obovate; fruits red and at first semi-fleshy, drying as capsules ..... *Stegnosperma*

Phaulothamnus spinescens A. Gray. *Putilla*; snake-eyes; *kuh kuta, kus kuta, va'ako* (Yaqui). Woody *Lycium*-like shrub, spinescent and glabrous; drought deciduous. Flowers inconspicuous. Fruits globose, ca. 5 mm in diameter. Canyon bottom and north-facing slopes. *F 12006, 92-1014.*

Rivina humilis L. *Chile de coyote*; pigeon berry; *wo'i ko'oko'i* (Yaqui). Bushy perennial often 1–1.2 m, the leaves thin and quickly wilting. Flowers white; mostly with summer rains. Fruits fleshy and red. Shaded canyon bottom with *Coccoloba* and *Vallesia*. *F 92-1051*; *Phillips 75-151.*

Stegnosperma halimifolium Benth. [*S. watsonii* D. J. Rogers]. *Chapacolor*; *wokkoi aaki* (Yaqui). Shrub, nearly evergreen. Flowers white, fragrant, in terminal or axillary racemes; nonseasonal. Mostly in the canyon bottom near the entrance and at the spring. *F 92-1057*; *Starr 203.*

PLUMBAGINACEAE—Leadwort Family

Plumbago scandens L. *Estrenina*. Herbaceous perennial; tardily drought deciduous. Rachis, bracts, and calyx with stipitate glands that stick to almost anything. The calyx glands begin exuding at anthesis. Flowers white; nonseasonal with moist conditions. Mostly in shaded habitats along the canyon bottom and on north-facing slopes. *F 85-258.*

POLEMONIACEAE—Phlox Family

Gilia sonorae Rose [*Ipomopsis sonorae* (Rose) A. Grant]. Sonoran gilia. Small winter–spring ephemeral. Flowers small, pale pink. Often cryptic among ephemeral grasses. Canyon entrance and the open desert. *F 85-233, 95-104.*

POLYGONACEAE—Buckwheat Family

1. Vines bearing tendrils ..... *Antigonon*
1′ Woody shrubs, without tendrils ..... *Coccoloba*

Antigonon leptopus Hook. & Arn. *San Miguelito*; queen's wreath; masa'asai (Yaqui). Robust perennial vine with tuberous roots, often covering shrubs and trees; tardily drought and winter deciduous.

Panicles terminating in tendrils; floral bracts and flowers pink and showy; nonseasonal but flowering most vigorously with summer rains. Abundant in the canyon bottom and on rocky slopes. Widely cultivated in Sonora and southern Arizona. *F 3388, 11884.*

Coccoloba goldmanii Standl. Multiple-stemmed shrub 3–5 m. Essentially evergreen, although the larger leaves fall during drought. Leaf blades 5.5–17.0 cm, nearly orbicular, rather tough, glabrous or pubescent along veins of the lower surfaces. Dioecious. Flower stalks (peduncle and raceme) 7–30.5 cm, slender, pendent, appearing terminal. Pedicels 2 mm, the perianth 4.0–4.5 mm wide; sepals pale green, the filaments, anthers, ovary, style, and stigma white. Female flowers solitary; male flowers usually in clusters of three. Fruits 5.6–6.8 × 4.8–5.7 mm, rounded and hard. Flowering mostly June–July; fruit ripe October–December. Canyon bottom in winter-shaded portion and north-facing slopes below cliffs; closely associated with *Vallesia laciniata*. *F 8038, 85-839*; *Phillips 75-150*; *Van Devender 84-257.*

A few small populations also occur in other, nearby canyons and at Las Barajitas and Cañón los Anegados near Aguaje de Robinson. Otherwise recorded only from a few widely scattered riparian canyons in southeastern Sonora, southwestern Chihuahua, and northern Sinaloa.

PORTULACACEAE—Purslane Family

1. Leaves <3 cm; flowers sessile in leaf axils; capsules circumscissile ..... *Portulaca*
1′ Leaves 2.5–10+ cm; flowers in large panicles; capsules valvate ..... *Talinum*

Portulaca

1. Roots tuberous; leaves terete-conical (may appear flat when dry); leaf axils and flower clusters densely hairy ..... *P. suffrutescens*
1′ Roots not tuberous; leaves spatulate to obovate, thick but flattened; glabrous except for a few inconspicuous hairs.
   2. Capsule rim not collar-winged, the capsule opening about at the middle, the lid conical ..... *P. oleracea*
   2′ Capsule rim surrounded by a collarlike wing 1–2 mm wide, the capsule opening above the middle, the lid shallow, saucerlike ..... *P. umbraticola*

****Portulaca oleracea*** L. var. ***oleracea*** [*P. retusa* Engelm., perhaps not *P. retusa* of western authors]. *Verdolaga*; purslane; *bwaarom* (Yaqui). Hot-weather ephemeral, succulent. Flowers yellow. Canyon bottom in open often grazed and disturbed places and the nearby open desert. *85-1215, 85-1309.*

Portulaca suffrutescens Engelm. Hot-weather ephemeral, succulent, sometimes also growing and flowering with winter–spring rains. Flowers orange, relatively large. Canyon bottom in gravelly soil in open areas, arid slopes usually with shallow soil, and the open desert. *F 85-1308, 85-1506.*

Portulaca umbraticola Kunth subsp. ***lanceolata*** (Engelm.) J. F. Matthews & Ketron [*P. coronata* Small; *P. lanceolata* Engelm.]. Hot-weather ephemeral, succulent. Flowers probably yellow-orange. Canyon bottom near entrance. *Bertelsen 6 Nov 1992*; *F 84-128.*

Talinum paniculatum (Jacq.) Gaertn. Perennial from thick, fleshy, tuberous roots. Flowering in the first season but only during the summer rainy season. Stems and leaves succulent, the leaves quickly drought deciduous—by late September only the dry skeletons of the inflorescences remain. Flowers in loose, open panicles 30–100 cm, small, pink to dark red-purple, open about three hours in the late afternoon. Canyon slopes, less common along the canyon bottom. *F 85-841.*

RHAMNACEAE—Buckthorn Family

1. Vines with tendrils on inflorescences ..... *Gouania*
1′ Shrubs or trees, without tendrils.
   2. Fruit a dry capsule ..... *Colubrina*
   2′ Fruits fleshy.
      3. Leaves <0.5 cm wide, widest well above the middle with prominent raised pinnate veins on the lower surfaces; fruits <5 mm ..... *Condalia*
      3′ Leaves >0.5 cm wide, widest at or below middle, with three prominent main veins from the base and not prominently raised on lower surface; fruits 8–10 mm ..... *Ziziphus*

Colubrina

1. Leaves dull green, pubescent, the margins entire to toothed ..... *C. californica*
1′ Leaves bright green, glabrous or sparsely puberulent when young, the margins entire ..... *C. viridis*

Colubrina californica I. M. Johnst. [*C. texensis* (Torr. & A. Gray) A. Gray var. *californica* (I. M. Johnst.) L. D. Benson]. California snakewood. Much-branched hardwood shrub 2–3.5+ m. Leaves drought deciduous. Flowers small, yellow-green. Small, localized population along canyon floor near the entrance. *F 84-570, 94-850, 92-1043.* Also at Las Barajitas. These are the southernmost records for this desert species; the nearest record is from central Sonora, near Ures (Turner et al. 1995).

Colubrina viridis (M. E. Jones) M. C. Johnst. [*C. glabra* S. Watson]. *Granadita, palo colorado.* Shrub with rigid hardwood trunks and branches. Leaves quickly drought deciduous, appearing with each rainy period. Flowers small, yellow-green, the floral disk awash in nectar at anthesis; mass flowering during the summer–fall rainy season and sometimes at other seasons. Widespread; canyon bottom near entrance, south-facing slopes, and the open desert. *F 85-864*; *Starr 199.*

Condalia globosa I. M. Johnst. var. ***globosa***. *Crucerilla*; bitter condalia; *hu'upa keka'ala* (Yaqui). Hardwood shrub with rigid branches and thorn-tipped twigs. Long-shoot leaves petioled and larger; short shoots with crowded (fascicled) subsessile leaves. Flowers small, yellow-green, the disk at anthesis awash with sticky, glistening nectar. Occasional along the canyon bottom and the nearby desert. *F 11878.* Plants of var. *pubescens* I. M. Johnst., distinguished by pubescent leaves, are common in the nearby San Carlos–Guaymas region.

Gouania rosei Wiggins. Large vine overtopping shrubs and trees. Flowers greenish white; at least in summer. Fruits ca. 5 mm wide with three narrow wings; in fall and perhaps at other seasons. Canyon bottom and north-facing slopes. *F 84-93*; *Phillips 75-156*; *Starr 218.*

Ziziphus obtusifolia (Hooker ex Torr. & A. Gray) A. Gray var. ***canescens*** (A. Gray) M. C. Johnst. [*Condalia lycioides* (A. Gray) Weberb. var. *canescens* (A. Gray) Trel.; *Condaliopsis lycioides* (A. Gray) Suess. var. *canescens* (A. Gray) Suess.]. *Abrojo*; graythorn; *hutu'uki* (Yaqui). Large sprawling briarlike shrub. Nearly leafless during dry seasons, with sparse foliage in wetter seasons. Flowers inconspicuous, attracting many insects. Fruits edible but hardly worth the bother. *Fine 77-1.*

RUBIACEAE—Madder Family

1. Plants unarmed ..... *Hintonia*
1′ Twigs armed with stout spines ..... *Randia*

Figure 8. *Zanthoxylum mazatlanum*. A, Portion of a long-shoot branch, drawing from *Felger 85-1226* by Amy Eisenberg. B, Short-shoot twigs with several follicles, drawing from *85-1226* by Joel Floyd.

Hintonia latiflora (Sessé & Moç.) Bullock [*Coutarea latiflora* Sessé & Moç.]. *Copalquín, quina*. Slender shrub or small tree to 4 (–6) m. Leaves produced mostly with summer rains and gradually drought deciduous. Flowers showy, 6–9 cm, white; summer rainy season and sometimes in spring. Mostly in winter-shaded habitats; canyon bottom and lower north- and east-facing slopes. *F 84-129, 85-850*. The bark is much esteemed for its medicinal properties and is often harvested in Sonora and elsewhere in Mexico.

Randia

1. Twigs with spines in clusters of 2–4; fruits at least 3 cm in diameter, rather soft, leathery, and green, falling soon after ripening ..... *R. sonorensis*

1′ Twigs with spines in pairs; fruits 1.5–2.5 cm in diameter, hard-shelled, mottled green and white, semi-persistent. *R. thurberi*

Randia sonorensis Wiggins. *Papache borracho*. Shrub to ca. 4 m; leaves drought deciduous, appearing after rains. Flowers white; May, the fruits ripening November–December. Canyon bottom and lower north-facing slopes; not known elsewhere in the Guaymas–Sierra El Aguaje region except at Las Barajitas. *F 84-121, 85-1328; Van Devender 28 Dec 1982*.

Randia thurberi S. Watson. *Papache*. Shrub with rigid woody branches; leaves drought deciduous. Flowers white and fragrant; with summer rains. Fruits ripening at least in spring, the mesocarp (pulp) black, sweet, and edible (Felger and Moser 1985). Canyon bottom, south-facing slopes, and the open desert. *F 85-871A, 85-876*.

RUTACEAE—Rue or Citrus Family

Zanthoxylum

1. Leaf rachis winged; fruits with a stipe ..... *Z. fagara*

1′ Leaf rachis not winged; fruits sessile ..... *Z. mazatlanum*

Zanthoxylum fagara (L.) Sarg. [*Z. sonorense* Lundell]. Hardwood shrub 2.5–3.5 m, with rigid branches and sharp paired spines at the nodes of long shoots; gradually drought deciduous. Crushed leaves with a lemonlike fragrance. Flowers inconspicuous; probably with summer rains. Capsules small, splitting to reveal hard shiny black seeds; ripening October–December. Scattered along canyon bottom, north-facing slopes, and nearby arroyos. *F 84-166, 84-1227*.

Zanthoxylum mazatlanum C. I. Sandwith (Kew Bull. 1926: 433). Figs. 8 and 9. Dioecious shrub 3–4 m with well-developed hardwood trunks and branches. Long shoots mostly armed with one to sometimes several nonpaired internodal laterally flattened stout sharp prickles to ca. 1 cm, and with relatively larger leaves; short shoots unarmed and with smaller clustered leaves. Herbage and inflorescences hispidulous, the vegetative buds ferruginous. Leaves nearly evergreen, with a citruslike fragrance when crushed but the odor quickly dissipating, 3.8–8.0 cm (to 14 cm on vigorous long shoots), odd-pinnate with 3–7 leaflets, the rachis not winged; leaflets sessile to subsessile, ovate to broadly elliptic or oval or sometimes lanceolate, the lateral leaflets 15–33 × 7.4–16.5 mm, the terminal leaflet usually slightly larger, the margins crenulate with glands in the notches.

Inflorescences shorter than the leaves, one- to few-flowered racemes or corymbose panicles. Flowers inconspicuous. Sepals none. Petals mostly promptly deciduous, five or four and the fifth petal reduced or "missing" with a gap in its place, highly variable in shape and size on the same flower, 0.8–1.2 mm, linear to oblong, elliptic or ovate, pale yellow to green, somewhat fleshy, sometimes bifid at apex, ciliolate with red hairs. Staminate flowers with two or three stamens (from their positions the androecium appears to be 5-merous, with gaps where "missing" stamens would be expected); filaments pale yellow (like the petals); anthers red-brown. Pistillate flowers with mostly one but often two carpels and sometimes with a third reduced carpel; ovary green with clear to green rounded warty glands

Figure 9. *Zanthoxylum mazatlanum*. Pistillate inflorescence, enlarged flower, and portion of a leaf, drawing from *Purpus 382* by Joel Floyd.

(some ovaries appear asymmetric because of these warts); style, stigma, and disk below the ovary pale yellow, the style 0.8–1.2 mm, on most flowers bent about 45 degrees. Fruiting pedicels 1.0–2.5 mm; follicles (carpels) mostly one but often two per flower, 4.2–7.1 mm, and sometimes also with a reduced follicle or rudiment, sessile, somewhat obovoid-rounded to obpyriform, yellowish to red-brown or purplish, dotted with prominent pellucid glands with clear, golden exudate, plus a large, lateral glandular wart. Seeds 4.7–5.0 mm, ovoid, shiny black, often partially covered with a thin, red, aril-like endocarp. Flowering in August with hot, humid weather; fruits generally ripe at the end of the summer rainy season, September–October (November).

This shrub has been found in three canyons in the Sierra El Aguaje. At Nacapule the shrubs are scattered on the steep lower north-facing canyon slopes, east-facing slopes at the southeast side of the canyon, and mostly along the canyon bottom, especially near the north-facing canyon wall, which is shaded during winter months. There are probably no more than 500 plants in this population. It grows intermixed with *Celtis reticulata*, *Coccoloba goldmanii*, *Coursetia glandulosa*, *Gouania rosei*, *Passiflora mexicana*, *Sapindus saponaria*, *Vallesia laciniata*, *Verbesina felgeri*, *Zanthoxylum fagara*.

Alberto Búrquez and Angelina Martínez-Yrízar found a population of many shrubs of this species near Aguaje Robinson in Cañón Los Anegados, about 6 airline km northwest of Nacapule (although separated from Nacapule by high, impassible mountains). This long canyon drains eastward from near the center of the Sierra El Aguaje through the ranch and waterhole known as Aguaje Robinson. The vegetation, flora, and species richness seem to be comparable to that of Nacapule, but the canyon remains scarcely explored botanically.

In addition, I found a single shrub at Cañón Las Barajitas, on the western, seaward flank of the Sierra El Aguaje, about 15 km northwest of Nacapule. This canyon is more than 8 km long and likewise supports a flora and vegetation similar to those of Nacapule. It was about 3 km inland, growing among rich riparian thorn-scrub-like

vegetation. I have explored the canyon extensively and found no other plants of this *Zanthoxylum*. Perhaps there is a more extensive population in canyons or arroyos at higher elevations of the Sierra El Aguaje, in areas which remain inaccessible and botanically unknown despite more than 100 years of botanical exploration in the region.

Several years ago Fernando Chiang (MEXU) identified Nacapule specimens as *Z. mazatlanum*. This species was previously known only from the holotype (K) collected at Mazatlán, Sinaloa. Figure 9 is the first published illustration of it. The available information and specimens incdicate that the Mazatlán plants differ from the Sonoran plants by their much longer and denser ferruginous hairs on young leaves and twigs, many-flowered pistillate inflorescences, and by having only one-carpeled rather than both one- and two-carpeled fruits (Fig. 9). Although there is a fairly good match between the Sinaloa and Sonora specimens, the question of acutal relationship remains unresolved, and the Sonoran population might be worthy of taxonomic distinction.

In Sinaloa *Zanthoxylum mazatlanum* is a plant of coastal thorn scrub. Natural vegetation has disappeared from the Mazatlán region, and the vast majority of the remaining potential habitat for *Z. mazatlanum* in western Sinaloa has long been converted to agriculture or is poorly explored botanically. *Z. mazatlanum* has not been located elsewhere in Sonora in spite of intensive botanical investigation in the state during the past several decades (e.g., Felger and Moser 1985, Turner et al. 1995), especially in the Río Mayo region in the southern part of Sonora (e.g., Friedman 1996, Martin et al. 1998), which would seem to contain the most likely habitats. Perhaps the most likely place to search for additional populations would be the Sierra Libre in west-central Sonora, to the northeast of the Sierra El Aguaje (see Yetman and Búrquez 1996). The interior and higher elevations of this large, rugged mountain have never been explored botanically, and investigations at its periphery indicate a flora similar to that of the Sierra El Aguaje. Note added in proof: Two additional populations were recently discovered, one south of Alamos, Sonora, by Tom Van Devender, and one near El Fuerte, Sinaloa, by Ignacio Basemo Cota and David Yetman; *Z. mazatlanum* seems to be rare at both localities.

Zanthoxylum mazatlanum is a member of the subgenus *Zanthoxylum*, with about 15 species in eastern Asia and at least three species ranging from Central America to Canada (Brizicky 1962). This subgenus is probably not monophyletic, and infrageneric studies are much needed (Beurton 1994). No other members of subgenus *Zanthoxylum* are known from northwestern Mexico, although there are two species in subgenus *Fagara*, *Z. fagara* in Baja California Sur and Sonora and *Z. arborescens* Rose in Baja California Sur.

Cañón Los Anegados, 2.2–2.4 km SW of Aguaje Robinson, many individuals on the arroyo bottom 4 Feb 1996, *Búrquez & Martínez 96-3*, *96-4* (MEXU). Cañón las Barajitas, vicinity of 28° 03′03.6″ N, 111° 11′01.7″ W, north-facing rock slope in upper part of canyon, shrub 1.7 m, 6 Jan 1996, *F 96-45*. Nacapule: *Daniel 2004* (ASU); *F 84-167*, *84-577*, *85-868*, *85-1226*, *92-1025*, *96-84*; *Phillips 75-148*. Sinaloa: El Zapote, Mun. de Mazatlán, "Muelilla," 1923, *Ortega 5210* (isotype, US 1208572). Mazatlan, small tree, Jan.–March 1902, *Purpus 382* (UC).

SAPINDACEAE—Soapberry Family

1. Stems vining.
   2. Fruits globose, inflated capsules, not winged. *Cardiospermum*
   2′ Fruits three-winged samaras ..... *Serjania*
1′. Shrubs or trees.
   3. Shrubs; leaves simple; fruits papery, three-winged, three-seeded capsules ..... *Dodonaea*
   3′ Trees; leaves pinnate; fruits firm, globose, and drupe-like. ..... *Sapindus*

Cardiospermum corindum L. *Farolitos*, *huevo de toro*, *tronadór*; balloon vine; *too vichom*, *toora* (Yaqui). Perennial vine; drought deciduous. Flowers white; various seasons. Fruits resembling small paper lanterns. Canyon bottom, slopes, and open desert. *F 85-1200*; *Starr 200*.

Dodonaea viscosa Jacq. *Tarachique*; hop bush. Shrub, the herbage, especially the young shoots, resinous-sticky; evergreen to very tardily drought deciduous. Flowers inconspicuous, yellow-green. Occasional in the canyon bottom and on rocky slopes. *F 11899*.

Sapindus saponaria L. *Amolillo*; soapberry. Slender unarmed tree to 8 m with a well-developed trunk; evergreen to ultimately drought deciduous in extreme drought. Leaves pinnate, the rachis conspicuously winged. Flowers small, cream color, often unisexual; at various seasons including November–December. Canyon bottom. *F 85-1504*; *Starr 200*.

Along the Sonora coast *S. saponaria* does not range north of the Guaymas region, but inland it extends northward along the east side of the desert as part of the foothill thorn scrub (subtropical scrub or riparian thorn scrub, see Búrquez et al. 1999).

Benson and Darrow (1981) reduced *S. drummondii* Hook. & Arn. to a variety of *S. saponaria*. However, they seem best treated as distinct species. *S. saponaria* has a more southern distribution, ranging south to northern Argentina, and much larger leaves and leaflets. *S. drummondii*, ranging from northern Sonora east to northeastern Mexico and north to Kansas, has much smaller leaves and leaflets. Their distributions are allopatric in Sonora, and there is no morphological intergradation. *S. drummondii* is essentially a temperate, frost-hardy species. *S. saponaria* is largely tropical or subtropical and is highly frost-sensitive in cultivation in southern Arizona.

Serjania palmeri S. Watson. Robust sprawling perennial vine, woody toward the base with leafy stems to 5 m. Leaves divided into many small segments; tardily drought deciduous. Flowers white. Localized and scattered, near the streambed and lower slopes; also on rocky slopes of Arroyo Nacapule. I have not found this plant elsewhere in the region except at Las Barajitas, although Edward Palmer reported it "common about Guaymas" (Watson 1889). *F 85-1218*, *94-875*.

SAPOTACEAE—Sapodilla Family

Sideroxylon occidentale (Hemsl.) T. D. Penn. [*Bumelia occidentalis* Hemsl.]. *Bebelama*; bumelia; *vapsa* (Yaqui). Large hardwood shrub or tree to 6+ m, the bark checkered. Branches rigid, the twigs often thorn-tipped. Flowers white; probably at various seasons including July. Scattered along the canyon floor and on north-facing slopes. *F 85-257*, *Phillips 75-140*.

SCROPHULARIACEAE—Figwort Family

1. Leaf margins toothed.
   2. Annuals; pedicel longer than the flower, the corollas yellow. ..... *Mimulus*
   2′ Perennials; pedicel shorter than the flower, the corollas dark blue ..... *Stemodia*
1′ Leaf margins entire.
   3. Larger leaves not in a basal rosette; corollas not spurred. ..... *Antirrhinum*
   3′ Larger leaves in a basal rosette; corollas with a prominent, slender spur ..... *Linaria*

Antirrhinum—Snapdragon

1. Herbage glandular but not viscid; leaves linear, sessile or nearly so ..... *A. costatum*

1′ Herbage glandular-viscid; leaves ovate to broadly lanceolate, prominently petioled ..... *A. cyathiferum*

Antirrhinum costatum Wiggins. Spring ephemeral with elongated stems usually unbranched or few-branched above. Corollas white with pink-purple guidelines. Gravelly soil in open areas in canyon bottom and on rocky slopes. *F 85-241, 95-115.*

Antirrhinum cyathiferum Benth. Desert snapdragon. Nonseasonal ephemeral, often branched near the base. Corollas blue-purple. Canyon bottom, slopes, and open desert. *F 85-1193, 95-54.*

Linaria canadensis (L.) Dum. Cours. var. ***texana*** (Scheele) Pennell. Toadflax. Winter–spring ephemeral; leaves in a basal rosette. Flowers blue. Sandy soil at canyon entrance and open desert. *F 85-246.*

Mimulus floribundus Douglas ex Lindl. Cool-season ephemeral; herbage slimy with glandular hairs. Corollas pale yellow. Seasonally and locally common in wet soil beneath *Washingtonia* palms in the upper part of the canyon and at Nacapule Spring. *F 85-603.*

Stemodia durantifolia (L.) Sw. Annual to short-lived perennial to ca. 50 cm; first leaves in a basal rosette. Corollas dark blue. Wet soil at pools in upper part of canyon beneath *Washingtonia* palms. *F 84-107; Starr 48.*

SIMMONDSIACEAE—Jojoba Family

Simmondsia chinensis (Link) Schneid. Jojoba. Shrub; evergreen to very tardily drought deciduous during prolonged drought. Dioecious. Male flowers yellow-green, visited by honeybees; female flowers green; mid-winter. South-facing slopes, canyon bottom, arroyo near canyon entrance, and open desert. *F 85-549A, 85549B.*

SOLANACEAE—Nightshade Family

1. Herbage densely covered with stellate hairs, the leaves and stems generally spiny ..... *Solanum*
1′ Hairs, if present, not stellate; herbage not spiny.
  2. Hardwood shrubs ..... *Lycium*
  2′ Plants herbaceous or if bushy the stems not with hard wood.
    3. Corollas >10 cm; fruits spiny ..... *Datura*
    3′ Corollas <4 cm; fruits not spiny.
      4. Corollas tubular; fruit a capsule (dry) ..... *Nicotiana*
      4′ Corollas as broad or broader than long or deep (not tubular); fruit a berry (fleshy).
        5. Fruiting calyx not inflated, not growing around fruit; corollas white; fruits bright red when ripe. *Capsicum*
        5′ Fruiting calyx completely and loosely growing around the berry like an inflated paper lantern; corollas yellow or purple; fruits green when ripe .... *Physalis*

Capsicum annuum L. var. ***aviculare*** (Dierb.) D'Arcy & Eschb. *Chiltepín*; *huya ko'oko'i* (Yaqui). Subshrub 1.0–1.3 m with slender, brittle stems. Flowering during warmer weather. Fruits red when fully ripe and very hot to the taste. Rare, north-facing slopes and canyon bottom near *Washingtonia* palms. *F 84-581, 85-251.*

Datura discolor Bernh. *Toloache*; poisonous nightshade; *tebwi* (Yaqui). Nonseasonal ephemeral but responding poorly to cooler weather. Flowers large, white, nocturnal. Infrequent along the canyon bottom, generally in areas disturbed by cattle, and in nearby open desert. *F 85-577.*

Lycium

1. Flowers slender, longer than wide, the corolla tubular, the lobes lavender; filaments glabrous or sparsely hairy at base of free portion ..... *L. andersonii*
1′ Flowers as wide as or wider than long, the corollas campanulate (tube conspicuously expanded above), white; filaments densely hairy at base of free portion ..... *L. berlandieri*

Lycium andersonii A. Gray var. ***andersonii*** [*L. andersonii* var. *deserticola* (C.L. Hitchc.) Jeps.; *L. andersonii* var. *wrightii* A. Gray]. *Salicieso*; desert wolfberry; *roiya*, *roira* (Yaqui). Thorny shrub; drought deciduous, the leaves narrow. Flowering December–January and at other seasons. Fruits bright orange. Canyon bottom, slopes, and the open desert. *F 84-169.*

Lycium berlandieri Dunal. *Bachata, salicieso*. Thorny shrub; drought deciduous, the leaves often larger and broader than those of *L. andersonii*. Flowering December–January. Canyon bottom at entrance. *F 94-882.*

Nicotiana obtusifolia M. Mart. & Gal. [*N. palmeri* A. Gray; *N. trigonophylla* Dunal]. *Tabaquillo de coyote, tabaco de coyote*; desert tobacco; *wo'i viva* (Yaqui). Herbaceous perennial with sticky glandular-pubescent herbage and calyces. Flowers cream white; nonseasonal. Germinating during the winter–spring season. *F 85-574, Phillips 75-83.*

Physalis—Tomatillo; ground cherry

1. Herbage glandular-pubescent, clammy or "slimy"; corollas pale yellow with five maroon spots in the center; anthers purplish ..... *P. pubescens*
1′ Herbage glabrous or nearly so, "dry" and not slimy; corollas purple or yellow but without maroon spots; anthers yellow.
  2. Perennials; corollas pale yellow ..... *P. crassifolia*
  2′ Annuals; corollas purple ..... *P. purpurea*

Physalis crassifolia Benth. var. ***versicolor*** (Rydb.) Waterf. [*P. versicolor* Rydb. var. *microphylla* Rydb.]. *Tomatillo del desierto*; desert ground cherry; *kau toma'arisi* (Yaqui). Bushy herbaceous perennial, flowering in the first season. Flowering during warmer months. Uncommon and scattered in gravelly soil along the canyon bottom and near the canyon entrance. *F 92-1018.*

Physalis pubescens L. var. ***integrifolia*** (Dunal) Waterf. *Tomatillo*. Annual. Stems semi-succulent with swollen nodes; herbage pale green, the leaf blades thin and quickly wilting. Canyon bottom in wet soil; abundant beneath the *Washingtonia* palms and at Nacapule Spring. *F 84-580, 85-240.*

Physalis purpurea Wiggins. Annual to herbaceous perennial. Mostly along the canyon bottom, sometimes on lower north-facing slopes and at Nacapule Spring. *F 85-245; Starr 717; Van Devender 28 Dec 1982.*

Endemic to the Guaymas region, occurring usually in less xeric habitats than does *P. crassifolia*. Waterfall (1967:212) linked it to the *P. crassifolia* complex. However, I agree with Wiggins (1940:74) that it "does not seem to be closely related to any of the other species in the Sonoran Desert."

Solanum hindsianum Benth. *Mariola, mala mujer*. Sparsely branched spiny shrub to 2.5 m. Flowers showy with lavender corollas and large yellow anthers; nonseasonal. Common at canyon entrance and on open desert, occasional on slopes, and relatively rare along the canyon bottom. *F 92-1031.*

STERCULIACEAE—Cacao Family

1. Capsules conspicuously 5-angled.
  2. Stems herbaceous; flowers yellow; capsules bristly along angles, many-seeded ..... *Hermannia*
  2′ Stems somewhat woody; flowers rose-lavender; capsules not bristly, 5-seeded ..... *Melochia*
1′ Capsules not angled.
  3. Capsules 5-seeded; flowers minute and maroon ..... *Ayenia*
  3′ Capsules 1-seeded; flowers small and yellow ..... *Waltheria*

Ayenia

1. Annuals to slender perennials, not shrubby; leaves 1–3.8 cm, linear to narrowly lanceolate ..... *A. filiformis*
1′ Small shrubs; leaves 4–8 cm, ovate ..... *A. jaliscana*

Ayenia filiformis S. Watson [*A pusilla* of various authors, not *A. pusilla* L.]. Plant to ca. 1 m, slender and few-branched. Leaves gradually drought deciduous. Growing and flowering mostly during warmer weather. Shaded places in the canyon bottom, on canyon slopes, and on nearby open desert. *F 11965, 85-557.*

Ayenia jaliscana S. Watson [*A. glabra* S. Watson]. Shrub 1–1.6 m, leaves gradually drought deciduous. Flowering response nonseasonal. Canyon bottom among *Coccoloba*, and above the canyon entrance on north- and east-facing brushy slopes. *F 94-848, 95-29.*

Hermannia pauciflora S. Watson. Herbaceous perennial to 30 cm from a semi-woody caudex. Flowering response nonseasonal. Mostly on north- and south-facing slopes, also on canyon bottom and in arroyos in the nearby open desert. *F 84-99*; *Starr 212.*

Melochia tomentosa L. [*M. speciosa* S. Watson; *M. speciosa* var. *speciosa* (S. Watson) A. Goldberg]. Dove plant. Slender-stemmed shrub to ca. 1.5 m; gradually drought deciduous. Flowers showy, nonseasonal. Canyon bottom, mostly in open, arid habitats and disturbed areas, also nearby open desert. *F 85-576*; *Starr 51.*

The characters of pubescence, carpel shape, and leaf texture tend to suggest *M. speciosa* during the summer rainy period but approach *M. tomentosa* during dry seasons.

Waltheria detonsa A. Gray. Subshrub 50–60 cm, woody at the base, severely grazed by cattle. Flowers bright yellow; warmer seasons. Localized on a sandy bench near the canyon entrance. *F 95-58.*

THEOPHRASTACEAE—Theophrasta Family

Jacquinia macrocarpa Cav. subsp. ***pungens*** (A. Gray) Stahl [*J. pungens* A. Gray]. *San Juanico*; *tahsi'o*, *tassio* (Yaqui). Small tree with a thick trunk and dense evergreen crown of firm, spine-tipped leaves. Corollas bright orange-red, readily falling with the attached stamens. Fruits 2.0–2.5 cm, ovoid, hard-shelled; mesocarp fleshy-gelatinous, sweet and edible (Felger and Moser 1985). Common along the canyon bottom. *F 92-1020*; *Phillips 75-84.*

TROPAEOLACEAE—Nasturtium Family

****Tropaeolum majus*** L. Nasturtium. Annual with orange flowers. A small colony found in February 1995, in the canyon bottom along road, apparently not established. Cultivated in the Guaymas–San Carlos region. *F 95-121.*

ULMACEAE—Elm Family

Celtis—Hackberry

1. Shrubs, the stems usually armed; fruiting pedicels shorter than the fruits ..... *C. pallida*
1′ Trees, the stems unarmed; fruiting pedicels as long as or longer than the fruits ..... *C. reticulata*

Celtis pallida Torr. subsp. ***pallida*** [*C. tala* Gillies var. *pallida* (Torr.) Planch.]. *Garambullo*; desert hackberry; *kunwo*, *kungo* (Yaqui). Briarlike shrubs to 4 m; evergreen to tardily drought deciduous. Flowers inconspicuous, green or yellow-green. Fruits orange, with a thin but fleshy, semi-sweet, edible pericarp; fruits abundantly in early fall, sparsely at other seasons. Canyon floor in the lower part of the canyon and the nearby open desert. *F 85-1302, 92-1016.*

Celtis reticulata Torr. *Cúmaro*, *cumbro*; canyon hackberry, western hackberry; *kumaro* (Yaqui). Tree to 6+ m; trunk well developed, the bark smooth and gray. Leaves evergreen, highly variable, nearly as wide as long, with entire margins; sometimes producing new growth and leaves even during mid-winter. Fruits hard and dull red. Common along the canyon bottom. *F 3121, 85-1201.*

Not known elsewhere in the Guaymas–Sierra El Aguaje region. The Nacapule trees and those from southern Sonora (e.g., the Alamos region) have smooth trunks, without the irregular corky ridges characteristic of the species in northern Sonora and Arizona. Furthermore, the trees of the northern populations are winter deciduous.

URTICACEAE—Nettle Family

Parietaria floridana Nutt. [*P. hespera* Hinton var. *californica* Hinton]. Desert pellitory. Winter–spring ephemeral with delicate semi-succulent stems and quickly wilting leaves. Mostly in shaded habitats including the canyon floor, north-facing slopes, and open desert. *F 92-1033.*

VERBENACEAE—Vervain Family

1. Stems including twigs rigid, not brittle, the twigs spinose-tipped; inflorescences racemose, the flowers pedicellate ..... *Citharexylum*
1′ Stems including twigs brittle, not rigid, the twigs not spinose-tipped; inflorescences spicate or capitate, the flowers sessile or nearly so.
   2. Flowers in a headlike globose cluster, the corollas yellow, fading orange; fruits fleshy ..... *Lantana*
   2′ Flowers in elongated conelike structures, the corollas cream-white to pale purple with a yellow center; fruits dry. ..... *Lippia*

Citharexylum flabellifolium S. Watson. Shrub; leaves produced after rains and quickly drought deciduous. Flowers lavender and showy; nonseasonal. Canyon entrance and adjacent open desert. *Warren 18 Aug 1975*; *Wiens 93-4.*

Lantana camara L. [*L. horrida* Kunth]. *Confiturilla.* Openly branched straggly shrub to 2.5 m with powerfully scented foliage. Flowering during warmer months. Locally rare; bottom of upper part of canyon. *F 96-75.*

Lippia palmeri S. Watson. *Oregano*, *mariola.* Shrub with aromatic herbage; leaves appearing after rains, gradually drought deciduous. Flowering response nonseasonal. Canyon entrance and the adjacent open desert. The leaves are widely used in Sonora as oregano (see Felger and Moser 1985). *F 85-260*; *Starr 21.*

VIOLACEAE—Violet Family

Hybanthus fruticulosus (Benth.) I. M. Johnst. [*Calceolaria fruticulosa* var. *flavescens* Dowell; *Hybanthus fruticulosus* var. *flavescens* (Dowell) I. M. Johnston]. Herbaceous perennial to ca. 50 cm; drought deciduous. Flowers inconspicuous, white, with rains at various seasons. Canyon floor, north-facing slopes, and less common on south-facing slopes and in arroyos in the adjacent open desert. *F 85-871.*

The variety *flavescens* is distinguished by its yellowish green herbage. However, vigorously growing plants have greener herbage.

VISCACEAE—Mistletoe Family

Phoradendron diguetianum Tiegh. [*P. globyliferum* Trel.]. Upright clump of green, leafy stems. Parasitic on *Celtis pallida* and *Jacquinia macrocarpa* near the canyon entrance. Leaves dimorphic,

some branches or plants with relatively narrow, elongated, and thinner leaves, others with broader, shorter, and thicker leaves. These differences seem to be influenced by growth rate, season, and flowering time. Flowers small, yellow. *Van Devender 84-256.*

ZYGOPHYLLACEAE—Caltrop Family

1. Trees or shrubs ..... *Guaiacum*
1′ Hot-weather annuals ..... *Kallstroemia*

Guaiacum coulteri A. Gray. *Guayacán*; *huya'awo*, *huyawo* (Yaqui). Large shrub or small tree with extremely hard wood; nearly evergreen. Produces spectacular masses of indigo blue flowers in the hot, dry season of early summer. Seeds large, enclosed in a thin bright red aril. Canyon bottom, slopes, and nearby open desert. *F 85-867*; *Starr 489.*

Kallstroemia grandiflora Torr. *Baiborón*; orange caltrop. Summer ephemeral. Flowers showy, orange. Gravelly soils at canyon entrance and open desert. *F 84-597.*

MONOCOTYLEDONS

1. Palms, with a trunk reaching 5 m or more ..... Arecaceae
1′ Not palms, herbaceous or acaulescent rosette succulents.
  2. Leaves succulent and in rosettes, the margins spiny and/or leaf spine-tipped.
    3. Flowers bisexual; leaves various colors, lacking peltate scales, the spines not strongly recurved ..... Agavaceae
    3′ Flowers unisexual; leaves often silvery, with peltate scales, the spines recurved ..... Bromeliaceae
  2′ Leaves not succulent and not in rosette, the plants unarmed.
    4. Flowers conspicuous, the perianth evident: calyx green, the corollas blue or white.
      5. Emergent from shallow water; leaf blades strap-shaped to arrow-shaped; flowers white ..... Alismataceae
      5′ Terrestrial habitats; leaf blades linear-lanceolate to lanceolate; flowers blue ..... Commelinaceae
    4′ Flowers inconspicuous, the perianth not evident, reduced to bristles, microscopic scales, or absent.
      6. Cattails; leaves linear, erect, thickened, and pithy; wetland habitats ..... Typhaceae
      6′ Grasses, sedges, and sedgelike plants; leaves not as above; wetland or dryland habitats.
        7. Sedges and sedgelike plants; wetland habitats or temporarily wet soils; stems solid (pithy); leaf sheaths usually closed; each flower subtended by a single bract ..... Cyperaceae
        7′ Grasses; wetland to desert habitats; stems hollow or solid (firm, not pithy); leaf sheaths usually open; each flower usually subtended by two bracts (the lemma and palea) ..... Poaceae

AGAVACEAE—Agave Family

Agave—*Maguey*; century plant; *kuu'u* (Yaqui)
1. Leaf margins entire except for the terminal spine; inflorescences unbranched or the branches small and inconspicuous ... . *A. chrysoglossa*
1′ Leaf margins spiny; inflorescences branched (paniculate).
  2. Leaves obovate to lanceolate, 12–20 cm wide, with ash-colored cross bands ..... *A. colorata*
  2′ Leaves linear, usually <10 cm wide, uniformly blue-green. ..... *A. vivipera*

Agave chrysoglossa I. M. Johnst. *Amole*. Solitary or occasionally offsetting (commonly forming offsets in cultivation). Leaves slender, thick, green to moderately glaucous. Flowers yellow; late March–May. North-facing rocky slopes and cliffs.

Agave colorata Gentry. *Maguey*; banded century plant. Solitary or producing a few offsets. Leaves 50–100 cm, glaucous gray and often with ashy or purple-brown to reddish bands (cross-zoned). Flowers clear yellow; late spring–June. Fairly common on north-facing slopes, infrequent on other slopes and at higher elevations. *Boutin & Kimnach 3273* (HNT); *Gentry 19881*, *23560*; *Phillips 75-161.*

Agave vivipera L. var. ***vivipera*** [*A. angustifolia* Haw. var. *angustifolia* (see Forster 1992); *A. owenii* I. M. Johnst.; *A. pacifica* Trel.; *A. yaquiana* Trel.]. *Bacanora*, *lechugilla*, *maguey*; narrow-leaf century plant. Usually suckering and forming small colonies. Flowers yellow-green, at dusk producing a strong odor like overripe apricot fruit; February. Scattered across the open desert.

ALISMATACEAE—Water Plantain Family

Echinodorus berteroi (Spreng.) Fassett [*E. rostratus* (Nutt.) Engelm.]. Emergent aquatic annual. Rare, in a pool in the upper part of the canyon. It was not seen prior to 1994 and perhaps grew from a bird-transported seed. *F 94-865.* Common in standing water of roadside ditches and other swampy habitats in the region, especially south and east of Guaymas.

ARECACEAE (PALMAE)—Palm Family

1. Petioles unarmed (entire), the leaves prominently costapalmate (petiole extending well into blade on the lower surface), the blade decurved, not flat; inflorescences shorter than or sometimes as long as the leaves ..... *Sabal*
1′ Petioles armed at least on younger plants, the leaves not or only moderately costapalmate, the leaf blades flat or nearly so; inflorescences longer than the leaves.
  2. Petioles armed on all plants; leaf blades tough and dull green or silvery; sepals separate, entire; fruits rounded, 1.5–2 cm in diameter ..... *Brahea*
  2′ Petioles armed on younger plants, entire or nearly so on taller, adult palms; leaf blades shiny green; sepals united below, the lobes with ragged margins; fruits rounded to ellipsoid, <1 cm ..... *Washingtonia*

Brahea elegans (Franceschi ex Becc.) H. E. Moore [*Erythea elegans* Franceschi ex Becc.; *Erythea clara* L. H. Bailey, Gentes Herb. 6:197, fig. 69, 1943; *Brahea clara* (L. H. Bailey) Espejo & López-Ferrari; *B. roezlii sensu* Wiggins 1964, not *B. roezlii* Linden]. *Palmilla*. Trunks to 10 (–15+) m. Leaf blades moderately costapalmate, relatively flat, tough, dull green to gray or bluish (glaucous), densely to moderately silvery-lepidote. Flowers white; early summer prior to the rains. Fruits ripen in April.

Canyon bottom including the drier, lower portions, in the upper canyon intermixed with the other two palms. Also common on rocky slopes including cliffs to peak elevations in the surrounding mountains, often growing from rock crevices. The hesper palms of the Sierra El Aguaje, Sierra Libre, and to the northeast in Sonora appear to be conspecific (Felger and Joyal 1999). *Bailey 4* (BH), *263* (BH); *F 3382*, *11985.*

Sabal uresana Trel. *Palma del taco*; Sonoran palmetto; *tako* (Yaqui). Trunks to 10+ m; leaves reaching 3–4 m, the blades relatively tough, glaucous but otherwise glabrous, and conspicuously decurved (not flat). Inflorescences shorter than the leaves. Flowers white; April–June, mostly May. Fruits depressed-globose, 18–20 mm wide, ripening in August.

Canyon floor near the streambed, densest along permanent water and extending into areas of temporary water. The fruit, called *taco*, is eaten in Sonora. *Bailey 26* (BH).

Washingtonia robusta H. Wendl. *Abanico*; Mexican fan palm. This is the tallest palm native to Sonora (Felger and Joyal 1999) and the tallest tree in the canyon, where it reaches ca. 20 (–25) m. Petioles of younger trees with stout spines, those of the taller trees essentially entire. Leaf blades nearly flat except the distal portions of the segments are free and often pendent. Flowers white; May–June. Fruits ellipsoid to rounded, 7.5–9.0 mm, blackish, often ripening in fall, the pericarp sweet like a date.

Restricted to the streambed in the upper canyon where it locally outnumbers the other palms. Also at several other oases in the Sierra El Aguaje; otherwise native only to Baja California Sur. This palm is now one of the most widely cultivated palms in the world, especially in Mediterranean and subtropical regions. It is planted extensively at San Carlos and Guaymas. *Bailey 3* (BH), *262* (BH); *F 3118*, *92-1027*.

BROMELIACEAE—Pineapple Family

Hechtia montana Brandegee. *Mescalito*. Rosette-forming perennial, usually suckering profusely. Leaves silvery-green, sometimes reddish, semi-succulent, the margins with sharp recurved spines. Dioecious. Staminate and pistillate inflorescences distinctive, to 1 m. Flowers inconspicuous; August. Common on protected rocky slopes and cliffs with north and east exposures and at higher elevations, often with *Euphorbia ceroderma*; less common on south- and west-facing slopes. *Turner 79-307*; *Yatskievych 82-152*.

COMMELINACEAE—Spiderwort Family

Commelina erecta L. *Hierba del pollo*; day flower. Herbaceous perennial, appearing with summer rains and sometimes growing with winter–spring rains. Flowers blue, opening at dawn and deliquescent by mid-morning on summer days. Canyon bottom and north-facing slopes. *F 84-98*

CYPERACEAE—Sedge Family

1. Leaves reduced to basal sheaths, the blades lacking; inflorescence a single terminal spikelet ..... *Eleocharis*
1′ Leaf blades present but sometimes relatively short and near base of stem; inflorescence of more than one spikelet.
  2. Scales of spikelets two-ranked (distichous), not spiralled ..... *Cyperus*
  2′ Scales of spikelets spiralled.
    3. Annuals; stems and leaves similar, filiform to narrowly linear; perianth absent ..... *Fimbristylis*
    3′ Perennials; stems and leaves quite different, the leaf blades flat, broadly linear; perianth of three paddle-like structures ..... *Fuirena*

Cyperus

1. Perennials, >15 cm; scales of spikelets straight, the tips awnless and not recurved ..... *C. odoratus*
1′ Annuals, mostly <10 cm; scales subtending flowers with recurved awn-tips ..... *C. squarrosus*

****Cyperus odoratus*** L. [*C. ferox* Rich.]. Stems triangular. Spikes slender, the styles three-branched. Flowering at various seasons. Locally common in pools of upper canyon beneath *Washingtonia* palms. *F 84-246*; *Phillips 75-163*; *Van Devender 28 Dec 1982*.

Cyperus squarrosus L. [*C. aristatus* Rottb.]. Dwarf sedge. Diminutive tufted sedge; winter–spring. Wet soil at edge of pools in the upper canyon. I noted it during spring 1984 but have not seen it in the canyon since then.

Eleocharis geniculata (L.) Roem. & Schult. [*Scirpus geniculatus* L.; *Eleocharis caribaea* (Rottb.) S.F. Blake]. *Tulillo*; spikerush. Small grassy annual. Edges of pools in the upper canyon. *F 3384*, *84-125*.

Fimbristylis annua (All.) Roem. & Schult. Warm-weather ephemeral. Achenes white with an iridescent sheen like ancient glass. Emergent from pools in the upper canyon beneath *Ficus insipida* and *Washingtonia*. Locally common in October 1984 but apparently extirpated, presumably because of cattle grazing. *F 84-155*.

Fuirena simplex Vahl. Umbrella-grass. Herbaceous perennial; stems rounded in cross-section. Emergent from pools in the upper canyon beneath the *Washingtonia* palms; locally common. *F 3385*, *84-615*; *Daniel 1976* (ASU).

POACEAE (GRAMINEAE)—Grass Family

1. Low, spreading perennials with stolons and/or rhizomes, often forming dense colonies or mats.
  2. Plants with long, slender, nonscaly stolons; spikes alternate on the axis; spikelets in threes and awned ..... *Cathestecum*
  2′ Plants with creeping, scaly rhizomes; spikes digitately arranged at the summit of the stem; spikelets single, awnless ..... *Cynodon*
1′ Annuals or perennials without conspicuous stolons or rhizomes.
  3. Stems somewhat bamboolike, mostly >1 m; leaf blades mostly >2 cm wide; glumes and lemma with a small terminal tuft of hairs ..... *Lasiacis*
  3′ Stems not bamboolike, mostly <1 m; leaf blades mostly 1 cm wide or less; glumes and lemmas without a terminal tuft of hairs.
    4. Spines or bristles surrounding or just below the spikelets; sometimes spines or bristles united into a bur enclosing the spikelets.
      5. Spikelets not enclosed in burs, but most spikelets subtended by slender bristles and breaking off above the bristles ..... *Setaria*
      5′ Spikelets enclosed in burs, the bur falling as a unit with the attached bristles or spines.
        6. Burs with sharp, stiff spines, the spines and bristles conspicuously united at least in lower fourth of the bur ..... *Cenchrus*
        6′ Burs with flexible bristles, the bristles separate except scarcely united at very base ..... *Pennisetum*
    4′ Inflorescences without spines or bristles just below the spikelets; spikelets not in burs.
      7. At least some spikelets awned.
        8. Inflorescences of one-sided spikes, the rachis flattened on one side.
          9. Spikes arranged laterally along the main axis; rachis (in ours) not extending beyond spikelets ..... *Bouteloua*
          9′ Spikes digitately arranged at top of main axis; rachis tip extending beyond spikelets ..... *Dactyloctenium*
        8′ Spikelets not on one-sided spikes, the rachis not flattened.
          10. Plants glabrous or scabrous, the lemma with one or three awns each 12–20 mm ..... *Aristida*
          10′ Plants pubescent with soft, often pinkish hairs on the spikelets, the lemma with a single terminal awn to 2 mm ..... *Rhynchelytrum*
      7′ Spikelets not awned.
        11. Spikelets with two or more distinct bisexual florets.
          12. Primary panicle branched two or more times, the secondary branches usually ascending to spreading; pedicels as long as or longer than the spikelets; lower glume blunt or acute, shorter than the lowest floret ..... *Eragrostis*
          12′ Primary panicle branches unbranched, spikelike,

or with secondary branchlets closely appressed; pedicels shorter than the spikelets; lower glume acuminate, longer than the lowest floret ..... *Leptochloa*

11′ Spikelets with one bisexual floret, sometimes also with one or two reduced or vestigial floret(s) (the spikelet may appear one-flowered on casual inspection).

13. Inflorescences of digitate spikelike branches, the spikelets sessile and evenly spaced in regular rows ..... *Digitaria*

13′ Inflorescences paniculate, the spikelets pedicellate and not in regular rows.

14. Plants hairy, including panicle branches, branchlets, and spikelets; prominent veins of spikelets longitudinal and transverse on upper part of spikelet to form a netlike pattern ..... *Brachiaria*

14′ Plants variously hairy but panicle branches, branchlets, and spikelets glabrous; prominent veins of spikelets longitudinal only ..... *Panicum*

Aristida

1. Annuals; spikelets with three well-developed and flattened awns ..... *A. adscensionis*

1′ Perennials; spikelets one-awned, or lateral awns greatly reduced, the awn(s) terete ..... *A. ternipes*

Aristida adscensionis L. *Zacate tres barbas, zacate de semilla*; six-weeks threeawn. Nonseasonal ephemeral. Widespread, mostly in open, xeric habitats; canyon bottom, slopes, and open desert. *F 92-1045*; *Van Devender 28 Dec 1982*.

Aristida ternipes Cav. var. ***ternipes***. *Zacate araña*; spidergrass. Tufted perennial, flowering in the first season; often to nearly 1 m, the panicles open with spreading branches; flowering nonseasonal. Abundant and widespread but largely absent from the more densely vegetated habitats; canyon bottom, slopes, and open desert. *F 84-103*; *Reina 95-102*; *Van Devender 28 Dec 1982*.

Bouteloua

1. Perennials; basal (lower) leaves densely clumped, nodes between them not readily visible ..... *B. repens*

1′ Ephemerals; basal leaves sparse, nodes between them readily visible; common and widespread.

2. Spikes dart-shaped, with 1–4 spikelets closely appressed to the spike axis ..... *B. aristidoides*

2′ Spikes comb-shaped, with ca. 20–50 crowded spikelets, the spikelets perpendicular to the spike axis ..... *B. parryi*

Bouteloua aristidoides (Kunth) Griseb. *Aceitilla*; six-weeks needle grama. Summer–fall ephemeral. Abundant, mostly in open, arid habitats; canyon bottom, slopes, and open desert. *F 85-1318*; *Van Devender 8 Dec 1982*.

As soon as the grain ripens and the plants dry, *Pogonomyrmex* ants stream out along their pathways and carry home the whole disarticulated spikelets. They remove the grain at their nests and pile the chaff in craterlike mounds around the entrances to their subterranean colonies.

Bouteloua parryi (E. Fourn.) Griffiths. Hot-weather ephemeral, sometimes with weak regrowth in winter or spring. Spikes including the glumes and awns often dark purple-brown, the anthers orange. Open desert near the canyon mouth. *Starr 220*.

Bouteloua parryi resembles *B. barbata*, which is widespread and common in nearby, surrounding regions, except in being conspicuously papillose-pilose with relatively long hairs on spikes and especially on the peduncle, rachis, and keel of second glumes. Leaf ligules and margins of the blades also usually pilose to hispid with stout often papillose-based hairs.

Bouteloua repens (Kunth) Scribn. & Merr. [*B. filiformis* (E. Fourn.) Griffiths; *B. bromoides* Lag.]. *Zacate navajita*; slender grama. Tufted perennial, sometimes flowering in the first season but the spikelets not maturing; flowering mostly during warmer months. Slopes, soil pockets in rocks, and open areas along the canyon floor. *Burgess 6377*; *F 85-1306*; *Toolin 1938*.

Brachiaria arizonica (Scribn. & Merr.) S. T. Blake [*Panicum arizonicum* Scribn. & Merr.]. Hot-weather ephemeral. Canyon bottom, slopes, and nearby open desert. *F 84-139*, *85-1313*.

Cathestecum brevifolium Swallen. *Grama china*. Nonseasonal, but flowering most vigorously with moist weather during the warmer months. Abundant; hillsides including hot south-facing slopes and open desert. *Burgess 6529*; *F 85-1311*.

****Cenchrus brownii*** Roem. & Schult. *Zacate toboso*; sandbur. Warm-weather annual or perhaps sometimes perennial. Inflorescence dense; burs with smaller as well as larger spines and a basal collar or ring of slender spines. Several dozen plants near the streambed beneath the palms in the upper part of the canyon. Probably not native in the canyon. *F 85-1497*; *Van Devender 28 Dec 1982*.

****Cynodon dactylon*** (L.) Pers. var. ***dactylon***. *Zacate Bermuda*; Bermuda grass; *mo'oko vaso* (Yaqui). Flowering any season but mostly in the warmer months. Well established and common on moist, alkaline soils in the canyon bottom. *F 84-112*.

****Dactyloctenium aegyptium*** (L.) P. Beauv. *Zacate de cuervo*; crowfoot grass. Warm-weather ephemeral, sometimes persisting through the winter. Canyon bottom in wet soil and also at the spring, especially in disturbed, grazed habitats. *F 84-156*, *85-1499*.

****Digitaria ciliaris*** (Retz.) Koel. [*D. adscendens* (Kunth) Henrard; *D. sanguinalis* (L.) Scop. var. *ciliaris* (Retz.) Parl.]. *Zacate cangrejo*; crabgrass. Warm-weather ephemeral, occasional in winter or spring, the plants spreading, rather open, and sparse. Canyon bottom near water, especially common in gravelly soil where cattle grazing has altered the riparian vegetation. *F 84-591*, *85-1207*.

Eragrostis pectinacea (Michx.) Nees. Summer ephemeral. Stems and inflorescences delicate and filmy, the slender pedicels closely appressed (var. *pectinacea*) to sometimes spreading [var. *miserrima* (E. Fourn.) J. Reeder]. Widespread, especially along the canyon bottom. *F 84-592*.

Lasiacis ruscifolia (Kunth) Hitchc. *Yo vakau, wo'i vaaka* (Yaqui). Perennial, 1.2–1.6 m; nonseasonal but mostly during warmer months. Fruits blackish. Steep north-facing rocky slopes below cliffs and shaded densely vegetated north-facing portions of the canyon bottom. *F 84-572*, *85-1325*.

Leptochloa panicea (Retz.) Ohwi subsp. ***mucronata*** (Michx.) Nowack [*L. mucronata* (Michx.) Kunth; *L. filiformis* (Lam.) P. Beauv.]. *Zacate salado, desparramo rojo*; red sprangletop. Summer ephemeral. Widespread; canyon bottom, slopes, and the open desert and arroyos. *F 84-162*.

Panicum hirticaule J. Presl var. ***hirticaule***. Summer ephemeral, highly variable in size, the roots weakly developed. Widespread and common; canyon bottom often in open areas, slopes, and open desert. *F 84-174*, *85-1213*.

****Pennisetum ciliare*** (L.) Link [*Cenchrus ciliaris* L.]. *Zacate buffel*; buffelgrass. Tufted perennials, flowering in the first season.

Well established along the road at the canyon entrance. This now widespread grass, well established in the Guaymas region at least since the 1980s, was first found in the canyon in December 1992. *F 92-1056*.

****Rhynchelytrum repens*** (Willd.) C. E. Hubb. [*R. roseum* (Nees) Stapf & Hubb.; *Tricholaena rosea* Nees]. *Espiga, zacate rosado*, Natal grass. Winter–spring annual. North-facing side of canyon bottom near *Ficus insipida*, rare. First found in the canyon in 1994. It is common elsewhere in the San Carlos–Guaymas region. *F 94-846*.

Setaria
1. Coarse, tufted perennials ..... *S. leucopila*
1′ Hot-weather annuals ..... *S. liebmannii*

Setaria leucopila (Scribn. & Merr.) K. Schum. *Zacate temprano*; white-haired bristlegrass. Mostly growing and fruiting in warm, generally moist times of the year. Canyon bottom and slopes. *F 84-589, 85-1495*.

Setaria liebmannii E. Fourn. *Cola de zorra*; summer bristlegrass. Widespread; canyon bottom, slopes, open desert, and arroyos. *F 84-165, 84-1219*.

TYPHACEAE—Cattail Family

Typha domingensis Pers. *Tule*; cattail. Perennial, emergent from shallow permanent water beneath *Ficus insipida*. Several young plants found in the mid-1980s failed to establish themselves. This species is common in wetland habitats at San Carlos and elsewhere in the region.

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LITERATURE CITED

Bailey, L. H. 1937. *Erythea*, the hesper palms. Gentes Herb. 4:85–118.

Benson, L., and Darrow, R. A. 1981. Trees and Shrubs of the Southwestern Deserts, 3rd ed. University of Arizona Press, Tucson.

Beurton, C. 1994. Gynoecium and perianth in *Zanthoxylum* s. l. (Rutaceae). Plant Systematics and Evolution 161:97–134.

Boutin, F. C. 1971. A new locality for *Psilotum nudum* in Sonora, Mexico. American Fern Journal 61:141–142.

Brizicky, G. K. 1962. The genera of Rutaceae in the southeastern United States. Journal of the Arnold Arboretum 43:1–22.

Búrquez, A., and Martínez-Yrízar, A. 1997. Conservation and landscape transformation in Sonora, Mexico. *Journal of the Southwest* 39: 371–398.

Búrquez, A., Martínez-Yrízar, A., Felger, R. S., and Yetman, D. 1999. Vegetation and habitat diversity at the southern edge of the Sonoran Desert. Pp. 36–67 *in* R. H. Robichaux (ed.). Ecology of Sonoran Desert Plants and Plant Communities. University of Arizona Press, Tucson.

Búrquez, A., and Quintana, M. 1994. Islands of diversity: ironwood ecology and the richness of perennials in a Sonoran Desert biological reserve. Pp. 9–27 *in* G. P. Nabhan and J. L. Carr (eds.). Ironwood: An ecological and cultural keystone of the Sonoran Desert. Conservation International Occasional Paper 1. Conservation International, Washington, D.C.

Daniel, T. 1984. The Acanthaceae of the southwestern United States. Desert Plants 5:162–179.

Felger, R. S. 1966. Ecology of the islands and gulf coast of Sonora, Mexico. Ph.D. dissertation, University of Arizona, Tucson.

Felger, R. S., and Johnson, M. B. 1995. Trees of the northern Sierra Madre Occidental and sky islands of southwestern North America. Pp. 71–83 *in* L. F. DeBano et al. (eds.). Biodiversity and management of the Madrean Archipelago: The sky islands of the southwestern United States and northern Mexico. Rocky Mountain Forest and Range Experiment Station, U.S.D.A. Forest Service, Ft. Collins, Colorado.

Felger, R. S., and Joyal, E. 1999. The palms (Arecaceae) of Sonora, Mexico. Aliso 18:1–18.

Felger, R. S., and Lowe, C. H. 1967. Clinal variation in the surface–volume relationships of the columnar cactus *Lophocereus schottii* in northwestern Mexico. Ecology 48:530–536.

Felger, R. S., and Lowe, C. H. 1976. The island and coastal vegetation and flora of the northern part of the Gulf of California, Mexico. Natural History Museum of Los Angeles County Contributions in Science 285.

Felger, R. S., and Moser, M. B. 1985. People of the Desert and Sea: Ethnobotany of the Seri Indians. University of Arizona Press, Tucson.

Forster, P. I. 1992. New varietal combinations in *Agave vivipera* (Agavaceae). Brittonia 44:74–75.

Friedman, S. L. 1996. Vegetation and flora of the coastal plains of the Río Mayo region, southern Sonora, México. Master's thesis, Arizona State University, Tempe.

Fryxell, P. A. 1988. Malvaceae of Mexico. Systematic Botany Monographs 25.

Gentry, H. S. 1942. Rio Mayo plants. Carnegie Institute of Washington Publications 527.

Gentry, H. S. 1949. Land plants collected by the *Velero III*, Allan Hancock Pacific Expeditions 1937–1951. Allan Hancock Pacific Expeditions 13. University of Southern California Press, Los Angeles.

Godfrey, R. K. 1952. *Pluchea* section *Stylimnus*, in North America. Journal of the Elisha Mitchell Scientific Society 68:238–271.

Henrickson, J. 1996. Studies in *Macrosiphonia* (Apocynaceae): Generic recognition of *Telosiphonia*. Aliso 14:179–195.

Johnston, I. M. 1924. Expedition of the California Academy of Sciences to the Gulf of California in 1921: The botany (vascular plants). Proceedings of the California Academy of Sciences, Series IV, 12:951–1218.

Kuijt, J. 1975. The identity of *Struthanthus haenkei* (*Spirostylis haenkei*) (Loranthaceae). Canadian Journal of Botany 53:249–255.

Levin, G. 1994. Systematics of the *Acalypha californica* complex (Euphorbiaceae). Madroño 41:254–265.

Lindsay, G. 1963. The genus *Lophocereus*. Cactus and Succulent Journal (U.S.) 35:176–192.

Martin, P. S., Yetman, D., Fishbein, M., Jenkins, P., Van Devender, T. R., and Wilson, R. K. (eds.). 1998. Gentry's Río Mayo Plants. University of Arizona Press. Tucson.

McVaugh, R. 1956. Edward Palmer, Plant Explorer of the American West. University of Oklahoma Press, Norman.

McVaugh, R. 1987. Leguminosae. Flora Novo-Galiciana 5. University of Michigan Press, Ann Arbor.

Parfitt, B. D. 1987. *Echinocereus nicholii* (L. D. Benson) Parfitt, stat. nov. (Cactaceae). Phytologia 63:157–158.

Pinkava, D. J., Baker, M. A., Parfitt, B. D., Mohlenbrock, M. W., and Worthington, R. T. 1985. Chromosome numbers in some cacti of western North America. V. Systematic Botany 10:471–483.

Rollins, R. 1941. The cruciferous genus *Dryopetalon*. Contributions of the Dudley Herbarium 3:199–207.

Shreve, F. 1951. Vegetation of the Sonoran Desert. Carnegie Institute of Washington Publication 591.

Simpson, B. B. 1989. Krameriaceae. *Fl. Neotrop. Monog.* 49:1–108.

Steinmann, V. W., and Felger, R. S. 1997. The Euphorbiaceae of Sonora, Mexico. *Aliso* 16:1–71.

Strong, S. K. 1977. A study of *Abutilon* (Malvaceae) in the southwestern United States and Mexico. Ph.D. dissertation, University of Texas, Austin.

Toolin, L. J., Van Devender, T. R., and Kaiser, J. M. 1979. The flora of Sycamore Canyon, Pajarito Mountains, Santa Cruz County, Arizona. Journal of the Arizona–Nevada Academy of Sciences 14:66–74.

Turner, B. L. 1985. *Verbesina* (Sect. *Pterophyton*) *felgeri* (Asteraceae), a new species from Sonora, Mexico. Phytologia 57:127–129.

Turner, R. M., Bowers, J. E., and Burgess, T. L. 1995. Sonoran Desert Plants: An Ecological Atlas. University of Arizona Press, Tucson.

Van Devender, T. R., Steinmann, V. W., Wiens, J. F., and Bertelsen, C. D. 1995. Noteworthy Collections: Sonora. *Madroño* 42:410–411.

Waterfall, U. T. 1967. *Physalis* in Mexico, Central America, and the West Indies. Rhodora 69:82–120, 202–239, 319–329.

Wiggins, I. L. 1940. New and poorly known species of plants from the Sonoran Desert. Contributions of the Dudley Herbarium 3:65–88.

Wiggins, I. L. 1964. Flora of the Sonoran Desert. Pp. 189–1740 *in* F. Shreve and I. L. Wiggins. Flora and Vegetation of the Sonoran Desert, 2 vols. Stanford University Press, Stanford, California.

Williams, J. K. 1996. The Mexican genera of the Apocynaceae (sensu A. DC.), with key and additional taxonomic notes. Sida 17:197–213.

Wilson, R. T. 1978. Reconnaissance geology and petrology of the San Carlos area, Sonora, Mexico. Master's thesis, Arizona State University, Tempe.

Woodson, R. E., Jr. 1937. New or otherwise noteworthy Apocynaceae of Tropical America, V. Annals of the Missouri Botanic Garden 24:11–16.

Yetman, D. A., and Búrquez, A. 1996. A tale of two species: Speculation on the introduction of *Pachycereus pringlei* in the Sierra Libre, Sonora, Mexico, by *Homo sapiens*. Desert Plants 12:23–32.