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Acanthaceae of Sonora: Taxonomy and Phytogeography

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Forty-one species in 15 genera of Acanthaceae are treated from the Mexican state of Sonora. Only a single species (*Tetramerium yaquianum*) is endemic to the state, but 14 others occur only in Sonora and surrounding states and are considered as regional endemics. The occurrences of three species (*Carlowrightia texana, Ruellia leucantha*, and *R. parryi*) in Sonora are reported for the first time. Three Acanthaceae collected in Sonora (*Justicia spicigera, Odontonema cuspidatum*, and *Ruellia malacosperma*) are possibly not native there. A new name, J*usticia hilsenbeckii*, is proposed for the species previously treated as *Siphonoglossa mexicana*. Lectotypifications are designated for five names that pertain to Sonoran plants: A*nisacanthus thurberi, Jacobinia mexicana, Ruellia malacosperma, R. nudiflora*, and *R. parryi*. Sonoran Acanthaceae occur in the following biotic communities (number of species): Sonoran desertscrub (17), Chihuahuan desertscrub (5), thornscrub (21), tropical deciduous forest (23), grasslands (10), oak-pine woodland and/or forest (15). Descriptions of taxa, distribution maps, illustrations of macromorphological features, images of pollen, local names, economic uses, flowering periods, and taxonomic and nomenclatural discussions are provided where appropriate.

RESUMEN

Se presenta un tratado de 41 especies en 15 géneros de la familia Acanthaceae del estado de Sonora, México. Solamente una especie (*Tetramerium yaquianum*) es endémica al estado, pero 14 especies se consideran endémicas regionales por ocurrir sólo en Sonora y estados adyacentes. Se reportan por primera vez 3 especies nuevas para Sonora: *Carlowrightia texana, Ruellia leucantha*, y *R. parryi*. Tres especies colectadas en Sonora: *Justicia spicigera, Odontonema cuspidatum*, y *Ruellia malacosperma* es probable que no son nativas del estado. Se propone un nombre nuevo: *Justicia hilsenbeckii* para la especie tratada anteriormente como *Siphonoglosa mexicana*. Se presentan lectotipificaciones para 5 nombres de las plantas de Sonora: *Anisacanthus thurberi, Jacobinia mexicana, Ruellia malacosperma, R. nudiflora* y *R. parryi*. Las especies de Acanthaceae en Sonora se distribuyen en las siguientes comunidades bióticas: matorral desértico Sonorense (17), matorral desértico Chihuahuense (5), matorral espinoso (21), selva baja caducifolia (23), pastizales (10), bosque abierto y/o bosque cerrado de pino-encino (15). De acuerdo a la especie, se presentan: descripciones de taxa, mapas de distribución, ilustraciones de características macromorfológicas, imágenes de polen, nombres locales, usos económicos, períodos de floración y discusiones taxonómicas y de nomenclatura.

The predominantly tropical Acanthaceae comprise some 4000 species in about 230 genera. The family is worldwide in distribution although most genera are restricted to either the New World or the Old World. Mexico is a center of species richness, diversity, and endemism for Acanthaceae. The family is represented there by about 400 species of terrestrial herbs, shrubs, and trees, as well as epiphytes and subaquatics. These occur in a diversity of plant communities at elevations from sea level to 2900 meters. Daniel (1993) summarized information on Mexican Acanthaceae. A more recent estimate of endemism at the rank of species for the family in Mexico is 61% (Daniel 2004a). Mexican Acanthaceae are particularly well represented in the dry forest and scrub communities throughout the country (Daniel 1993). Several regional taxonomic accounts of Mexican Acanthaceae have been published recently (Daniel 1995a, 1997, 1999a; Daniel and Acosta 2003) and a comprehensive treatment of the family for the entire country is being prepared. The following account of Sonoran Acanthaceae was undertaken in response to recent intensive collecting activities in various portions of the state and the need to resolve several taxonomic questions among taxa there.

Physical geography of Sonora.— The state of Sonora in northwestern Mexico is one of that nations largest in area (185,430 square km; second in size after Chihuahua), driest in climate, and least densely populated (García de Miranda and Falcón de Gyves 1986; Stevenson et al. 1988). Most of Sonora lies within the Basin and Range Physiographic Province that consists of broad, alluvial basins at low elevations bordered by long, narrow, and parallel mountain ranges often trending in a northwest to southeast orientation. Eastern Sonora consists of north-south trending mountains forming the western cordillera of the Sierra Madre Occidental, which reaches an elevation of 2625 m at the highest known point in the state (Sierra le los Ajos in northeastern Sonora). The Sonoran climate varies from arid and tropical in the south and west to cool and temperate in the east. The eastern mountains are semiarid and aridity increases northward and westward in the state. Precipitation is bimodal with a monsoonlike summer rainy season (characterized by intense, but often very local, thunderstorms) and winter rains that tend to be gentler in nature, more extensive in coverage, and longer in duration. Summer rains are most pronounced in southern and eastern Sonora and are especially important for species of tropical origin (Felger et al. 2001). Winter rains are best developed toward the northwestern portion of the state. Freezing temperatures in northern and eastern Sonora limit the distributions of many tropical and subtropical species.

Summary of Sonoran Acanthaceae.— The vascular flora of Sonora is estimated to comprise 5000 species (Felger et al. 2001). Among these are 41 species in 15 genera of Acanthaceae: *Anisacanthus* (2), *Aphanosperma* (1), *Blechum* (1), *Carlowrightia* (3), *Dicliptera* (1), *Dyschoriste* (3), *Elytraria* (1), (1), *Holographis* (2), *Justicia* (10), *Odontonema* (1), *Pseuderanthemum* (1), *Ruellia* (7), *Stenandrium* (1), and *Tetramerium* (6). The types (excluding syntypes) of 18 names of Acanthaceae were collected in Sonora. *Justicia* is the most species-rich genus of Mexican Acanthaceae (with more than 100 species in the country; i.e., 25% of the total) and is also the most species rich in Sonora (with 10 species; i.e., 24% of the total). Taxonomic recognition of numerous local and regional endemics has resulted in the proliferation of *Justicia* in Mexico. Among the nine native species of *Justicia* in the state, four are widespread and five are regional endemics. Three species of Acanthaceae that have been collected in Sonora are likely not native to the state: *Justicia spicigera*, *Odontonema cuspidatum*, and *Ruellia malacosperma*. All of these are widely cultivated, have been collected in gardens in the state, and are elsewhere known to either escape from or persist after cultivation.

Sonoran Acanthaceae in a phylogenetic context.— Scotland and Vollesen (2000) presented a comprehensive phylogenetic classification of Acanthaceae based on molecular studies, pollen morphology, corolla aestivation, and other characters. Subsequent studies (e.g., McDade et

al. 2000a) have provided insights into, revisions of, and refinements to this system. Two of the three subfamilies of Acanthaceae treated by Scotland and Vollesen (2000) are present in Sonora: Nelsonioideae (*Elytraria*) and Acanthoideae (all other genera). *Thunbergia* of the subfamily Thunbergioideae is doubtless cultivated in Sonora and *T. alata* Bojer ex Sims might ultimately escape there. Among Acanthoideae, genera representing three major lineages (here treated as tribes) occur in Sonora: Justicieae (*Anisacanthus*, *Aphanosperma*, *Carlowrightia*, *Dicliptera*, *Henrya, Justicia, Odontonema, Pseuderanthemum*, and *Tetramerium*), Acantheae (*Holographis* and *Stenandrium*), and Ruellieae (*Blechum, Dyschoriste*, and *Ruellia*). Among genera of Justicieae several of the lineages delimited by McDade et al. (2000a) are present: New World "justicioid" lineage (*Justicia*), Diclipterinae (*Dicliptera*), *Tetramerium* lineage (*Anisacanthus, Aphanosperma, Carlowrightia, Henrya*, and *Tetramerium*), and *Pseuderanthemum* lineage (*Odontonema* and *Pseuderanthemum*). It is not surprising that several of the rather poorly circumscribed genera of the *Tetramerium* lineage are present in Sonora. This lineage includes numerous genera either restricted to or concentrated in dry regions of Mexico. Of the Acantheae, *Holographis* and *Stenandrium* appear to be particularly closely related to one another; both have the same basic chromosome number ($x = 13$), they are similar palynologically, and there does not appear to be any single macromorphological character that universally distinguishes them (Daniel 1998, 2000). Among Sonoran Ruellieae, *Ruellia* and *Blechum* appear to be more closely related to one another than either is to *Dyschoriste* (Daniel 2000; McDade et al. 2000b).

Palynology.— Pollen of Acanthaceae shows a definite taxonomic (rather than pollinator, ecological, or geographic) basis. As such, it is of considerable utility for characterizing and identifying taxa (e.g., Daniel 1998) and for interpreting phylogeny in the family (e.g., McDade et al. 2000a). Perhaps more so than in some other large families, it is important that pollen of each species of Acanthaceae should be characterized in circumscribing taxa. To this end, and to provide general palynological data for other scientific disciplines (e.g., paleoecology), dry (vs. hydrated) pollen of all Sonoran Acanthaceae was studied to some extent and is illustrated below (Figures 3, 12, 18, 20, 21, 31, 38). Most of the pollen samples for species of Acanthaceae occurring in Sonora were taken from collections from within the state or from nearby regions. Pollen is particularly useful for distinguishing species of *Justicia*, a genus in which there is a diversity of aperture number and accompanying insulae. For example, 2-aperturate (most species), 3-aperturate (*J. longii*), and 4-aperturate (*J. masiaca*) pollen grains are known among Sonoran species of *Justicia* (Figures 20, 21), and the number of rows of insulae bordering the aperture on each side varies from one to three, depending on the species.

Floral phenology.— Flowering periods by month were noted for all species of Sonoran Acanthaceae based on the collections studied for each species. Pooling the known months of flowering for all native Sonoran acanths (Fig. 1) reveals that: 1) during each month of the year at least 12 species have been collected in flower, 2) more species (30) flower in March than in any other month, 3) there are two flowering peaks throughout the year (February–April and September–December), and 4) the fewest species (12) have been collected in flower in June. For the most part, flowering periods of Sonoran Acanthaceae can be correlated with the general bimodal precipitation pattern there. The summer rains of July through September are followed by a dry season that typically gives way to winter rains in December and January (and often into February). A second, and more intense, dry season lasts from March until the onset of summer rains. March is obviously the month during which more species flower, and the period March-April appears to be a major peak for acanth flowering. A second, somewhat smaller, peak in flowering appears to take place beginning in September, culminates in October, and continues into December.

The variation in flowering periodicity among Sonoran Acanthaceae reveals five patterns: 1)

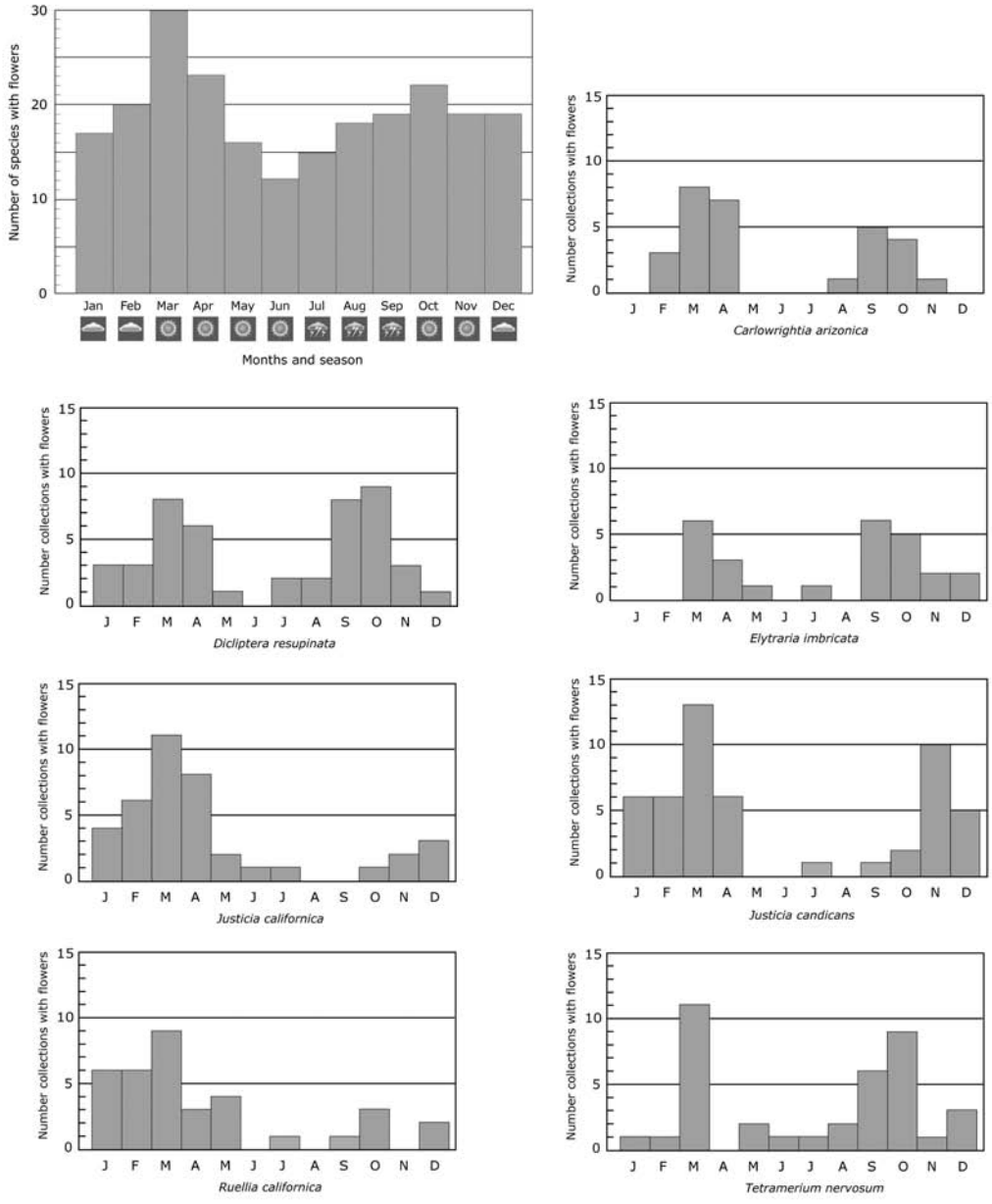


FIGURE 1. Floral phenological data for Sonoran Acanthaceae: histogram at upper left shows the number of species in flower by month; other histograms show peak flowering periods for species with lengthy flowering times based on collections at CAS/DS (see text for additional explanation).

nineteen species flower following both rainy seasons (i.e., *Anisacanthus thurberi, Aphanosperma sinaloensis, Blechum pyramidatum, Carlowrightia arizonica, C. pectinata, Dyschoriste decumbens, D. hirsutissima, Elytraria imbricata, Justicia caudata, J. longii, J. masiaca, J. phlebodes, J. sonorae, Ruellia inundata, R. nudiflora, Tetramerium abditum, T. glandulosum, T. tenuissimum*, and *T. yaquianum*); 2) six species flower only following winter rains (i.e., *Anisacanthus andersonii, Henrya insularis, Holographis pallida, H. virgata, Justicia salviiflora*, and *Stenandrium pilosulum*); 3) two species appear to flower only following summer rains (*Dyschoriste xylopoda* and *Ruellia intermedia*); 4) *Pseuderanthemum praecox* produces chasmogamous flowers following winter rains and cleistogamous flowers following summer rains; and 5) five species have been collected in flower during every month of the year (i.e., *Dicliptera resupinata, Justicia californica, J. candicans, Ruellia californica*, and *Tetramerium nervosum*). Five Sonoran Acanthaceae (*Carlowrightia texana, Justicia hilsenbeckii, Ruellia leucantha, R. parryi*, and *Tetramerium fruticosum*) are each known from the state by a single flowering collection, and thus, there is insufficient data to reveal a pattern for their flowering periods. Based on the date of collection for these species, however, each of them is only known to flower following the period of summer precipitation in Sonora.

It thus appears that most Sonoran Acanthaceae flower immediately following the two rainy seasons, that is, in the first month of each dry season. This is undoubtedly when potential pollinators are most active. Such timing also allows for an extended period of flowering and fruiting prior to the next rainy season when seeds might germinate. Fruit-set is either simultaneous with or begins about a month or two following onset of flowering. Fruits of all Sonoran species mature within a few weeks and expel the seeds. Seeds of 24 species of Sonoran Acanthaceae that have been tested (Daniel unpublished) reveal that no period of dormancy is required prior to germination. Because freezing temperatures are rare in those portions of Sonora where most Acanthaceae occur, sufficient moisture appears to be the primary requirement for germination and establishment in soil. This likely helps to explain the year-round or lengthy flowering periods of some Sonoran Acanthaceae, i.e., they are able to flower opportunistically in response to variable and local rainfall.

In order to determine whether species that have been collected with flowers in most or all months of the year also have one or more peak flowering periods, the number of flowering collections per month was noted for all Sonoran collections at CAS/DS of *Carlowrightia arizonica*, *Dicliptera resupinata, Elytraria imbricata, Justicia californica, J. candicans, Ruellia californica*, and *Tetramerium nervosum*. These data are summarized in Figure 1. They suggest that *Carlowrightia arizonica, Dicliptera resupinata, Elytraria imbricata, J. candicans*, and *Tetramerium nervosum* are similar to most Sonoran Acanthaceae by having peak flowering periods following both winter and summer rains. All of these species are widely distributed and their flowering throughout (or nearly throughout) the year likely reflects an opportunistic response to adequate precipitation. Both *Justicia californica* and *Ruellia californica* appear to have a peak flowering period only following winter rains. Among the dry regions of Mexico, winter rainfall is largely restricted to the northwestern portion of the country and helps to distinguish the Sonoran Desert from other Mexican deserts. Both *J. californica* and *R. californica* are endemic to northwestern Mexico and nearly restricted to the Sonoran Desert. Their peak flowering periods likely reflect an adaptive response to the winter rains that take place there. Among the six Sonoran Acanthaceae that are only known to flower following winter rains, four of them (*Anisacanthus andersonii, Holographis pallida, H. virgata*, and *Stenandrium pilosulum*) also have distributions restricted to northwestern Mexico.

Major collections of and studies on Sonoran plants.— Because of the state's histori-

cal isolation from major scientific and population centers in the eastern United States and south-central Mexico, botanical explorations in Sonora got a relatively late start. The first comprehensive plant collections, including Acanthaceae, emanating from Sonora resulted from the United States and Mexican boundary surveys following the Treaty of Guadalupe Hidalgo in 1848. Plant collectors attached to the surveying parties included John M. Bigelow, Charles C. Parry, Arthur Schott, E.K. Smith, George Thurber, and Charles Wright. Their Sonoran collections, often accompanied by imprecise locality data, were generally restricted to the northern portions of the state, but included the types of several Acanthaceae. The intrepid Mexican collector Edward Palmer collected in Sonora between 1869 and 1897 and gathered the types of several Sonoran Acanthaceae. During the final two decades of the nineteenth century, Sonora was visited by several prominent plant collectors, all of whom collected Acanthaceae: Townshend S. Brandegee, Marcus E. Jones, Charles R. Orcutt, Cyrus G. Pringle, and Carl A. Purpus. Two botanists, C.A. Hartman and C.E. Lloyd, attached to Carl Lumholtz's expedition to the Sierra Madre Occidental beginning in 1890 collected in northeastern Sonora. Beginning in 1897 and extending through various trips during the first decade of the twientieth century, Joseph N. Rose (often accompanied by others) collected in Sonora (especially in the Pinacate Region, vicinity of Guaymas, and vicinity of Alamos). Collecting activities in the state intensified in the 1930's with the commencement of studies there by Forrest Shreve, Ira Wiggins, and Howard S. Gentry on the vegetation and flora of various portions of the state. Stephen S. White made substantial collections from the region of the Río Bavispe in northeastern Sonora between 1938 and 1941. Following Wiggins's last trip to Sonora in 1962, the major botanical exploration of Sonora was, and continues to be, undertaken by a dedicated group of naturalists from Tucson. Paul Martin, Tom Van Devender, and others have made significant and extensive collections in the nondesert portions of southern Sonora. Richard Felger has made numerous collections in several parts of western Sonora (especially the Gran Desierto, Isla Tiburón and the Seri lands of the adjacent coastal mainland, and in the vicinity of Guaymas). As a result of the activities of these collectors, and given their institutional affiliations or specimen deposition proclivities, the major repositories of Sonoran Acanthaceae are at ARIZ and CAS/DS.

Shreve (1951), Wiggins (1964), Gentry (1942), and White (1948) published pioneering and invaluable studies on plant life in Sonora. These studies were undertaken when significant portions of the state were largely inaccessible. Indeed, some regions of the state remained generally inaccessible until very recently. A cadre of botanists, mostly working from institutions or organizations in Tucson, have recently provided additional, detailed knowledge of vegetation and flora in the state (e.g., Brown 1982; Felger and Moser 1985; Turner et al. 1995; Martin et al. 1998; Felger 2000; Robichaux 1999; Robichaux and Yetman 2000; Felger et al. 2001; Yetman and Van Devender 2002). Most botanical studies in Sonora have concentrated on the Sonoran Desert. Indeed, McLaughlin and Bowers (1999) concluded that the Sonoran Floristic Province (comprising the Sonoran and Mohave deserts) probably has one of the best-known floras, especially for an arid region, of all of the earth's floristic provinces. Recent floristic activities concentrating on the nondesert regions in the vicinities of Alamos and Yécora (e.g., Fishbein et al. 1998; Van Devender et al. 2003) have filled some of the obvious gaps in our knowledge of the state's plant life. Despite the lack of a floristic account of the entire state, as a result of all these studies, Sonora has become one of the botanically best known of Mexico's states. This increased knowledge of Sonora's botanical resources is particularly timely because destruction of natural habitats in the state has accelerated in the past 30 years largely associated with hydrologic modifications and conversion of lowland plant communities to large-scale irrigated agricultural lands.

Phytogeography

Sonora is the meeting ground of three major phytogeographic regions: the Sonoran Floristic Province in the western half of the state, the Madrean Floristic Province in northern and eastern Sonora, and the Central American Floristic Province in central and southern Sonora (*cf*. Takhtajan 1986; McLaughlin and Bowers 1999). Vegetationally, at least 11 regional formations (biomes) in five formation-types (forest, woodland, scrub, grassland, and desertscrub) are represented in the state (Brown and Lowe 1980; Fig. 2). Most prominent among the regional formations are Sonoran desertscrub and thornscrub, which together cover about two-thirds of the state's area and in which more than half of the native species of Sonoran Acanthaceae are found. The following discussion of biotic communities in Sonora is based largely on the excellent summaries found in Brown (1982a), Dimmitt (2000), and Felger et al. (2001). Only the 37 species of Acanthaceae known to be native to Sonora are considered in the context of these communities.

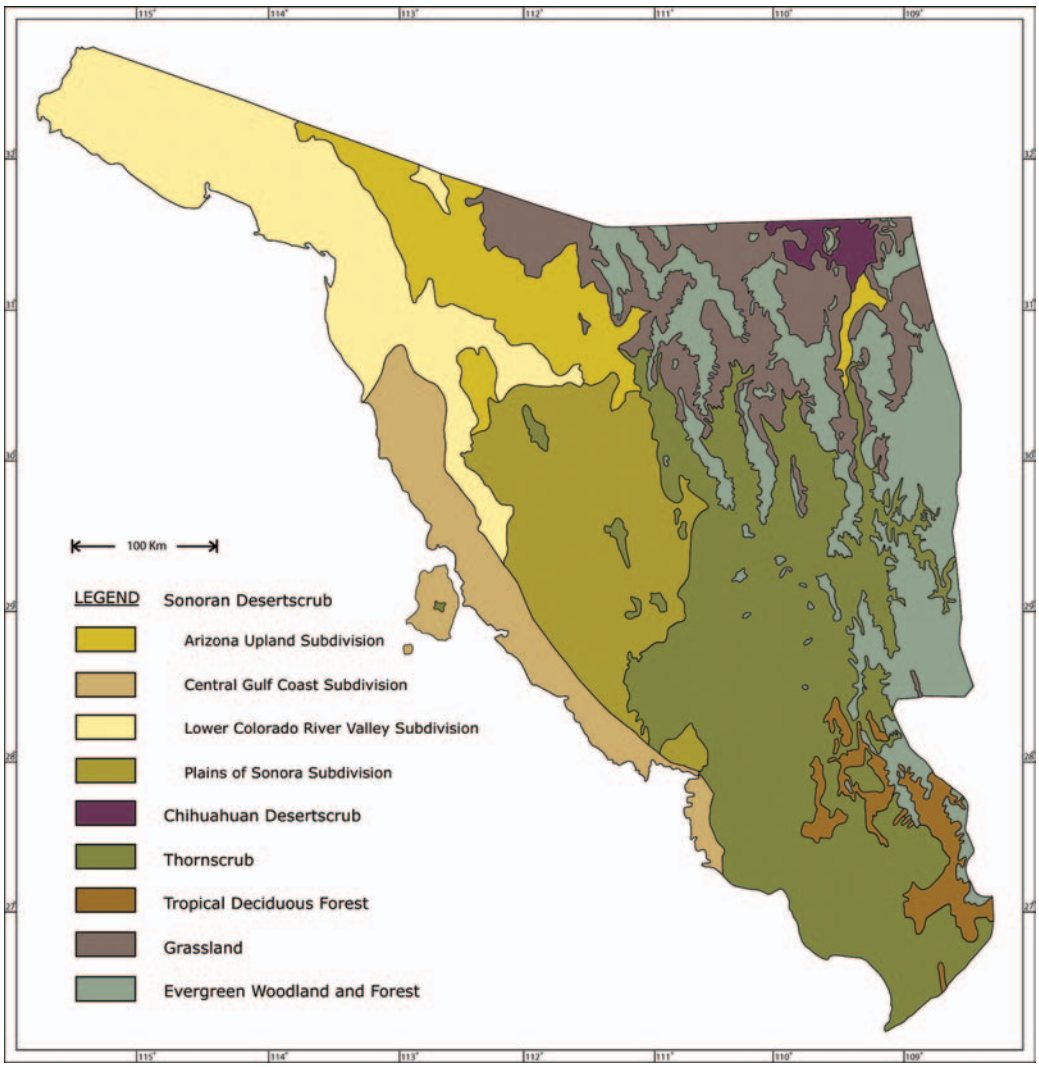


Figure 2. Biotic communities of Sonora modified from Brown and Lowe (1980) and Felger et al. (2001).

Biotic communities of Sonora and Acanthaceae therein.— The western half of Sonora lies within the Sonoran Desert. This large, arid region of northwestern Mexico and the southwestern United States differs from the other three warm deserts of North America (Chihuahuan, Great Basin, and Mohave deserts) by its bimodal rainfall pattern, milder winters, and greater structural complexity of the vegetation. The Sonoran Desert is characterized by open ground with little or no buildup of leaf litter. Its vegetation (Sonoran desertscrub) comprises a great diversity of life forms — especially arboreal elements (trees and columnar cacti), myriad cacti and other succulent plants, and a preponderance of short-lived annuals. In Sonora, the Sonoran Desert is subdivided into four subdivisions: Lower Colorado River Valley, Arizona Upland, Plains of Sonora, and Central Gulf Coast. At least 17 species of Acanthaceae occur in at least one subdivision of the Sonoran Desert. Each subdivision has a distinctive climatic pattern, vegetational physiognomy, and unique assemblage of Acanthaceae.

The Lower Colorado River Valley in northwestern Sonora is the largest, hottest, and driest subdivision of the Sonoran Desert. Vegetation there is open and simple in structure; trees and columnar cacti are absent, rare, or restricted to drainages. Fewer Acanthaceae occur there than in any other subdivision of the Sonoran Desert. The following six species are known from the Lower Colorado River Valley subdivision in Sonora: *Anisacanthus thurberi, Carlowrightia arizonica, Dicliptera resupinata, Holographis virgata, Justicia californica*, and *Ruellia nudiflora*. Among these, most appear to be rare in the subdivision with only *H. virgata* and *J. californica* collected there more than a few times. Included in the Lower Colorado River Valley subdivision is the hyperarid Gran Desierto, near the delta of the Colorado River, in northwesternmost Sonora. Felger (2000) noted only two species of Acanthaceae (*C. arizonica* and *J. californica*) in this region and listed likely limiting factors there as the lack of summer rains and freezing winter temperatures. These two species appear to be the most drought tolerant among Sonoran Acanthaceae, the northern- and western-most occurring acanths in the state, and the only two taxa in the family that occur in the Lower Colorado River Valley subdivision of southern California.

The Arizona Upland in southern Arizona and adjacent Sonora is the highest, wettest, and coldest subdivision in the Sonoran Desert. Trees are common and not restricted to drainages; cacti are common as well. For this subdivision, physiognomy of the vegetation, diversity of life forms, and richness of species are often more suggestive of thornscrub than desertscrub. At least nine species of Acanthaceae occur in the Sonoran portion of the Arizona Upland: *Anisacanthus thurberi, Carlowrightia arizonica, Dicliptera resupinata, Elytraria imbricata, Justicia californica, J. candicans, J. longii, Ruellia nudiflora*, and *Tetramerium nervosum*.

The Plains of Sonora in the west-central portion of the state is the smallest subdivision of the Sonoran Desert and the only one restricted to Sonora. It is similar to the Arizona Upland, but because of warmer winter temperatures and greater precipitation, its vegetation is denser and its flora contains more tropical elements. Its vegetation is dominated by trees, shrubs, and forbs (rather than cacti). At least 14 species of Acanthaceae have been collected there: *Anisacanthus thurberi, Aphanosperma sinaloensis, Carlowrightia arizonica, Dicliptera resupinata, Elytraria imbricata, Holographis virgata, Justicia californica, J. candicans, J. longii, J. sonorae, Ruellia californica, R. intermedia, R. leucantha*, and *R. nudiflora*.

The Sonoran portion of the Central Gulf Coast subdivision consists of a dry, narrow lowland strip along the east coast of the Gulf of California. This region also encompasses Isla San Esteban, Isla Turners, and most of Isla Tiburón in the Gulf of California. Rainfall is meager and sporadic. The vegetation is commonly dominated by stems succulents and generally lacks a low shrub layer. At least 15 Acanthaceae have been collected there: *Anisacanthus thurberi, Aphanosperma sinaloensis, Carlowrightia arizonica, C. pectinata, Dicliptera resupinata, Elytraria imbricata,*

Holographis virgata, Justicia californica, J. candicans, J. longii, J. sonorae, Ruellia californica, R. nudiflora, Tetramerium fruticosum, and *T. nervosum. Tetramerium fruticosum*, a species otherwise restricted to Baja California Sur, has its only known mainland occurrence near Puerto Libertad (see Daniel 1986).

The Chihuahuan Desert occurs primarily on limestone and at generally higher elevations than most of the Sonoran Desert. Unlike Sonoran desertscrub, Chihuahuan desertscrub generally lacks an arboreal element. It consists primarily of grasses, shrubs, and small cacti. In Sonora, Chihuahuan desertscrub is restricted to a small region in the extreme northeastern portion of the state and is surrounded mostly by grassland and oak woodland communities. Five Acanthaceae are known from the limited expanse of Chihuahuan desertscrub in Sonora: *Anisacanthus thurberi, Carlowrightia texana, Dicliptera resupinata, Ruellia nudiflora*, and *R. parryi*. The Sonoran distributions of *C. texana* and *R. parryi* are restricted to Chihuahuan desertscrub, whereas *A. thurberi, D. resupinata*, and *R. nudiflora* occur in other biotic communities in the state. Outside of Sonora, the overall distribution of *R. parryi* is limited to Chihuahuan desertscrub and that of *C. texana* is largely concentrated therein.

Thornscrub is characterized by a generally dense cover of thorny shrubs and small trees that occur in regions with greater precipitation than those covered by desertscrub. In our region it is transitional between the more arid desertscrub and the more mesic tropical deciduous forest between which it is usually positioned in central and southern Sonora. It differs from desertscrub by having denser vegetation with taller trees and cacti and by requiring more moisture. It differs from tropical deciduous forest by its shorter and sparser vegetation that does not require as much moisture. Brown and Lowe (1980) and Brown (1982b) referred to thornscrub in Sonora as "Sinaloan thornscrub." Thornscrub occurs both at low elevations on the coastal plain in southwestern Sonora (coastal thornscrub) and on slopes at somewhat higher (to more than 900 m) elevations, mostly to the east of the Sonoran Desert (foothills thornscrub). Foothills thornscrub was treated by Shreve (1951) as a subdivision of the Sonoran Desert. Label data on herbarium specimens rarely distinguish between coastal and foothills thornscrub. At least 21 species of Acanthaceae are known from thornscrub in Sonora: *Anisacanthus andersonii, A. thurberi, Carlowrightia arizonica, C. pectinata, Dicliptera resupinata, Dyschoriste hirsutissima, Elytraria imbricata, Henrya insularis, Holographis pallida, H. virgata, Justicia californica, J. candicans, J. longii, J. masiaca, J. sonorae, Ruellia californica, R. intermedia, R. nudiflora, Tetramerium nervosum, T. tenuissimum*, and *T. yaquianum*. However, none of them is restricted to this community; most of them also occur in Sonoran desertscrub and/or tropical deciduous forest; and some (e.g., *A. andersonii*) occur in regions of thornscrub only along riparian corridors. *Justicia masiaca* is known only from thornscrub and grassland communities.

Tropical deciduous forest (*cf.* "Sinaloan deciduous forest" in Brown and Lowe (1980) and Gentry (1982)) is a wetter, drought-deciduous forest with a conspicuous tropical composition. It is taller and more structurally complex than thornscrub. It generally has a closed canopy 10–15 m above the ground and hosts more vines and epiphytes than other plant communities in Sonora. Tropical deciduous forest is found in southern Sonora between thornscrub at lower elevations to the west and oak woodlands/forests at higher elevations to the east. At least 23 species of Acanthaceae occur in Sonora's tropical deciduous forests: *Anisacanthus andersonii, Aphanosperma sinaloensis, Blechum pyramidatum, Carlowrightia arizonica, C. pectinata, Dicliptera resupinata, Dyschoriste hirsutissima, Elytraria imbricata, Henrya insularis, Holographis pallida, Justicia candicans, J. caudata, J. hilsenbeckii, J. phlebodes, J. salviiflora, Ruellia intermedia, R. inundata, R. nudiflora, Tetramerium abditum, T. glandulosum, T. nervosum, T. tenuissimum, T. yaquianum*. Four of them (*B. pyramidatum, J. hilsenbeckii, R. inundata*, and *T.*

glandulosum) are known only from this community in the state. Both *B. pyramidatum* and *R. inundata* are widespread in the Neotropics and occur in diverse communities outside of Sonora. Both species reach the northern extent of their geographic distributions in southern Sonora and their restriction to tropical deciduous forest in the state likely is a result of this being the most tropical of Sonora's biotic communities. Both *J. hilsenbeckii* and *T. glandulosum* are widespread in Mexico, but both are either mostly or entirely restricted to regions of tropical deciduous forest in the country.

In Sonora, grassland communities are mostly found in the northeastern portion of the state at elevations above desertscrub and thornscrub but below woodland and forest communities. Cold-temperate grasslands in Sonora were treated by Brown and Lowe (1980) and Brown (1982c) as "Plains and Great Basin grasslands," two iterations of the North American prairie, with apparently only Plains grassland actually occurring in Sonora. Although various genera of grasses dominate in this community, some trees (largely restricted to riparian corridors) and shrubs are often present. In lower and warmer regions where the presence of trees and shrubs is significant, the resulting grass-shrub community is often referred to as "desert grassland" or "semidesert grassland" (Brown 1982d; McClaran and Van Devender 1995). Desert grassland occupies considerably more area in Sonora than typical Plains grassland. Distinctions between different types of grasslands are rarely indicated on labels of herbarium specimens. Ten species of Acanthaceae (*Anisacanthus thurberi, Dicliptera resupinata, Dyschoriste decumbens, D. hirsutissima, Elytraria imbricata, Justicia californica, J. candicans, J. masiaca, Ruellia nudiflora*, and *Tetramerium nervosum*) are known from grasslands in Sonora, but none of them is restricted to these communities. Based on their mapped distributions and collection data, it would appear that at least *Dyschoriste decumbens* and *Elytraria imbricata* might occur in Plains grasslands. The other Sonoran Acanthaceae that occur in grasslands all appear to have been collected in desert grasslands. Among the five vegetational formation-types in Sonora, grasslands contain the fewest species of Acanthaceae. This would appear to reflect a pattern among all New World Acanthaceae, relatively few of which occur in grasslands.

Several woodland and forest communities dominated by oaks and/or pines occur at elevations above the more arid communities previously discussed. Brown (1982e) and Pase and Brown (1982) referred to them as "Madrean evergreen woodland" and "Madrean montane conifer forest." Ascending in elevation, oak woodlands are usually encountered first. Various species of deciduous and evergreen oaks are found therein. In more mesic sites, the density of oaks may become sufficient to form a closed canopy, resulting in an oak forest. Above the oak zone, oak-pine woodlands and forests occur on the western slope of the Sierra Madre in Sonora. Pines typically form the overstory and oaks the understory in these communities. Pine forests occur at somewhat higher elevations where any of several species of pines become more prominent than the oaks. Oak and pine woodlands and forests are treated together here because information recorded by collectors is often insufficient to distinguish between woodlands and forests and/or between dominance by oaks vs. pines. At least 15 species of Acanthaceae have been collected in oak-pine woodlands and forests of Sonora: *Anisacanthus andersonii, A. thurberi, Dicliptera resupinata, Dyschoriste decumbens, D. hirsutissima, D. xylopoda, Elytraria imbricata, Henrya insularis, Justicia caudata, J. phlebodes, J. salviiflora, Pseuderanthemum praecox, Stenandrium pilosulum, Tetramerium abditum*, and *T. nervosum*. Three of them (*D. xylopoda, P. praecox*, and *S. pilosulum*) are known from Sonora only in these communities. *Stenandrium pilosulum* is restricted to these communities throughout its narrow range, but *P. praecox* and *D. xylopoda* are more widespread and are known from both oak-pine and other biotic communities outside of Sonora. Above the oak-pine zone, a mixed conifer forest occurs in a few high regions in the Sonoran portion of the Sierra Madre Occidental, but Acanthaceae are not known from this community.

New World Acanthaceae are especially abundant in and along watercourses (including ephemeral and perennial streams). Riparian communities in Sonora include: mesquite bosques, palm oases, riparian scrub, and riparian forests. Data on herbarium labels indicate that most (at least 29) species of Sonoran Acanthaceae occur, at least in part, in riparian communities. Riparian corridors often allow intrusions of plants from more mesic communities into the midst of more arid ones, e.g., thornscrub into desertscrub and deciduous forest into thornscrub. This is evident in the distributions of *Aphanosperma sinaloensis* and *Ruellia leucantha*, species of tropical deciduous forests that enter regions of Sonoran desertscrub only along riparian corridors.

Historical phytogeography and current distributional patterns among Sonoran Acanthaceae.— The age and origins of vegetation in Sonora (especially Sonoran desertscrub) have been studied in some detail (e.g., Axelrod 1979; Van Devender 2000) and it is perhaps worthwhile to speculate on the causes of the current distributions of Acanthaceae there. Mexican Acanthaceae are especially abundant in regions of tropical deciduous forest (Daniel 1993). Indeed, this is the most acanth-rich biotic community in Sonora with at least 23 of the 38 presumed native Sonoran Acanthaceae occurring there. In North America, tropical deciduous forests may have had their origins, or at least became increasingly common, in the Eocene (ca. 58 to 36 million years ago) (Van Devender 2000). With the change in climate associated with the rise of the Sierra Madres in southern North America during the Miocene (ca. 24 to 5 million years ago), tropical deciduous forest became restricted to the coastal lowlands in Mexico and thornscrub evolved in drier regions along its margins (possibly including the region now covered with Sonoran desertscrub) (Van Devender 2000). The Sonoran Desert had its origins during a drying trend in the middle Miocene (by about 8 million years ago). Subsequent geologic events that altered both landscapes and climate regimes resulted in contractions and expansions of the Sonoran Desert during the subsequent several millions of years. These perturbations were particularly common during the Pleistocene (beginning 1.8 million years ago) (Van Devender 2000). Sonoran desertscrub was formed by 9000 years ago with relatively modern community composition being achieved about 4500 years ago. Much of the Sonoran Desert's present flora likely predates the Sonoran Desert itself, having evolved in its precursors: seasonally dry thornscrub and tropical deciduous forest. Other plants, primarily those currently restricted to the Sonoran Desert, possibly evolved along with the desert itself. The contractions and expansions of the Sonoran Desert associated with glacial and interglacial cycles likely served as stimuli to both plant speciation and extinction during the Pleistocene.

Although at least 24 species of Sonoran Acanthaceae are found in regions of Sonoran desertscrub and thornscrub, a similar quantity (at least 23 species) is known from the much smaller region of tropical deciduous forest in the state. This reflects both the tropical nature of Acanthaceae and the enrichment of Sonora's flora by the incursions of this biotic community into its southern section. Today, the northern distributional extent of both tropical deciduous forest and thornscrub is in Sonora. This undoubtedly accounts for many of the 22 species of Acanthaceae that attain the northern extent of their distributional ranges in the state. Sonoran Desert is the most "tropical" of the North American warm deserts with its geographic, biologic, and historic connections to these seasonally dry tropical communities. Given these connections to tropical deciduous forest and thornscrub, many primarily Sonoran Desert species reach their southern distributional limits in one of these communities further to the south. Among Sonoran Acanthaceae, *Holographis virgata, Justicia californica, J. longii, J. sonorae, Ruellia californica*, and *Tetramerium fruticosum* appear to have distributions representative of this pattern.

Only one species of Acanthaceae, *Tetramerium yaquianum*, is endemic to Sonora. Fourteen Sonoran Acanthaceae occur only in the state and nearby regions (i.e., southern California, Arizona, New Mexico, trans-Pecos Texas, Chihuahua, Sinaloa, and the peninsula of Baja California), and

can be considered as regional endemics: *Anisacanthus andersonii, A. thurberi, Aphanosperma sinaloensis, Holographis pallida, H. virgata, Justicia californica, J. longii, J. masiaca, J. phlebodes* (also known from Durango), *J. sonorae, Ruellia californica, R. leucantha, Stenandrium pilosulum*, and *Tetramerium fruticosum*. Five of these (*A. andersonii, H. pallida, J. masiaca, J. sonorae*, and *S. pilosulum*) barely occur outside of the state and might be considered as nearly endemic to Sonora. Because the Sonoran Desert is a unique and geographically restricted entity, one might expect considerable endemism associated with it. Indeed, a "greater Sonoran Desert region" (i.e., regions of Sonoran desertscrub and associated thornscrub and desert grassland) harbors at least eight endemic species of Acanthaceae (*Holographis virgata, Justicia californica, J. hians* (Brandegee) Brandegee, *J. longii, J. masiaca, J. sonorae, Ruellia californica*, and *R. comonduensis* T.F. Daniel), with six of them occurring in Sonora.

The overall distributions of 15 Sonoran Acanthaceae are widespread, i.e., they occur in one or several biotic communities over a broad distributional area and they are often weedy: *Carlowrightia arizonica, Blechum pyramidatum, Dicliptera resupinata, Dyschoriste decumbens, D. hirsutissima, Elytraria imbricata, Henrya insularis, Justicia candicans, J. caudata, J. salviiflora, Pseuderanthemum praecox, Ruellia intermedia, R. inundata, R. nudiflora*, and *Tetramerium nervosum*. For example, *Tetramerium nervosum* occurs in numerous communities from the southwestern United States to Peru. The remaining eight species of Sonoran Acanthaceae have overall distributions intermediate between widespread and restricted to northwestern Mexico and the southwestern United States. They are either restricted to a particular biotic community in North America (e.g., *Ruellia parryi* occurs throughout the Chihuahuan Desert in the United States and northern Mexico), or occur in several communities over a somewhat restricted geographic area (e.g., *Carlowrightia texana* occurs in various habitats in the southern United States and northern Mexico). At least two species that occur in regions adjacent to Sonora (and in biotic communities represented in Sonora) might be expected to occur within the state: *Carlowrightia linearifolia* (Torr.) A. Gray and *Ruellia paniculata* L.

Several species of Sonoran Acanthaceae were observed or noted by other collectors to occur in disturbed habitats. These include roadsides, fencerows, ditches, fields, pastures, and recently burned sites. Some, but not all, Acanthaceae occurring in these man-made (or artificially created) habitats are widespread and weedy species (e.g., *Blechum pyramidatum, Elytraria imbricata, Ruellia inundata, Tetramerium nervosum*). As I have noted previously (Daniel 1983a), the propensity of some Acanthaceae to occur in artificially disturbed habitats may reflect a preadaptation among them for occurring in naturally disturbed habitats (e.g., along watercourses). Indeed, as noted above, most Sonoran Acanthaceae have been collected along watercourses of one type or another. Two of these widespread and weedy species have the broadest ecological amplitude among Sonoran Acanthaceae: *E. imbricata* occurs from desertscrub to pine forests (0–1680 m) and *T. nervosum* occurs from desertscrub to oak-pine woodlands (20–1450 m).

The small region supporting Chihuahuan desertscrub in northeasternmost Sonora is one of the least known regions of the state. Recent collecting activity there has resulted in the discovery of two Acanthaceae not previously reported for the state, *Carlowrightia texana* and *Ruellia parryi*. Both of these are common plants that are widespread in the Chihuahuan Desert region of northern Mexico and adjacent portions of the United States. Additional exploration in the region should locate a Sonoran occurrence for *C. linearifolia* (Torr.) A. Gray, another species of the Chihuahuan Desert that occurs in nearby regions of southeastern Arizona and southwestern New Mexico.

Plant/Animal Interactions

Acanthaceae as forage.— Acanthaceae are generally palatable to animals that ingest them. Virtually all Sonoran Acanthaceae serve as browse for both native animals and livestock. Hence, they are often found grazed back to or nearly to the ground; more luxuriant growth is often encountered among cacti and thorny shrubs that make it less accessible to large browsers. Felger (1999) indicated that *Holographis virgata* near Guaymas is heavily browsed by cattle, deer, and rabbits. He also noted (2000:64) that in open places in northwestern Sonora, *Carlowrightia arizonica* "is almost always grazed by rabbits, rodents, and especially chuckwallas, which reduce the plant to a mass of short, stubby stems." Yetman and Van Devender (2002) noted the importance of numerous Acanthaceae as forage for livestock. One of their informants noted that in the tropical deciduous forests of southern Sonora many goats and cows depend on these palatable and abundant plants for survival following the regional rains.

Floral visitors.— Acanthaceae offer two possible rewards for floral visitors and potential pollinators, sugary nectar and protein-rich pollen. Known pollinators of Mexican Acanthaceae include insects, birds, and bats (Daniel 1993). For Acanthaceae that occur in Sonora, the following floral visitors have been noted in Sonora or in nearby regions (based on Daniel 1982, 1983a, 1986, 1990, 1995d; Grant 1983; Hilsenbeck 1990b; Michener 1979; Felger 2000, and unpublished data): thrips (*Justicia californica*), bombyliid flies (*Carlowrightia arizonica, Dicliptera resupinata, Henrya insularis, Tetramerium nervosum, T. tenuissimum*), syrphid flies (*Justicia californica*), apid bees (*Anisacanthus thurberi, Justicia californica, J. candicans*), halictid bees (*Carlowrightia arizonica, Henrya insularis, Justicia californica*), megachilid bees (*Dicliptera resupinata*), xylocopid bees (*Justicia californica, J. candicans*), wasps (*Anisacanthus andersonii, Justicia californica*), butterflies (*Dicliptera resupinata, Henrya insularis, Justicia californica, Tetramerium abditum, T. nervosum*), hawkmoths (*Justicia californica, J. longii*), hummingbirds (*Anisacanthus andersonii, A. thurberi, Justicia californica, J. candicans, Odontonema cuspidatum, Ruellia californica, Tetramerium abditum*), and perching birds (*Justicia californica*). Many of these floral visitors were observed to gather either pollen or nectar; some were nectar robbers only. From these observations, it is evident that a diversity of visitors is attracted to each of several floral forms. For some species, multiple kinds of floral visitors have been implicated as pollinators. For example, both *Anisacanthus thurberi* and *Justicia californica* are effectively pollinated by both hummingbirds and bees. As noted by Michener (1979) this may be a result of having both nectar and pollen as rewards. Based on their floral form and nectar sugar ratios (where determined), probable floral visitors/pollinators for other Sonoran Acanthaceae can be inferred as follows: bees/flies (*Aphanosperma sinaloensis, Carlowrightia pectinata, C. texana, Ruellia* spp., *Tetramerium fruticosum, T. yaquianum*) and butterflies (*Justicia hilsenbeckii, J. masiaca, J. phlebodes, J. sonorae, Pseuderanthemum praecox*). Further documentation of floral visitors, their behaviors, and their effectiveness as pollinators among Acanthaceae is highly desirable.

Ethnobotany of Sonoran Acanthaceae.— Sonora was and is home to several prominent indigenous groups of partially or mostly sedentary farmers: Mayo (southern Sonora), Yaqui (southern Sonora), Pima Alto (northwestern Sonora), Pima Bajo (central and east-central Sonora), Papago or Tohono O'odham (northwestern Sonora), Guarijío (southeastern Sonora), and Opata (central and northeastern Sonora). Historically, the Seri fished, hunted, and gathered wild plants on Isla Tiburón, Isla San Esteban, and along the adjacent coast of the mainland. Ethnobotanical studies published for several of these cultural groups (e.g., Gentry 1963; Felger and Moser 1985; Yetman 2002; Yetman and Van Devender 2002) reveal that each made considerable use the region's plants for a variety of purposes. Uses of and local names given to Acanthaceae by both pre-

Colombian and post-Colombian Americans are cited in this treatment. Some of these are derived from ethnobotanical publications, but many are taken from unpublished information recorded on labels of herbarium specimens.

Materials and Methods

The following taxonomic account of Sonoran Acanthaceae is based on field and herbarium studies over the past 27 years. The generic descriptions are based primarily on New World species. Comprehensive descriptions of species are provided for those not fully and recently described elsewhere or where sufficient additional collections from Sonora have resulted in either taxonomic renovations or significant new morphological information. Otherwise, a reference to a recent description is cited. Complete synonymies are provided for most taxa. For those taxa with many synonyms, only names based on types from Sonora or names applied to Sonoran plants are provided; however in such cases, reference to a recent full synonymy is also cited. The months of flowering and fruiting noted for each species are derived solely from Sonoran collections. Habitat and elevational data are derived primarily from information provided on herbarium specimens. These data have occasionally been augmented based on mapping each collection using the map of biotic communities by Brown and Lowe (1980). Smaller versions of these maps are provided for all Sonoran Acanthaceae that are presumed to be native to the state. Illustrations of macromorphological characteristics are provided for several species and citations of previously published illustrations are also given. This account includes scanning electron micrographs of representative pollen for each species. Discussions deal with morphological variation, nomenclature, and distribution as appropriate for each taxon. All specimens studied are cited.

Taxonomic Treatment

Acanthaceae

Terrestrial (rarely aquatic) perennial herbs or shrubs, less often trees or twining perennial vines, vegetative and floral organs glabrous or pubescent with various types of eglandular (simple and compound), subglandular (i.e., lacking a conspicuous capitate gland at apex but apically enlarged), and glandular trichomes, often covered with cystoliths visible in epidermis (these absent in some genera). Young stems usually with swollen nodes. Leaves opposite and decussate or sometimes quaternate (rarely alternate), simple, estipulate, sessile to petiolate, margin usually entire. Inflorescence of 1–many-flowered dichasia borne in axils of leaves or bracts, dichasia alternate (= solitary) or opposite (= paired) at nodes, sessile or pedunculate, when borne in axils of bracts then usually forming dichasiate spikes (i.e., dichasia and flowers sessile to subsessile), racemes (i.e., dichasia sessile to subsessile and flowers pedicellate), or thyrses (i.e., dichasia pedunculate), if spikes or racemes or thyrses branched then forming panicles. Bracts large and brightly colored or small and green. Flowers sessile or pedicellate, usually subtended by 2 bracteoles, bisexual, chasmogamous and often cleistogamous, rarely heterostylous. Calyx comprising 5 sepals, free or usually fused and deeply 4-5-lobed, lobes equal to unequal in length, sometimes partially or completely fused with one another and forming heteromorphic segments. Corolla sympetalous, comprising 5 petals, tube cylindric or funnelform (i.e., gradually or abruptly expanded distally into a ± distinct throat), sometimes resupinate, limb subactinomorphic or usually bilabiate with an upper lip of 2 lobes and a lower lip of 3 lobes, corolla lobes imbricate (including cochlear and quincuncial) or contorted in bud. Stamens epipetalous, included in corolla tube or exserted from mouth of corolla, usually 2 or 4 and didynamous, anthers 1–2-thecous, sometimes with basal or apical appendages,

thecae of a pair parallel to perpendicular, collaterally attached to filament to superposed to widely separated by a modified connective, pollen extremely diverse, staminodes 0-3. Nectariferous disk usually present around base of ovary, annular. Gynoecium 2-carpellate, ovary superior, generally 2-locular, placentation usually axile, ovules 2-many in each locule, style simple, terminal, filiform, included within corolla tube or exserted from mouth of corolla, stigma funnelform, 2-lobed, or with one lobe suppressed. Fruit a loculicidal, explosively dehiscent, stipitate or estipitate, 2-valved capsule (elsewhere, rarely a fleshy drupe), septa sometimes separating from inner wall of mature capsule. Seeds 2-many, each usually subtended by a prominent hook-shaped retinaculum, globose to lenticular, glabrous or pubescent, trichomes often hygroscopic or becoming mucilaginous when wet. ($x = 7$).

Most of the ca. 4000 species occur in the tropics and subtropics with major centers of endemism, morphological diversity, and species richness in Indo-Malesia, Africa (including Madagascar), South America, and Mexico-Central America. Plants occur in most tropical habitats except those at very high elevations (i.e., above 3000 meters). Sonoran Acanthaceae consist of 41 species in 15 genera.

Key to Genera of Acanthaceae in Sonora

1. Leaves alternate, often crowded at stem apices; inflorescence borne on scapes covered with coriaceous and clasping scales; corollas 4-8.5 mm long; stigma touch-sensitive; capsule 2.8–4.1 mm long; seeds irregularly blocky, borne on papilliform placentae (i.e., hooklike retinacula lacking). . . . . *Elytraria*
1. Leaves opposite, usually ± evenly distributed along stems; inflorescence not borne on scaly scapes; corollas (except in occasional cleistogamous flowers) 5.5–60 mm long; stigma not touch-sensitive; capsule 3.5-30 mm long; seeds subglobose to lenticular, borne on hooklike retinacula.
   2. Fertile stamens 4.
      3. Cystoliths absent; anthers 1-thecous; corolla lobes imbricate (ascending cochlear) in bud; pollen 3-colpate.
         4. Shrubs to 2 m tall; corolla strongly zygomorphic; occurring west of the Sierra Madre Occidental in desertscrub, thornscrub, and tropical deciduous forest at elevations of 20–600 m . . . . . *Holographis*
         4. Acaulescent perennial herbs less than 10 cm tall; corolla appearing subactinomorphic; occurring in the Sierra Madre Occidental of eastern Sonora in oak-pine communities at elevations of 1540–2250 m. . . . . *Stenandrium*
      3. Cystoliths present; anthers 2-thecous; corolla lobes contorted in bud; pollen otherwise.
         5. Inflorescence of densely bracted, often elongate, 4-sided dichasiate spikes with the bracts broadly ovate to cordate to subcircular; placentae separating from mature capsule wall; pollen 3-syncolporate. . . . . *Blechum*
         5. Inflorescence otherwise; placentae remaining attached to mature capsule wall; pollen not 3-syncolporate.
            6. Thecae basally awned or mucronate; calyx tube with weak, usually hyaline, regions proximal to sinuses between lobes; corollas with colored markings within, 13–29 mm long; pollen 3-colporate, mesocolpia multi-striate with 4–15 pseudocolpi. . . . . *Dyschoriste*
            6. Thecae lacking basal awns or mucros; calyx tube lacking weak and hyaline regions proximal to sinuses between lobes; corollas concolorous, 20–65 mm long; pollen 3-porate, exine coarsely reticulate. . . . . *Ruellia*

2. Fertile stamens 2.
   7. Androecium of 2 fertile stamens and 2 staminodes.
      8. Perennial herbs less than 6 dm tall; corolla salverform (i.e., tube cylindric or tapered distally, limb subactinomorphic), the tube 1.5–1.7 mm in diameter at apex, the limb 14–28 mm in diameter, or if chasmogamous flowers absent, then with budlike cleistogamous flowers; calyx 4–6 mm long during anthesis. . . . . *Pseuderanthemum*
      8. Shrubs, often more than 1 m tall; corolla funnelform (i.e., tube gradually expanded distally, limb bilabiate), the tube 2.5–4 mm in diameter at apex, the limb 6.5–13 mm in diameter; calyx 2–4 mm long during anthesis. . . . . *Odontonema*
   7. Androecium of 2 fertile stamens and 0 staminodes.
      9. Stems hexagonal in cross-section; inflorescence of axillary bracteate cymes bearing (1–) 3 (–5) pedunculate cymules; cymules consisting of 1 or more flowers subtended by an involucre of 2 or more pairs of bracteoles; outer pair of cymule bracteoles cordate to deltate, conspicuous and larger than inner pair(s); septa with attached retinacula separating from inner capsule wall at maturity and protruding prominently from each valve of capsule, the mature capsule conspicuously ruptured near base of head; corolla resupinate 180°. . . . . *Dicliptera*
      9. Stems terete to quadrate-alate in cross-section; inflorescence various but not as described above; cymules never present; flowers subtended by 1 pair of bracteoles; retinacula remaining attached to inner capsule wall at maturity or separating slightly near base of head (i.e., *Henrya* and *Tetramerium*) but not protruding prominently from each valve of capsule, mature capsule not or barely ruptured near base of head; corolla not resupinate.
         10. Upper lip of corolla rugulate (i.e., with a stylar furrow); stamens appressed to upper lip of corolla, anthers dehiscing toward lower lip (i.e., flower nototribal); thecae subequally to unequally inserted or superposed, often with a basal appendage on at least one theca; pollen 2 (–3 or 4)-aperturate, apertures al); thecae subequally to unequally inserted or superposed, often with a basal flanked on each side by 1–3 rows of ± circular insulae and/or peninsulae (i.e., al); thecae subequally to unequally inserted or superposed, often with a basal lacking pseudocolpi). . . . . *Justicia*
         10. Upper lip of corolla not rugulate (i.e., lacking a stylar furrow); stamens appressed to lower lip of corolla, anthers dehiscing toward upper lip (i.e., flower stenotribal); thecae equally to subequally inserted, lacking basal appendages; pollen 3-aperturate, apertures flanked on each side by a solid band of exine and a pseudocolpus (i.e., 6-pseudocolpate).
            11. Capsules completely reflexed at maturity, expanded and truncate (to subemarginate) at apex, base of stipe covered with uncinate trichomes; seeds fused to and permanently retained within capsule valves. . *Aphanosperma*
            11. Capsules erect at maturity, narrowed and acute at apex, base of stipe lacking uncinate trichomes; seeds free from capsule valves and ejected therefrom at maturity.
               12. Either bracts or bracteoles conspicuous, concealing calyx; septa with attached retinacula separating slightly from inner wall of mature cap sule near base of head; seeds 0.8–2.8 mm long.
                  13. Bracteoles fused, if at all, only at base for a distance up to 1 mm, not forming an involucre; bracts longer than bracteoles; seeds 4,

lacking trichomes; pollen with colpi narrow, not or barely exceeding width of centrally positioned ora.. . . . . *Tetramerium*

13. Bracteoles fused along 1 side from base to near apex, forming a conspicuous involucre; bracts shorter than bracteoles; seeds 2, pubescent with stiff, interwoven, hygroscopic trichomes to 0.5 mm long; pollen with colpi broad, far exceeding width of centrally positioned ora. . . . . *Henrya*

12. Neither bracts nor bracteoles conspicuous, not concealing calyx, or if subfoliose (as in *Anisacanthus thurberi*) then at least calyx plainly visible; septa with attached retinacula remaining attached to inner wall of mature capsule; seeds 2.5–8 mm long.

14. Shrubs to 3 m tall; corollas red to orange, concolorous, (24–) 30–60 mm long; thecae 3–4.8 mm long; capsule 12–30 mm long. . . . . *Anisacanthus*

14. Mostly perennial herbs to 1 m tall; corollas white, cream, or yellow, usually with colored markings, 5.5–18 mm long; thecae 0.5–1.9 mm long; capsule 6.5–14 mm long.. . . . . *Carlowrightia*

Anisacanthus Nees

Anisacanthus Nees, Linnaea 16:307. 1842. TYPE: *Anisacanthus quadrifidus* (Vahl) Nees (≡ *Justicia quadrifida* Vahl).

Erect shrubs with cystoliths. Leaves opposite. Inflorescence of dichasia in leaf axils or, more commonly, of dichasiate (spikes to) racemes (to thyrses); dichasia (opposite) alternate, 1 (-3)-flowered, sessile (to pedunculate), subtended by a leaf or a bract. Flowers homostylous, (sessile to) pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic, usually accrescent in fruit. Corolla pink, reddish, or orange, lacking colored markings, tube gradually expanded distally, throat indistinct to ± distinct, limb 2-labiate, upper lip comprising 2 fused lobes, entire to emarginate at apex, lower lip 3-lobed with lobes homomorphic and often recoiled, corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla, anthers 2-thecous, thecae equal in size, parallel to subsagittate, equally inserted on filament, lacking basal appendages, dehiscing toward upper lip of corolla (i.e., flowers stenotribal); pollen (Fig. 3) euprolate to perprolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium, exine reticulate; staminodes 0. Style exserted from mouth of corolla, stigma 2-lobed. Capsule stipitate, head subspheric, retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 2–4, homomorphic, lenticular, lacking trichomes. (x = 18).

This American genus of about 18 species has centers of diversity in Mexico (8 species) and Brazil (6 species). Hagen's (1941) revision of the North American species is very much out of date. North American species all occur in arid to semiarid regions. The large, brightly colored, and nectariferous flowers are commonly visited by hummingbirds. In some aspects of floral morphology, the North American species appear more similar to one another than to the Central or South American species. The generic description above is based exclusively on North American taxa.

1. Corolla usually dark red, (38–) 45–60 mm long, lobes of lower lip 20–28 mm long; bracts not subfoliose, 3–6.5 mm long; thecae 3.5–4.8 mm long; capsule 20–30 mm long; style red, 40–65 mm long.. . . . . *A. andersonii*

1. Corolla usually orangish, (25-) 30–43 mm long, lobes of lower lip 10–17 mm long; bracts

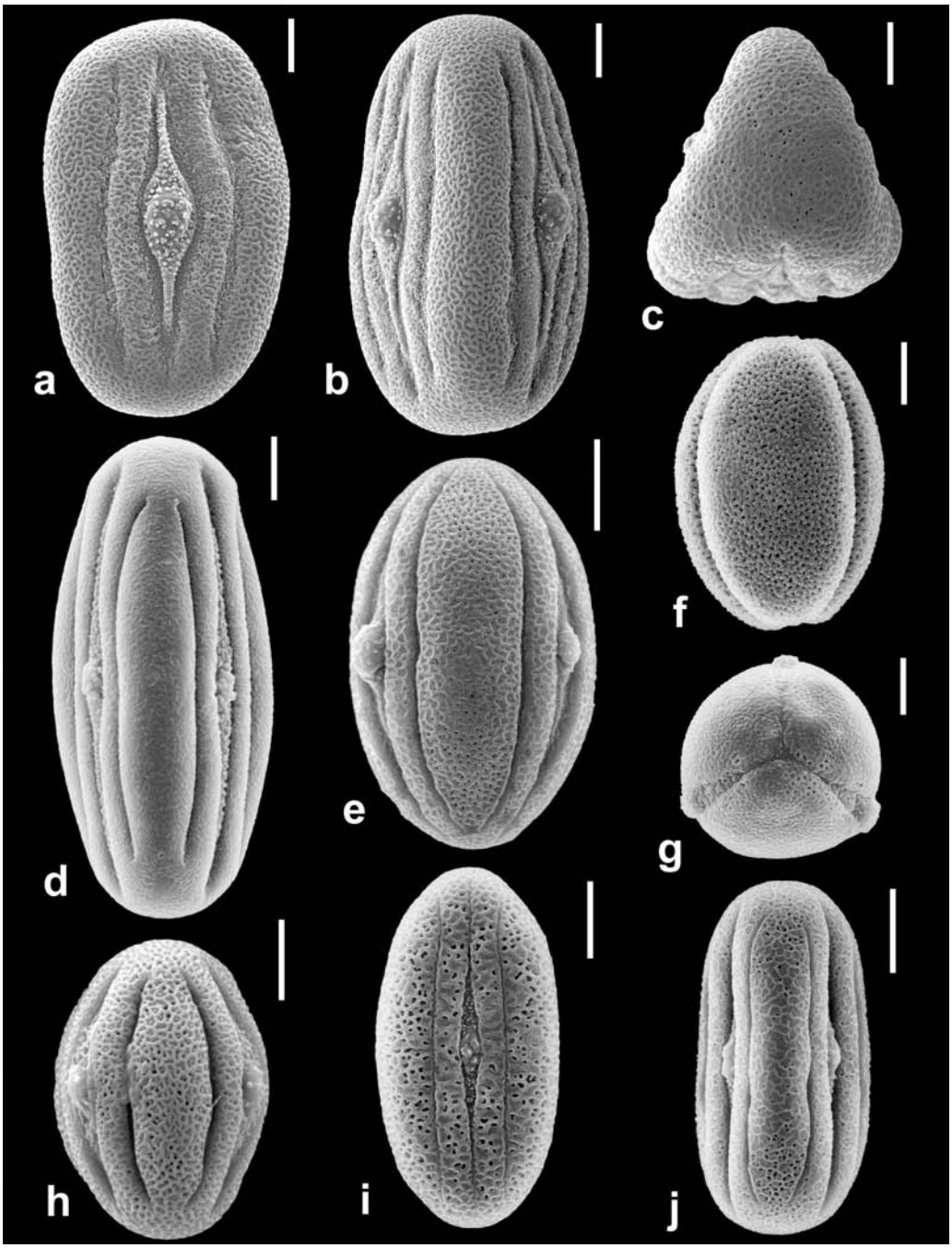


FIGURE 3. Pollen of Sonoran Acanthaceae. a. *Anisacanthus andersonii* (*Gallagher & Hodgson 2814*), apertural view. b. *A. andersonii* (*Gallagher & Hodgson 2814*), interapertural view. c. *A. andersonii* (*Gallagher & Hodgson 2814*), polar view. d. *A. thurberi* (*Daniel 118*), interapertural view. e. *Aphanosperma sinaloensis* (*Van Devender et al. 93-1494*), interapertural view. f. *Blechum pyramidatum* (*Daniel et al. 5454*), interapertural view. g. *B. pyramidatum* (*Daniel et al. 5454*), polar view. h. *Carlowrightia texana* (*Daniel & Butterwick 10000*), interapertural view. i. *C. arizonica* (*Daniel et al. 6845*), apertural view. j. *C. pectinata* (*Daniel et al. 6846*), interapertural view. Scales = 10 μm.

(sometimes caducous) subfoliose, 6.5–28 mm long; thecae 3-4 mm long; capsule 12–17 mm long; style white, 26–44 mm long. . . . . *A. thurberi*

Anisacanthus andersonii T.F. Daniel, Bull. Torrey Bot. Club 109:148. 1982. TYPE: MEXICO. Sonora: Sierra Baviso, Palm Canyon, 17 mi SE of Magdalena on road to Cucurpe (30°28”N, 110°48′W), 1212 m, 19 Mar 1978, *N. McCarten & R. Bittman 2690* (holotype: ARIZ!; isotypes: MICH!, UC!).

Phenology. Flowering: February–July; fruiting: March–July.

Distribution and habitats. Northwestern Mexico (Chihuahua, Sonora); Sonoran plants occur on slopes, in canyon bottoms of riparian gallery forests, and in palm oases in regions of thornscrub, tropical deciduous forests, and oak woodlands at elevations from 480 to 1212 meters.

Illustration. *Bulletin of the Torrey Botanical Club* 109:149. 1982.

Daniel (1982) provided a description of this species. Color of the corolla varies from orange-red to scarlet. Most collections from Sonora have glands inconspicuous or absent in the inflorescence. In *Sanders et al. 4789* (CAS) from Chihuahua, they are conspicuous (to 0.2 mm long) on the rachis, bracts, bracteoles, and calyx. Also, the calyces during anthesis vary from 5-6 mm in length on this collection (vs. 8-12 mm long among other collections of the species). Its identity remains uncertain, and it is not included in the above key. *Breedlove 16445* (CAS, US) from the Sierra Surutato in northern Sinaloa also resembles *A. andersonii*, but it has conspicuous glands (to 0.3 mm long) on these same organs, calyces to 20 mm long during anthesis, and evenly pubescent young stems. It may also represent a different species.

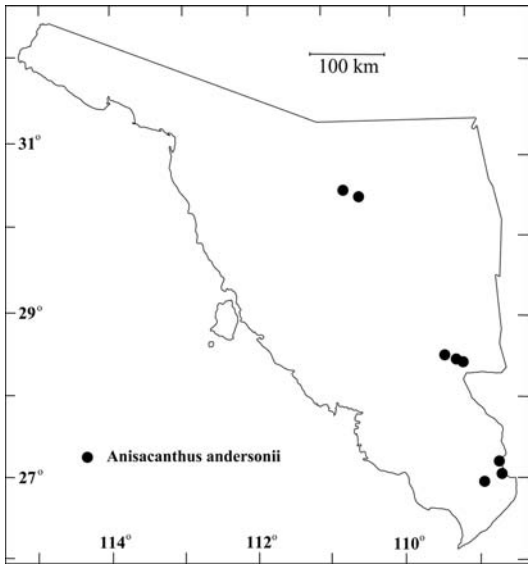


FIGURE 4. Sonoran distribution of *Anisacanthus andersonii*.

Anisacanthus andersonii is endemic to northwestern Mexico. In Sonora, where the species attains the western extent of its geographic range, it is known from canyons or riparian habitats in three isolated regions (Fig. 4). The species tends to occur in somewhat more mesic habitats (and usually at higher elevations) than its close relative, *A. thurberi*. However, *Anisacanthus andersonii* and *A. thurberi* apparently grow in the general vicinity of one another at Ignimbrite Canyon. Martin collected both species there on the same day. Flowers of both are visited by hummingbirds (Daniel 1982) and hybridization between them might occur (see Daniel 1984a). Both species were flowering when collected by Martin, and the distinctions noted in the key above are maintained in his collections.

SONORAN COLLECTIONS: Palm Canyon, 17 mi SE of Magdalena on road to Cucurpe, *R. Bittman 262* (ARIZ); Mpio. Onavas, Rancho La Mula, near Hwy. 16, 18.9 km SE jct. to Onavas, ca. lat. 28°29′N, 109°22′W, *T. Daniel et al. 8553* (ARIZ, ASU, BR, CAS, K, MEXU, MICH, MO, US); Mpio. Yécora, Arroyo La Quema, 0.3 km SE of Tepoca on Hwy. 16, ca. 28°26′N, 109°15′W, *T. Daniel et al. 8634* (CAS); vicinity of ‘palm canyon,’ 25 km SSE of Magdalena toward Cucurpe, 30°28′N, 110°48′W, *D. Ducote et al. 76-6* (MEXU); Mpio. Magdalena de Kino, 17.4 mi SE of Magdalena on road to Cucurpe, SW part of Sierra Remedio, Palm Canyon, *R. Felger 409* (ARIZ), *3423* (ARIZ, CAS, MEXU); Arroyo Uvalama (Igualamas),

26°59′N, 108°59′W, *M. Fishbein et al. 1104* (ARIZ); ca. 14 mi E of Magdalena, Cañón des Palmas, *P. Gallagher & W. Hodgson 2814* (CAS); Ignimbrite Canyon, 3 km N of La Brisca, Río Santo Domingo, [between Magdalena and Arispe], 30°26′N, 110°33′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); R. San Pedro, 23 km E and 4 km N of Alamos, 27°03′N, 108°42′W, *P. Martin et al. s.n.* (ARIZ); Mpio. Yécora, Arroyo San Nicolás, below San Nicolás, 28°26′N, 109°21′W, *A. Reina G. & T. Van Devender 97-483* (CAS); Mpio. Onavas, Rancho La Mula, 5 km W of Agua Amarilla, 28.2 km E of Río Yaqui on Mex. 16, 28°29′N, 109°22′W, *A. Reina G. et al. 97-116* (ARIZ, CAS, MEXU); Mpio. Yécora, 2.7 km WNW of Tepoca on Mex. 16, 28°28′N, 109°16′W, *A. Reina G. et al. 98-260* (MO); Las Chinacas to Taymucho, *S. Richardson et al. s.n.* (ARIZ); Mpio. Alamos, upper Río Cuchujaqui, 27°06′N, 108°43′W, *R. Rondeau & G. Rodda 90-66* (ARIZ); 17 mi E of Magdalena, Palm Canyon, *R. Thompson & O. Davis 82-40* (ARIZ); Palm Canyon, 17 mi SE of Magdalena in Sierra Babiso (= Cerro Cinta de Plata), *T. Van Devender s.n.* (ENCB); Mpio. Yécora, Arroyo Los Huérigos (tributary of Arroyo San Nicolás) at Mex. 16, 9.3 km E of Tepoca, 3.5 km WNW of San Nicolás, 28°26′N, 109°12′W, *T. Van Devender et al. 96-51* (ARIZ, CAS, MEXU); Palm Canyon in Cerro Cinto de Plata, 17.7 mi SE of Magdalena, *T. Van Devender et al. s.n.* (ARIZ).

Anisacanthus thurberi (Torr.) A. Gray, Syn. Fl. N. Amer. 2(1):328. 1878. *Drejera thurberi* Torr. in W.H. Emory, Rep. U.S. Mex. Bound. 2(1):124. 1859. TYPE: UNITED STATES. New Mexico: Las Animas, 1 June 1851, *G. Thurber 352* (lectotype, designated by Rose and Standley, 1912, see discussion below: NY ex Torrey hb.!; isolectotypes: F!, GH! see below).

Shrubs to 1.5 (–3) m tall. Young stems subquadrate, evenly pubescent with an understory of erect subglandular and eglandular trichomes 0.05–0.2 mm long and sometimes with a bifariously disposed overstory of scattered to dense erect to flexuose eglandular trichomes 0.2–1 mm long, soon becoming bifariously pubescent with flexuose to retrorse to retrorsely appressed eglandular trichomes to 1 mm long (hirsute), nodes often hirsute, epidermis of older stems exfoliating in papery strips. Leaves (plants often leafless during anthesis), petiolate, petioles to 7 (–14) mm long, blades narrowly lanceolate to lanceolate to ovate, 11–50 (–65) mm long, (2–) 4–14.5 (–35) mm wide, 3.8–5.6 (–13) times longer than wide, (acute to) acuminate at apex, (rounded to) acute at base, surfaces pubescent with flexuose to antrorse eglandular trichomes to 0.5 mm long. Inflorescence of axillary or terminal dichasiate racemes to 3 cm long, axillary racemes usually borne at nodes of older woody stems and often condensed (i.e., lacking a prominent rachis) and appearing as an axillary cluster of subfoliose bracts and flowers, rachis pubescent like young stems; dichasia 1 (or more)-flowered, opposite, sessile in axils of distal reduced leaves or subfoliose bracts, 1 or more per axil. Bracts sometimes caducous, subfoliose, linear-lanceolate to lance-ovate to elliptic to obovate, (6.5–) 8–28 mm long 1–8.5 mm wide, abaxial surface pubescent like rachis, several pairs of smaller sterile and closely imbricate bracts sometimes present at base of inflorescence. Bracteoles sometimes caducous, linear-lanceolate to linear to linear-elliptic to oblanceolate, (2–) 4–12 (–20) mm long, 0.5–2.5 mm wide, abaxial surface pubescent like bracts. Flowers pedicellate, pedicels 2–10 mm long, pubescent like young stems and also with conspicuous glandular trichomes to 0.3 mm long. Calyx 6.5–14 mm long during anthesis (accrescent and up to 16 mm long in fruit), lobes subulate, 4.5–13 mm long, abaxially pubescent like pedicels. Corolla orange (or sometimes dull reddish), (25–) 30–43 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.1–0.3 mm long, tube (13–) 17–22 mm long, upper lip recurved, strap shaped, 10–22 mm long, entire to 2-lobed at apex, lobes to 0.3 mm long, lower lip 11–21 mm long, lobes often recurved or recoiled, linear, homomorphic, 10–17 mm long. Stamens 19–35 mm long, filaments glabrous, thecae red, 3–4 mm long. Style white, (26–) 28–44 mm long, glabrous, stigma lobes 0.2–0.3 mm long. Capsule 12–17 mm long, glabrous, stipe 5–7 mm long, head 7–11 mm long. Seeds 4.8–7 mm long, 4.4–5.8 mm wide, surfaces smooth to rugose. (n = 18).

Phenology. Flowering: October–July; fruiting: October, February–July.

Distribution and habitats. Southwestern United States (Arizona, New Mexico), northwestern Mexico (Sonora); Sonoran plants occur on slopes and along watercourses in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora), Chihuahuan desertscrub, palm oases, thornscrub, mesquite scrub, mesquite woodlands, desert grasslands, and oak woodlands at elevations from 396 to 1320 m.

Illustrations. Figures 5–6; *Trees, Shrubs and Woody Vines of the Southwest*, 932. 1960; *Trees and Shrubs of the Southwestern Deserts*, 3rd. ed., 217. 1981.

Local names. "Colegaiyo" (Mexican, *Gentry 1309*); "lustieh" (Guarijío, *Gentry 1309*).

The following collections were listed by Torrey in the protologue of *Drejera thurberi* (hence syntypes): "along water-courses, Las Animas, Sonora; June; *Thurber*. Sierra del Pajarito; *Schott*. Cañon of Guadaloupe; April; *Capt. E.K. Smith*." In the Torrey Herbarium at NY, there are several specimens of *A. thurberi*. On one sheet, there are representatives of three collections: a Schott collection from Sonora (now Arizona), "Camp Alamo near Tucson, Sierra del Pajarito," made in July, 1885; a Smith collection from "Cañon of Guadaloupe" (which includes border regions of Sonora, Arizona, and New Mexico); and another Schott collection (no. *732*) from Tucson, Sonora (now Arizona). There are later indications as to which label information goes with which plants on the sheet. There is also a collection of Charles Wright (no. *1456*), collected in 1851–52, which was not mentioned by Torrey in the protologue of *D. thurberi*. Finally, there is the Thurber collection (no. 352, collected in June of 1851) from Las Animas, Sonora (now New Mexico), which was cited in the protologue. *Drejera thurberi* can be assumed to have been lectotypified by Rose and Standley (1912), who noted that the type locality was "along water-courses, Las Animas, Sonora." Johnston (1924) and Standley (1926) also indicated that the type was from Las Animas. Although an herbarium of deposit was neither cited in the protologue nor in any of these indications of the lectotype, and although there are duplicates at other herbaria of Thurber's collection from this locality, the specimen in Torrey's herbarium at NY can considered to be the lectotype (i.e., it is definitely a syntype whereas the duplicates might be isosyntypes). This specimen was annotated by Hagen in 1937 as the type of *A. thurberi* (i.e., of *D. thurberi*), but none of the collections noted by Torrey in the protologue was cited by Hagen (1941). Hagen's annotation does not constitute a typification because it was never published and therefore does not conform to Article 7.10 of the ICBN (Greuter et al. 2000). If the earlier, and likely unintentional, lectotypifications are eventually shown to have been inadequate according to evolving rules on lectotypification in the ICBN (Greuter et al. 2000), then *Thurber 352* at NY is designated here as the lectotype of *Drejera thurberi*. A duplicate of it at F gives a more specific date of collection (1 June 1851).

Most plants of *Anisacanthus thurberi* have orange corollas. Label data of *Reina G. et al. 2004-469* and *Van Devender et al. 89-115* note that the plants collected had red flowers and that the typical orange-flowered plants were present as well. Label data of *Fishbein et al. 2259* also notes variation in flower color from orange to brick-red.

Anisacanthus thurberi occurs in a variety of biotic communities throughout the state (Fig. 7), but appears to be most abundant in Sonoran desertscrub and desert grassland. Although there is some overlap in the habitats of *A. thurberi* and *A. andersonii*, the former tends to occur in more arid situations (and at lower elevations) than the latter. Some ecological aspects of *A. thurberi* were noted by Turner et al. (1995). It reaches the southern extent of its distribution in southern Sonora, where it occurs in thornscrub and possibly in tropical deciduous forest.

Sonoran collections: 10 mi S of Llano, *L. Abrams 13268* (DS); canyon back of Palma, 40 mi S of Hermosillo, *L. Abrams 13349* (DS); 11.2 mi S of cemetery at Agua Prieta, *A. Carter et al. 71-5* (UC); 13 km del Rancho El Colorado, 47 km S de la Garita de Sásabe, *A. Castellanos 192* (MEXU); Palm Canyon, 25 km SSE of Magdalena on road to Cucurpe, 30°28′N, 110°48′W, *D. Ducote 76-6* (MEXU-257162); Rancho La

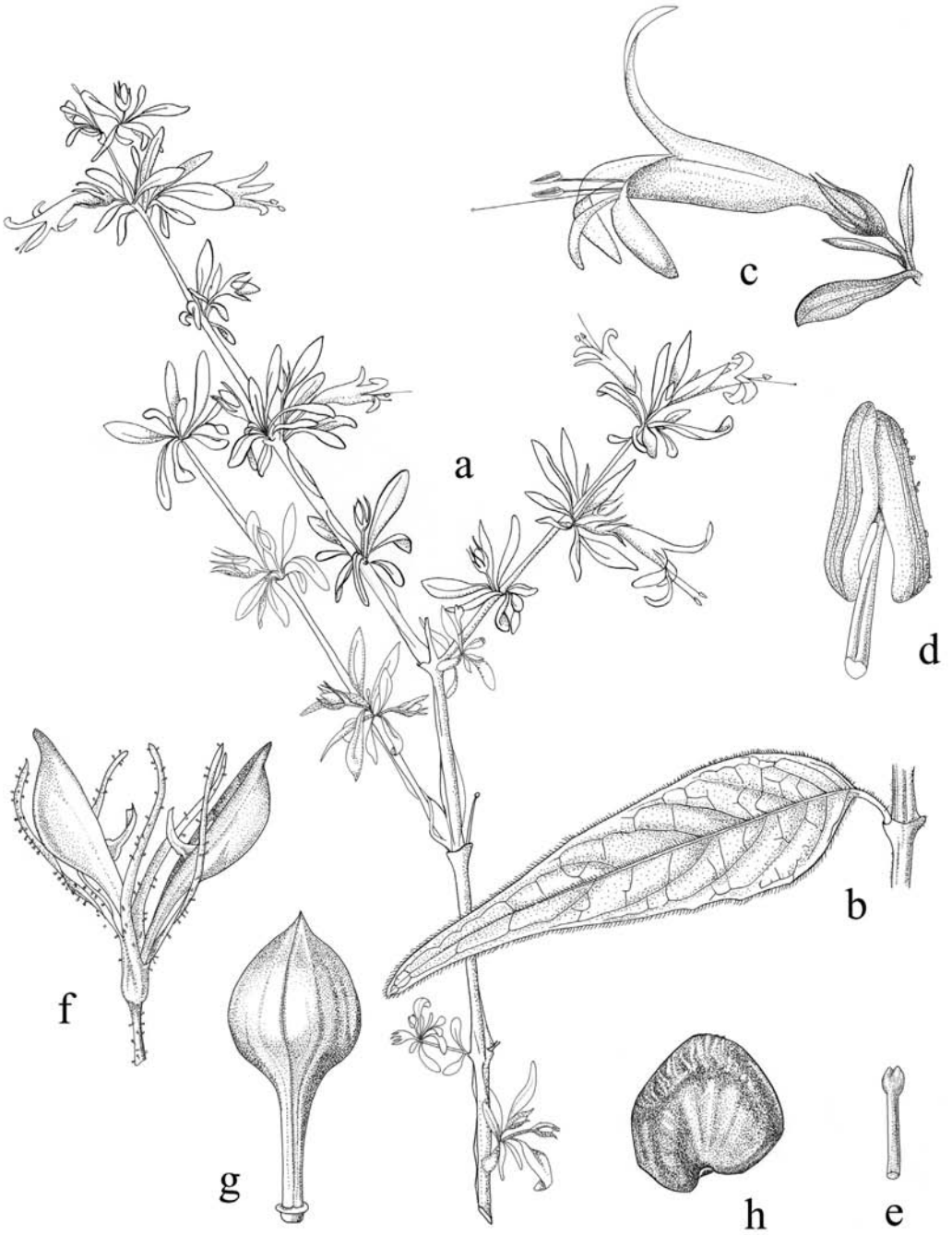


FIGURE 5. *Anisacanthus thurberi*. a. Habit (*Daniel & Butterwick 2911*), × 0.5. b. Vegetative node with leaf (*Daniel 118cv*), × 1.3. c. Inflorescence node with flower (*Daniel & Butterwick 2911*), × 1.5. d. Distal portion of stamen with anther (*Daniel & Butterwick 2911*), × 8.5. e. Distal portion of style with stigma (*Daniel & Butterwick 2911*), × 6.5. f. Dehisced capsule with calyx (*Valenciano s.n.*), × 2.7. g. Undehisced capsule (*Butterwick & Mittleman 8212*), × 2.6. h. Seed (*Butterwick & Mittleman 8212*), × 4.1. Drawn by Zina Deretsky.

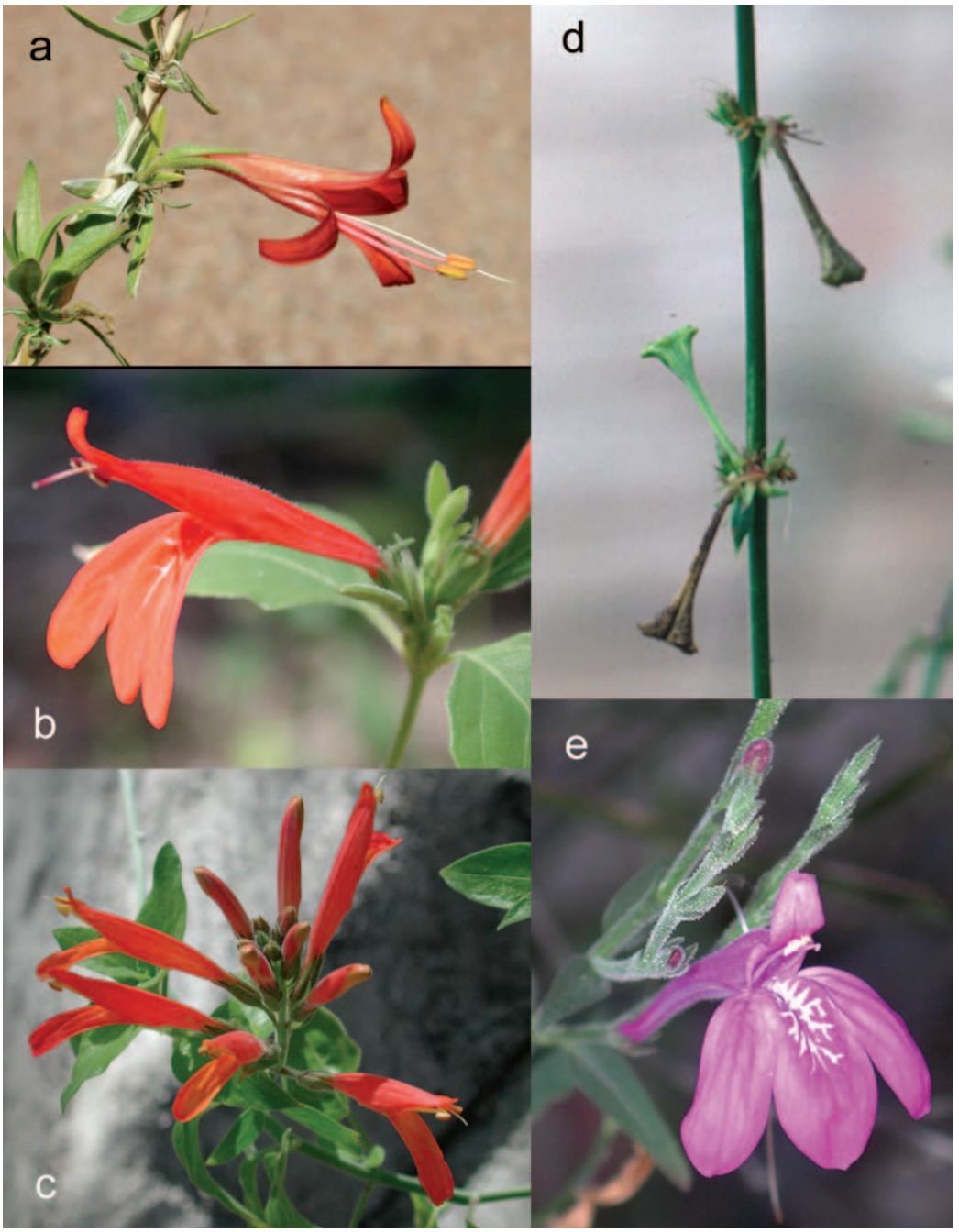


FIGURE 6. Sonoran Acanthaceae. a. *Anisacanthus thurberi*. b. *Justicia candicans*. c. *J. californica*. d. *Aphanosperma sinaloensis*. e. *J. sonorae*.

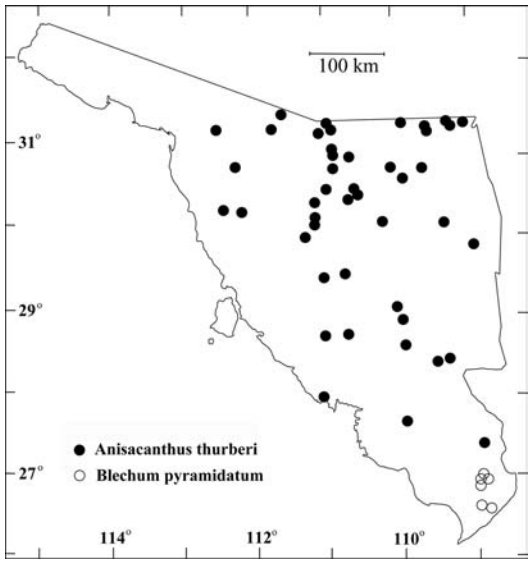


FIGURE 7. Sonoran distributions of *Anisacanthus thurberi* and *Blechum pyramidatum*.

Brisca, ca. 8 mi ENE of Cucurpe, *J. Duek s.n.* (ENCB); Hwy. 83, Nogales, US-Mexico border, J. *Dwyer 14093* (MEXU, MO); San Miguel de Horcasitas, *G. Eisen s.n.* (UC); 4 mi E of Rancho La Primavera in western foothills of Cerro Jojoba, S of Caborca, *R. Felger & H. Gentry s.n.* (ARIZ); Mpio. Imuris, 14.7 mi N of Imuris on Mex. 15, *R. Felger & J. Wright 7266* (ARIZ, CAS, MEXU); ca. 0.5 mi from San Carlos Bay, ca. 8 mi N of Guaymas, *R. Ferris 8736* (DS, US); 9 mi from Imuris in canyon of Magdalena River, *R. Ferris 8799* (DS); Sierra de Los Ajos, 3 mi SE of Mututucachi, 10.4 mi SW of Rancho La Volanta, 30°44′N, 109°59′W, *M. Fishbein et al. 2259* (ARIZ, MEXU); 277 km S of Nogales on road to Hermosillo, *T. Frye & E. Frye 2284* (DS, GH, NY, UC, US); San Bernardo, Río Mayo, *H. Gentry 1309* (A, ARIZ, F, MEXU, MO, NY, S, UC, US, WIS); 13 mi SE of Bacoachi along road to Nacozari, *H. Gentry & Arguelles 22930* (ARIZ, MEXU, US); 100 mi S of Nogales along Mex. 15, *D. Goldberg & T. Van Devender 76-2* (ARIZ); Oputo, *C. Hartman 194* (GH); Nacori, *C. Hartman 277* (GH, PH, US); 2 mi N of San Carlos Bay, *P. Hutchison 2448* (MEXU, UC, US); San Carlos Bay, *I. Johnston 4360* (CAS, GH, US); Mpio. Yécora, Rancho El Palmar, 20 km E of Onavas, 28°29-30′N, 109°23′W, *E. Joyal 1957* (CAS, MEXU, TEX), *2055* (CAS); 5 mi NW of Caborca on road to Tajitos, *D. Keck 4053* (C, CAS, DS, MO); between Caborca and Quitovac, 18 mi NW of Tajitos, near Garambullo, *D. Keck 4110* (DS); El Alamo near Magdalena, *P. Kennedy 7107* (CAS, UC, US); 15 mi SE of Cucurpe, *R. Marin MF65-34* (ENCB); Ignimbrite Canyon, La Brisca, Río Santo Domingo, 30°26′N, 110°33′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Cajón Bonito [vic. of Agua Prieta], *R. McManus & C. Mason 728* (ARIZ); Mexican line S of Bisbee, Arizona, *E. Mearns 1024* (DS), *1031* (DS); Torres, *C. Purpus 409* (MO, UC, US); Mpio. Imuris, 2.7 km S of Imuris on Mex. 15, 30°45′N, 110°51′W, *A. Reina G. & T. Van Devender 98-496* (CAS, MEXU, TEX); Mpio. Nogales, SE edge of Nogales on road to Santa Cruz, 31°18′N, 110°54′W, *A. Reina G. & T. Van Devender 2001-528* (CAS, MEXU); Mpio. Altar, 4.8 km W of Las Ladrilleras (6.6 km S of Sásabe on road to Altar) on road to Chula Vista, 31°26′N, 111°36′W, *A. Reina G. et al. 2003-1297* (CAS); Mpio. Nogales, 16 km W of Mex. 15 on roqad to Sáric, SW of Nogales, 31°07′N, 111°04′W, *A. Reina G. et al. 2004-188* (CAS); Mpio. Villa Pesqueira, 10.9 km NE of Mátape (Villa Pesqueira) on road from San Pedro de la Cueva to Mazatan, 29°11′N, 109°56′W, *A. Reina G. et al. 2004-469* (CAS); ca. 8 km E of Tecoripa on Hwy. 16, Rancho San Juanico, *R. Rondeau 89-82* (ARIZ, CAS); 23 mi S of Santa Ana along Hwy. 15 (ca. 30°14′N, 111°06′W), *A. Sanders et al. 2469* (TEX); 30 mi NW of Hermosillo, *F. Shreve 5981* (ARIZ, F); 20 mi W of Estación Noria, *F. Shreve 6055* (ARIZ, F); San Carlos Bay, ca. 15 mi NW of Guaymas, *F. Shreve 6553* (ARIZ), *7304* (ARIZ); 5 mi NW of Caborca, *F. Shreve 7529* (ARIZ); Cañón of Guadaloupe, *E. Smith s.n.* (NY); Mpio. Imuris, microondas 14 km S de Imuris, 30°52′N, 110°50′W, *P. Tenorio L. & C. Romero de T. 13517* (CAS, IEB, MEXU, TEX, WIS); Mpio. Agua Prieta, 67 km E de Agua Prieta, carr. a Janos, 31°19′N, 109°18′W, *P. Tenorio L. & C. Romero de T. 13651* (CAS, IEB, MEXU, WIS); Hermosillo to Sahuaripa road, ca. 70 mi E of Hermosillo, *L. Toolin & K. Roever 584* (ARIZ); 11.2 mi S of cemetery at Agua Prieta, 31.2°N, 109.6° W, *R. Turner et al. 71-5* (ARIZ); 9.3 km S de Cíbuta por Mex. 15, ca. 35 km S de Nogales, 30°59′N, 110°52′W, *T. Van Devender 95-549* (ARIZ); Rancho Seri, 5.3 mi S of Rancho el Carrizo (which is ca. 11 mi S of Benjamín Hill and 14 mi W of Mex. Hwy. 15, *T. Van Devender et al. 89-115* (ARIZ); Mpio. Yécora, just NW of Curea, 28°18'40"N, 109°16'40"W, *T. Van Devender et al. 99-136* (ARIZ, CAS, MEXU); 25 mi N of Puerto Libertad, 30°10′N, 112°25′W, *G. Webster 22487* (ARIZ, DAV, MEXU, TEX); 7 mi S of Onavas, 23.5 mi S of Tónichi, 28°23′N, 109°33′W, *G. Webster 23821* (DAV, MEXU); Cañada Motepori, ca. 9 mi NW of Banámichi crossing, ca. 30°04′N, 110°20′W, *G.*

Webster & R. Murphey 21476 (ARIZ, DAV); 20 mi W of Norio, *I. Wiggins 6172* (DS, US); Río Magdalena at Imuris, *I. Wiggins 6198* (DS); 17 mi NE of Cajeme on road to Tesopaco, *I. Wiggins 6396* (DS, UC, US); 5.7 mi NW of Caborca toward Sonoyta, *I. Wiggins 8255* (DS, UC); 24 mi E of Imuris, *I. Wiggins 11676* (DS, TEX, UC, US); 4.6 mi E of Rancho Mababi, *I. Wiggins 11753* (DS, TEX, US).

Aphanosperma T.F. Daniel

Aphanosperma T.F. Daniel, Amer. J. Bot. 75:547. 1988. TYPE: *Aphanosperma sinaloensis* (Leonard & Gentry) T.F. Daniel (≡ *Carlowrightia sinaloensis* Leonard & Gentry).

Erect perennial herbs to shrubs with cystoliths. Leaves opposite. Inflorescence of dichasiate spikes; dichasia (alternate to) opposite, 1-flowered, sessile, subtended by a bract. Flowers homostylous, sessile to subsessile, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes equal to subequal in size. Corolla cream to white with purple markings on upper lip, tube subcylindric, throat indistinct, limb 2-labiate (although sometimes appearing nearly regular), upper lip comprising 2 fused lobes, emarginate at apex, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla, anthers 2-thecous, thecae equal in size, subsagittate to subparallel, equally to subequally inserted on filament, lacking basal appendages, dehiscing toward upper lip of corolla (i.e., flower stenotribal); pollen (Fig. 3) euprolate to perprolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium, poles sometimes with a 3-armed aperturelike indentation, arms aligned with colpi and extending from pole toward equator, exine reticulate; staminodes 0. Style exserted from mouth of corolla, stigma 2-lobed. Capsule stipitate, cuneiform, reflexed at maturity, stipe densely pubescent at base with uncinate trichomes, head truncate to ± emarginate at apex, retinacula not visible in mature capsule. Seeds 2, permanently invested in capsule valves. ($x = 18$).

The genus consists of a single species from tropical dry forests in northwestern Mexico.

Aphanosperma sinaloensis (Leonard & Gentry) T.F. Daniel, Amer. J. Bot. 75:548. 1988. *Carlowrightia sinaloensis* Leonard & Gentry, Brittonia 6:327. 1948. TYPE: MEXICO. Sinaloa: Cerro Prieto, vicinity of Culiacán, 30 Nov 1944, *H. Gentry 7111* (holotype: US!; isotypes: ARIZ!, CAS!, DS!, F!, GH!, MICH!, NY!, PH!, RSA!, UC!).

Phenology. Flowering: October–March; fruiting: October–March.

Distribution and habitats. Northwestern Mexico (Baja California Sur, Sinaloa, Sonora); Sonoran plants occur on slopes, along watercourses, and in canyon bottoms in riparian Sonoran desertscrub (Central Gulf Coast, Plains of Sonora) and tropical deciduous forests at elevations from 60 to 740 m.

Illustrations. Figure 6; *American Journal of Botany* 75:548. 1988; *Proceedings of the California Academy of Sciences* 49:319. 1997.

Descriptions of *Aphanosperma sinaloensis* were provided by Daniel (1988a, 1997). This unispecific genus is endemic to northwestern Mexico and is known primarily from Sonoran collections (Fig. 8). It attains the northern extent of its distribution in west-central Sonora. Although its distribution includes regions of Sonoran Desert, all such occurrences appear to be in thornscrub or deciduous forests that intrude into regions of desertscrub along watercourses. Flowers of *A. sinaloensis* are similar to those of *Carlowrightia pectinata* and *C. arizonica*, but its capsules are unique among Mexican Acanthaceae in four features: they are apically truncate, they reflex as they mature, they have uncinate trichomes at the base, and their seeds are permanently retained. Specimens from Sonora resemble the type and other collections from Sinaloa. Plants from these

two states of mainland Mexico differ from those occurring in the Cape Region of Baja California Sur by their larger corollas (7–10 vs. 5.5–6.8 mm long), longer stamens 4.5–6.5 vs. 3.7–4.3 mm long), and pollen without (vs. with) a polar aperture (Daniel 1997).

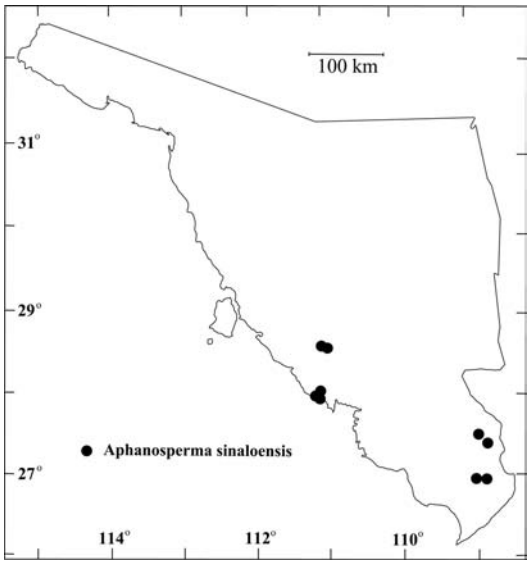


FIGURE 8. Sonoran distribution of *Aphanosperma sinaloensis*.

SONORAN COLLECTIONS: N end of Sierra Libre, mouth of Cañada Prieta, 28°35′N, 110°58′W, *T. Burgess et al. 6747* (CAS); La Pintada, 49 km S de Hermosillo, carr. 15, 28°35′N, 110°58′W, *A. Búrquez & R. Felger 93-22* (MEXU); Cañón Nacapules, ca. 4 km N of Bahía San Carlos, *R. Felger & B. Straub 85-1316* (CAS, MEXU, TEX); Mpio. Guaymas, Cañón del Nacapule, 6 km N of San Carlos Road, 28°01′N, 111°02′W, *R. Felger & F. Reichenbacher 85-1221* (ARIZ, CAS, MEXU, MO, TEX); Cañón las Barajitas, Sierra el Aguaje, ca. 18 km NW of San Carlos, ca. 28°03-04′N, 111°11-12′W, *R. Felger & M. Wilson 95-133* (ARIZ, CAS, MEXU), *95-198* (ARIZ, CAS); Mpio. Guaymas, N side of Sierra el Aguaje, Arroyo Las Pirinolas, ca. 5.6 km S from Rancho Las Pirinolas, 28°03′N, 111°03′W, *R. Felger et al. 02-246* (CAS); Río Mayo region, Arroyo Gochico, ca. 4.5 km E of San Bernardo, 27°24′N, 108°47′W, *M. Fishbein et al. 2138* (ARIZ, CAS, MEXU); Distr. Alamos, Arroyo Cuchuhacki [Cuchujaqui], *H. Gentry 854* (DS, F, MICH); Mpio. Alamos, Sierra de Alamos along Arroyo El Huirotal, ca. 26°57′N, 108°57′W, *V. Steinmann 1290* (ARIZ, CAS, NY); Río Mayo region, near Tojibampo, 19.5 km NNW of San Bernardo on road to Mesa Colorada, 27°02′N, 108°47′W, *T. Van Devender et al. 93-1494* (ARIZ, CAS, MO, TEX).

Blechum P. Brown

Blechum P. Browne, Civ. Nat. Hist. Jamaica 261. 1756. TYPE: *Blechum brownei* Juss. (≡ *Ruellia blechum* L.; = *Blechum pyramidatum* (Lam.) Urb.).

Spreading to decumbent to erect perennial herbs or shrubs with cystoliths. Leaves opposite. Inflorescence of mostly terminal densely bracteate dichasiate spikes; dichasia opposite, 1-3-flowered, sessile to subsessile (i.e., peduncles to 1 mm long), subtended by a bract (or sometimes a distal leaf). Flowers homostylous, sessile, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic or subequal in length. Corolla white to blue to purplish, tube expanded distally into a distinct throat, limb subregular and ± equally 5-lobed to subbilabiate with upper lip 2-lobed and lower lip 3-lobed, corolla lobes contorted in bud. Stamens 4, didynamous, included in corolla tube or barely exserted from mouth of corolla, anthers 2-thecous, thecae equal in size, parallel, equally inserted on filament, lacking basal appendages, dehiscing toward lower lip of corolla (i.e., flower nototribal); pollen (Fig. 3) oblate spheroidal to euprolate, 3-syncolporate, exine finely to coarsely reticulate; staminodes 0. Style included in corolla tube, stigma 2-lobed or with only 1 lobe prominent or evident. Capsule substipitate, ellipsoid, retinacula present, septa with attached retinacula separating from inner wall of mature capsule. Seeds 8-12, homomorphic, lenticular, beset with hygroscopic trichomes on and near margin. (x = 17).

This genus of fewer than 10 species is native to tropical America. *Blechum pyramidatum*, a weedy species, has become naturalized in the Paleotropics.

Blechum pyramidatum (Lam.) Urb., Fedde Repert. Spec. Nov. Regni. Veg. 15:323. 1918. *Barleria pyramidata* Lam., Encycl. 1:380. 1785. TYPE: SANTO DOMINGO. An illustration of Plumier (Pl. Amer. 2:t. 42, fig. 3. 1756) was cited; specimens, if any exist, not seen.

Ruellia blechum L., Syst. Nat., ed. 10, 2:1120. 1759, as "blechnŭ". *Blechum brownei* Juss., Ann. Mus. Natl. Hist. Nat. 9:270. 1807. *Blechum blechum* (L.) Millsp., Publ. Field Columbian Mus., Bot. Ser. 2:100. 1900. TYPE: illustrations of Sloane (Voy. Jamaica 1:t. 109, fig. 1. 1707) and Plumier (Pl. Amer. 2:t. 42, fig. 3. 1756) were cited (syntypes); see Proc. Calif. Acad. Sci. 48:255. 1995.

Phenology. Flowering: March–July, October–November; fruiting: February–July, October–November.

Distribution and habitats. Southern United States (Florida), Mexico (Baja California Sur, Campeche, Chiapas, Colima, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, Quintana Roo, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz, Yucatán), Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, West Indies, Colombia, Venezuela, Guyana, Suriname, French Guiana, Peru, Bolivia, Old World tropics (where presumably introduced); Sonoran plants occur along watercourses and in disturbed areas in regions of tropical deciduous forest at elevations from 150 to 400 m.

Illustrations. Figure 9; *Fieldiana, Botany* 24(10):343. 1974; *Flora of the Bahama Archipelago*, 1346. 1982; *Flora of the Venezuelan Guayana*, vol. 2, 344. 1995; *Flora of Chiapas* 4:17. 1995; *Flora del Valle de Tehuacán-Cuicatlán* 23:14. 1999; *Flora del Bajio* 117:13. 2003.

Daniel (1995a, 1999a) and Daniel and Acosta (2003) provided descriptions of this widespread and weedy species. Use of the name *B. pyramidatum* versus *B. brownei* was discussed by Daniel (1995b). *Blechum pyramidatum* reaches the northern extent of its distribution in southern Sonora (Fig. 7). Sonoran collections greatly resemble plants described from other regions of Mexico and cleistogamous flowers are sometimes evident among them.

Sonoran collections: southeastern border of Alamos (road to mirador), ca. lat. 27°01′N, long. 108°56′W, *T. Daniel 9769* (CAS); Güirocoba crossing of Río Cuchujaqui, 12.3 km SSE of Alamos, 26°56′N, 108°53′W, *T. Van Devender 92-514* (ARIZ); Río Cuchujaqui, Rancho el Conejo, 13.4 km SSE of Alamos, 26°54′N, 108°55′W, *T. Van Devender 92-621* (ARIZ); Alamos, 27°01′N, 108°50′W, *T. Van Devender 94-204* (ARIZ); El Ranchería crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos on road to El Chinal, 26°51′N, 108°55′W, *T. Van Devender & S. Friedman 92-692* (ARIZ, CAS); Río Cuchujaqui near jct. of Arroyo El Mentidero, 11 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender et al. 92-212* (ARIZ, CAS); Arroyo Alamos between jcts. with Arroyo Potrero and Río Cuchujaqui, 9 km SE of Alamos, 26°58′N, 108°52′W, *T. Van Devender et al. 93-1427* (ARIZ); Río Cuchujaqui, ca. 1 km SW of Los Muertos, 26°44′N, 108°55′W, *T. Van Devender et al. 94-903* (ARIZ); Río Cuchujaqui at El Paso, 26°41′N, 108°49′W, *T. Van Devender et al. 95-87* (ARIZ); Alamos, 27°01′N, 108°50′W, *T. Van Devender et al. 2000-13* (MEXU).

Carlowrightia A. Gray

Carlowrightia A. Gray, Proc. Amer. Acad. Arts 13:364. 1878, nom. cons. LECTOTYPE (Bremekamp, Ind. Nom. Gener. Card 01197. 1956): *Carlowrightia linearifolia* (Torr.) A. Gray (≡ *Schaueria linearifolia* Torr.).

Cardiacanthus Nees & S. Schauer in A. de Candolle, Prodr. 11:331. 1847, nom. rej. TYPE: *Cardiacanthus neesianus* S. Schauer ex Nees. (≡ *Carlowrightia neesiana* (S. Schauer ex Nees) T.F. Daniel).

Croftia Small, Fl. S.E. U.S. 1088. 1903, non King & Prain (1896). TYPE: *Croftia parvifolia* (Torr.) Small (≡ *Schaueria parvifolia* Torr.).

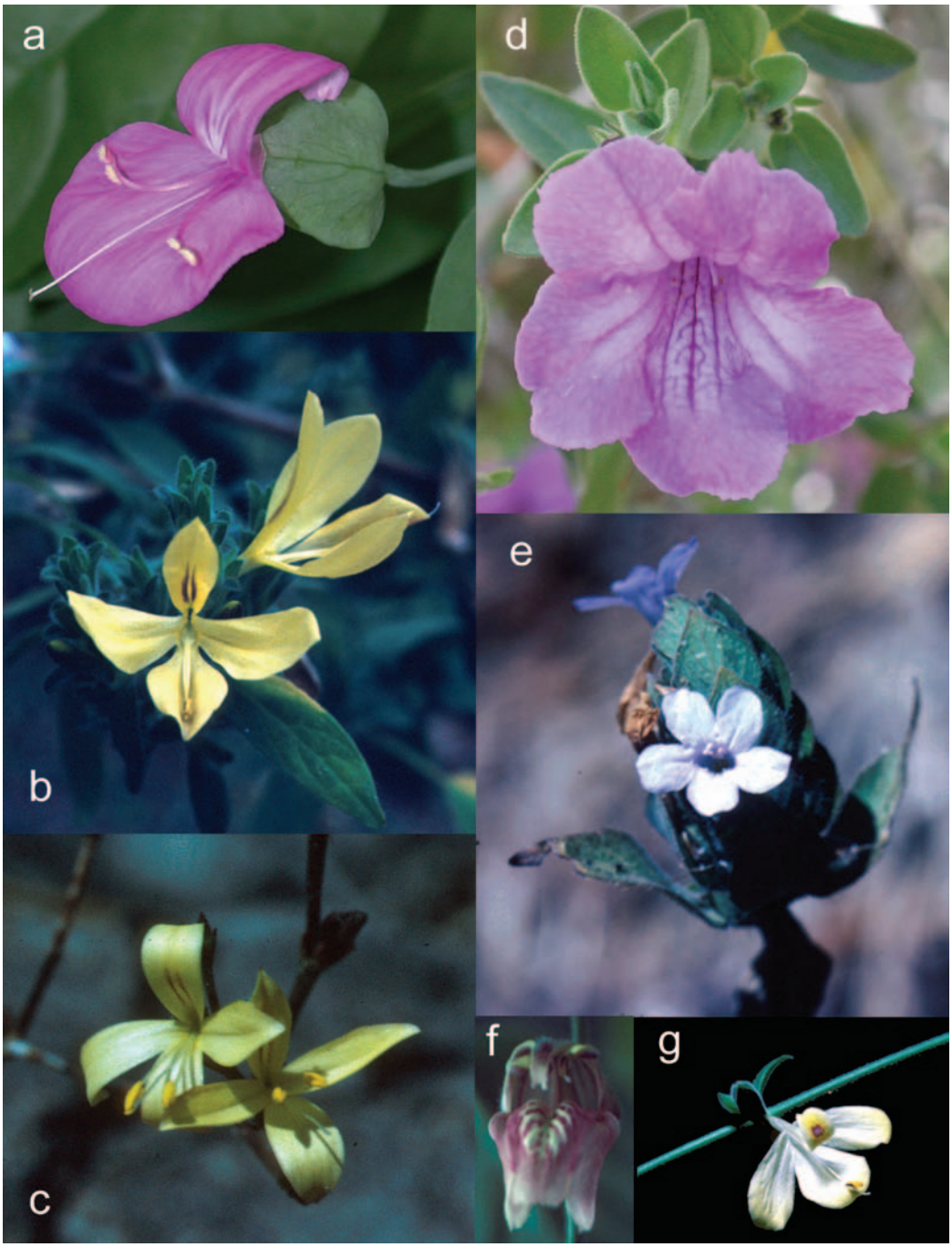


FIGURE 9. Sonoran Acanthaceae. a. *Dicliptera resupinata*. b. *Tetramerium glandulosum*. c. *Carlowrightia pectinata*. d. *Ruellia californica*. e. *Blechum pyramidatum*. f. *Justicia salviiflora*. g. *Henrya insularis*.

Erect to ascending or decumbent perennial herbs or shrubs with cystoliths. Leaves opposite (rarely subopposite). Inflorescence of dichasia in leaf axils, or, more commonly, of dichasiate spikes, racemes, thyrses, or thyrses, the inflorescences sometimes branching and becoming panicles; dichasia alternate or opposite, 1–3 (or more)-flowered, sessile or pedunculate, subtended by a leaf or bract. Flowers homostylous, sessile or pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic. Corolla white to cream to yellowish to rose-purple to blue, usually with yellow and maroon or purple markings on upper lip, tube cylindric to subcylindric, throat indistinct, limb pseudopapilionaceous, 2-labiate, or subactinomorphic, upper lip comprising 2 fused lobes, lower lip consisting of 2 similar lateral lobes and a lower-central lobe that is either similar in form to lateral lobes or ± recurved or conduplicate-keeled and enclosing stamens and distal portion of style during anthesis, corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla, anthers 2-thecous, thecae equal in size, parallel or subsagittate, subequally inserted on filament, lacking basal appendages, dehiscing toward upper lip of corolla (i.e., flowers stenotribal); pollen (Fig. 3) prolate spheroidal to perprolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium, exine reticulate; staminodes 0. Style exserted from mouth of corolla, stigma 2-lobed. Capsule stipitate, head flattened to nearly spheric, circular to ovate-elliptic in outline, retinacula present, septae with attached retinacula remaining attached to inner wall of mature capsule. Seeds 2–4, homomorphic or heteromorphic, flat to concavoconvex, smooth or variously ornamented, lacking trichomes. (x = 18).

Twenty-six species are recognized in this New World genus. They occur from the southwestern United States throughout Mexico to northwestern Costa Rica and disjunctly to Ecuador and Argentina. With 24 species, Mexico is the center of diversity for *Carlowrightia*.

1. Corolla 5.5–7 mm long, white with maroon veins on all lobes; dichasia borne in leaf axils throughout plant; bracteoles foliaceous, usually petiolate, narrowly ovate to elliptic-lanceolate, 2–12 mm long, 0.7–5 mm wide; seed margin entire; Chihuahuan desertscrub. . . . . *C. texana*
1. Corolla 8–18 mm long, white to yellow with maroon veins (if present) restricted to upper lip; dichasia borne in axils of usually reduced, distal leaves or minute bracts; bracteoles subulate to lanceolate, 1.5–4 (–7) mm long, 0.3–0.8 mm wide; seed margin (entire to) denticulate to dentate to coarsely pectinate; Sonoran desertscrub, thornscrub, and tropical deciduous forest.
   2. Leaf blades petiolate, ovate to elliptic, 1.6–2.5 times longer than wide, margin flat; lower-central lobe of corolla conduplicate-keeled, enclosing stamens and style; thecae maroon turning black; capsule glabrous, head 5.5–7.5 mm long; seeds 4, homomorphic . . . . . *C. arizonica*
   2. Leaf blades sessile to subsessile, linear to narrowly elliptic-lanceolate, 6–29 times longer than wide, margin revolute; lower-central lobe of corolla neither conduplicate nor keel-like, not enclosing stamens and style; thecae golden yellow; capsule pubescent (sometimes only sparsely so at apex), head 3.5–5.5 mm long; seeds 2–4, the third and fourth seeds (when present) usually markedly different in form from others (i.e., partially conduplicate and with a conspicuous pectinate margin). . . . . *C. pectinata*

Carlowrightia arizonica A. Gray, Proc. Amer. Acad. Arts 13:364. 1878. TYPE: UNITED STATES. Arizona: Pinal Co., near Camp Grant, 1867, *E. Palmer 165* (holotype: GH!).

Carlowrightia cordifolia A. Gray, Proc. Amer. Acad. Arts 21:406. 1886. TYPE: MEXICO. Chihuahua: mountains above Batopilas, 1885, *E. Palmer 224* (holotype: GH!; isotypes: K!, NY!, US!).

Carlowrightia glabrata Fernald, Bot. Gaz. (Crawfordsville) 20:536. 1895. TYPE: MEXICO.

Sinaloa: Villa Union, Jan 1893, *F. Lamb 420* (lectotype, designated by Daniel, 1983a: GH!; isolectotypes: DS!, F!, G!, MO!, MSC!, NY!, US!).

Carlowrightia californica Brandegee, Zoe 5:172. 1903. TYPE: MEXICO. Baja California Sur: Comondú, 22 Mar 1889, *T. Brandegee s.n.* (holotype: UC!).

Carlowrightia californica var. *pallida* I.M. Johnst., Proc. Calif. Acad. Sci., ser. 4, 12:1169. 1924. TYPE: MEXICO. Sonora: San Esteban Island, 20 Apr 1921, *I. Johnston 3195* (holotype: CAS!; isotypes: GH!, US!).

See Daniel (1995a) for a complete listing of synonyms.

Phenology. Flowering: February–April, August–October, with a major peak in March-April and a lesser peak in September-October (Fig. 1); fruiting: February–May, September–November.

Distribution and habitats. Southwestern United States (Arizona, California, Texas), Mexico (Baja California, Baja California Sur, Chiapas, Chihuahua, Coahuila, Colima, Guerrero, Jalisco, México, Michoacán, Nayarit, Oaxaca, Puebla, San Luis Potosí, Sinaloa, Sonora), Guatemala, Honduras, Nicaragua, Costa Rica; Sonoran plants occur on slopes, along watercourses, on plains, and in disturbed areas in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora), thornscrub, and tropical deciduous forests at elevations from sea level to 800 m.

Illustrations. *Trees, Shrubs and Woody Vines of the Southwest*, 934. 1960; *Fieldiana, Botany* 24 (10):350. 1974; *Desert Plants* 5:172. 1984; *Trees and Shrubs of Trans-Pecos Texas*, 399. 1988; *The Jepson Manual, Higher Plants of California*, 127. 1993; *Flora of Chiapas* 4:21. 1995; *Flora of the Gran Desierto and Río Colorado of Northwestern Mexico*, 65. 2000.

Local names. "Anima aguo" (Mayo, *Van Devender et al. 93-1447*); "ánima ogua" (Mayo, *Van Devender et al. 98-2116*); "lemilla" (fide Felger 2000); "palo blanco" (*Van Devender et al. 93-1447*); "rama toro" (fide Gentry 1942, as *C. californica*).

Use. According to Yetman and Van Devender (2002) the Mayo brew leaves into a tea that is taken for fevers. This tea is considered to be more effective when combined with leaves and inflorescences of *Elytraria imbricata*.

Carlowrightia arizonica is widely distributed in Sonora except for the northeastern portion of the state (Fig. 10). Although it occurs in all four subdivisions of the Sonoran Desert in the state, it appears to be rare in the Lower Colorado River Valley. It was noted to occur on Isla Tiburón by Moran (1983), but I have no record of having seen a collection of it from there. It undoubtedly occurs on that island and has been collected on the adjacent Isla San Esteban. Daniel (1983a) provided a description of this widespread and morphologically variable species, including all of its known forms. Forms occurring in the peninsula of Baja California and Chiapas were subsequently described and discussed in more detail by Daniel (1995a, 1997). Four more or less distinctive forms have been noted to occur in Sonora (Daniel 1983a). Many Sonoran plants do not readily correspond to any of them and

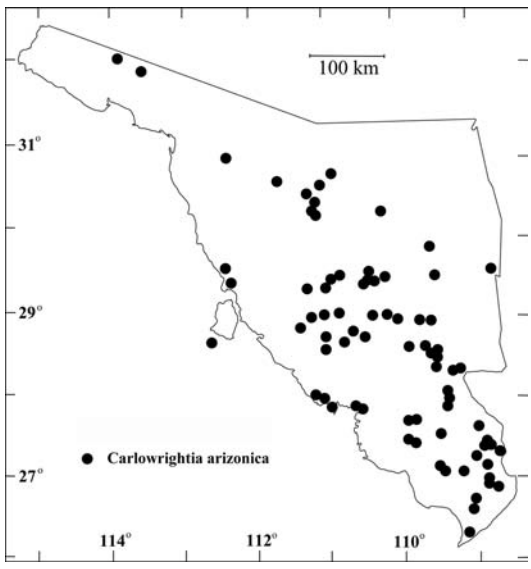


FIGURE 10. Sonoran distribution of *Carlowrightia arizonica.*

others combine characteristics of them in various ways. Perhaps it is more useful to note the range of morphological variation among Sonoran plants of *Carlowrightia arizonica* than to try to assign specimens to one form or another. Among Sonoran plants, habit varies from spreading perennial herbs to erect shrubs; cauline trichomes vary from evenly to bifariously disposed, retrorsely appressed to retrorse to flexuose to erect, eglandular to glandular (inconspicuous in an understory layer), and 0.05 to 1 mm in length; leaf blades vary from lanceolate to ovate to cordate to elliptic, 3 to 85 mm in length, and 1 to 65 mm in width; the inflorescence varies from having dichasia in distal leaf axils to having them in bracteate spicate axes, the axes vary from slender (with dichasia 1 per node) to stout (with dichasia opposite at nodes), bracts vary from 1 to 7 mm in length, and trichomes in the inflorescences vary from eglandular to glandular; calyces vary from 1.5 to 5 mm in length; corollas vary from 9 to 19 mm in length; and capsules vary from 7.5 to 14 mm in length. In any of its guises, this species is readily distinguishable from the other two species of *Carlowrightia* known from Sonora.

Sonoran collections: 9 mi S of Magdalena, *L. Abrams 13242* (DS, F); Sierra Lopez Rancho [37 mi NW of Hermosillo], *L. Abrams 13321* (DS); 2 mi N of Noria, *L. Abrams 13376a* (DS, F); ca. 6 mi E of Alamos, *F. Almeda 2522* (LA); Cerro El Bachoco, NW of Bahía de Guásimas, 27°54', 110°40′W, *T. Burgess et al. 6941* (ARIZ); 2.5 km S de Hermosillo, 29°01′N, 110°57′W, *A. Búrquez & A. Quijada 90-211* (MEXU); along road between Arizpe and Ures, 17.1 mi NE of Ures, ca. 29°30′N, 110°08′W, *T. Daniel 931* (CAS, ENCB, F, GH, MEXU, MICH, MO, NY, TEX, US); along road between Ures and Hermosillo, 17.1 mi SW of Ures, *T. Daniel 939* (CHAPA, DUKE, MICH, UC); along road between Hermosillo and Kino Bay, 2.5 mi E jct. Son. 16 (Calle 4 Sur) to Guaymas, *T. Daniel 941* (CAS, ENCB, F, GH, MEXU, MICH, US); along road between Hermosillo and Sahuaripa, 24.1 mi W of Mazatan, *T. Daniel 945* (ASU, CAS, DUKE, ENCB, F, GH, K, MEXU, MICH, NY, TEX, UC, US); along road between Hermosillo and Sahuaripa, 3 mi W of Mazatan, *T. Daniel 954* (MICH); along road between Mazatan and Sahuaripa, 10.4 mi E of Mazatan, *T. Daniel 962* (ENCB, MEXU, MICH, NY, US); along road between Mazatan and Sahuaripa, 5.9 mi E of Rebeiquito and 3.9 mi W of El Novillo, *T. Daniel 965* (CHAPA, MICH); along road between El Novillo and Sahuaripa, 14.4-17.2 mi E of El Novillo, *T. Daniel 967* (MEXU, MICH), *T. Daniel 971* (ENCB, F, MICH, US); along Son. 16 between Hermosillo and La Colorada, 0.9 mi W of La Colorada, *T. Daniel 974* (MICH); along road between La Colorada and Tecoripa, 12.6 mi E of La Colorada, *T. Daniel 976-980* (MICH); along road between Tecoripa and Tónichi, 9.3 mi E of Tecoripa, *T. Daniel 983* (ENCB, F, GH, MICH, MO, TEX, UC), *984* (CAS, MEXU, MICH, US), *986* (MICH); along road between Tónichi turnoff and Onavas, 4.4 mi S of Tónichi turnoff, *T. Daniel 987* (MICH), *988* (ENCB, MICH), *989* (ENCB, MICH); along road between Tónichi and Onavas, 7.4 mi N of Onavas, *T. Daniel 990* (MICH); along road between Tónichi and Movas, 2.6 mi S of Río Chico, *T. Daniel 992* (ENCB, MICH); along hwy. between Esperanza and Rosario de Tezopaco, 3-30 mi E of jct. with road to Presa Obregón, *T. Daniel 996* (CAS, MEXU, MICH, US), *998* (ENCB, MICH, NY); along road between Navojoa and Alamos, 24.6 mi E jct. Hwy. 15 in Navojoa, *T. Daniel 999* (ENCB, F, GH, MICH, MO, NY, UC); along road between Alamos and San Bernardo, 8.1–33.4 mi NE of Alamos, *T. Daniel 1005* (MEXU, MICH, US), *1006* (MICH); along road from San Bernardo to Chihuahua, 1.8 mi from San Bernardo, *T. Daniel 1007* (MICH), *1008* (MICH); "Microondas Mountain" overlooking Guaymas, along road which is 1.8 mi from Mex. Hwy. 15 on paved road to airport, N of Guaymas, *T. Daniel 1949* (ASU); Mpio. Soyopa, crossing of Río Yaqui with Hwy. 16, 8.5 km W of jct. to Onavas, ca. 28°34′N, 109°33′W, *T. Daniel et al. 8509* (CAS, MEXU); SW of Villa de Seris [= Hermosillo on S side of Río Sonora fide Felger], *F. Drouet et al. 3473* (F); Miramar, NW of Guaymas, *R. Felger 5512* (ARIZ); 5.8 mi S of Imuris on Mex. 15, *R. Felger 7295* (MEXU); Sierra del Viejo, 50 km W of Los Vidrios on Mex. Hwy. 2, ca. 32°09′N, 113°56′W, *R. Felger & M. Dimmitt 85-723* (ARIZ, MEXU); ca. 5 km SW of Ortíz (SE of Guaymas), *R. Felger & N. Gonzales 85-393* (ARIZ, CAS); Pinacate Region, Tinaja de los Papagos, *R. Felger & G. Joseph 86-485A* (ARIZ, MEXU); Cañón Nacapules, ca. 4.5 mi N of Bahía San Carlos, *R. Felger & D. Valdez Z. 84-614* (ARIZ); 2.7 mi E of Tajitos on Mex. Hwy. 2 (between Caborca and Sonoyta), *R. Felger & J. Wright 7420* (ARIZ); El Novillo (E-central Sonora), *R. Felger et al. 84-281* (ARIZ, MEXU); Cañón Las Barajitas, Sierra El Aguaje, ca. 18 km NW of San Carlos, ca. 28°03′N, 111°11′W, *R. Felger et al. 95-194* (ARIZ, CAS); Isla San Esteban, vicinity of Limansur, SE side of island, 29°39′N, 112°34′W, *R. Felger et al. 17650* (CAS); vic. of Rancho Arivaipa,

ca. 8 mi ENE of Pozo Coyote, ca. 29°37′N, 112°17′W, *R. Felger et al. 17833* (ARIZ); Sierra Seri, 29°17′N, 112°08′W, *R. Felger et al. 18131* (ARIZ); 0.2 mi S of San Bernardo, 27°23′N, 108°51′W, *M. Fishbein et al. 932* (ARIZ); 5.9 mi SE of San Bernardo toward mine at San Rafael, 27°21′N, 108°49′W, *M. Fishbein et al. 938* (ARIZ); Mpio. Hermosillo, La Pintada, 50 km S de Hermosillo, 28°35′N, 110°58′W, *A. Flores M. & J. Sánchez E. 5453* (IEB); 15 mi N of Magdalena, *R. Fosberg 7901* (LA, PH); 43 km N of Hermosillo toward Nogales, *T. Frye & E. Frye 2302* (DS, GH, MO, NY, UC, US); Cd. Obregón, *H. Gentry 275* (MICH); Distr. Alamos, Qüirocoba, *H. Gentry 808* (DS, F, MICH); Canyon Sapopa, *H. Gentry 1049* (ARIZ, F); KM 180 S of Nogales, *H. Gentry 16569* (ARIZ, LL, US); Ures, *D. Gold 762* (MEXU); 21 mi E of Tesopaco by old road to Nuri, *D. Goldberg s.n.* (UC); ca. 30 mi S of Hermosillo, *B. Hansen et al. 1379* (LL, MEXU, MICH); Río El Naranjo, N of Taymuco, 27°15′N, 108°43′W, *P. Jenkins & P. Martin 88-253* (ARIZ); Guaymas, *I. Johnston 3100* (CAS, US); Onavas road, 28°28-35′N, 109°31-32′W, *E. Joyal 1363* (CAS, MEXU); Rancho El Aguilar Noria, N of Ures and Santiago, 29°33′N, 110°25-26′W, *E. Joyal 1990* (CAS, MEXU, TEX); 1 mi NW of Navojoa on Hwy. 15, *W. Mahler & J. Thieret 6012* (SMU); Mocúzari, La Cruz, 27°13′N, 109°05′W, *P. Martin s.n.* (ARIZ, CAS); 5 km N of Rosario de Tesopaco, *P. Martin s.n.* (ARIZ); 8 km E of Alamos toward Sabinito Sur, *P. Martin s.n.* (ARIZ); Mazocahui Canyon of the Río Sonora, 66 mi ENE of Hermosillo near Ures, ca. 110°15′N, 29°28′W, *P. Martin & S. Nilsson 38* (S); Estacion Margarita, 10 km NW of Navojoa, 109°29′N, 27°05′W, *P. Martin et al. s.n.* (ARIZ); 18 mi N of Tesopaco, *S. McLaughlin 496* (ARIZ); Mpio. Nacori Chico, El Río Bonito about La Nopalera, *C. Muller 3682* (GH, LL, MICH, UC, US); Agiabampo, *E. Palmer 769* (US); Las Guásimas, *B. Perrill 5355* (ARIZ); 21.6 mi S of Santa Ana, *B. Perrill 5576* (ARIZ); 8 mi E of Moctezuma, 29°50′N, 109°23′W, *F. Reichenbacher 193* (ARIZ); Mpio. Yécora, Arroyo El Encino, ca. 1 km N of Curea, ca. 28°19′N, 109°17′W, *A. Reina G. & T. Van Devender 99-450* (CAS); Mpio. Baviácora, ca. 5 km WSW of Mazocahui on Son. 89, 29°32′N, 110°08′W, *A. Reina G. & T. Van Devender 2000-716* (CAS); Mpio. Arizpe, ca. 19.4 km N of Sinoquipe on Son. 89, 30°19′N, 110°12′W, *A. Reina G. & T. Van Devender 2000-727* (ARIZ, CAS); Mpio. Onavas, Rancho El Palmar, 5 km SE of Río Yaqui on Mex. 16, 28°30′N, 109°24′W, *A. Reina G. et al. 97-93* (ARIZ, CAS, MEXU); Guaymas, *H. Ripley 14270* (CAS, NY); vic. of Hermosillo, *J. Rose et al. 12352* (NY, US); San Carlos Bay, W of Guaymas, near Cerro Los Algodones, ca. 27°58′N, 111°04′W, *A. Sanders et al. 2511* (TEX); near Santa Ana, *F. Shreve 5957* (F); Río San Miguel at first crossing S of Horcasitas, *F. Shreve 6695* (ARIZ, MICH, UC); Río Sonora, 23 mi NE of El Sacatón, *F. Shreve 6701* (ARIZ); ca. 2.2 mi NE of Hwy. 15 (toward microwave tower), ca. 6.9 mi SE of Cd. Obregón, *W. Stevens & M. Fairhurst 2083* (ENCB); ca. 20 mi SE of Altar on Hwy. 2, *R. Straw 2106* (DUKE, SD); Mpio. Yécora, La Concepción, 29°19′N, 109°02′W, *W. Trauba s.n.* (CAS); 4 mi S of Mazocahui, *R. Turner 59-68* (ARIZ); Isla San Esteban, Arroyo Limantur, 28.7°N, 112.6°W, *R. Turner 83-28* (ARIZ); 11 mi E of Hermosillo toward Mazatan, *R. Turner & J. Hastings 65-139* (ARIZ, DS, SD); 4 mi S of Torres, *R. Turner & J. Hastings 65-179* (ARIZ, DS, SD); 8 mi WSW of Santa Ana, *R. Turner & J. Hastings 69-87* (ARIZ); Isla San Esteban, Arroyo Limantur, *T. Van Devender 92-483* (ARIZ, CAS); Mpio. Yécora, El Llano de Curea, 28°18′N, 109°52′W, *T. Van Devender & A. Reina G. 2004-162* (CAS); 21.6 mi S of Santa Ana via Mex. Hwy. 15, *T. Van Devender et al. 84-131* (ARIZ); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Van Devender et al. 84-143* (ARIZ); below Guajaráy on Arroyo Guajaráy, 6.5 km WNW of jct. with Río Mayo, 27°36′N, 108°56′W, *T. Van Devender et al. 93-455* (ARIZ, CAS); Mpio. Alamos, Cerro El Chorro, 4 km NW of Yocogigua, 26°49′N, 109°03′W, *T. Van Devender et al. 93-1447* (ARIZ); La Gacela, 26°52′N, 108°52′W, *T. Van Devender et al. 95-57* (TEX); Mpio. San Javier, 2.7 mi E of La Barranca on Mex. Hwy. 16, 28°34′N, 109°40′W, *T. Van Devender et al. 96-6* (ARIZ); Mpio. Soyopa, Río Yaqui bridge on Mex. 16, just S of Tónichi, ca. 28°34′N, 109°33′W, *T. Van Devender et al. 97-1475* (CAS); Ejido Francisco Solis, 7 km (air) ENE of Estacion Luis, ca. 26°35′N, 109°06′W, *T. Van Devender et al. 98-2116* (NY); 8 mi S of Nuri, ca. 27°58′N, 109°18′W, *G. Webster & R. Murphey 24377* (MEXU); S of Magdalena, *Whitehead 48* (ARIZ); 17 mi NE of Cajeme on road to Tezopaco, *I. Wiggins 6397A* (DS, MICH, US); 19 mi NW of Quiriego toward Cajeme, *I. Wiggins 6451* (DS, MICH, US); above second crossing of Río San Miguel just above Fábrica de Los Angeles, *I. Wiggins 7294* (ARIZ, DS, MO, TEX, US); 21 mi S of Divisadero, *I. Wiggins 7480* (DS, US); 27 mi W of Hermosillo toward Kino Bay, *I. Wiggins & R. Rollins 142* (A, ARIZ, DS, MICH, MO, NY, UC, US).

Carlowrightia pectinata Brandegee, Proc. Calif. Acad. Sci., ser. 2, 3:160. 1891. TYPE: MEXICO. Baja California Sur: San José del Cabo, 24 Sep 1890, *T. Brandegee 452* (holotype: UC!; isotypes: F!, GH!, US!).

Carlowrightia fimbriata Brandegee, Proc. Calif. Acad. Sci., ser. 2, 3:161. 1891. TYPE: MEXICO. Baja California Sur: San Pedro, 29 Oct 1890, *T. Brandegee 453* (holotype: UC!; isotypes: CAS!, F!, G!, GH!, MIN!, PH!, US!).

Carlowrightia lanceolata Leonard, Kew Bull. 1938:66. 1938. TYPE: MEXICO. México: Distr. Temascaltepec, Tejupilco, 1340 m, 21 Nov 1932, *G. Hinton 2672* (holotype: K!; isotypes: ENCB!, F!, G!, GH!, K!, MO!, NY!, PH!, RSA!, TEX!, US!).

Phenology. Flowering: September–March; fruiting: October–March.

Distribution and habitats. Western and southern Mexico (Baja California Sur, Colima, México, Morelos, Oaxaca, Sinaloa, Sonora); Sonoran plants occur in canyon bottoms, along watercourses, and on slopes in riparian Sonoran desertscrub (Central Gulf Coast), thornscrub, and tropical deciduous forests at elevations from 30 to 850 m.

Illustrations. Figure 9; *Proceedings of the California Academy of Sciences* 49:326. 1997.

Local name. “Lemilla” (Mexican, *Gentry 1349*).

Daniel (1983a, 1997) provided descriptions of *Carlowrightia pectinata*. The species attains the northern extent of its distribution in central Sonora (Fig. 11). Among Sonoran plants, color of the corolla varies from white (e.g., *Daniel 936*) to yellow (e.g., *Daniel 3381*).

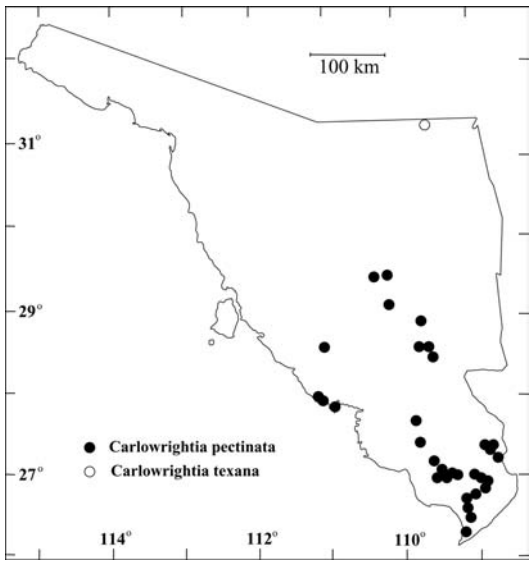


FIGURE 11. Sonoran distributions of *Carlowrightia pectinata* and *C. texana*.

SONORAN COLLECTIONS: 6 km E of Navojoa, *A. Carter & L. Kellogg 3644* (GH, MEXU, UC); 17.1 mi NE of Ures between Arizpe and Ures, *T. Daniel 936* (ASU, CAS, ENCB, GH, MEXU, MICH, NY, US); along Hwy. 16 between Tecoripa and Tónichi, 0.3 mi E of Río Yaqui, *T. Daniel 3345* (CAS, MEXU, NY, US); Arroyo Cuchujaqui, 7.4 mi SE of Alamos on road to Güirocoba, *T. Daniel 3381* (ASU, CAS, MEXU); Mpio. Soyopa, crossing of Río Yaqui with Hwy. 16, 8.5 km W of jct. to Onavas, ca. 28°34′N, 109°33′W, *T. Daniel et al. 8500* (BR, CAS, K, MEXU, MO); Cañón del Nacapule, ca. 6 km N of Bahía San Carlos, ca. 28°10′N, 111°03′W, *R. Felger & A. Búrquez 92-1055* (ARIZ, CAS, TEX); Mpio. Guaymas, Cañón del Nacapule, 6 km N of San Carlos Road, 28°01′N, 111°02′W, *R. Felger & F. Reichenbacher 85-1212* (ARIZ, CAS, MEXU); El Novillo, E-central Sonora, *R. Felger et al. 84-280* (ARIZ, MEXU, TEX); Cañón Nacapules, ca. 4.5 mi N of Bahía San Carlos, *R. Felger et al. 84-603* (ARIZ); Río Mayo Region, Arroyo Infiernillo, near confluence with Arroyo Tepopa, 27°20′N, 108°44′W, *M. Fishbein et al. 993* (ARIZ, CAS); Mpio. Guaymas, Sierra el Aguaje, Aguaje Robinson, ca. 10 km NW de San Carlos, 28°03′N, 111°07′W, *A. Flores M. & O. Gutierrez R. 5086* (ARIZ); vicinity of Fco. Sarabia, Cerro Tasirogojo, 5.5 km SE of Melchor Ocampo, 26°31′N, 109°08′W, *S. Friedman & E. Espinosa 227-94* (ARIZ); Mesa Masiaca, 6.5 km WNW San José de Masiaca, 26°46′N, 109°18′W, *S. Friedman & J. Freeh 376-94* (ARIZ, TEX); vicinity of Sirebampo, 9.5 km S on Mex. Hwy. 15 from Las Bocas road turnoff, 3.5 km W on Sirebampo road, 11.5 km S of San José de Masiaca, 26°39′N, 109°15′W, *S. Friedman & J. Zittere 88-95* (ARIZ); Distr. Alamos, Pichiquate Canyon, *H. Gentry 966* (DS), *966M* (MICH); San Bernardo, Río Mayo, *H. Gentry 1349* (ARIZ, F, MEXU); Curohui, Río Mayo, *H. Gentry 2144* (ARIZ, F, GH, MEXU, MO, S, UC, US, WIS); Cerro de Bayájori, 12 mi W of Navojoa, *H. Gentry 7946*

(ARIZ); Sierra Bojihuacame, SE of Cd. Obregón, *H. Gentry 14533* (ARIZ, LL); Tepustete microwave tower, W of Alamos, *P. Jenkins s.n.* (ARIZ, CAS); San Carlos Bay, *I. Johnston 4388* (CAS); Onavas road, 28°28-35′N, 109°31-32′W, *E. Joyal 1385* (CAS, MEXU, TEX); Mazocahui Canyon of the Río Sonora, 66 mi ENE of Hermosillo near Ures, ca. 110°15′N, 29°28′W, *P. Martin & S. Nilsson 37* (S); Microondas Masiaca, 7 km W of Masiaca, 26°46', 109°18′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Estación Margarita, 10 km NW of Navojoa, 27°08′N, 109°29′W, *P. Martin et al. s.n.* (ARIZ, CAS); turn to La Viñateria on road between Taymuco and Las Chinacas, *P. Martin et al. s.n.* (ARIZ); along Hwy. 15 ca. 23 mi N of Navojoa, *D. Norris et al. 20083* (CAS, MEXU, MO); W of Guaymas, *E. Palmer 259* (ARIZ, C, MICH, S, US); Agiabampo, *E. Palmer 764* (ARIZ, MICH, S, UC, US); Onavas, ca. 28°28′N, 109°32′W, *A. Rea 1221* (ARIZ); Mpio. Soyopa, NE side of Río Yaqui bridge on Mex. 16, just S of Tónichi, ca. 28°34′N, 109°33′W, *A. Reina G. et al. 97-42* (CAS); Cerro Prieto, 8.6 mi E of Navojoa on road to Alamos, ca. 27°15′N, 109°17′W, *A. Sanders et al. 4617* (ARIZ, TEX); Mpio. Alamos, Cerro La Luna, ca. 14 km NW of Alamos, ca. 27°07′N, 109°02′W, *A. Sanders et al. 13262* (CAS, TEX); 40 mi NE of Cajeme, *F. Shreve 6156* (ARIZ, F); Cerro Prieto, 1.3 mi up road to microwave tower from road between Navojoa and Alamos, *E. Smith 3966* (CAS, MEXU, TEX); Nacopuli Canyon, 28°01′N, 110°03′W, *G. Starr & C. Starr 216* (ARIZ); Arroyo Gochico, ca. 14 km E of San Bernardo, 27°24′N, 108°41′W, *V. Steinmann et al. 601* (ARIZ, CAS, MEXU, MO); Mpio. Navojoa, Cerro Prieto, ca. 14 km E of Navojoa, ca. 27°05′N, 109°17′W, *V. Steinmann 1299* (ARIZ, CAS, IEB, MO, TEX); Cañón La Pintada, ca. 78 km N of Guaymas on Mex. Hwy. 15, Cerro Bola, Sierra Libre, *R. Van Devender & T. Van Devender 84-23* (ARIZ); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Van Devender & R. Nishida s.n.* (ARIZ); Güirocoba crossing of Río Cuchujaqui, 12.3 km SSE of Alamos, 26°56′N, 108°53′W, *T. Van Devender & R. Van Devender 93-156* (ARIZ, CAS); below microwave tower on Cerro Prieto, ca. 9 mi E of Navojoa, 27°05′N, 109°17′W, *T. Van Devender et al. 93-243* (ARIZ, CAS); Cerro las Tatemas, below Microondas La Luna, 13.8 km NW of Alamos, 27°07′N, 109°02′W, *T. Van Devender et al. 93-341* (ARIZ, CAS, TEX); Mpio. Alamos, Cerro El Chorro, 4 km NW of Yocogigua, 26°49′N, 109°03′W, *T. Van Devender et al. 93-1499* (ARIZ, CAS); La Gacela, 26°52′N, 108°52′W, *T. Van Devender et al. 95-57* (ARIZ); Mpio. Soyopa, NE side of Río Yaqui bridge on Mex. 16 just S of Tónichi, ca. 28°34′N, 109°33′W, *T. Van Devender et al. 97-1476* (ARIZ, CAS, MEXU, TEX); Mpio. Ures, SSW of Satebuche, ca. 10 km NW of Nacori Grande, E. slope of Sierra de Mazatan, 29°07′N, 110°08′W, *T. Van Devender et al. 2004-483* (CAS); San Javier, cañón entre los cerros El Potrerito y Los Amoles, 7 km S del poblado, 28°32′N, 109°45′W, *L. Varela E. 96-312* (MEXU); 35 mi NE of Cajeme on road to Tesopaco, *I. Wiggins 6415B* (DS, MICH, US).

Carlowrightia texana Henr. & T.F. Daniel, Madroño 26:27. 1979. TYPE: U.S.A. Texas: Val Verde Co., along Hwy. 163, 6 mi N of Juno, 19 Jun 1957, *D. Correll & M. Johnston 18254* (holotype: LL!; isotypes: GH!, NY!, SMU!).

Phenology. Flowering: September; fruiting: September.

Distribution and habitat. Southern and southwestern United States (New Mexico, Texas), northern Mexico (Chihuahua, Coahuila, Nuevo León, San Luis Potosí, Sonora); Sonoran plants occur on a roadside in Chihuahuan desertscrub at an elevation of 1215 m.

Illustrations. *Madroño* 26:28. 1979; *Trees and Shrubs of Trans-Pecos Texas*, 401. 1988.

Daniel (1983a) provided a description of *Carlowrightia texana*. It was only recently (in 2002) collected in Sonora for the first time. The locality in northeastern Sonora (Fig. 11) represents the western extent of the known distribution of the species. It should be sought in similar habitats in nearby Arizona where its occurrence is likely, but has yet to be documented.

Sonoran collection: Mpio. Agua Prieta, W edge of Agua Prieta on Mex. 2, ca. 31°19′N, 109°34′W, *T. Van Devender et al. 2002-617* (CAS).

***Dicliptera* Juss.**

Dicliptera Juss., Ann. Mus. Natl. Hist. Nat. 9:267. 1807, nom. cons. TYPE: *Dicliptera chinensis* (L.) Juss. (≡ *Justicia chinensis* L.).

Diapedium K.D. Koenig, Ann. Bot. 2:189. 1805 ("1806"), nom. rej. TYPE: *Diapedium chinense* (L.) K.D. Koenig (≡ *Justicia chinensis* L.).

Solenochasma Fenzl in J. Jacquin, Ecl. Pl. Rar. 2:1. 1844. TYPE: *Solenochasma assurgens* (L.) Fenzl (≡ *Justicia assurgens* L.).

Dactylostegium Nees in Martius, Fl. Bras. 9:162. 1847. TYPE: *Dactylostegium sparsiflorum* Nees.

Erect to ascending or decumbent perennial herbs or shrubs with cystoliths, young stems ± distinctly 6-angled in cross-section. Leaves opposite. Inflorescence of axillary cymes (= modified dichasia ?) bearing 1 or more, bracteolate cymules; cymes alternate or opposite, subtended by paired bracts, sessile or pedunculate in leaf axils or in axils of inflorescence bracts forming a terminal spikelike thyrse or panicle of thyrses; cymules sessile or pedunculate, comprising an involucre of several pairs of bracteoles, outermost pair usually conspicuous and larger than inner (often hyaline) pair(s), cymule bracteoles of a pair equal or unequal in size. Flowers 1-several per cymule, homostylous, sessile. Calyx deeply 5-lobed, usually reduced and hyaline, lobes equal to subequal. Corolla often resupinate (i.e., tube twisted 180°; elsewhere sometimes twisted 360°), pink to purple, red, white, or blue, often with pink to purple markings, tube cylindric to gradually expanded distally but lacking a distinct throat, limb 2-labiate, upper lip comprising 2 fused lobes, entire to emarginate at apex, lower lip entire to shallowly 3-lobed (normal position of lips reversed when corolla resupinate), corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla or rarely included in corolla tube, anthers 2-thecous, thecae equal to subequal in size, parallel to perpendicular, equally to unequally inserted on filament, lacking basal appendages (in Mexican species; elsewhere rarely with lower theca minutely appendaged at base), dehiscing toward lower lip (i.e., flower nototribal) in species with corollas either not resupinate or twisted 360°, dehiscing toward upper lip (i.e., flower stenotribal) in species with resupinate corollas; pollen (Fig. 12) euprolate to perprolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium, exine reticulate; staminodes 0. Style exserted from mouth of corolla or rarely included in corolla tube, stigma 2-lobed, lobes equal. Capsule substipitate to stipitate, head ellipsoid to obovoid, retinacula present, septa with attached retinacula separating elastically and rising from inner wall of mature capsule. Seeds 2-4, homomorphic, subreniform to lenticular. (x = 40 in New World taxa; x = 13 or 15? in Old World taxa).

Although about 300 species have been described from tropical and temperate regions of the world, the number of species usually given is about one-half that number or fewer. The genus is in need of critical taxonomic study. About 20 species occur in Mexico.

Dicliptera resupinata (Vahl) Juss., Ann. Mus. Natl. Hist. Nat. 9:268. 1807. *Justicia sexangularis* Cav., Icon. 3:2. 1795, non L. (1753). *Justicia resupinata* Vahl, Enum. Pl. 1:114. 1804. *Diapedium resupinatum* (Vahl) Kuntze, Revis. Gen. Pl. 2:485. 1891. TYPE: not designated (see discussion in Daniel, 1997).

Dicliptera pseudoverticillaris A. Gray, Proc. Amer. Acad. Arts 20:308. 1885. TYPE: MEXICO. Sonora: valley of the Altar, 2 Apr 1884, *C. Pringle 27* (lectotype, designated by Daniel, 1997: GH!).

Dicliptera torreyi A. Gray, Proc. Amer. Acad. Arts 20:309. 1885. *Diapedium torrey* (A. Gray) A. Heller, Cat. N. Amer. pl. 7. 1898. TYPE: UNITED STATES. Arizona: unspecified collections of Thurber, Wright, Schott, Rothrock, Lemmon, and Pringle were cited (syntypes, see discussion in Daniel 1997).

Dianthera sexangularis Sessé & Moc., Pl. Nov. Hisp. 5. 1887. TYPE: Icones Florae

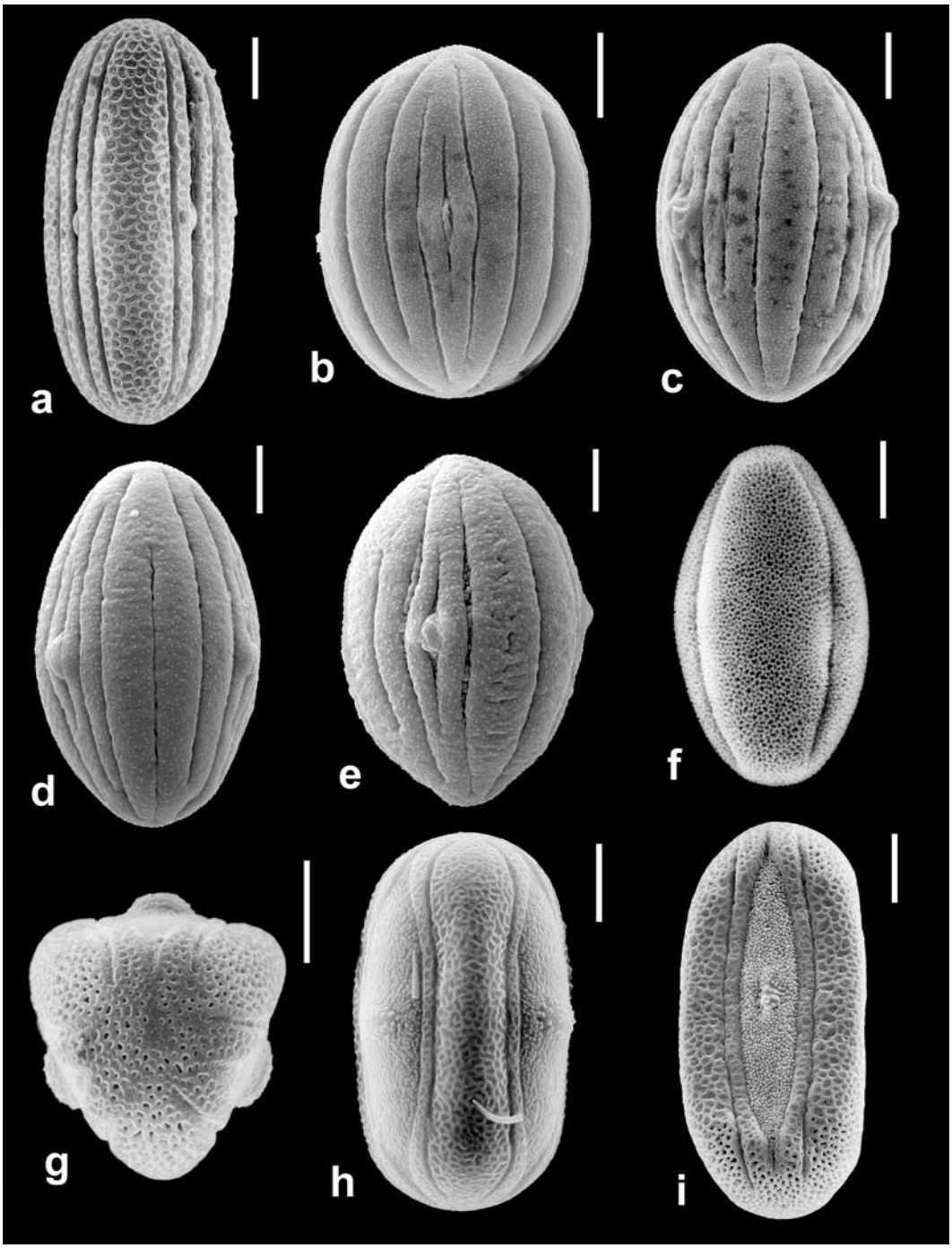


FIGURE 12. Pollen of Sonoran Acanthaceae. a. *Dicliptera resupinata* (*Daniel 1947*), interapertural view. b. *Dyschoriste decumbens* (*Jones 24437*), apertural view. c. *D. xylopoda* (*Wilbur & Wilbur 2137*), interapertural view. d. *D. hirsutissima* (*Daniel et al. 8559*), interapertural view. e. *D. hirsutissima* (*Daniel et al. 8559*), apertural view. f. *Elytraria imbricata* (*Porter 297*), interapertural view. g. *Henrya insularis* (*Daniel 2116*), polar view. h. *H. insularis* (*Daniel & Bartholomew 4822*), interapertural view. i. *H. insularis* (*Daniel & Bartholomew 4731*), apertural view. Scales = 10 μm.

Mexicanae no. 22. Original plate preserved at Hunt Institute for Botanical Documentation, Pittsburgh, Pennsylvania, USA (lectotype, designated by Daniel, 1997).

Dicliptera formosa Brandegee, Proc. Calif. Acad. Sci., ser. 2, 3:162. 1891. TYPE: MEXICO. Baja California Sur: summit of Sierra de San Francisquito, 20 Oct 1890, *T. Brandegee 455* (holotype: UC!; isotypes: GH!, NY).

Dicliptera resupinata var. *orbicularis* B.L. Rob. & Seaton, Proc. Amer. Acad. Arts 28:114. 1893. TYPE: MEXICO. Jalisco: barranca near Guadalajara, Oct 1891, *C. Pringle 5169* (holotype: GH; isotype: MEXU!).

Phenology. Flowering: throughout the year, with peaks in March-April and September-October (Fig. 1); fruiting: September–June.

Distribution and habitats. Southwestern United States (Arizona, New Mexico), western Mexico (Baja California Sur, Chihuahua, Colima, Durango, Guerrero, Jalisco, Michoacán, Nayarit, Sinaloa, Sonora, Zacatecas); Sonoran plants occur on rocky slopes, sand dunes, and along watercourses in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora), Chihuahuan desertscrub, palm oases, thornscrub, grasslands, tropical deciduous forests, and oak woodlands at elevations from sea level to 1330 m.

Illustrations. Figure 9; *Flora of Baja California*, 190. 1980; *Proceedings of the California Academy of Sciences* 49:331. 1997.

Local names. "Alfalfilla" (fide Van Devender et al. 2000; *Varela & Cuameca 96-496, 97-56*); "himarí" (Wahrio, *Gentry 1075*); "kokpondam" (Pima Bajo, *Rea 1231*); "puenta cita" (Mexican, *Rea 1231*); "rama del toro" (*Van Devender et al. 94-226*); "yerba de la mula" (Mexican, *Rea 1231*).

Daniel (1997) provided a description of this species and discussed some of its morphological variation in northwestern Mexico. In Sonora, length of the corolla varies from 19–34 mm, and length of the outer cymule bracteoles varies from 6–20 mm. Plants with larger bracteoles and corollas occur in vicinity of Guaymas and San Carlos. *Dicliptera resupinata* occurs nearly throughout Sonora (Fig. 13), but is not known from the northwestern portion of the state.

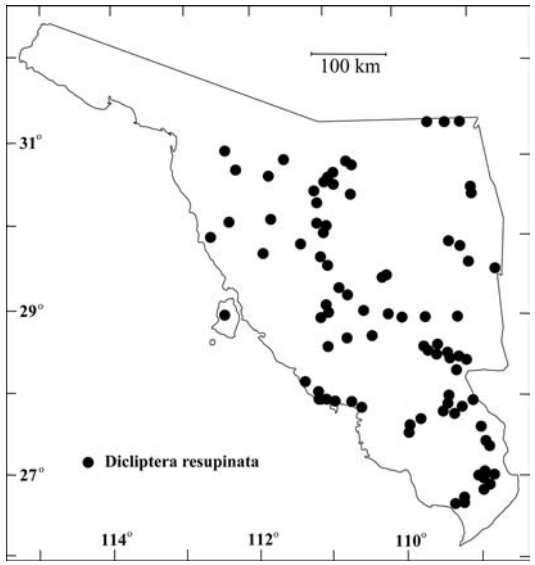


FIGURE 13. Sonoran distribution of *Dicliptera resupinata*.

SONORAN COLLECTIONS: 3 mi S of Magdalena, *L. Abrams 13213* (DS, F); Camou, *L. Abrams 13273* (DS); 1 mi S of Camou on road to Poza, *L. Abrams 13283* (DS); San Miguel River, 15 mi NE of Alamitos near Labor, L. *Abrams 13359* (DS); puerto de Hermosillo, *G. Black 36-6773* (US); Mpio. Guaymas, 12.7 mi S of Puente Douglas across Guaymas Bay, *D. Breedlove 1477* (DS); Mpio. Hermosillo, 7 mi W of Hwy. 15 along southern road to Bahía Kino, *D. Breedlove 15939* (DS, ENCB); N end of Sierra Libre, 28°35′N, 110°58′W, *T. Burgess & R. Turner 6722* (ARIZ, MEXU); Microwave Mountain, N of Guaymas, *M. Burgess et al. s.n.* (ARIZ); San Javier, microondas en el Cerro El Durazno, 28°37', 109°45′W, *A. Búrquez 94-009* (MEXU); 2.5 km S de Hermosillo, 29°01′N, 110°57′W, A. Búrquez & I. Granillo 93-94 (MEXU), *A. Búrquez & A. Quijada 91-11* (MEXU), *91-129* (MEXU); Cañón Tepoca, KM 177 de la Carr. Fed. 16, 28°27′N, 109°16′W, *A. Búrquez et al. 94-134* (MEXU); Mpio. Benjamín Hill, ca. 22 km N of Benjamín Hill, *C. Cowan*

et al. 5523 (CAS, MEXU, NY, TEX); 3 mi W of Mazatan, between Hermosillo and Sahuaripa, *T. Daniel 946* (CAS, ENCB); between Mazatan and Sahuaripa, 10.4 mi E of Mazatan, *T. Daniel 963* (ASU, CAS, MEXU); "microondas mountain" overlooking Guaymas, along road to top which is 1.8 mi from Hwy. 15 on road to airport N of Guaymas, *T. Daniel 1947* (ASU, CAS, NY, US); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Daniel & M. Butterwick 3200* (ASU, CAS); between Esperanza and Rosario de Tezopaco, 3.17 mi SE jct. Hwy. 15, *T. Daniel 3360* (CAS); along road to El Tezal, 0.2 mi N hwy. between Navojoa and Alamos, 2.6 mi W of Alamos, *T. Daniel 3376* (CAS); near San Carlos (NW of Guaymas), ca. 2 mi E of town, *T. Daniel 3972* (CAS); Mpio. Onavas, Rancho La Mula, near Hwy. 16, 18.9 km SE jct. to Onavas, ca. 28°29′N, 109° 22′W, *T. Daniel et al. 8552* (CAS); Mpio. Yécora, along road between San Nicolás and Nurí, just S of Curea, ca. 24 km SW jct. Hwy. 16, ca. 28°19′N, 109°17′W, *T. Daniel et al. 8582* (CAS); Bahía San Carlos, *E. Dawson 1071* (F); S of Villa de Seris, *F. Drouet & D. Richards 3766* (F); mountain W of Alamos, *F. Drouet & D. Richards 4003* (F); S of Villa de Seris, *F. Drouet et al. 3432* (F); 20 mi NE of Ures, *F. Drouet et al. 3591* (DS, F, US); Rancho San Jorge, W of Hermosillo, ca. 29°44′N, 111°51′W, *R. Felger 6915* (ARIZ); 0.8 km E of Las Guásimas, *R. Felger & R. Devine 85-293* (ARIZ, MEXU); N end of Bahía San Carlos, ca. 0.5 mi inland, *R. Felger & C. Lowe 2686* (ARIZ); 9 mi E of Empalme end of Douglas Bridge on Mex. 15, then 2.5 mi S of Hwy. on Playa del Sol road, 27°54′N, 110°41′W, *R. Felger & F. Reichenbacher 85-1110* (ARIZ, CAS, MEXU); Cañón las Barajitas, Sierra El Aguaje, ca. 18 km NW of San Carlos, ca. 28°04′N, 111°12′W, *R. Felger & M. Wilson 95-175* (ARIZ, CAS); El Novillo (E central Sonora), *R. Felger et al. 84-265* (ARIZ); Ensenada Grande, ca. 0.5 km inland from S end of bay [NW of Guaymas], *R. Felger et al. 11407* (ARIZ); Ensenada Grande (= Bahía San Pedro), *R. Felger et al. 11571* (ARIZ, ENCB), *11631* (ARIZ); Isla Tiburón, ca. 13 mi S of Tecomate, ca. 28°57′N, 112°27′W, *R. Felger et al. 12365* (ARIZ, ENCB), *17309* (ARIZ); Isla Tiburón, ca. 13 mi S of Tecomate, ca. 28°57′N, 112°27′W, *R. Felger et al. 17309* (ARIZ); 4 mi W of Alamos toward Navojoa, *J. Fish 7* (UC); 3.2 mi SE of San Bernardo to mine at San Rafael, 27°22′N, 108°49′W, *M. Fishbein et al. 936* (ARIZ); Mpio. Arivechi, 2 km NW de Arivechi, carr. a Sahuaripa, 28°58′N, 109°10′W, *A. Flores M. & M. Arvizo Y. 4756* (ARIZ, MEXU); 75 km N of Hermosillo toward Nogales, *T. Frye & E. Frye 2307* (GH, NY, UC, US); San Lorenzo, *H. Gentry 226* (DS, SMU); Distr. Alamos, Canyon Estrella, *H. Gentry 379* (ARIZ, DS); Distr. Alamos, Saucito Canyon, *H. Gentry 687* (DS, US); Canyon Sapopa, *H. Gentry 1075* (ARIZ, US); Canyon Sapopa, Río Mayo, *H. Gentry 1075* (F, GH, MO, WIS); San Bernardo, Río Mayo, *H. Gentry 1160* (ARIZ, F, UC); Alamos, *H. Gentry et al. 19347* (ARIZ, US); ca. 0.5 km inland from Algodones Bay, Guaymas area, *D. Goldberg s.n.* (ARIZ); Granados, *C. Hartman 237* (GH, NY, PH, UC, US); 4 mi W of Rancho San Nicolás on road between Nuri and Yécora, *P. Hubbell s.n.* (ARIZ); N of Cd. Obregón, *P. Jenkins s.n.* (ARIZ); San Carlos Bay, *I. Johnston 4363* (CAS, GH); N of Alamos between Cerros el Cucurucho and El Aguaje, 27°04-05′N, 108°58′W, *E. Joyal 1342* (CAS, MEXU); Las Cabras, ESE of Alamos, 27°00′N, 108°55′W, *E. Joyal 1522* (CAS); Agua Caliente drainage between Rancho El Alamo and Buena Vista, 29°36′N, 108°56′W, *E. Joyal & M. Silva* C. *1772* (CAS, MEXU); 4 mi W of Caborca toward Tajitos, *D. Keck 4050* (DS, US); 3 mi NW of Tajitos (25 mi NW of Caborca) toward Quitovac, *D. Keck 4087* (DS, GH, UC, US); Alamo, Magdalena, *P. Kennedy 7056* (US); Mpio. Hermosillo, Hwy. 21, 25 km E of Hwy. 15, ca. 3 km E of San Francisco de Batuc, 29°15′N, 110°40′W, *G. Levin 2186* (CAS, MEXU); Badehuachi, *C. Lloyd 441* (GH, US); KM 145 on Hwy. 15 between Santa Ana and Hermosillo, *M. Luckow 2978* (MEXU, TEX); Cernas, *D. MacDougal & F. Shreve 7* (GH, US); 34 mi NE of Cajeme on road to Tesopaco, *T. Mallery s.n.* (ARIZ); La Fundicion camp, road to San Pedro, 27°01′N, 108°45′W, *P. Martin s.n.* (ARIZ); Guaymas, 2 mi below microwave, 27°57′N, 110°54′W, *P. Martin s.n.* (ARIZ); 1 km NE of Bachoco, 26°44′N, 109°21′W, *P. Martin & M. O'Rourke s.n.* (ARIZ, MEXU, MO); Micoondas Masiaca, 26°46′N, 109°18′W, *P. Martin & M. O'Rourke s.n.*, (ARIZ); near Mesa La Lagunita on road to Sierra Obscura, 5 mi W of Rancho Agua Blanca, *P. Martin & R. Robichaux s.n.* (ARIZ); Arroyo San Pablo, ca. 2.5 mi S of Guajaráy, 27°35′N, 108°51′W, *P. Martin & P. Sundt s.n.* (ARIZ); Cerro Verde, along Río San Javier, 28°34′N, 109°44′W, *P. Martin et al. s.n.* (CAS); Rancho La Presa (Tetagiosa) and road N 10 km to Alamos-Navojoa road, 27°00'–03′N, 109°04–06′W, *P. Martin et al. s.n.* (ARIZ); 2 mi SE of Agua Fria on road to La Brisca, NE of Cucurpe, *N. McCarten & T. Van Devender 2252* (ARIZ, ENCB); 5 mi N of Tezopaco, *S. McLaughlin 488* (ARIZ); Guadalupe Cañón, *E. Mearns & E. Merton 2037* (DS, US); San Pedro Bay, 30°03′N, 111°17′W, *R. Moran 4039* (DS); Mpio. Nacori Chico, El Río Bonito about La Nopalera (W slope of Sierra Madre), *C. Muller 3632* (F, GH, LL, UC); Magdalena, *C. Orcutt 1349* (US); Yaqui River, *E. Palmer 5* (GH, NY, PH); Alamos, *E. Palmer 632* (GH, NY, US); Yaqui River, *E. Palmer s.n.* in 1869 (US);

6 mi N of Obregón, *K. Parker 8212* (ARIZ, CAS); 2 mi NE of ariport, NW of Hermosillo, *D. Pinkava et al. 942* (ENCB); Torres, *C. Purpus 410* (UC); 6 km WNW of San Carlos, 27°57′N, 111°06′W, *M. Quinn & P. Sundt 071* (ARIZ); Onvas, along Río Yaqui, 28°28′N, 109°32′W, *A. Rea 1231* (ARIZ); Ensenada Chica, 15.1 mi W of Hermosillo-Guaymas Hwy., 6 mi S of San Augustín Beach turnoff, 28°07′N, 111°17′W, *F. Reichenbacher 243* (ARIZ); 14 mi by Tecolote road W of Mex. Hwy. 15, 29°48′N, 111°16′W, *F. Reichenbacher 1022A* (ARIZ); Mpio. Yécora, Restaurant La Palmita, 9.5 km W of Restaurant Puerto de la Cruz on Mex. 16 (KM 258 E of Cd. Obregón), N side of Mesa el Campanero, 28°22′N, 109°04′W, *A. Reina G. & T. Van Devender 2000-796* (CAS); Mpio. Opodepe, Arroyo San Cayetano, E side of Querobabi, 30°03′N, 111°01′W, *A. Reina G. & T. Van Devender 2001-595* (CAS); 2.7 km WNW of Tepoca on Mex. 16, ca. 28°28′N, 109°16′W, *A. Reina G. et al. 98-255* (NY); Playa San Carlos, NW of Guaymas, *H. Ripley 14258* (CAS, NY); Arroyo San Xavier between Rancho Lo de Campo and Rancho Panzicola, *R. Rondeau s.n.* (ARIZ); ca. 5 mi below Minas Nuevas, *J. Rose et al. 12674* (NY, US); Sierra de Alamos, vicinity of Alamos, *J. Rose et al. 13001* (NY, US); Mpio. Alamos, Alamos Wash on E side of Alamos, ca. 27°02′N, 108°55′W, *A. Sanders & G. Helmkamp 13306* (TEX); near Mina Sahuarito, S of Cerro San Luis, 20 mi SW of Trincheras, ca. 30°09′N, 111°43′W, *A. Sanders et al. 3587* (MEXU); near Sta. Magdalena, *Scott s.n.* (F); Sta. Magdalena y Imuris, *Schott s.n.* (F); 14 mi W of Pozo Serna on road to Puerto Libertad, *F. Shreve 5452* (ARIZ); near Santa Ana, *F. Shreve 5956* (ARIZ, F); Magdalena Canyon, 11 mi NE of Imuris, *F. Shreve 6626* (ARIZ, F, GH); 26 mi NW of Caborca, *F. Shreve 7556a* (ARIZ); ca. 3-4 mi NW of San Carlos, *E. Smith 3969* (CAS, MEXU, TEX); 25 mi E of La Motica on road to Tezopaco, *W. Spaulding 75-3-16* (ARIZ); Sierra Madre Occidental, ca. 4 mi N of Santa Ana on road to Yepachic, *W. Spaulding 75-3-52* (ARIZ); 2.6 mi ESE of Alamos, 27°01′N, 108°54′W, *G. Starr & D. Palzkill 322* (ARIZ); 18.5 mi SE of Río Yaqui crossing on Mex. Hwy. 16, *G. Starr & C. Starr 189* (ARIZ); Microondas Hill, Guaymas, *G. Starr & C. Starr 195* (ARIZ); Mpio. Alamos, La Huerta, 1.8 km NNW of Alamos toward San Bernardo, ca. 27°02′N, 108°57′W, *V. Steinmann et al. 9324* (ARIZ, MEXU); Río Yaqui, *R. Studhalter 1379* (US); Xorim, *R. Studhalter 1447* (US); Agua Prieta, *J. Thornber s.n.* (ARIZ); Magdalena, *G. Thurber 1028* (F, GH); San Carlos, *L. Toolin & K. Roever 562* (ARIZ); 1.5 mi N of Bavispe, *R. Turner & J. Hastings 65-45* (ARIZ, DS); 31 mi E of Hermosillo toward Mazatan, *R. Turner & J. Hastings 65-154* (ARIZ, DS); 2.5 mi SW of Atil, 30.8°N, 111.6°W, *R. Turner & J. Hastings 72-31* (ARIZ, MEXU); 59 km ESE of Hermosillo on Son. 16, 28°45′N, 110°28′W, *T. Van Devender & V. Markgraf s.n.* (ARIZ); near Rancho Agua Fria on Río Saracachi, E of Cucurpe, *T. Van Devender & C. Miksicek s.n.* (ARIZ); Playa La Manga, N of San Carlos Bay, *T. Van Devender & F. Nishida s.n.* (ARIZ); ca. 4 mi SE of Magdalena, *T. Van Devender & K. Schmidt s.n.* (ARIZ); Güirocoba crossing of Río Cuchujaqui, 12.3 km SSE of Alamos, 26°56′N, 108°53′W, *T. Van Devender et al. 92-940* (ARIZ); El Ranchería crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos on road to El Chinal, 26°51′N, 108°55′W, *T. Van Devender et al. 93-52* (ARIZ, CAS); Mpio. Navojoa, Arroyo Masiaca, ca. 0.5 km N of Teachive de Masiaca, 26°48′N, 109°14′W, *T. Van Devender et al. 93-956* (ARIZ); El Rincón Viejo, ca. 3.4 km N of Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 93-1063* (ARIZ); Cerro Piedra Boluda, ca. 1 km NE of El Rincón Viejo, ca. 4.5 km N of Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 94-226* (ARIZ); Mpio. Yécora, El Barranco de la Vinateria Los Sauces, 4 km S of Mex. 16 on road to Santa Ana, 28°23′N, 109°08′W, *T. Van Devender et al. 97-228* (MEXU); Mpio. Agua Prieta, Arroyo Gallardo, 8 km E of Agua Prieta on Mex. 2, 31°19′N, 109°23′W, *T. Van Devender et al. 2002-635* (CAS); 3.9 mi SW of Mazocahui, *T. Van Devender et al. s.n.* (ARIZ); San Javier, entre los cerros El Potrerito y Los Amoles, 7 km S del poblado, 28°32′N, 109°45′W, *L. Varela & E. Cuamea 96-496* (MEXU); San Javier, 28°36′N, 109°45′W, *L. Varela & E. Cuamea 97-56* (MEXU); 8 mi S of Nuri, ca. 27°58′N, 109°18′W, *G. Webster & R. Murphey 24376* (MEXU); Bavispe, Río Bavispe, *S. White 2886* (ARIZ, GH, US); Hacienda Oquitoa, 6 mi E of Altar, *I. Wiggins 5975* (DS, UC, US); Tinaja Picu in Picu Mts., 2 mi N of monument on N side of Libertad Road, *I. Wiggins 6052* (DS, US); Rancho San Ignacio, *I. Wiggins 6107* (DS, UC, US); 6 mi S of Carbo, from hwy. to San Miguel, *I. Wiggins 6237* (DS); road to Remedios, 3 mi from jct. Cananea Road, *I. Wiggins 7091A* (DS); ca. 2 mi E of Rancho Noria de Navaso, *I. Wiggins 7284* (DS, US).

Dyschoriste Nees

Dyschoriste Nees in N. Wallich, Pl. Asiat. Rar. 3:75, 81. 1832. LECTOTYPE (Britton & Brown, Ill. Fl. N. U.S., ed. 2, 3:240. 1913): *Dyschoriste depressa* Nees.

Calophanes D. Don in Sweet, Brit. Fl. Gard. ser. 2, 2:t. 181. 1833. TYPE: *Calophanes oblongifolia* (Michx.) D. Don (≡ *Ruellia oblongifolia* Michx.).

Linostylis Fenzl ex Sond., Linnaea 23:94. 1850. TYPE: *Linostylis ovata* Sond.

Decumbent to erect perennial herbs with cystoliths. Leaves opposite. Inflorescence of dichasia in leaf axils throughout plant or restricted to axils of distal leaves or bracts and forming a spike or thyrse; dichasia alternate or opposite, 1–many-flowered, sessile to pedunculate, subtended by a leaf or bract. Flowers homostylous, sessile to subsessile (in ours), subtended by 2 homomorphic bracteoles. Calyx 5-lobed, tube often as long as or longer than lobes during anthesis, regions between lobes usually subhyaline, often splitting nearly to base in fruit, lobes equal to subequal in length, usually somewhat setaceous. Corolla blue to blue-purple (in ours, elsewhere also pinkish purple, red, white, and yellow), tube gradually or abruptly expanded distally into a ± distinct throat, limb subactinomorphic to 2-labiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes contorted in bud. Stamens 4, didynamous, filaments connate in pairs (i.e., a long and a short stamen connate) proximally, exserted from mouth of corolla (at least longer pair and usually with at least a portion of anthers of shorter pair also), anthers 2-thecous, thecae equal in length, parallel to subsagittate, equally inserted, appendaged at base with awns or stout trichomes (in ours, elsewhere sometimes unappendaged at base), dehiscing toward lower lip (i.e., flower nototribal); pollen (Fig. 12) subprolate to perprolate, 3-colporate, irregularly polypseudocolpate, pseudocolpi 4–12 per mesocolpium, exine minutely verrucate to microechinate (and often microfoveolate to microfossulate); staminodes 0. Style exserted from mouth of corolla, stigma unequally 2-lobed, 1 lobe greatly reduced, rudimentary, or sometimes not evident. Capsule substipitate, subellipsoid to ellipsoid, retinacula present, septae with attached retinacula remaining attached to inner wall of mature capsule. Seeds 2-4, homomorphic, lenticular, covered with appressed hygroscopic trichomes. (x = 15).

Dyschoriste consists of approximately 75 species occurring in tropical and warm-temperate regions of America, Africa, and Asia. The genus is best developed in the New World where it has a discontinuous distribution from the southern United States southward through Mexico and Central America to northern Argentina. Major concentrations of species are found in west-central and southern Mexico and southeastern Brazil. The actual number of Mexican species is likely fewer than the 22 presently recognized. *Dyschoriste* is a complex genus the described species of which offer few characters for their recognition. Kobuski's (1928) treatment of the American species is now outdated and inadequate both for delimiting and identifying taxa.

1. Herbage glandular or glands restricted to calyx, external surface of lower lip of corolla, and base of style. . . . . *D. hirsutissima*
1. Plants lacking glandular trichomes.
   2. Plants usually decumbent; stems puberulent with trichomes less than 0.05 to 0.2 mm long; calyx puberulent with mostly appressed trichomes 0.5–0.2 mm long; corolla 13–21 (–25) mm long; thecae (including basal appendage) 0.8–2 mm long. . . . . *D. decumbens*
   2. Plants mostly erect to diffuse; stems pubescent with at least some (usually all) trichomes 0.3–1.5 mm long; calyx pubescent with flexuose trichomes 0.5–2 mm long; corolla 20–29 mm long; thecae (including basal appendage) 2–2.6 mm long. . . . . *D. xylopoda*

Dyschoriste decumbens (A. Gray) Kuntze, Revis. Gen. Pl. 2:486. 1891. *Calophanes decumbens* A. Gray, Syn. Fl. N. Amer. 2(1):325. 1878. TYPE: MEXICO. Sonora: "near Santa Cruz, stony soil, in mountain valleys," 1851, *C. Wright 1462* (lectotype, designated by Henrickson, 1999: GH, photo at CAS!; isolectotypes: GH?, NY?).

Phenology. Flowering: March–September; fruiting: July–September.

Distribution and habitats. Southwestern United States (Arizona, New Mexico, Texas), Mexico (Baja California Sur, Chihuahua, Coahuila, Durango, Hidalgo, Querétaro, San Luis Potosí, Sonora, Zacatecas); Sonoran plants occur on rocky slopes in grasslands, oak woodlands, oak forests, and oak-pine forests at elevations from 1390 to 1800 m.

Illustrations. *Flora of Baja California*, 190. 1980; *Desert Plants* 5:169. 1984; *Proceedings of the California Academy of Sciences* 49:337. 1997.

In the protologue of *Calophanes decumbens*, Gray cited unspecified collections of Wright, Thurber, Rothrock, and others from western Texas, southern Arizona, and adjacent Mexico. Henrickson (1999) designated a specimen of *Wright 1462* at GH as the lectotype of that name. He further indicated that the lectotype was collected in the United States (Arizona). Whether the lectotype was collected in Arizona or Sonora (as treated here) depends on the date it was collected. It was undoubtedly collected in September of 1851 when Wright traveled through Santa Cruz Co., Arizona between Patagonia and Canelo Pass to Santa Cruz, Sonora (ca. 16 km S of the international border). Most of collections prior to 23 September were made in Arizona, those of 23 September were probably mostly made in Arizona, and those made from 24 September until 2 October were from Sonora (Shaw 1987). Shaw (1987) provided correlations between Wright's field numbers and localities, but there is no field number on either the lectotype or the isolectotype at GH. Nor are there any collections listed by Shaw (1987) in the field lists with the exact locality, habitat, and plant habit information as presented on the lectotype (see type citation above and habit described as "stems many, procumbent"). Based on the locality provided on the lectotype and localities in Wright's field lists (as provided by Shaw 1987), it seems more likely that this plant was collected in the grassland communities near Santa Cruz (in Sonora) rather than in similar habitats in nearby Arizona. Henrickson (1999) also noted that the number "1462" was assigned by Asa Gray to all of Wright's collections of this taxon, and that *Wright 1462* at MO from "valley of the Rio Grande" is therefore "not considered type material." However, Henrickson (1999) also indicated that *Wright 1462* at NY and another collection with this number at GH are isolectotypes. The label on these "isolectotype" specimens bear no locality data and therefore it remains a matter of speculation as to whether they represent type material or not.

Daniel (1984b, 1997) provided descriptions of this species. Henrickson (1999) treated *D. decumbens* as one of several varieties of a polymorphic *D. schiedeana* (Nees) Kuntze. He studied this difficult genus in considerable detail throughout north-central Mexico and the southwestern United States over many years. As a result, he is far more familiar with *Dyschoriste* in these regions than I am, and he is probably correct that *D. decumbens* is not deserving of specific rank. The problems for taxonomic delimitation that he noted (Henrickson 1999) are not restricted to the southwestern United States and northern Mexico, however. Study of plants occurring further to the south in Mexico reveals similar complexities involving these and other taxa (e.g., Daniel and Acosta 2003, cf. *D. microphylla* (Cav.) Kuntze), some of which have older names than *D. schiedeana*. Until such time as a satisfactory taxonomy has been promulgated for the genus throughout North America, I prefer to use traditionally recognized taxa with familiar names for regional treatments such as this one.

The leaves of *Van Devender et al. 98-882* vary from linear to narrowly elliptic (vs. elliptic to

oblanceolate to obovate in most other Sonoran collections of the species). This species is likely more common in the northern and eastern portions of Sonora than the relatively few known collections from the state (Fig. 14) would suggest.

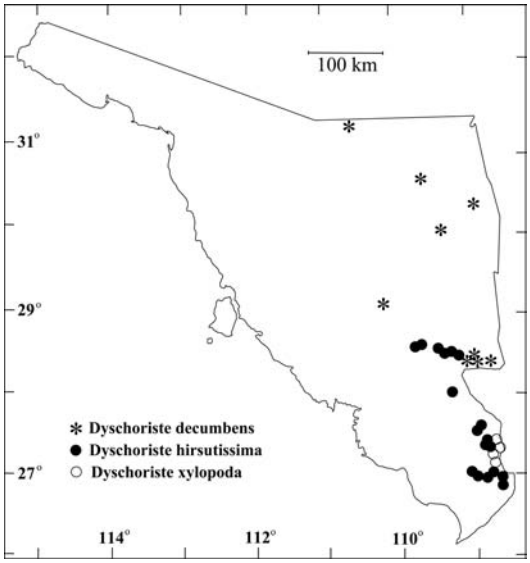


FIGURE 14. Sonoran distributions of *Dyschoriste decumbens, D. hirsutissima*, and *D. xylopoda*.

SONORAN COLLECTIONS: Yécora, 0.5 mi E of Arroyo Yécora, 28°23′N, 108°54′W, *M. Fishbein et al. 2487* (ARIZ); S of Pena Blanca on Hwy. 16, 28°23′N, 109°04′W, *P. Martin & G. Ferguson s.n.* (ARIZ); Mesa Grande, 28°26′N, 108°59′W, *P. Martin et al. s.n.* (ARIZ); Hwy. 16, 5.6 mi E of Río Maycoba, 6.5 mi W of Maycoba, 28°23′N, 108°43′W, *S. McMahon et al. 177* (ARIZ); Rancho La Pinosa, 5.9 mi W of Maycoba on Hwy. 16, 28°25′N, 108°43′W, *S. McMahon et al. 179* (ARIZ); "Sonora," *G. Thurber 114* (GH); Mpio. Yécora, 0.2 km N of Yécora on road to Agua Blanca, 28°23′N, 108°56′W, *W. Trauba s.n.* (CAS), *T. Van Devender et al. 97-786* (ARIZ, CAS); Mpio. Yécora, Rancho La Pinosa, 9 km E of Río Maycoba, 10.3 km W of Maycoba on Mex. 16, 28°25′N, 108°43′W, *T. Van Devender et al. 98-882* (CAS); Mpio. Santa Cruz, 3 km N of Santa Cruz on road to Nogales, 31°16′N, 110°36′W, *T. Van Devender et al. 2001-704* (CAS); Mpio. Ures, Cañada El Yugo, Sierra de Mazatan, 29°06′N, 110°12′W, *T. Van Devender et al. 2004-478* (CAS); KM 223, Rt. 69, 13 km NE of Guásabas, *T. Walker & S. Walker s.n.* (ARIZ); region of the Río de Bavispe, Horconcitos, Arroyo del Salto, *S. White 3761* (ARIZ); region of the Río de Bavispe, El Tajo, Río Fronteras, *S. White 4060* (ARIZ).

Dyschoriste hirsutissima (Nees) Kuntze, Revis. Gen. Pl. 2:486. 1891. *Calophanes hirsutissimus* Nees in A. de Candolle, Prodr. 11:109. 1847. TYPE: MEXICO. Hidalgo: "supra Hacienda de Guadalupe" [vicinity of Zacualtipán where Ehrenberg collected in November and December of 1839 fide Urban (1897)], Dec, *C. Ehrenberg 1223* (holotype: B, destroyed; fragment and photo: MO).

Calophanes bilabiatus Seem., Bot. Voy. *Herald*. 324. 1856. *Dyschoriste bilabiatus* (Seem.) Kuntze, Revis. Gen. Pl. 2:486. 1891. TYPE: MEXICO. Sinaloa: "Cerro de Pinal," Dec 1848, *B. Seemann 1513* (holotype: K!). "*Calophanes bilobatus* Rose" as treated in the synonymy of *D. hirsutissima* by Kobuski (1928), is treated as an orthographic error for *C. bilabiatus* because Rose (Contr. U.S. Natl. Herb: 1:109. 1891) cited the name as "Calophanes bilobatus Seem."

Ruellia viscosa Sessé & Moc., Pl. Nov. Hisp. 100. 1889, non *Ruellia viscosa* H.B.K. (1817). TYPE: not designated, see below.

Phenology. Flowering: March–July, October–December; fruiting: March–April, July, December.

Distribution and habitats. Mexico (Chiapas, Chihuahua, Colima, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Sinaloa, Sonora, Veracruz), El Salvador; Sonoran plants occur in thornscrub, tropical deciduous forests, oak grasslands, oak forests, and various riparian habitats at elevations from 220 to 1200 m.

Illustrations. *The Botany of the Voyage of H.M.S.* Herald, t. 65. 1856; *Flora del Valle de Tehuacán-Cuicatlán* 23:29. 1999.

Local names. “Ciática” (fide Van Devender et al. 2000); “valeriana del monte” (fide Van Devender et al. 2000).

Ruellia viscosa Sessé & Moc. is here treated as a synomym of *D. hirsutissima* for the first time. In the protologue of the former name, a locality is given as “in aridis Ayacapixtlae agris.” According to McVaugh (2000) this is Yecapixtla, Morelos. In the Sessé and Mociño herbarium at MA no. *2156* (CNHM negs. 48997–48999) is labelled with this name and pertains to *Dyschoriste hirsutissima* (Nees) Kuntze. A painting in the Torner Collection (6331.0634) at the Hunt Institute for Botanical Documentation, Pittsburgh, U.S.A. is also labelled with this name and could represent *D. hirsutissima*. The description in the protologue, especially the foliar pubescence being “villoso-viscosa,” would appear to pertain to this species as well.

Daniel (1995a, 1999a) and Daniel and Acosta (2003) provided descriptions of *Dyschoriste hirsutissima*. The vegetative organs of plants of this species are commonly viscid and have a somewhat mephitic odor (similar to that of *Ruellia inundata*). The species attains the northern and western extents of its distribution in southeastern Sonora (Fig. 14).

Sonoran collections: Mpio. San Javier, 2.7 km E of La Barranca on Mex. 16, 28°34′N, 109°40′W, *A. Búrquez M. 96-135* (CAS, MEXU); along Hwy. 16 between Tecoripa and Tónichi, 7.6 mi W of Río Yaqui, *T. Daniel 3344* (CAS); Mpio. Yécora, along Hwy. 16, 15.5 km NW of Tepoca, ca. 28°28′N, 109°21′W, *T. Daniel et al. 8559* (CAS); W of Alamos, *F. Drouet & D. Richards 3982* (CAS, DS, F, NY, US); 5.9 mi SE of San Bernardo on road up Arroyo Taymuco to mine at San Rafael, 27°21′N, 108°49′W, *M. Fishbein et al. 940* (ARIZ, CAS); Sierra de Alamos, Arroyo Uvalama, 27°00′N, 108°59′W, *M. Fishbein et al. 1098* (ARIZ); 8.2 mi S of Guajaráy on road to San Bernardo, 27°32′N, 108°56′W, *M. Fishbein et al. 1592* (ARIZ); KM 196 on Hwy. 16 W of Tepoca, *G. Ferguson & C. Moore s.n.* (ARIZ); Distr. Alamos, Qüiricoba, *H. Gentry 757* (DS), *757M* (F); Arroyo Gochico, Río Mayo, *H. Gentry 3634* (ARIZ, F, MEXU); Mpio. Alamos, Río Cuchujaqui near San Pedro, 27°02′N, 108°42′W, *P. Jenkins 89-427* (ARIZ), *89-428* (ARIZ); Sierra de Alamos, 27°54′N, 108°57′W, *P. Jenkins s.n.* (ARIZ); 20 mi E of Río Yaqui on Mex. Hwy. 16, *G. Joseph & B. Perrill 83-042* (ARIZ); Puenta La Pila above “El Palmar,” ca. 20 km E of Onavas, 28°29′N, 109°22′W, *E. Joyal 1567* (CAS, MEXU); Arroyo Verde, *P. Martin s.n.* (ARIZ); 12 km E of Alamos, *P. Martin s.n.* (ARIZ, CAS); Río Yaqui drainage, Cerro Verde, 28°34′N, 109°44′W, *P. Martin & G. Ferguson s.n.* (ARIZ, CAS); above Rancho Palo Injerto, 27°03′N, 108°44′W, *P. Martin & M. O’Rourke s.n.* (ARIZ); Río Cuchujaqui, between Rancho San Pedro and Cerro El Tarahumara, ca. 27°03′N, 108°42–43′W, *P. Martin et al. s.n.* (ARIZ); Jorinabo, 27°15′N, 108°46′W, *P. Martin et al. s.n.* (ARIZ); Alamos, *E. Palmer 402* (US); 18 mi SE of Río Yaqui on Mex. Hwy. 16, *R. Perrill 5322* (ARIZ); Mpio. Yécora, 3 km N of Tepoca on Mex. 16, 28°27′N, 109°16′W, *A. Reina G. & T. Van Devender 97-349* (CAS); Mpio. Alamos, Upper Río Cuchujaqui, Arroyo Verde, 27°06′N, 108°43′W, *R. Rondeau & G. Rodda 90-68* (ARIZ); Sierra de Alamos, vicinity of Alamos, *J. Rose et al. 12833* (US); 7 mi N of Güirocoba, 26°59′N, 108°41′W, *J. Salmon s.n.* (ARIZ); Sierra de la Cebollita, 6.4 mi S of Nuri along road from Tesopaco, ca. 28°04′N, 109°20′W, *A. Sanders 3689* (CAS); Mpio. Alamos, SW edge of Alamos in foothills of Sierra de Alamos, ca. 27°01′N, 108°57′W, *A. Sanders et al. 13359* (CAS, TEX); Mpio. Alamos, Cañón Los Laureles, E slope Sierra de Alamos, 108°58′W, 26°58′N, *A. Sanders et al. 14343* (CAS, MO); Arroyo Gochico, ca. 10 km E of San Bernardo, ca. 27°24′N, 108°44′W, *V. Steinmann et al. 605* (ARIZ, CAS, MEXU, NY); Sierra de Alamos, W of Aduana, ca. 6 km W of Alamos, 27°02′N, 109°01′W, *V. Steinman et al. 93-122* (ARIZ, MEXU); 21 mi E of Tónichi (at Río Yaqui) on road to Yécora, *L. Toolin 296* (ARIZ); Canyon las Piedras, Sierra de Alamos, 3.5 km S of Alamos, 26°59′N, 108°57′W, *T. Van Devender et al. 92-743* (ARIZ, CAS); El Guayabo crossing of Río Cuchujaqui, 14 km ESE of Alamos, 27°00′N, 108°47′W, *T. Van Devender et al. 93-170* (ARIZ); 4.5 km ESE of El Caracol on Alamos-Navojoa Road, 27°04′N, 109°02′W, *T. Van Devender et al. 93-225* (ARIZ, CAS, TEX); Rancho La Junta, 1 km upstream from Mesa Colorada, 3 km NNE of Burapaco, 27°35′N, 108°52′W, *T. Van Devender et al. 93-395* (ARIZ, CAS); near Tojibampo, 19.5 km NNW of San Bernardo on road to Mesa Colorado, 27°02′N, 108°47′W, *T. Van Devender et al. 93-1491* (ARIZ); Mpio. San Javier, 2.7 km E of La Barranca on Mex. 16, 28°34′N, 109°40′W, *T. Van Devender et al. 96-3* (ARIZ, CAS, MEXU, MO, NY, TEX); Mpio. Yécora, Agua Amarilla, 15 km WNW of Tepoca, ca. 28°08′N, 109°20′W, *T. Van Devender et al. 96-21* (ARIZ); 3 km E turnoff to Santa Ana on Mex. 16, 28°25′N,

109°07′W, *T. Van Devender et al. 97-248* (MEXU); Mpio. San Javier, Puerto San Juan, Cerro San Juan, near San Javier, 28°35′N, 109°45′W, *L. Varela E. 97-55* (CAS); San Javier, Cerro San Juan, 28°36′N, 109°45′W, *L. Varela & E. Cuamea 97-80* (MEXU); above Aduana, Sierra de Alamos, 7.5 km ESE of Alamos, 27°02′N, 109°01′W, *J. Wiens et al. 93-078* (ARIZ, CAS).

Dyschoriste xylopoda Kobuski, Ann. Missouri Bot. Gard. 15:54. 1928. TYPE: MEXICO. Jalisco: near Guadalajara, 19 Jul 1893, *C. Pringle 4442* (holotype: MO!; isotypes: F, GH!, MEXU!, MO!, PR!, PRC!, UC!, US!).

Erect to spreading (to decumbent) perennial herbs to 4 dm tall. Young stems subquadrate to quadrate-sulcate, ± evenly to ± bifariously pubescent with flexuose eglandular trichomes 0.2–2 mm long (sometimes with an understory of shorter, ± bifariously disposed, and antrorse trichomes as well). Leaves subsessile to short-petiolate, petioles to 2 mm long, blades linear to narrowly elliptic to elliptic to obovate, 10–36 mm long, 2–17 mm wide, 2.3–9 times longer than wide, rounded to acute at apex, acute to subattenuate at base, surfaces sparsely pubescent (sometimes nearly glabrous) with flexuose eglandular trichomes to 1.5 mm long, margin entire, ciliate (at least near base of blade) with similar trichomes. Inflorescence of dichasia borne in axils of leaves along distal portion of stems; dichasia opposite, 1 per axil, 1–many-flowered, pedunculate, peduncles 0.5–1.5 mm long. Bracteoles foliose, linear to narrowly elliptic to obovate, 8–21 mm long, 0.8–4 mm wide, sometimes slightly curved, abaxial surface pubescent like leaves, secondary bracteoles similar to bracteoles except often smaller. Flowers sessile to subsessile (i.e., pedicels to 1 mm long). Calyx 9.5–17 mm long, tube 3–7 mm long, .27–.44 times as long as calyx, lobes subulate-setaceous, 6.5–10 mm long, 1.3–2.7 times longer than tube, abaxially and marginally (at least near base) pubescent with flexuose eglandular trichomes (sometimes dense) 0.5–2 mm long. Corolla bluish-purple, 20–29 mm long, externally pubescent with flexuose eglandular trichomes 0.1–0.5 mm long, tube expanded just distal to midpoint, 15–19.5 mm long, 2.8–3 mm in diameter near midpoint, limb 15–20 mm in diameter, upper lip 7.5–9.5 mm long, lobes 4.5-6 mm long, 4–5.8 mm wide, lower lip 7.5–10 mm long, lobes 6–8.5 mm long, 4–6 mm wide. Stamens with longer pair 7–13 mm long, shorter pair 6–11.5 mm long, thecae parallel, 2–2.6 mm long (including basal appendage), awned at base, awn 0.2–0.3 mm long. Style 19–22 mm long, pubescent with eglandular trichomes, stigma 1.2–1.6 mm long, only 1 lobe evident. Capsule 8–10 mm long, glabrous.

Phenology. Flowering: July–September; fruiting: August–October.

Distribution and habitats. Western Mexico (Aguascalientes, Chihuahua, Durango, Jalisco, Nayarit, Sonora); Sonoran plants occur on slopes in oak woodlands and oak-pine woodlands at elevations from 900 to 1600 m.

Illustration. None found.

Sonoran plants resembling those of *Dyschoriste xylopoda* from the Nueva Galicia region to the south are treated as conspecific with them pending a satisfactory taxonomic treatment of the genus in North America. The species attains the northern and western extents of its distribution in the upper drainage of the Río Mayo in southern Sonora (Fig. 14). Most Sonoran plants are erect to spreading in habit. *Pennell 19615* is described as a "depressed herb" and looks to be spreading on the ground with upturned distal shoots. Thus, it has a habit similar to most plants of *D. decumbens*. The relationship of this species to that traditionally referred to *D. ovata* (Cav.) Kuntze (see discussion of this name in Daniel, 1995a) remains to be resolved.

Sonoran collections: ca. 35 km NE of Alamos, between El Chiribo and La Vinateria, 27°18′N, 108°42′W, *M. Fishbein et al. 1440* (ARIZ, CAS); 1 km E of Los Llanitos on road to Chiribo from Huicoche, 27°19′N, 108°39′W, *P. Martin & D. Yetman s.n.* (ARIZ); ridge S of Arroyo Gochico, E of San Bernardo, *F. Pennell 19540* (PH, US); Cerro Saguarivo, E of San Bernardo, *F. Pennell 19615* (PH, US); Rancho Santa

Bárbara, E of Alamos, 27°07′N, 108°43′W, *J. Rascon & C. Smith s.n.* (ARIZ); Sierra Sahuaribo, ca. 3 km N of La Lobera toward Huicochic, ca. 27°17′N, 108°37′W, *V. Steinmann et al. 93-237* (CAS).

Elytraria Michx.

Elytraria Michx., Fl. Bor.-Amer. 1:8. 1803, nom. cons. TYPE: *Elytraria virgata* Michx., nom. illegit. (= *Elytraria caroliniensis* (J.F. Gmel.) Pers.).

Tubiflora J.F. Gmel., Syst. Nat. 2:27. 1791, nom. rej. TYPE: *Tubiflora caroliniensis* J.F. Gmel.

Erect to ascending, acaulescent to caulescent perennial herbs lacking cystoliths. Leaves alternate, mostly in basal rosettes or crowded at apices of branches, sometimes ± diffuse along stems. Inflorescence of scapose or pedunculate densely bracteate axillary and terminal dichasiate spikes; spikes cylindric, simple or sometimes branched, scapes or peduncles covered with imbricate, coriaceous, clasping scales; dichasia alternate (spirally arranged), 1-flowered, sessile in axil of a bract. Flowers homostylous, sessile, subtended by 2 homomorphic (often mostly hyaline) bracteoles. Calyx deeply 4-lobed, mostly hyaline, lobes heteromorphic, anterior and posterior lobes external, anterior lobe 2-dentate to ± deeply 2-cleft. Corolla relatively small, pinkish or blue or white or yellow, often with colored markings, tube cylindric or slightly expanded near mouth, throat indistinct or evident only near mouth, limb 2-labiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes often apically divided or 2-cleft, imbricate in bud. Stamens 2, anthers partially exserted from mouth of corolla, 2-thecous, thecae (covered by stigma during anthesis) equal in size, parallel, equally inserted on filament, lacking basal appendages (at least in Mexican species), dehiscing toward lower lip (i.e., flower nototribal); pollen (Fig. 12) euprolate to perprolate, 3-colpate, exine finely reticulate; staminodes 0–2, minute. Style exserted from mouth of corolla, stigma unlobed, expanded, flat, subelliptic to subspatulate, folded over anthers during anthesis and straightening when touched (touch-sensitive) and gradually refolding. Capsule estipitate, subconic to ovoid, sometimes irregularly constricted proximally, retinacula absent, placentae minute, papilliform. Seeds numerous (up to 20 per capsule), irregularly shaped (often blocky or cubelike), lacking trichomes. (x = 11 or 12?).

Elytraria consists of about 15 species occurring in the tropics and subtropics of both the Old World and the New World. The majority of species are American with four occurring in Mexico. Leonard's (1934) brief account of the American species is much out of date.

Elytraria imbricata (Vahl) Pers., Syn. Pl. 1:23. 1805. *Justicia imbricata* Vahl, Eclog. Amer. 1:1. 1796. TYPE: not located, see Daniel (1995a).

Verbena squamosa Jacq., Pl. Hort. Schoenbr. 1:3. 1797. *Tubiflora squamosa* (Jacq.) Kuntze, Revis. Gen. Pl. 2:500. 1891. *Elytraria squamosa* (Jacq.) Lindau, Anales Inst. Fís.-Geogr. Nac. Costa Rica 8:299. 1895. TYPE: unknown.

Elytraria tridentata Vahl, Enum. Pl. 1:107. 1804, nom. illegit. (*Justicia imbricata* Vahl cited as synonym).

See Daniel (1995a) for a complete listing of synonyms for this species.

Phenology. Flowering: August–May, but with peak flowering periods in March and September (Fig. 1); fruiting: throughout the year.

Distribution and habitats. Southwestern United States (Arizona, New Mexico, Texas), Mexico (Baja California Sur, Campeche, Chiapas, Chihuahua, Coahuila, Colima, Durango, Guanajuato, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, Sinaloa, Sonora, Veracruz, Yucatán, Zacatecas), Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Ecuador, Peru, Bolivia, Brazil, Argentina, West Indies,

Old World (introduced); Sonoran plants occur on slopes, along watercourses, and in disturbed areas in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Plains of Sonora), thornscrub, grasslands, tropical deciduous forests, riparian forests, oak forests, oak-pine forests, and pine forests at elevations from sea level to 1680 m.

Illustrations. Figure 15; *Contributions from the United States National Herbarium* 31:91. 1951; *Fieldiana, Botany* 24(10):365. 1974; *Flora of Baja California*, 192. 1980; *Flora of the Venezuelan Guayana*, vol. 2, 347. 1995; *Flora of Chiapas* 4:38. 1995; *Proceedings of the California Academy of Sciences* 49:340. 1997; *Flora del Valle de Tehuacán-Cuicatlán* 23:35. 1999.

Local names. "Baiboria" (fide Gentry 1963); "cola alacrán" (*Felger & Yetman 97-132*); "cordoncillo" (Mexican, e.g., *Búrquez et al. 94-160*, *Felger & Yetman 96-193*, *Palmer 285*, *Pennington 258*, *White 2772*); "cordonsillo" (*Hartman 91*); "coronia" (*Gentry 1048*); "mahilí guasira" (Guarijío, *Felger & Yetman 96-193, 97-132*); "nachachíkoli" (Guarijío, *Gentry 1133*).

Uses. Used medicinally to treat scorpion sting (*Felger & Yetman 96-193*); tea made from root drunk three or more times per day for fevers or influenza (*Felger & Yetman 97-132*); herbage decocted or infused for fevers (*Gentry 1048, 1133*, and fide Gentry 1963 in reference to its use by the Guarijío); a medicinal tea (mix with mescal) made from plant taken for colds and fever (*Pennington 226*); remedy for fevers, venereal diseases, etc. (*Palmer 285*); a refreshing tea made from leaves (*Pennington 258*); a tea from the whole plant used to treat diarrhea and the leaves and inflorescence are boiled (often together with leaves of *Carlowrightia arizonica*) and taken as a tea for fever (including malarial fevers), according to Yetman and Van Devender (2002) in reference to its medicinal uses by the Mayo.

Daniel (1995a, 1997, 1999a) and Daniel and Acosta (2003) provided recent descriptions of this species in various regions of Mexico. *Elytraria imbricata* occurs in diverse communities (noted above) and is widespread in Sonora (Fig. 16). It occurs in three of the four subdivisions of the Sonoran Desert there, but appears to be absent from the Lower Colorado River Valley subdivision in northwestern Sonora. Plants are often leafless or nearly so during the dry season (e.g., January–May) when most flowering occurs; plants collected during the rainy season (e.g., August–September) are very leafy.

Sonoran collections: Río de los Alisos, ca. 6 mi N of Cumeral, *L. Abrams 13159* (DS); 1 mi N of Cumeral on Nogales road, *L. Abrams 13175* (DS, F); Nacopule Canyon, ca. 4 mi. N of San Carlos Bay, *M. Ames 77-67* (ARIZ); Río Cuchujaqui, near Alamos, *M. Ames 77-85* (ARIZ); Mpio. Opodepe, road to La Colmena Microwave Station at KM 76 N of Hermosillo, *B. Bartholomew et al. 2468* (CAS, GH, MEXU, MO, NY); Yaqui River, El Toledo, 28°34′N, 109°33.5′W, *G. Boyer et al. s.n.* (ARIZ); Guaymas, *T. Brandegee s.n.* (F); 2.5 km S de Hermosillo, 29°01′N, 110°57′W, *A. Búrquez & A. Quijada 91-21* (MEXU); El Himalaya (Peña Blanca), entre San Carlos y Tastiota, 28°11′N, 111°20′W, *A. Búrquez et al. 91-300* (MEXU); KM 295 carr. fed. 16, 2.5 km W de los Vallecitos, 28°23′N, 108°50.5′W, *A. Búrquez et al. 92-415* (MEXU); Cañón Tepoca, KM 177, Carr. Fed. 16, 28°27′N, 109°15′W, *A. Búrquez et al. 94-160* (MEXU); Cerro El Verde, San Javier, 28°33′N, 109°43′W, *A. Búrquez et al. 96-042* (MEXU); Mpio. Alamos, 53.9 km N of Alamos, 3.5 km NE of San Bernardo toward San Rafael, *C. Cowan et al. 5554* (TEX); between Cananea and Arizpe, 27.7 mi N crossing of Río Bacanuchi, ca. 30°50′N, 110°20′W, *T. Daniel 922* (CAS); between Tecoripa and Tónichi, 9.3 mi E of Tecoripa, *T. Daniel 982* (CAS); "Microondas Mountain" overlooking Guaymas, along road which is 1.8 mi from Mex. Hwy. 15 on paved road to airport, N of Guaymas, *T. Daniel 1953* (ASU); Nacapuli Canyon, 6.3 mi W of Hwy. 15 on road to San Carlos then 4.4 mi N, *T. Daniel 1986* (ASU); road between Hwy. 16 E of Tónichi and Onavas, 0.5 mi S jct. Hwy. 16, *T. Daniel 3351* (CAS); Río Cuchujaqui, 7.4 mi SE of Alamos toward Güirocoba, *T. Daniel 3383* (CAS), *4001* (CAS); southeastern border of Alamos (road to mirador), ca. lat. 27°01′N, long. 108°56′W, *T. Daniel 9770* (CAS); Mpio. Soyopa, crossing of Río Yaqui with Hwy. 16, 8.5 km W of jct. to Onavas, ca. 28°34′N, 109°33′W, *T. Daniel et al. 8512* (CAS, MEXU); Mpio. Yécora, between San Nicolás and Nuri, just S of Curea, ca. 24 km SW jct. Hwy. 16, ca. 28°19′N, 109°17′W, *T. Daniel et al. 8578* (CAS); W of Río Magdalena, Magdalena, *F. Drouet & D. Richards 3813* (DS, F); moun-

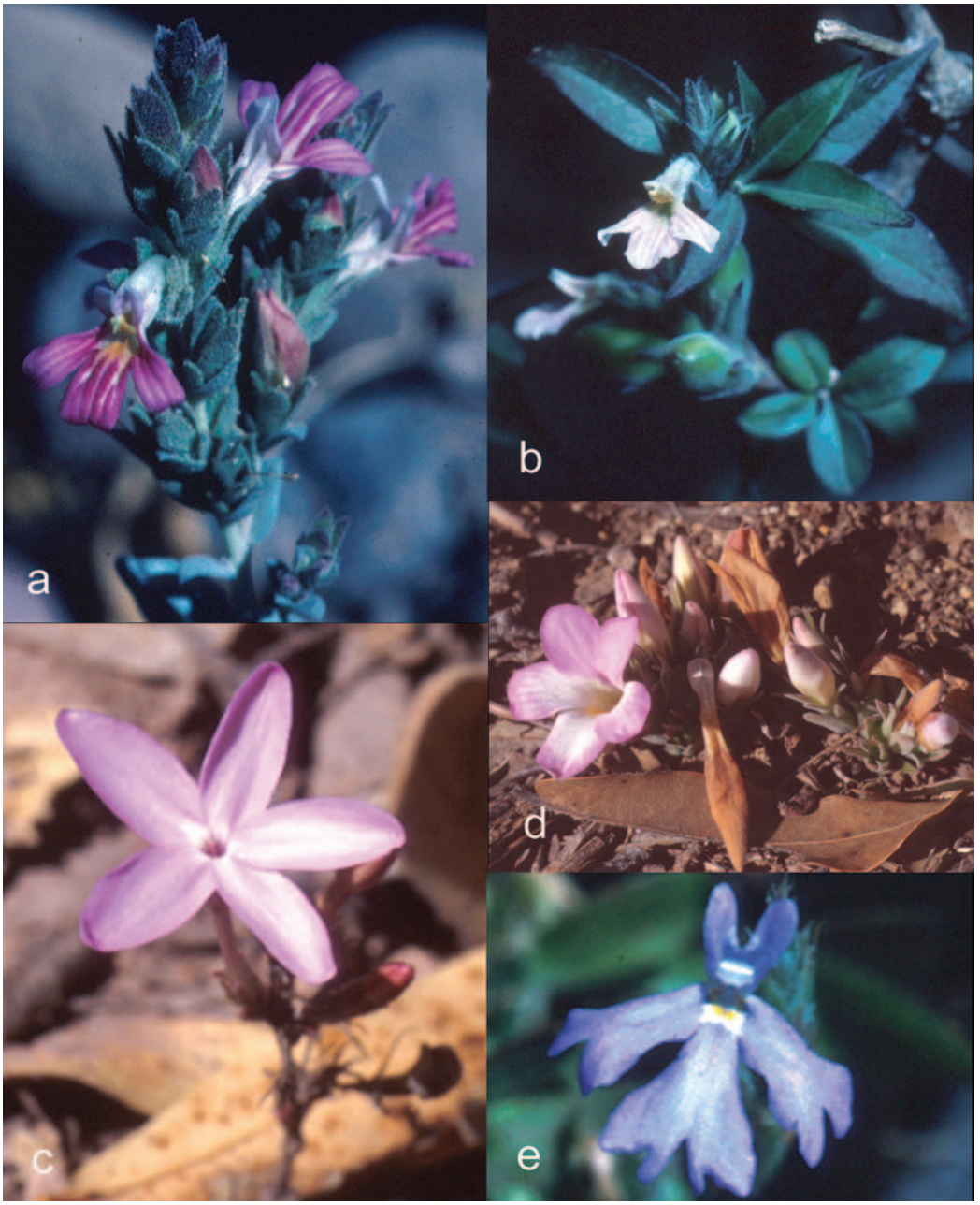


FIGURE 15. Sonoran Acanthaceae. a. *Holographis virgata*. b. *Holographis pallida*. c. *Pseuderanthemum praecox*. e. *Stenandrium pilosulum*. e. *Elytraria imbricata*.

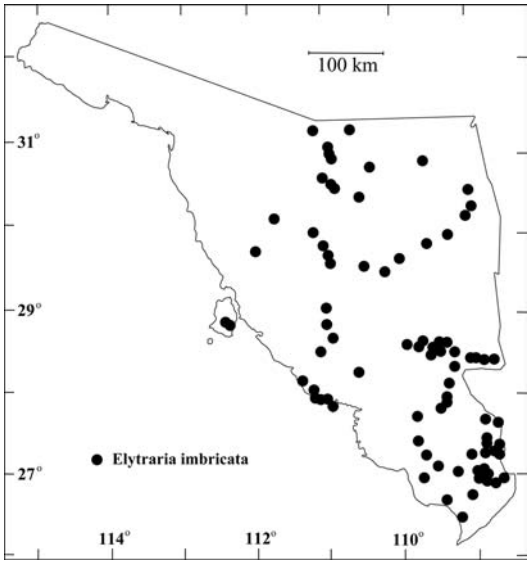


FIGURE 16. Sonoran distribution of *Elytraria imbricata*.

tain E of Guaymas, *F. Drouet & D. Richards 3843* (CAS, DS, F, MO, NY, US); 4 km NW of Alamos, *F. Drouet & D. Richards 4011* (F); El Cerro de la Campana, Hermosillo, *F. Drouet et al. 3388* (DS, F, GH, US); Rancho La Brisca, 3.5 mi. N of Agua Fria, 30°24′N, 110°33′W, *R. Duncan s.n.* (ARIZ); 6.3 mi. E of Río Bavispe on Guásabas-El Coyote Road, Cañón Cruz de Peñasco, *R. Felger 3645* (ARIZ); Nacapule Spring, NE of Bahía San Carlos, *R. Felger 4082* (ARIZ); 3 mi W of Nuri, *R. Felger 4096* (ARIZ); 0.8 mi S of Sabino, ca. 10 mi NE of Alamos, *R. Felger 5060* (ARIZ); Agua Caliente, 3.6 mi. S of La Casita on Mex. 15, *R. Felger 5629* (ARIZ, ENCB); E end of Bahía San Carlos, *R. Felger 6552* (ARIZ); Rancho San Jorge (W of Hermosillo), ca. 29°44′N, 111°51′W, *R. Felger 6907* (ARIZ); 14.7 mi. N of Imuris on Mex. 15, *R. Felger 7248* (ARIZ); Isla Tiburón, SE base of Sierra Kunkaak, *R. Felger 9315* (ARIZ, ENCB); Agua Caliente, *R. Felger 13989* (ARIZ, UC); ca. 1 km N of Bahía San Carlos toward Bahía Algadones, *R. Felger & R. Devine 85-3301* (ARIZ); Cañón Nacapuli, ca. 4 km N of Bahía San Carlos, *R. Felger & M. Dimmitt 85-862* (ARIZ, CAS); 10.2 mi. S of La Pintada (between Hermosillo and Guaymas) on Mex. 15, *R. Felger & C. Lowe 8365* (ARIZ); Cerro de la Vigia, Guaymas, *R. Felger & R. Thomas 11832* (ARIZ); Cañón Nacapule, NE of Bahía San Carlos, *R. Felger & R. Thomas 11861* (ARIZ, ENCB), *12002* (ARIZ); Mpio. Alamos, Río Mayo drainage, ca. 16 km N of Mesa Colorado, ca. 27°42′N, 108°50′W, *R. Felger & D. Yetman 96-193* (ARIZ, CAS); Mpio. Alamos, ca. 3 km SE of Bavícora, 27°40′N, 108°47′W, *R. Felger & D. Yetman 97-132* (CAS); Cañón Nacapules, ca. 6 km NE of Bahía San Carlos, *R. Felger et al. 84-120* (ARIZ); 0.5 mi SE of Alamos at jct. Güirocoba and El Fuerte rds., *J. Fish 44* (UC); S of Los Molinos, 7.8 mi. N of Los Tanques on road from Alamos to San Bernardo, 27°18.5′N, 108°53′W, *M. Fishbein et al. 930* (ARIZ); Mpio. La Colorada, 2.5 km S de El Pilar, 28°39′N, 110°52′W, *A. Flores M. & J. León G. 5396* (IEB); Distr. Alamos, Qüirocoba, *H. Gentry 760* (DS, US); Canyon Sapopa, Río Mayo, *H. Gentry 1048* (F, GH, MO, S, WIS); Conejos, Río Mayo, *H. Gentry 1133* (F); Guaymas, *H. Gentry 4697* (ARIZ); Sierra Bojihuacame SE of Cd. Obregón, *H. Gentry 14494* (ARIZ, MEXU, LL, US); 4.3 km SW of Santa Ana de Yécora on road to Nuri, 28°23′N, 109°19′W, *D. Goldberg & S. McLaughlin 77-165* (ARIZ); ca. 30 mi S of Hermosillo on Hwy. 15, *B. Hansen et al. 1380* (LL, MEXU, US, WIS); Cochuto, *C. Hartman 91* (GH, NY, PH, US); Calabasas, *C. Hartman 109* (F, GH); Río El Naranjo crossing, N of Taymuco, 27°15′N, 108°43′W, *P. Jenkins 88-175* (ARIZ); Guaymas, *I. Johnston 3092* (CAS); San Carlos Bay, *I. Johnston 4389* (CAS); Hermosillo, *M. Jones 22576* (MEXU, MO, PH); Las Cabras, ESE of Alamos, 27°00′N, 108°55′W, *E. Joyal 1422B* (CAS); Rancho El Aguilar Noria, N of Ures and Santiago, 29°33′N, 110°25–26′W, *E. Joyal 1819* (MEXU); Tiburón Island, Sierra Kunkook, *Knight 1016* (UNM); Tiburón Island, San Miguel Peak, *Knight et al. 961* (UNM); ca. 70 mi S of Hermosillo, *G. Lindsay 1137* (DS); Salsipuede, *C. Lloyd 442* (GH); Palm Canyon, 18 mi. SE of Magdalena, *P. Martin s.n.* (ARIZ); 5 km N of Rosario de Tesopaco, *P. Martin s.n.* (ARIZ); Mocúzari, La Cruz, 27°13′N, 109°05.5′W, *P. Martin s.n.* (ARIZ); La Fundición camp., road to San Pedro, 27°06′N, 108°45.5′W, *P. Martin & G. Ferguson s.n.* (ARIZ); Cerro Verde, 28°34′N, 109°44′W, P. *Martin & G. Ferguson s.n.* (ARIZ); 3 km S of Santini, KM 175 on Obregón-Navojoa road, 27°16′N, 109°39′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); 1 km NE of Bachoco, *P. Martin & M. O'Rourke s.n.* (ARIZ); 1 km E of El Chiribo, 27°18′N, 108°42′W, *P. Martin & D. Yetman s.n.* (ARIZ); Yaqui River, El Toledo, 28°34′N, 109°34′W, *P. Martin et al. s.n.* (MO, US); Estación Margarita, 10 km NW of Navojoa, 27°08.5′N, 109°29′W, *P. Martin et al. s.n.* (ARIZ); Arroyo Santa Rosa, 10 km NE of Tesopaco, 27°56′N, 109°19′W, *P. Martin et al. s.n.* (ARIZ); Canyon de las Palmas, Sierra Baviso, 16 mi SE of Magdalena, *N. McCarten 2264* (ENCB); Cañón Los Anegados, Sierra El Aguaje, Ejido Francisco Villa, 28°02′N, 111°08′W,

Moreno L. et al. 99-25 (ARIZ); Alamos District, near Minas Nuevas, *R. Moran 4030* (DS, UC); Guaymas, *E. Palmer 285* (C, GH, NY, US); without locale, *E. Palmer 12691* (MO), *s.n.* [in 1869] (PH, US); Maicoba, *C. Pennington 226* (TEX); Onavas, *C. Pennington 258* (TEX); 2.5 mi. W and 0.75 mi S of Alamos, *R. Perrill & V. Phelps 5167* (ARIZ); Nacopuli Canyon, 3.5 mi. N of San Carlos Bay, *A. Phillips et al. 75-158* (ARIZ); 8 mi E of Moctezuma on Huásabas Road, 29°50′N, 109°23′W, *F. Reichenbacher 188* (ARIZ); Mpio. Guaymas, old road to Algodones, San Carlos, 27°58′N, 111°04′W, *A. Reina G. & T. Van Devender 2000-916* (CAS); Guaymas, *J. Rose 1275* (US); vicinity of Guaymas, *J. Rose et al. 12588* (NY, US); vicinity of Alamos, *J. Rose et al. 12726* (NY, US); vicinity of Puerta de Mano, 26°59′N, 108°39′W, *J. Salmon s.n.* (ARIZ); 10 mi N of San Carlos, "Catch-22" site, *D. Shaw 29* (MO); Mpio. Villa Pesqueira, Sierra Pinta, ca. 33 mi. S of Moctezuma, ca. 29°35′N, 110°01′W, *J. Shortman & M. Wilson 96-58* (ARIZ); 37 mi. NE of Cajeme on road to Tesopaco, *F. Shreve 6155* (ARIZ); Sierra Baviso, 19 mi E of Magdalena, *F. Shreve 6642* (F, GH, MO); 7 mi S of Estación Carbo, *F. Shreve 6688* (GH); 25 mi. E of La Motica on road to Tezopaco, *W. Spaulding 75-3-17* (ARIZ); ca. 10 mi W of Tezopaco toward Cd. Obregón, *W. Spaulding 75-3-36* (ARIZ); 2.6 mi. ESE of Alamos toward Río Cuchujaqui crossing at Sabinito Sur, Cerro Las Campas, 27°01′N, 108°54′W, *G. Starr & D. Palzkill 335* (ARIZ); Mpio. Alamos, Sierra de Alamos, ca. 6 km W of Alamos, ca. 27°02.5′N, 109°01′W, *V. Steinmann & C. Smith 93-123* (ARIZ); along road between Yepachic and Yécora, 19 mi W of Chihuahua border, *S. Sundberg & M. Lavin 2837* (MO); Cerro Prieto Microondas, 15 km E de Navojoa, *P. Tenorio et al. 10185* (MEXU); Santa Cruz, *G. Thurber 950* (F); 4 mi. S of Mazocahui, *R. Turner 59-69* (ARIZ); 7.4 mi N of Las Chinacas, 27°18′N, 108°37′W, *R. Turner & P. Martin 79-396* (ARIZ); Bahía San Pedro, ca. 28.1°N, 111.2°W, *R. Turner et al. 79-258* (ARIZ); Güirocoba crossing of Río Cuchujaqui, 12.3 km SSE of Alamos, 26°56′N, 108°53′W, *T. Van Devender et al. 92-903A* (ARIZ); Camahuiroa between Agiabampo and Las Cocas on Gulf of California, 26°31′N, 109°16′W, *T. Van Devender et al. 92-1084* (ARIZ, CAS); Mpio. Alamos, 1 km S of Yocogigua, 26°47′N, 109°02′W, *T. Van Devender et al. 93-1091* (ARIZ); Saucito Canyon, Rancho la Sierrita, E slopes of Sierra de Alamos, ca. 6 km SSW of Alamos, 26°58′N, 108°58′W, *T. Van Devender et al. 93-1333* (CAS); Mpio. Yécora, 5.3 km W of Yécora on Mex. 16, 28°22′N, 108°59′W, *T. Van Devender et al. 96-64* (ARIZ, MEXU); Mpio. Soyopa, near Arroyo Garambullo on NE side of Río Yaqui bridge on Mex. 16, just S of Tónichi, ca. 28°34′N, 109°33′W, *T. Van Devender et al. 98-1119* (NY, TEX); Mpio. Nogales, 1.3 km SE of Rancho Las Borregas headquarters on road to Nogales, 31°12′N, 111°07′W, *T. Van Devender et al. 2004-248* (CAS); Palm Canyon, 17.7 mi SE of Magdalena in Cerro Cinta de Plata, *T. Van Devender et al. s.n.* (ARIZ); San Javier, cañón lo de Campa entre los cerros El Potrerito y Los Amoles a 7 km S del poblado, 28°32′N, 109°45′W, *L. Varela E. 96-443* (MEXU); San Javier, Cerro San Juan, 28°36′N, 109°45′W, *L. Varela & E. Cuamea 97-66* (MEXU); Alamos, *F. Vilas 69-VII* (WIS); N of Guaymas, *U. Waterfall 12848* (F, SMU); 2 mi S of El Coyote, ca. 29°56′N, 109°08′W, *G. Webster & R. Murphey 21349* (ARIZ); Mpio. Yécora, ca. 2 km NW of Yécora toward Santa Rosa, 28°23′N, 108°51′W, *J. Weins et al. 96-107* (ARIZ); loop of the Río Bavispe, Cañón de Huépari, N of Aribabi, *S. White 2649* (ARIZ, GH); loop of the Río Bavispe, Puerto de Huépari, NW of Aribabi, *S. White 2772* (DS, MEXU); Bavispe, *S. White 2863* (GH); Horconcitos, Arroyo del Salto, *S. White 3774* (GH); 100 mi. from Magdalena, *J. Whitehead M127* (ARIZ); 4 mi N of Nuri, 28°10′N, 109°11′W, *A. Whittemore et al. 83-084* (MEXU, TEX); 2 mi E of Rancho San Carlos on road to Noria, *I. Wiggins 6146* (DS, US); Río Sásabe, 10 mi E of Magdalena, *I. Wiggins 7106* (DS, US); 10 mi N of Carbo, *I. Wiggins 7265* (DS, GH, UC, US); 1 mi E of RR on road from Carbo to Horcasitas, *I. Wiggins 7277* (DS, F, GH, LL, MO, UC, US); Sahuaribo (108°40′W, 27°20′N) to Corogui (108°41.5′W, 27°22′N), *D. Yetman et al. s.n.* (ARIZ).

***Henyra* Nees ex Benth.**

Henrya Nees ex Benth., Bot. Voy. *Sulphur*, t. 49. 1845. TYPE: *Henrya insularis* Nees ex Benth.

Solenoruellia Baill., Hist. Pl. 10:445. 1891. TYPE: *Solenoruellia galeottiana* Baill. (= *Henrya insularis* Nees ex Benth.).

Baillonacanthus Kuntze in Post and Kuntze, Lex. Gen. Phan. 58. 1903 ("1904"). TYPE: *Solenoruellia galeottiana* Baill. (= *Henrya insularis* Nees ex Benth.).

Erect or ascending perennial herbs or shrubs with cystoliths. Leaves opposite. Inflorescences

of axillary and terminal stout to lax dichasiate spikes (to thyrses) collectively forming leafy terminal panicles; dichasia alternate or opposite, 1–3-flowered, sessile or short-pedunculate in axils of bracts. Flowers homostylous, sessile, subtended by 2 homomorphic bracteoles, bracteoles oblanceolate to obovate, usually larger and more conspicuous than bracts, concavoconvex, fused from base to near apex along side adjacent to rachis, rounded to acute at apex, mucronate with straight, apical or dorsal, erect or divergent pointed projection, secondary bracteoles, if present, much reduced. Calyx deeply 5-lobed, lobes homomorphic or heteromorphic (i.e., posterior lobe reduced in size). Corolla white, cream, or yellow, with maroon, purple, yellow, and/or white markings on upper lip, tube subcylindric to cylindric, throat indistinct, limb pseudopapilionaceous, upper lip comprising 2 fused lobes, 2-fid at apex, lower lip 3-lobed, lateral lobes similar to one another, lower-central lobe usually larger and keeled, corolla lobes imbricate in bud. Stamens 2, anthers 2-thecous, thecae subequal, parallel, equally to subequally inserted on filament, lacking basal appendages, dehiscing toward upper lip (i.e., flower stenotribal); pollen (Fig. 12) euprolate to perprolate, 3-colporate, colpi broad (i.e., far exceeding width of centrally positioned ora), 6-pseudocolpate, pseudocolpi 2 per mesocolpium, exine reticulate to bireticulate; staminodes 0. Style exserted from mouth of corolla, stigma 2-lobed, lobes equal and often inconspicuous. Capsule stipitate, head subspheric to broadly ellipsoidal, retinacula present, septae with attached retinacula separating slightly from inner wall of mature capsule. Seeds 2, homomorphic, planoconvex, subcircular to subelliptic in outline, flat surface smooth to bumpy, convex surface and margin either pubescent with hygroscopic trichomes or covered with stout, branched or barbed tubercles. ($x = 18$).

Daniel (1990) treated *Henrya* as consisting of two species occurring in dry regions from the southwestern United States southward to Costa Rica. Both species occur in Mexico.

Henrya insularis Nees ex Benth., Bot. Voy. *Sulphur*, t. 49. 1845. TYPE: plate 49 of Bentham's *The Botany of the Voyage of H.M.S.* Sulphur, see Daniel (Taxon 38:265-270. 1989.)

Henrya costata A. Gray, Proc. Amer. Acad. Arts 21:406. 1886. *Tetramerium costatum* (A. Gray) Millsp., Publ. Field Columbian Mus., Bot. Ser. 1:47. 1895. TYPE: MEXICO. Chihuahua: near Batopilas, Aug-Nov 1885, *E. Palmer 211* (holotype: GH!; isotypes: K!, LE!, MEXU!, NY!, PH!, US!).

Henrya grandifolia Fernald, Bot. Gaz. (Crawfordsville) 20:537. 1895. TYPE: MEXICO. Sinaloa: Esquinapa, Jan 1895, *F. Lamb 505* (holotype: GH!).

Henrya costata A. Gray var. *glandulosa* Brandegee, Zoe 5:171. 1903. TYPE: MEXICO. Baja California Sur: Cape Region, Santa Anita, 1901, *C. Purpus 266* (lectotype, designated by Daniel, 1990: UC!; isolectotypes: ARIZ!, MO!, US!).

Henrya brevifolia Happ, Ann. Missouri Bot. Gard. 24:547. 1937. TYPE: MEXICO. Sonora: Las Durasnillas, 18 May 1892, *T. Brandegee s.n.* (holotype: UC!; isotypes: DS!, GH!, NY!, PH!, US!).

Henrya ortegana Happ, Ann. Missouri Bot. Gard. 24:552. 1937. TYPE: MEXICO. Sinaloa: Sind. San Juan, San Ignacio, Mar 1931, *J. Ortega 6868* (holotype: MO!; isotypes: CAS!, F!, MIN!).

See Daniel (1995a) for a complete listing of synonyms for this species.

Phenology. Flowering: January–June; fruiting: March–June.

Distribution and habitats. Southwestern United States (Arizona), Mexico (Aguascalientes, Baja California Sur, Chiapas, Chihuahua, Colima, Durango, Guanajuato, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, Veracruz, Yucatán, Zacatecas), Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica; Sonoran Plants occur along watercourses and on rocky slopes in thornscrub, tropical

deciduous forests, oak woodlands, and oak-pine woodlands at elevations from 200 to 1380 m.

Illustrations. Figure 9; *Botany of the Voyage of H.M.S.* Sulphur, t. 49. 1845; *Flora of Baja California*, 193. 1980; *Flora of Chiapas* 4:40. 1995; *Proceedings of the California Academy of Sciences* 49:345. 1997; *Flora del Valle de Tehuacán-Cuicatlán* 23:41. 1999; *Flora del Bajio* 117:56. 2003.

Local names. "Alfalfillo" (fide Van Devender et al. 2000); "hegregado" (*Joyal 1563*); "rama del toro" (*Búrquez & Steinmann 96-110*, *Joyal et al. 1627*, *Van Devender et al. 93-1523*, *94-220*).

Brandegee (1893:347) indicated that "Las Durasnillas," the type locality of *Henrya brevifolia*, is "a small collection of houses about sixty miles from Hermosillo, near a mountain range known as Sierra Matapan." I did not encounter these place names on the series of maps available to me. A "Rancho Duraznillas" is located at 28°15′N latitude and 109°46′W longitude (Anonymous 1992), near the railroad between Est. Corral (near Esperanza) and Tónichi. *Henrya insularis* has been collected in this region, and there is a "La Dura" on most maps near these coordinates. This locality is nearly 100 miles from Hermosillo, however. The American Geographical Society's (1937) map of this region shows a "Duraznillo" about 60 miles east of Hermosillo along the road to Mazatan (at about 29°02′N, 110°17′W). There is a Río Mátape and a Sierra Mazatan in the general vicinity. This latter locality would have been more accessible to Brandegee from Hermosillo and it is presumed to be the type locality for both *H. brevifolia* and *Tetramerium abditum*. This locale is well within the range of *H. insularis* and *T. abditum* has been collected nearby.

Daniel (1990, 1995a, 1997, 1999a) and Daniel and Acosta (2003) provided descriptions of *Henrya insularis* and discussed regional morphological variation throughout its range. Plants from Sonora represent a common and widespread (Arizona to Central America) form of the species with bracts shorter than the bracteoles and the bracteolar mucros apically situated. Vegetative pubescence of Sonoran plants consists of an understory of eglandular (and usually glandular as well) trichomes and an overstory of glandular trichomes. Most Sonoran collections are noted to have yellowish corollas, usually with maroon or reddish markings on the upper lip.

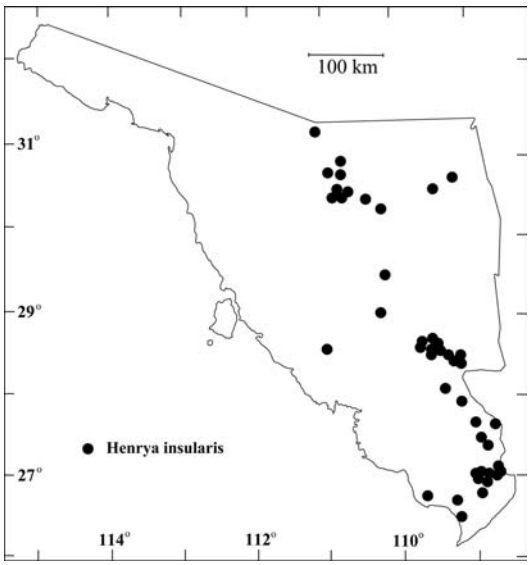


FIGURE 17. Sonoran distribution of *Henrya insularis*.

The species is widely distributed in Sonora (Fig. 17) and occurs in diverse habitats. It likely also enters the Arizona Upland subdivision of the Sonoran Desert along the Río Magdalena near Magdalena. Its northernmost known occurrence is in the lower reaches of Sycamore Canyon in the Parajito Mountains along the Arizona-Sonora border, west of Nogales.

SONORAN COLLECTIONS: El Rancheria crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos on road to El Chinal, 26°51′N, 108°55′W, *M. Baker et al. 10373* (TEX); Toro Muerto Canyon, ca. 2.5 mi W of Toro Muerto bridge on Hwy. 118, *J. Bowers et al. 2813* (ARIZ, ENCB); San Javier, 1 km de la Carr. Fed. 16, 28°35′N, 109°45′W, *A. Búrquez 93-121* (MEXU); San Javier, microondas en el Cerro El Durazno, 28°37′N, 109°45′W, *A. Búrquez 94-018* (MEXU); 0.5 km NW del Rancho Lo de Campa, San Javier, 28°34′N, 109°44.5′W, *A. Búrquez & V. Steinmann 96-110* (MEXU); Mpio. Huatabampo, Bocarehui [26°49′N, 109°43′W], *M. Cordova & R. Alcaraz s.n.* (ENCB); along road between Hwy. 16 E of Tonichi and Onavas, 0.5 mi S jct. Hwy. 16, *T. Daniel 3352* (CAS); along road between Rosario de Tezopaco and Nuri, 7.1 mi S of

turnoff to Nuri, *T. Daniel 3363* (ASU, CAS); Arroyo Cuchujaqui, 7.4 mi SE of Alamos toward Guiricoba, *T. Daniel 3377* (CAS); Mpio. Yécora, between San Nicolás and Nurí, ca. 6.4 km SW jct. Hwy. 16, ca. 28°24′N, 109°14′W, *T. Daniel et al. 8571* (CAS, MEXU); near Rancho La Brisca, ca. 8 mi ENE of Cucurpe, *J. Duek s.n.* (MEXU); Mpio. Guaymas, Sierra Libre, Cañón Tetabejo, 28°32′N, 110°59′W, *R. Felger et al. 02-297* (CAS); 9 mi from Imuris in Magdalena River canyon, *R. Ferris 8783* (DS, US); 6.3 mi NW of San Bernardo toward Guajaráy, 27°26′N, 108°57′W, *M. Fishbein et al. 1546* (ARIZ, CAS); Jopopaco vicinity, 2.2 km NE of Mex. 15 to Jopopaco, 25 km NW of Melchor Ocampo, 26°44′N, 109°16′W, *S. Friedman & O. Kiser 242-95* (ARIZ); Arroyo Camahuiroa, 1.5 km NE of Camahuiroa, 9.5 km WNW of Melchor Ocampo, 26°33′N, 109°16′W, *S. Friedman et al. 172-94* (ARIZ); Mpio. Imuris, 1.5 km W and 8 km S of Microondas Las Aguilas, Sierra de La Madera (E of Imuris), 30°40′N, 110°46.5′W, *G. Ferguson et al. 2338* (CAS); 21.5 mi E of Tecoripa, *P. Gallagher et al. 290* (ASU); 16.2 mi E of turnoff to Tonichi and 11.2 mi W of Tepoca along Mex. Hwy. 16, *P. Gallagher et al. 294* (ASU, CAS, NY); Alamos, Río Fuerte, *H. Gentry 2200* (ARIZ, F, GH, K, MEXU, MO, S, UC, US); Rancho Agrimincor, Río Mayo, *H. Gentry 3043* (ARIZ, F, GH, K, MEXU, MO, S, UC, US); Curohui, Río Mayo, *H. Gentry 3639* (ARIZ, F); Distr. Alamos, *H. Gentry s.n.* (MICH); 3.7 mi W of Santa Ana on old road to Yécora, *D. Goldberg 76-99* (ARIZ); Río Cuchujaqui, ca. 5 mi ESE of Alamos, 26°56′N, 108°53′W, *D. Goldberg & T. Van Devender 76-45* (ARIZ); Mpio. Alamos, cajón of the Río Cuchujaqui, 27°02–03′N, 108°42–42.5′W, *P. Jenkins 89-432* (ARIZ), *89-440* (ARIZ); Mpio. Alamos, Río Cuchujaqui, Guirocoba crossing 5 mi SE of Alamos, *P. Jenkins et al. 97-01* (ARIZ, CAS); Puente La Pila, ca. 20 km E of Onavas, 28°29′N, 109°22′W, *E. Joyal 1563* (CAS, MEXU); Río Cuchahaqui, SSE of Alamos, 26°52′N, 108°55′W, *E. Joyal et al. 1627* (MEXU); 7.5 mi W of Alamos, *R. Krizman 2* (ARIZ); ca. 4 mi NE of Santa Rosa on road to Yécora, *E. Lehto & T. Reeves L18746* (ASU); Rancho La Brisca, ca. 4-5 km N of Rancho Agua Fria on Río Santo Domingo, 30°24′N, 110°33′W, *P. Martin s.n.* (ARIZ, ENCB); 5 km SW of Santa Barbara, El Palmarito Canyon, 27°05′N, 108°45′W, *P. Martin & G. Ferguson s.n.* (ARIZ, CAS); Ignimbrite Canyon, 3 km N of La Brisca, Río Santo Domingo, 30°25′N, 110°53′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Microondas Masiaca, 7 km W of Masiaca, 26°46.5′N, 109°18′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); above Las Animas, 27°31.5′N, 108°42′W, *P. Martin et al. s.n.* (ARIZ); Palm Canyon, 19 mi E of Magdalena, *C. Mason et al. 3294* (ARIZ, MEXU); Mpio. Alamos, Arroyo Santa Barbara, 27°07′N, 108°43′W, *S. Mathes & P. Martin s.n.* (ARIZ); 1.3 mi S of Cucurpe, *L. McGill & D. Pinkava 6491* (ASU, F); 2 mi N of Nuri, *S. McLaughlin 512* (ARIZ); 21 mi NE of Río Yaqui crossing on Mex. 16, *R. Perrill 5317* (ARIZ); Onavas, NW of pueblo, ca. 28°28′N, 109°32′W, *A. Rea 1052* (ARIZ); Rancho El Palmar, 22.6 km SE of Río Yaqui on Mex. 16, 28°30′N, 109°24′W, *A. Reina G. et al. 97-104* (MEXU); Mpio. Onavas, 4 km W of Agua Amarilla, 18.9 km W of Tepoca on Mex. 16, 28°29′N, 109°22′W, *A. Reina G. et al. 98-603* (CAS); Cerro Redondo, 27°05′N, 108°45′W, *R. Rondeau & G. Rodda s.n.* (ARIZ); Sierra de Alamos, *J. Rose et al. 12829* (NY, US); Río Cuchujaqui, ca. 7 mi ESE of Alamos, ca. 26°59′N, 108°50′W, *A. Sanders et al. 2573* (ARIZ, ASU, RSA); NW side of Sierra de Alamos along road from Alamos–Navojoa road at Rancho Las Lomas to Promontorios, *A. Sanders et al. 2613* (ASU); Sierra Madre Occidental, at three-way jct., 6 mi E of Tepoca, *A. Sanders et al. 2668* (ASU); Río Chico, 2 mi N of Nuri, *W. Spaulding 75-3-22* (ARIZ); Las Piedras Canyon, E side of Sierra Alamos, 26°59′N, 108°57.5′W, *G. Starr & D. Palzkill 363* (ARIZ); 1.8 mi N of Alamos on Cerro Dos Negritos, *G. Starr & D. Palzkill 368* (ARIZ); 20-25 mi NE of Ures, *R. Straw 2118* (RSA, UC); Cucurpe, near Río Dolores, *R. Thompson & O. Davis 82-46* (ARIZ); 21 mi E of Tonichi on Río Yaqui, *L. Toolin 297* (ARIZ); Río Cuchujaqui at Rancho El Conejo, 12.4 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender 92-561* (ARIZ); Mpio. Santa Ana, Canada El Rincon del Diablo, W slope of Sierra Cucurpe, ca. 13 km W of Cucurpe, 30°20′N, 110°51′W, *T. Van Devender & A. Reina G. 98-446* (CAS); Cañón de la Bota, N end of Sierra el Tigre, ca. 34 km ESE of Esqueda, *T. Van Devender et al. 82-61* (ARIZ); near crossing of Río Cuchujaqui ca. 8 mi SE of Alamos, *T. Van Devender et al. 84-146* (ARIZ); canyon N of Los Aguaros on Arroyo Guajaray, 27°38.5′N, 108°58′W, *T. Van Devender et al. 93-485* (ARIZ); El Rincon Viejo, ca. 4 km N of Alamos, Sierra de Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 93-1523* (ARIZ); Cerro Piedra Boluda, ca. 1 km NE of El Rincon Viejo, ca. 4.5 km N of Alamos, *T. Van Devender et al. 94-220* (ARIZ, CAS); Mpio. Yécora, Agua Amarilla (Los Pinitos), 15 km WNW of Tepoca, 24.7 km WNW of San Nicolas on Mex. 16 at KM 200, ca. 28°08′N, 109°20′W, *T. Van Devender et al. 96-23* (ARIZ); 1.5 km SW of Santa Ana on road to Guadalupe Tayopa, 28°23′N, 109°09′W, *T. Van Devender et al. 97-201* (MEXU, MO, TEX); 2.7 mi WNW of Tepoca on Mex. 16, ca. 28°28′N, 109°16′W, *T. Van Devender et al. 99-71* (NY); Mpio. Nogales, Sierra Las

Avispas, 15.9 km W of MEX 15 on SON 43 (to Sáric), 31°04′N, 111°05'E, *T. Van Devender et al. 2002-757* (CAS); Mpio. Nogales, 3.8 km NE of El Correo (La Arizona), Rancho Las Borregas, Arroyo Planchas de Plata, 31°11.5′N, 111°10′W, *T. Van Devender et al. 2004-217* (CAS); ca. 17 mi SSE of Magdalena, Cerro Cinta de Plata (=Sierra Babiso), *T. Van Devender et al. s.n.* (ARIZ, NY); Río Saracachi, ca. 5 mi NE of Cucurpe, *T. Van Devender et al. s.n.* (ARIZ); San Javier, Cerro San Juan, 28°36′N, 109°45′W, *L. Varela & E. Cuamea 97-68* (MEXU), *L. Varela & A. Feliz 97-34* (MEXU); Los Banos near Angostura, *S. Walker BAN 7* (NY); 13 mi E of Imuris, *I. Wiggins 11665* (DS, MEXU, MICH, TEX, UC, US).

Holographis Nees

Holographis Nees in A. de Candolle, Prodr. 11:728. 1847. TYPE: *Holographis ehrenbergiana* Nees.

Berginia Harv. ex Benth. & Hook.f., Gen. Pl. 2:1096. 1876. TYPE: *Berginia virgata* Harv. ex Benth. & Hook.f. (≡ *Holographis virgata* (Harv. ex Benth. & Hook.f.) T.F. Daniel).

Pringleophytum A. Gray, Proc. Amer. Acad. Arts 20:292. 1885. TYPE: *Pringleophytum lanceolatum* A. Gray. (= *Holographis virgata* (Harv. ex Benth. & Hook.f.) T.F. Daniel).

Lundellia Leonard, Wrightia 2:1. 1959. TYPE: *Lundellia argyrea* Leonard (≡ *Holographis argyrea* (Leonard) T.F. Daniel).

Erect to ascending perennial herbs or shrubs lacking cystoliths. Leaves opposite (rarely subopposite) or quaternate. Inflorescence of axillary or terminal dichasiate spikes (reduced to 2 flowers in *H. ehrenbergiana*); dichasia opposite to alternate, 1-flowered, sessile in axil of a bract. Flowers homostylous, sessile, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic. Corolla greenish white, white, pinkish to purplish, or yellow, often with colored nectar guides, long axis horizontally to vertically oriented, tube subcylindric to ± abruptly expanded distally into a throat, limb 2-labiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 4, equally inserted to ± didynamous, anthers slightly exserted from mouth of corolla, anthers 1-thecous, often connivent, pubescent, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); pollen (Fig. 18) euprolate to perprolate, 3-colpate, colpi often bifurcate near poles, exine psilate to verrucate to foveolate to rugulate; staminode 1, borne between posterior pair of stamens, short. Style slightly exserted from mouth of corolla, stigma subfunnelform or 2-lobed, lobes equal or unequal. Capsule substipitate, ellipsoid to obovoid, retinacula present, septae with attached retinacula remaining attached to inner wall of mature capsule. Seeds 4 (or fewer by abortion), homomorphic, lenticular. (x = 13).

This genus of 15 species is restricted to, but occurs nearly throughout, the dry regions of Mexico (Daniel 1983b, 1988b).

1. Leaves opposite (or subopposite); inflorescence of terminal spikes to 15 cm long. . *H. virgata*
1. Leaves quaternate; inflorescence of axillary spikes to 3.7 cm long.. . . . . *H. pallida*

Holographis pallida Leonard & Gentry in H.S. Gentry, Brittonia 6:324. 1948. TYPE: MEXICO. Sinaloa: Cerro Llano Redondo, W of Caymanero, 25 Apr 1944, *H. Gentry 7022* (holotype: MICH!; isotypes: ARIZ!, F!, GH!, NY!, US!).

Phenology. February–April; fruiting: March–April.

Distribution and habitats. Northwestern Mexico (Sinaloa, Sonora); Sonoran plants occur on slopes and along watercourses in thornscrub and tropical deciduous forests at elevations from 50 to 600 m.

Illustrations. Figure 15; *Brittonia* 6:325. 1948.

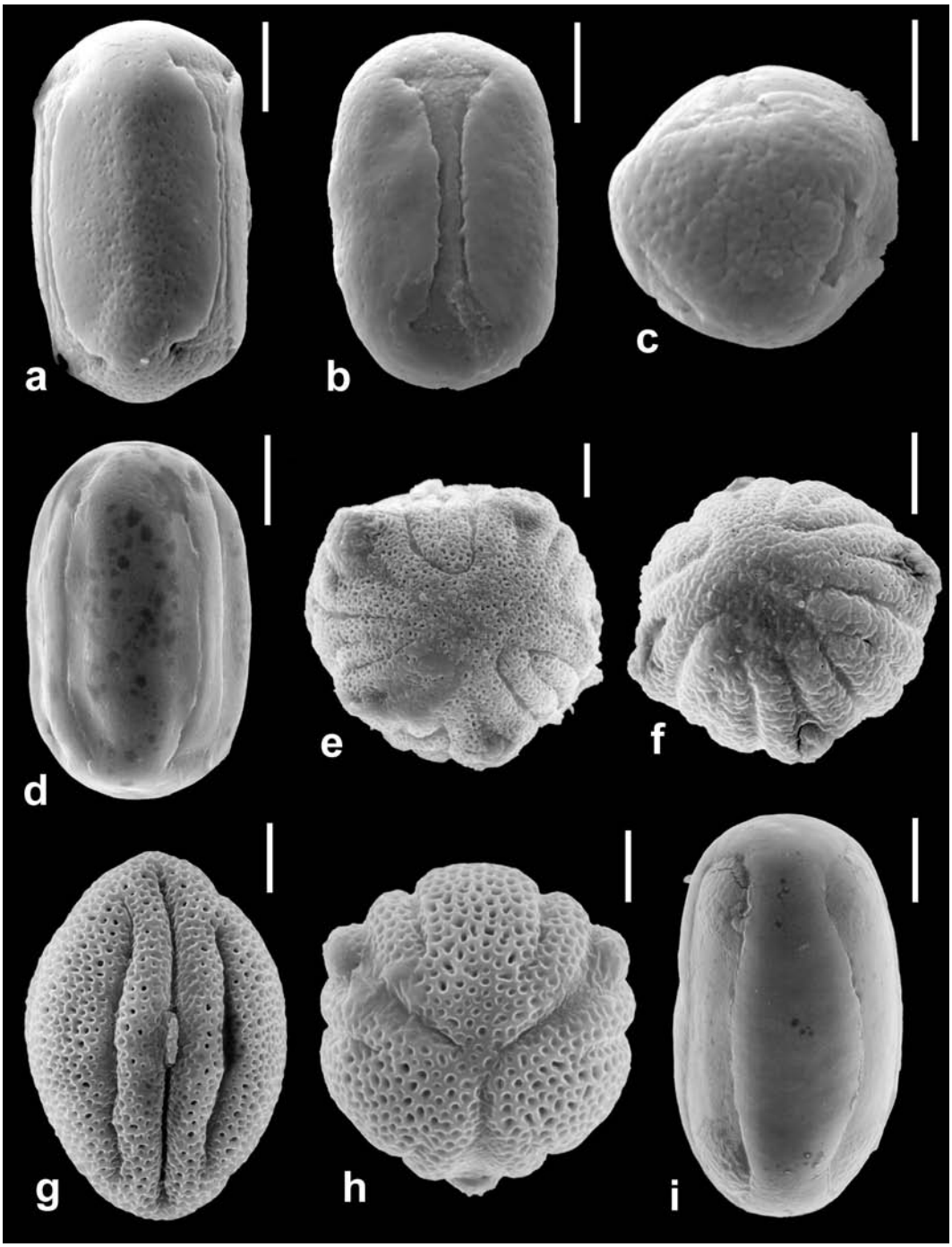


FIGURE 18. Pollen of Sonoran Acanthaceae. a. *Holographis pallida* (*Daniel 3382*), interapertural view. b. *H. pallida* (*Daniel 3382*), apertural view. c. *H. pallida* (*Daniel 3382*), polar view. d. *H. virgata* (*Breedlove 60981*), interaperatural view. e. *Odontonema cuspidatum* (*Jenkins & Yetman 91-115*), polar view. f. *O. cuspidatum* (*Breedlove & McClintock 23784*), polar view. g. *Pseuderanthemum praecox* (*McVaugh 26541*), apertural view. h. *P. praecox* (*Daniel 2131*), polar view. i. *Stenandrium pilosulum* (*Moran 21965*), interapertural view. Scales = 10 μm.

Local name. "Ramito chino" (*Gentry 1350*).

Daniel (1983b) provided a description of this species, which is endemic to northwestern Mexico. Its corollas are white to greenish white with light pink stripes on the lobes of the lower lip. *Holographis pallida* reaches the northern extent of its distribution in east-central Sonora (Fig. 19).

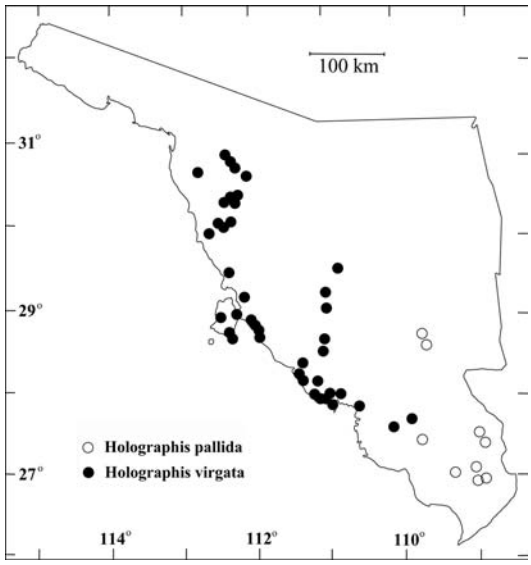


FIGURE 19. Sonoran distributions of *Holographis pallida* and *H. virgata*.

SONORAN COLLECTIONS: Arroyo Cuchujaqui, 7.4 mi SE of Alamos on road to Guiricoba, *T. Daniel 3382* (ASU, CAS), *3996* (CAS); Mpio. Soyopa, crossing of Río Yaqui with Hwy. 16, 8.5 km W of jct. to Onavas, ca. 28°34′N, 109°33′W, *T. Daniel et al. 8510* (ASU, BR, CAS, K, MEXU, MICH, MO, US); San Bernardo, *H. Gentry 1350* (A, ARIZ, F, MEXU, MO, UC, WIS), *3615* (ARIZ, F); Sierra Bojihuacame SE of Cd. Obregón, *H. Gentry 14492* (ARIZ, US); NE side of Río Yaqui bridge on Mex. 16, just S of Tonichi, ca. 28°34′N, 109°33′W, *A. Reina G. et al. 97-947* (CAS); Río Cuchujaqui, 8 mi SE of Alamos, ca. 26°56′N, 108°53′W, *A. Sanders 3685* (CAS); Mpio. Alamos, Cerro La Luna, ca. 14 km NW of Alamos, ca. 27°07′N, 109°02′W, *A. Sanders et al. 13257* (ARIZ, CAS, TEX, US); Río Cuchujaqui at Rancho El Conejo, 12.4 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender 92-562* (ARIZ); Cerro Prieto, ca. 9 mi E of Navojoa on Alamos Road, 27°05′N, 109°17′W, *T. Van Devender et al. 92-166* (ARIZ, CAS); below Guajaray on Arroyo Guajaray, 6.5 km WNW of jct. with Río Mayo, 27°36′N, 108°56′W, *T. Van Devender et al. 93-465* (ARIZ, CAS, TEX); between Rancho La Junta on Río Mayo and Guajaray on Arroyo Guajaray, 27°35–36′N, 108°52–56′W, *T. Van Devender et al. 93-504* (ARIZ, CAS); Mpio. Soyopa, Mina Soyopita, 1 km S of Soyopa, W side of Río Yaqui, 28°46′N, 109°38′W, *T. Van Devender et al. 99-911* (CAS).

Holographis virgata (Harv. ex Benth. & Hook.f.) T.F. Daniel, J. Arnold Arbor. 64:139. 1983. *Berginia virgata* Harv. ex Benth. & Hook.f., Gen. Pl. 2:1097. 1876. TYPE: MEXICO. State unknown: "California incola," *T. Coulter 603* (holotype: K!; isotypes: BM!, GH!, K!).

Pringleophytum lanceolatum A. Gray, Proc. Amer. Acad. Arts 20:293. 1885. TYPE: MEXICO. Sonora: 50 mi below Altar and 30 mi from Gulf of California, 13 Mar 1884, *C. Pringle s.n.* (holotype: GH!; isotypes: A!, F!, G!, MA!, NY!, P!, US!, WIS!).

Phenology. Flowering: December–May; fruiting: March–May.

Distribution and habitats. Northwestern Mexico (Baja California, Baja California Sur, Sonora); Sonoran plants occur on rocky slopes and along watercourses in Sonoran desertscrub (Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora) and thornscrub at elevations from 15 to 442 m.

Illustrations. Figure 15; *Proceedings of the California Academy of Sciences* 49:348. 1997.

Local name. "?áayaam" (Seri, *Felger et al. 17831*).

Daniel (1983b, 1997) provided descriptions of this species and its infraspecific taxa. Corollas of *Holographis virgata* have a white tube, light pink to whitish upper lip, and a dark pink lower lip with white veins (and a white area near the mouth) on the lobes of the lower lip. *Holographis virgata* subsp. *virgata* is the only infraspecific taxon present in Sonora. Both the species and the nominate subspecies attain their northern and eastern distributional limits in Sonora (Fig. 19).

Sonoran collections: 12 mi NW of Hermosillo, *L. Abrams 13305* (DS, F); canyon back of Palma, 40 mi S of Hermosillo, *L. Abrams 13348* (DS); Isla Tiburón, *J. Alcocer & C. Sosa R. 6* (ENCB); ca. 31 mi E of Punta Cirio between Puerto Libertad and Caborca, *J. Bowers & S. McLaughlin 1613* (ARIZ); S side of Algodones Bay, 2 km W of Cerro Tetas de Cabra, 27.9°N, 111.0°W, *T. Burgess et al. 6363* (ARIZ, ENCB, MEXU); ca. 3.5 km E of El Caracol, 30°02′N, 112°26′W, *T. Burgess et al. 6439* (ARIZ); El Himalaya (Peña Blanca), entre San Carlos y Tastiota, 28°11′N, 111°20′W, *A. Búrquez et al. 91-312* (MEXU); 10 mi NW of Hermosillo, *C. Carter s.n.* (MICH); "Microondas mountain" overlooking Guaymas, along road which is 1.8 mi from Mex. Hwy. 15 on paved road to airport, N of Guaymas, *T. Daniel 1958* (ASU); Nacapuli Canyon, 6.3 mi W of Hwy. 15 on road to San Carlos then 4.4 mi N, *T. Daniel 1969* (ASU), 1972 (ASU, CAS); near Guaymas, *E. Dawson 1075* (F, MICH); San Miguel de Horcasitas, *G. Eisen s.n.* (PH, US); N end of Bahía San Carlos, *R. Felger 2671* (ARIZ); 2.7 mi E of Tajitos on Mex. 2 (between Sonoyta and Caborca), *R. Felger 7419* (ARIZ); 10.2 mi S of La Pintada on Hwy. 15 (between Hermosillo and Guaymas), *R. Felger 8381* (CAS); Isla Turners (= Datil), island off S shore of Isla Tiburón, 28°43′N, 112°17′W, *R. Felger 9082* (ARIZ, CAS); NE end of Bahía San Carlos, *R. Felger 9617* (CAS); Isla Turners (=Datil), 28°43′N, 112°17.5′W, *R. Felger & J. Cooper 15320* (ARIZ); Sierra del Viejo (SW of Caborca), *R. Felger & H. Gentry 7912* (ARIZ); Bahía Colorado, ca. 28°18′N, 111°28′W, *R. Felger & E. Hamilton 15683* (CAS); ca. 0.5 mi SE of Cañón Nacapules, ca. 6 km NE of Bahía San Carlos, ca. 28°10′N, 111°03.5′W, *R. Felger & R. Thomas 11957* (ARIZ); ca. 0.8 mi N of Bahía San Carlos toward Bahía Algadones, *R. Felger & R. Thomas 12027* (CAS); Cerro San Nicolas, W of S end of Kino estuary, *R. Felger et al. 9555* (ARIZ); Ensenada Grande (= Bahía San Pedro), *R. Felger et al. 11616* (CAS); Isla Tiburón, ca. 13 mi S of Tecomate, ca. 28°57′N, 112°27′W, *R. Felger et al. 12384* (ARIZ), *12397* (ARIZ); Isla Tiburón, vicinity of Palo Fierro, Punta Tortuga, *R. Felger et al. 12555* (ARIZ, ENCB); Tiburón Island, Ensenada de la Perra, ca. 28°47′N, 112°16′W, *R. Felger et al. 17730* (ARIZ); vicinity of Rancho Arivaipa, ca. 8 mi ENE of Pozo Coyote, ca. 29°37′N, 112°17′W, *R. Felger et al. 17831* (ARIZ, CAS, MEXU); Cañón Nacapules, ca. 6 km N of Bahía San Carlos, ca. 28°10′N, 111°03′W, *R. Felger et al. 85-565* (ARIZ, CAS, MEXU); Picu Mts., Altar Distr., *H. Gentry 4479* (ARIZ, MICH, MO); Sierra Cajón del Diable, *H. Gentry 11622* (ARIZ, LL, MEXU, MICH); Bahía Algadones, San Carlos, Guaymas, *D. Goldberg 77-71* (ARIZ); 22.2 mi N of Bahía Kino Nuevo, *J. Hastings & R. Turner 64-40* (ARIZ, DS, SD); 0.9 mi E of Pitiquito, *J. Hastings & R. Turner 64-58* (ARIZ, DS, SD); 8 mi ESE of Vicam along Hwy. 15, 27.6°N, 110.2°W, *J. Hastings & R. Turner 69-64* (ARIZ); W of Obregón, *P. Jenkins 89-317* (ARIZ, CAS); Guaymas, *I. Johnston 3114* (CAS, GH, US); Hermosillo, *M. Jones 22531* (MEXU, MO); 8 mi NW of Caborca toward Tajitos, *D. Keck 4059* (C, CAS, DS, F, MO, NY); Mpio. Pitiquito, 54 km S of Pitiquito toward Puerto de la Libertad, ca. 11 km SW of Bimuri, 30°17′N, 112°07′W, *G. Levin 2172* (CAS, MEXU); near Pozo Cerna, *Long 62* (US); Isla Tiburón, *E. Lott & T. Atkinson 2518* (CAS, MEXU, TEX); New Kino, Bahía Kino, *W. Mahler & J. Thieret 6070* (SUM); N de Guaymas, *F. Miranda 8943* (MEXU), *8944* (MEXU); Tiburón Island, 28°46′N, 112°18′W, *R. Moran 4065* (DS, SD, UC); Guaymas, *E. Palmer 307* (GH); Las Guásimas, *R. Perrill 5353* (ARIZ); Mpio. Empalme, Rancho las Trincheras, ca. 6 km NW of Empalme, 28°01′N, 110°50′W, *A. Reina G. & T. Van Devender 2001-182A* (ARIZ, CAS); Guaymas area, near Rancho El Valiente, at jct. Hwy. 15 with bypass to Cd. Obregón, 3.8 mi N of turnoff to San Carlos Bay, ca. 28°02′N, 110°56′W, *A. Sanders et al. 8767* (MO); near Rancho Verruga, Distr. Altar, *F. Shreve 5823* (ARIZ, US); 5 mi NW of Caborca, *F. Shreve 7531* (ARIZ); 15 mi NW of Caborca, *F. Shreve 7553* (ARIZ, F, MICH, MO, US); ca. 20 mi NE of Obregón, *W. Spaulding 75-3-12* (ARIZ); Sierra Libre, 28°34.5′N, 110°58′W, *G. Starr 752* (ARIZ); 0.2 mi W of Rancho San Alfroso, 28.2°N, 111.2°W, *R. Turner & L. Duek 79-37* (ARIZ); 5.8 mi NW of Kino Bay on road to Punta Chueca, *R. Van Devender & T. Van Devender 83-96* (ARIZ, MEXU); Puerto Los Mochos, Rancho Los Mochos, ca. 20 mi NNE of Desemboque de San Ignacio, *T. Van Devender & M. Kearns s.n.* (ARIZ); Mpio. Hermosillo, Playa Esthela, just N of Bahía de Kino, 28°52′N, 112°01′W, *T. Van Devender & A. Reina G. 2000-932* (CAS, MEXU); Nacopuli Canyon, ca. 4 mi N of San Carlos Bay, *T. Van Devender et al. 84-239* (ARIZ); 8.6 mi NW of Caborca, *I. Wiggins 8268* (ARIZ, DS, TEX); Sierra Seri, ca. 29°17′N, 112°08′W, *R. Wilkinson s.n.* (ARIZ); Sierra del Viejo, 0.5 mi NE of Mina de la Santa Cruz, 30°23′N, 112°22′W, *G. Yatskievych & P. Fischer 82-04* (ARIZ).

Justicia L.

Justicia L., Sp. Pl. 1:15. 1753, nom. cons. prop. LECTOTYPE (Hitchcock and Green, International Botanical Congress, Cambridge (England), 1930: Nomenclature Proposals by British Botanists. 116. 1929): *Justicia hyssopifolia* L.

Dianthera L., Sp. Pl. 1:27. 1753. TYPE: *Dianthera americana* L. (≡ *Justicia americana* (L.) Vahl).

Adhatoda Mill., Gard. Dict. Abr. ed. 4, 1:[*Adhatoda* in alph. seq.]. 1754. TYPE: *Adhatoda* "*zeylanensium*" Mill. fide Graham (1988); *Adhatoda vasica* Nees = lectotype fide Index Nominum Genericorum (as of information dated 9 Feb 1996 at http://rathbun.si.edu/botany/ing/); both names pertain to *Justicia adhatoda* L.

Beloperone Nees in N. Wallich, Pl. Asiat. Rar. 3:76. 1832. LECTOTYPE (Bremekamp, Index Nom. Gen. Card 00123. 1955): *Beloperone amherstiae* Nees (≡ *Justicia brasiliana* Roth).

Sericographis Nees in Martius, Fl. Bras. 9:107. 1847. LECTOTYPE (Bremekamp, Index Nom. Gen. Card 02841. 1957): *Sericographis rigida* Nees (≡ *Justicia sericographis* V.A.W. Graham).

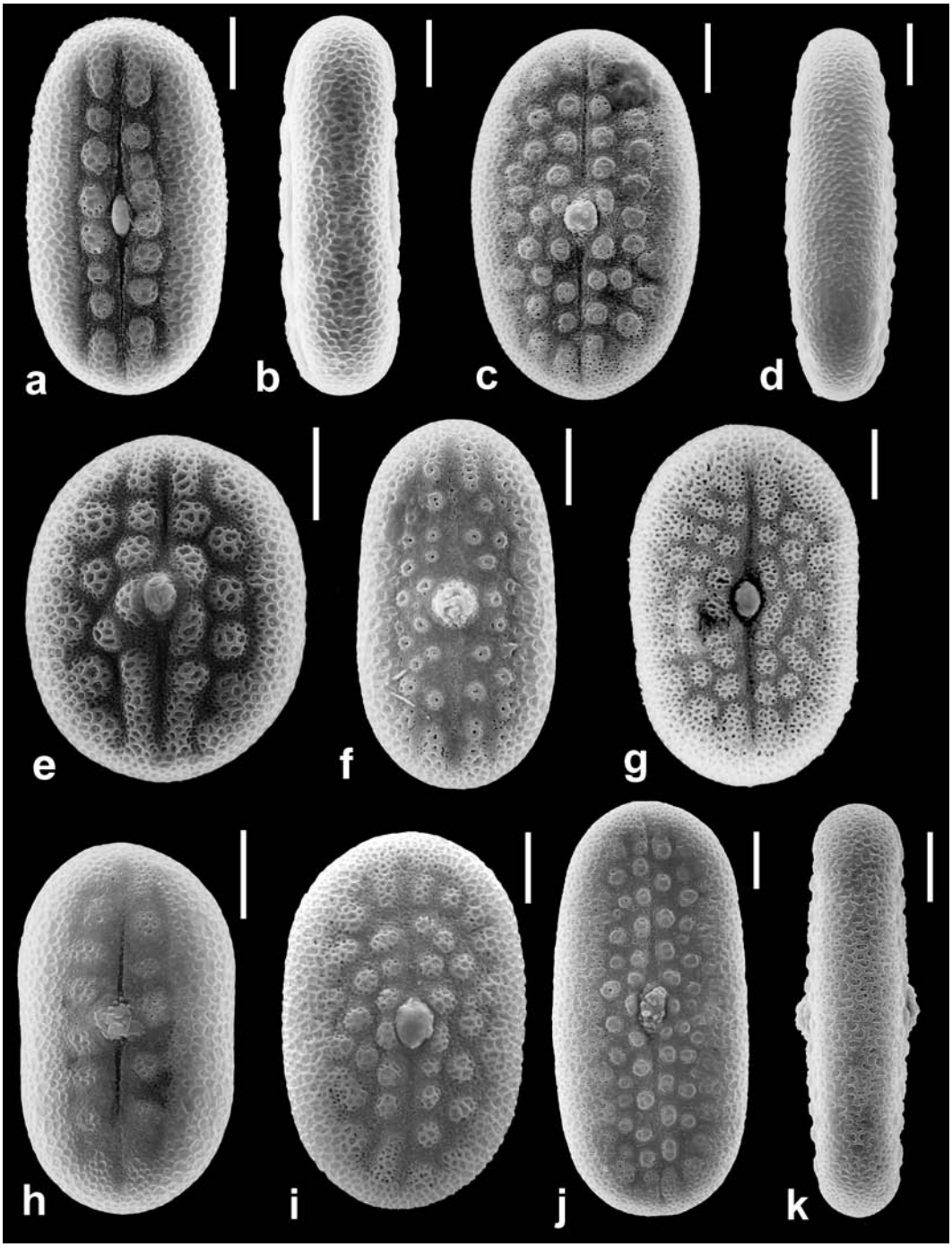
Sarotheca Nees in Martius, Fl. Bras. 9:113. 1847. LECTOTYPE (Bremekamp, Index Nom. Gen. Card 01996. 1956): *Sarotheca elegans* Nees (≡ *Justicia sarotheca* V.A.W. Graham).

Jacobinia Nees ex Moric., Pl. Nouv. Amér. 156. 1847, nom. cons. TYPE: *Jacobinia lepida* Nees (≡ *Justicia lepida* (Nees) Wassh.).

Siphonoglossa Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854:159. 1855. TYPE: *Siphonoglossa ramosa* Oerst. (≡ *Justicia ramosa* (Oerst.) V.A.W. Graham).

Decumbent to erect perennial herbs, shrubs, or small trees with cystoliths. Leaves opposite. Inflorescence of dichasia in leaf axils (or in axil of 2 partially fused bracts forming a cupulate involucre) or of axillary or terminal dichasiate spikes, racemes, or thyrses, inflorescences sometimes branched and becoming panicles; dichasia alternate or opposite, 1 (–3)-flowered, sessile or pedunculate, subtended by a leaf or a bract. Flowers homostylous, sessile or pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 4–5-lobed, lobes equal or unequal in size, posterior lobe sometimes greatly reduced in flowers with 5 calyx lobes. Corolla greenish, white, yellow, orange, pink, red, or purple, usually with white or colored markings (often restricted to lower lip), tube cylindric to expanded distally, usually lacking a distinct throat, limb strongly zygomorphic, 2-labiate, upper lip internally rugulate (i.e., with a stylar furrow), comprising 2 fused lobes, entire to 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla, anthers 2-thecous (1 theca rarely sterile), thecae equal or unequal in length, parallel to perpendicular, equally inserted on filament, unequally inserted (but overlapping for some portion of their length), or superposed (i.e., not overlapping), 1 or both with a basal appendage or appendages absent, dehiscing toward lower lip (i.e., flower nototribal); pollen (Figs. 20–21) subprolate to perprolate, 2–4-aperturate (varying from porate to colporate with distinctness of colpi sometimes questionable), apertures flanked on each side by 1-several rows of ± circular insulae and/or peninsulae or by both a solid band of exine and a pseudocolpus, exine variously ornamented but usually reticulate; staminodes 0 (although pubescent thickenings near attachment of filaments rarely

FIGURE 20 (right). Pollen of Sonoran *Justicia*. a. *J. californica* (*Daniel 1542*), apertural view. b. *J. californica* (*Daniel 1542*), interapertural view. c. *J. candicans* (*Daniel 8355*), apertural view. d. *J. candicans* (*Daniel 8355*), interapertural view. e. *J. hilsenbeckii* (*Lott & Guadalupe A. 2656*), apertural view. f. *J. caudata* (*Breedlove & Daniel 70945*), apertural view. g. *J. phlebodes* (*Van Devender et al. 93-483*), apertural view. h. *J. salviiflora* (*Raven & Breedlove 20133*), apertural view. i. *J. sonorae* (*Van Devender & Reina G. 98-434*), apertural view. j. *J. spicigera* (*Avila B. 28*), apertural view. k. *J. spicigera* (*Avila B. 28*), interapertural view. Scales = 10 μm.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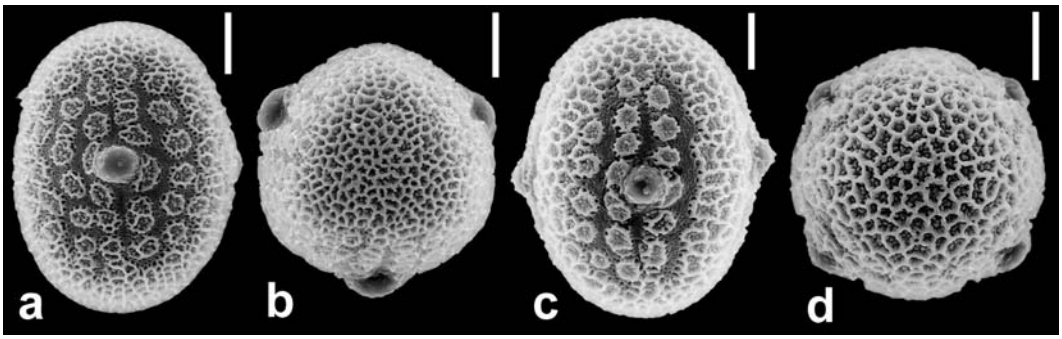


FIGURE 21. Pollen of Sonoran *Justicia*. a. *J. longii* (*Butterwick & Hillyard 7384*), apertural view. b. *J. longii* (*Butterwick & Hillyard 7384*), polar view. c. *J. masiaca* (*White 3590*), apertural view. d. *J. masiaca* (*White 3590*), polar view. Scales = 10 μm.

present). Style exserted from mouth of corolla, stigma lobes indistinct to distinct, when distinct equal to unequal in length (1 lobe sometimes vestigial). Capsule stipitate, retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 2-4, homomorphic, lenticular to globose. (x = 11, 14).

Justicia is the largest genus of Acanthaceae with estimates of up to 600 species worldwide. It is also the largest genus of the family in Mexico (ca. 100 species) and in Sonora (10 species). Morphological diversity in the genus is extensive and the above generic description is derived from North and Central American species only. The generic synonymy given above only includes genera in which species from our region have been previously treated. Daniel (1995a) provided a more complete listing of generic synonyms in which American species have been treated. Graham (1988) presented a comprehensive generic account of *Justicia* that includes generic synonyms on a worldwide basis.

1. Calyx 4-lobed with lobes homomorphic or 5-lobed with lobes heteromorphic (posterior lobe greatly reduced in size with respect to other 4 lobes); capsule pubescent with glandular and eglandular trichomes.
   2. Corolla cream or greenish with pink and maroon markings, tube 6–10.5 mm long; both thecae dorsally pubescent; capsule 14–20 mm long; seeds covered with barbed bristles. . . . . *J. salviiflora*
   2. Corolla pink to pale purplish, often with white markings on lower lip, tube 11–23.5 mm long; thecae glabrous (or sometimes with the upper theca pubescent); capsule 7–13.5 mm long; seeds tuberculate (lacking bristles).
      3. Corolla tube gradually expanded from near base to apex, 1.8–2.7 mm in diameter near midpoint, lower lip 8–17 mm long; thecae subequally inserted; capsule 10–13.5 mm long. . . . . J. *sonorae*
      3. Corolla tube cylindric (expanded only near mouth), 0.6–1.2 mm in diameter near midpoint, lower lip 4–7 mm long; thecae unequally inserted or superposed; capsule 7–10 mm long.
         4. Bracteoles 2–4.5 mm long, 0.2–0.4 mm wide; calyx 3–5 mm long, lobes subulate to lance-subulate; thecae unequally inserted (overlapping by 0.6–0.8 mm), lacking basal appendages; seeds 2.2–2.5 mm long.. . . . . *J. hilsenbeckii*
         4. Bracteoles 4.8–6.5 mm long, 0.5–0.7 mm wide; calyx (5-) 6.5–9 mm long, lobes linear; thecae superposed (separated by a gap 0.4–0.7 mm long), lower theca with a basal

appendage; seeds 1.5–1.7 mm long. . . . . *J. phlebodes*

1. Calyx 5-lobed, lobes homomorphic; capsule glabrous, pubescent with eglandular trichomes only, or pubescent with both eglandular and glandular trichomes.
   5. Bracts of axillary spikes heteromorphic, sterile bracts greatly reduced in size; calyx white-hyaline along margin; corolla externally pubescent with eglandular and conspicuous glandular trichomes, tube 5–8 mm in diameter near midpoint; thecae green; seeds smooth and puberulent. . . . . *J. caudata*
   5. Bracts (if present) homomorphic, sterile bracts (if present) similar to fertile bracts; calyx not white-hyaline along margin; corolla externally pubescent with eglandular trichomes only (infrequently with a few glandular trichomes in J. californica) or glabrous distally and very inconspicuously glandular proximally (J. spicigera), tube 1–4 mm in diameter near midpoint; thecae not green (often reddish); seeds smooth to tuberculate or covered with subconic papillae, lacking trichomes.
      6. Perennial herbs to 5 dm tall; corolla tube cylindric (expanded only near mouth), 1–1.5 mm in diameter near midpoint; calyx lobes widest above the base (i.e., narrowed proximally); pollen 3–4-aperturate; seeds bubbly tuberculate.
         7. Corolla purple (limb) and white (tube), tube 12.5–33 mm long; style 11–33 mm long; pollen 4-aperturate. . . . . *J. masiaca*
         7. Corolla entirely white, tube 23–43 mm long; style (23-)32–40 mm long; pollen 3-aperturate. . . . . *J. longii*
      6. Shrubs to 3 (or more) m tall; corolla tube gradually expanded from near base to apex, 1.7–4 mm in diameter near midpoint; calyx lobes widest at base; pollen 2-aperturate; seeds smooth to lumpy or covered with subconic papillae.
         8. Inflorescence of axillary panicles of dichasiate spikes; bracteoles abaxially glabrous or inconspicuously glandular-punctate; corolla orange, fusiform in bud, externally glabrous distally and inconspicuously pubescent with a few subsessile glandular trichomes to 0.1 mm long proximally, tube 19–32 mm long, lower lip recoiled; seeds covered with subconic papillae; introduced plants (cultivated or escaping). . . . . *J. spicigera*
         8. Inflorescence of dichasia in leaf axils, condensed dichasiate spikes (often appearing as clusters) in leaf axils, or (axillary or) terminal dichasiate thyrses; bracteoles abaxially pubescent with eglandular and sometimes stipitate glandular trichomes as well; corolla red (sometimes with white markings), linear-ellipsoid in bud, externally pubescent with eglandular (and sometimes also with stipitate glandular) trichomes to 0.5 mm long, tube 11–20 m long, lower lip not recoiled; seeds smooth to lumpy (i.e., covered with irregular, low, rounded bumps); native plants (rarely cultivated).
            9. Young stems ± pallid resulting from a dense and even covering of very short trichomes, the epidermis not (or but barely) visible; inflorescence of (axillary or) terminal dichasiate thyrses; dichasia pedunculate, peduncles 1–14 mm long; corolla entirely red, lobes of lower lip 1–5.5 mm long; thecae dorsally pubescent, lower (and sometimes upper) theca with a prominent basal appendage to 0.6 mm long; capsule pubescent; seeds subglobose to ± compressed, not red. . . . . *J. californica*
            9. Young stems glabrous or pubescent but not pallid as described above, the epidermis usually clearly visible; inflorescence of solitary dichasia in leaf axils or condensed dichasiate spikes (appearing as clusters) in leaf axils; dichasia sessile; corolla red with white markings on lower lip, lobes of lower lip 4.5–11.5 mm long; thecae dorsally glabrous, lacking basal appendages (or rarely the lower theca with an incon-

spicuous basal appendage to 0.1 mm long); capsule glabrous; seeds sublenticular, usually somewhat reddish. . . . . *J. candicans*

Justicia californica (Benth.) D.N. Gibson, Fieldiana, Bot. 34:67. 1972. *Beloperone californica* Benth., Bot. Voy. *Sulphur*, 38. 1844. *Jacobinia californica* Nees in A. de Candolle, Prodr. 11:729. 1847. *Sericographis californica* (Benth.) A. Gray in Torrey in W.H. Emory, Rep. U.S. Mex. Bound. 2(1):125. 1859. TYPE: MEXICO. Baja California Sur: Cape St. Lucas, 1841, *R. Hinds s.n.* (holotype: K!).

Phenology. Flowering: throughout the year, but with a peak in March(–April) and only sporadically in other months (Fig. 1); fruiting: throughout the year.

Distribution and habitats. Southwestern United States (Arizona, California), northwestern Mexico (Baja California, Baja California Sur, Sinaloa, Sonora); Sonoran plants occur on coastal dunes, along watercourses, and on rocky slopes in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora), thornscrub, and grasslands at elevations from sea level to 1046 m.

Illustrations. Figure 6; *Flora of Baja California*, 188. 1980; *Trees and Shrubs of the Southwestern Deserts*, 3rd. ed., 218. 1981; *Desert Plants* 5:169. 1984; *The Jepson Manual, Higher Plants of California*, 127. 1993; *Flora of the Gran Desierto and Río Colorado of Northwestern Mexico*, 65. 2000.

Local names. “Chuparosa” or “chuparrosa” (fide Felger 2000 and Felger and Moser 1985; *Búrquez 95-123, Búrquez et al. 91-280, Rea 1200, Nabhan et al. 249*, etc.); “hummingbird bush” (fide Felger 2000); “koo-me-me” (Guarijío, *Gentry 1291*); “noj-oopis” (Seri, fide Felger and Moser 1985); “semaluca” (Mayo, *Van Devender et al. 94-386*); “sewalulukut” (Yaqui, fide Felger 1999); “vipsumar hiosik” (Pima Bajo, *Rea 1200*); “wipisimal” (fide Felger 2000); “wipisomal” (Papago, *Bowers & Nabhan 172*, *Nabhan et al. 249*).

Uses. Source of food (floral nectar) for pre-Columbian cultures (Hodgson 2001).

Daniel (1997) provided a description of this species. Its distribution is nearly restricted to the Sonoran Desert of the southwestern United States and northwestern Mexico, where it is usually found in or along watercourses. In Sonora, it is widespread throughout western, central, and southern portions of the state (Fig. 22). Felger (2000) noted that in northwesternmost Sonora, the flowers attract Costa’s, Rufous, and Allen’s hummingbirds, as well as honeybees and butterflies. He also noted that carpenter bees (*Xylocopa*) and sometimes hummingbirds slit the floral tube and consume nectar. Other collectors have noted hummingbird visitation to flowers of *Justicia californica* from other portions of its range in Sonora (e.g., *Parfitt & Reeves 2398* notes visitation by Anna’s and either Rufous or Allen’s hummingbirds in west-central Sonora). Turner et al. (1995) noted additional ecological aspects of the species.

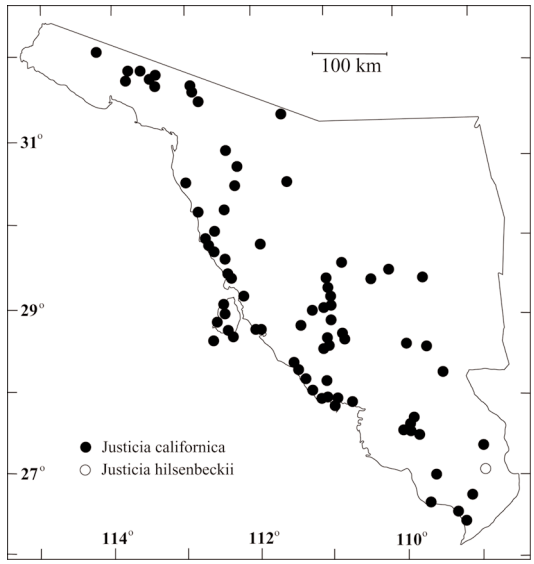


FIGURE 22. Sonoran distributions of *Justicia californica* and *J. hilsenbeckii*.

Sonoran collections: Sierra Bacha, ca. 17 km SE of Puerto Libertad, ca. 29°47′N, 112°33.5′W, *E. Abbey & R. Felger 20245* (ARIZ); 40 mi S of Hermosillo, *L. Abrams 13350* (DS); Guaymas, *R. Barr & W. Brewer 63-651* (ARIZ, MEXU); Kino Bay, *R. Barr & W. Brewer 63-663* (ARIZ, MEXU); Bahía San Carlos, Perinola Palms, ca. 7 mi N of Bahía San Carlos, *F. Boutin & F. Brandt 2827* (MEXU); Quitovac, between Sonoyta and Caborca, *J. Bowers & G. Nabhan 172* (ARIZ); Guaymas, *T. Brandegee s.n*. (UC); Mpio. San Luis Colorado, 11.4 mi S of Sonoita on Mex. 2, *D. Breedlove 1457* (DS, DUKE); Mpio. Hermosillo, 7 mi W of Hwy. 15 toward Bahía Kino, *D. Breedlove 15942* (DS, ENCB); Sierra del Viejo, 7 km N and 3 km E of El Plomito, 30°19′N, 112°20′W, *T. Burgess 5772* (ARIZ); Cañada Tetabejo, Sierra Libre, S de Hermosillo, 28°33′N, 110°58′W, *A. Búrquez 95-123* (MEXU); 2.5 km S de Hermosillo, 29°01′N, 110°57′W, *A. Búrquez & M. Quijada 90-179* (MEXU), *91-90* (MEXU), *A. Búrquez & M. Quintana 94-204* (MEXU); Cañón las Cocinas, entre San Carlos y Tastiota, 28°16′N, 111°23′W, *A. Búrquez et al. 91-280* (MEXU); 59 km SE de Caborca, 30°37′N, 111°36′W, *A. Campos V. et al. 4427* (CAS, MEXU); S Sonoyta, *O. Clark 11369* (UNM); N Guaymas, *O. Clark 14957* (UNM); Mpio. Hermosillo, S of Moro Colorado, 5 mi SSE of Estero Tastiota, *J. Copp 70-10* (CAS); Gran Desierto, SE side of Sierra del Rosario, ca. 32°05′N, 114°10.5′W, *H. Coss et al. 20389* (ARIZ, ENCB); Torres, *F. Coville 1651* (NY, US); near KM 74, Calle 4 Sur (diagonal road from Mex. 15 S of Hermosillo to Mex. 16 W of Hermosillo), *G. Cummins s.n*. (ARIZ); between Hermosillo and Kino Bay, 2.5 mi E jct. Son. 16 (Calle 4 Sur) to Guaymas, *T. Daniel 942* (CAS); "Microondas mountain" overlooking Guaymas, along road which is 1.8 mi from Mex. Hwy. 15 on paved road to airport, N of Guaymas, *T. Daniel 1956* (ASU, CAS); Nacapuli Canyon, 6.3 mi W of Hwy. 15 on road to San Carlos then 4.4 mi N, *T. Daniel 1992* (ASU); 1.6 mi NE of Masiaca toward Alamos, 7.1 mi NE Hwy. 15, *T. Daniel 2547* (CAS); along road between Hwy. 16 E of Tonichi and Movas, 15.8 mi S of Onavas, *T. Daniel 3354* (CAS); W base of Sierra Bojihuacame E of Cd. Obregón, 1.2–2.2 mi SE of Bachoco, *T. Daniel 3368* (CAS); ca. 2 mi E of San Carlos (NW of Guaymas), *T. Daniel 3976* (CAS); Bahía Kino, N of village, *F. Drouet & D. Richards 3518* (DS, F, US); NW edge of Guaymas, *F. Drouet & D. Richards 4033* (F); along Hwy. 15 ca. 2 mi N of jct. to Becachibampo Bay, *D. Dreyer 218* (CAS); Sierra de Calera E of Villa de Seris, *F. Drouet et al. 3398* (F); San Carlos Bay, ca. 7 mi W of Hwy. 15, *E. Engle 29* (MEXU); Pinacaté, derrame de lava en Campo Rojo, 31°45′N, 113°27′W, *M. Equihua s.n.* (ARIZ, MEXU); ca. 2 mi E of Esperanza (several mi N of Cd. Obregón, *R. Felger 360* (ARIZ); 1.8 mi NW of town of Bahía Kino, *R. Felger 2513* (ARIZ, MEXU); A. Rodríguez Dam, E side of Hermosillo, Río Sonora, *R. Felger 2785* (ARIZ, MEXU, TEX); Sau Sal landing field, S end of Tiburón Island, *R. Felger 6436* (ARIZ); NW part of Isla Tiburón, vicinity of Tecomate, Arroyo Agua Dulce, *R. Felger 6828* (ARIZ); Isla San Esteban, *R. Felger 7057* (CAS), *R. Felger et al. 17597* (CAS, MEXU); 2.2 mi W of Tajitos (NW of Caborca), *R. Felger 7450* (ARIZ); Isla Cholludo, between Isla Tiburón and I. Turners, *R. Felger 9162* (ARIZ); Hourglass Canyon, ca. 2 mi NE of Huarache Tank, W side of Pinacate region, *R. Felger 19136* (ARIZ, ENCB, GH); SW part of Pinacate region, ca. 1 km S of Tule Tank, *R. Felger 19228-F* (ARIZ); 1.3 mi N of village of Bahía Kino and ca. 1 km inland from shore, *R. Felger & J. Cooper 15251* (ARIZ); Isla San Esteban, N side of island, *R. Felger & J. Cooper 15408* (MEXU); Bahía Colorado, E base of Morro Colorado, ca. 28°18.5′N, 111°28′W, *R. Felger & E. Hamilton 15667* (ARIZ); ca. 5 mi N of El Desemboque San Ignacio, *R. Felger & M. Moser 5240* (ARIZ); Rancho San Jorge, ca. 20 mi W of Hermosillo, *R. Felger & A. Russell 6892* (ARIZ, MEXU); 1 mi N of Bahía San Carlos on road to Algadones, *R. Felger & A. Russell 9590* (ARIZ, MEXU); Isla Tiburón, ca. 13 mi S of Tecomate, ca. 28°57′N, 112°27′W, *R. Felger & A. Russell 12356* (ARIZ, ENCB, MEXU, UC); Isla Cholludo, between Isla Tiburón and I. Turners, *R. Felger & O. Soule 13414* (ARIZ); Cañón Nacapules, ca. 4 km N of Bahía San Carlos, *R. Felger & R. Thomas 11992* (ARIZ, MEXU); 11.8 mi S of Sonoyta, *R. Felger et al. 9824* (ARIZ); Ensenada Grande (= Bahía San Pedro, N of Guaymas), *R. Felger et al. 11600* (ARIZ); Isla Tiburón, vicinity of Tecomate, NW part of island, *R. Felger et al. 12527* (ARIZ); Isla Alcatraz, Bahía Kino, *R. Felger et al. 12723* (ARIZ); Isla San Esteban, E-central side of island, *R. Felger et al. 12763* (ARIZ); N side of Cerro Tepopa, SW of El Desemboque San Ignacio, ca. 29°22′N, 112°24′W, *R. Felger et al. 14141* (ARIZ, CAS); Pinacate Region, Tinaja Chivos, ca. 31°45′N, 113°36.5′W, *R. Felger et al. 18609* (ARIZ); Pinacate Region, E side of Sierra Blanca, ca. 31°34′N, 113°26′W, *R. Felger et al. 20210* (ARIZ); Sierra del Rosario, ca. 32°06′N, 114°11.5′W, *R. Felger et al. 20738* (ARIZ, ENCB); Sierra del Rosario, ca. 32°06', 114°11′W, *R. Felger et al. 75-15* (ARIZ, ENCB, MEXU); Cañón Nacapules, ca. 6 km N of Bahía San Carlos, ca. 28°10′N, 111°03.5′W, *R. Felger et al. 85-580* (ARIZ, CAS, MEXU, TEX); Loma Chomajabires, 1.8 mi N of Huatabampito, ca. 8 mi S of Huatabampo, 26°42′N,

109°36′W, *M. Fishbein & S. McMahon 2748* (ARIZ, CAS); vicinity of Nescotahueca, 4.5 km E of jct. of south Camahuiroa airstrip and Diez de Abril Road, 4 km W of Tierra y Libertad, 26°34′N, 109°15′W, *S. Friedman & G. Hall 398-93* (ARIZ); Arroyo Camahuiroa, 2 km NE of Camahuiroa, 9.5 km WNW of Melchor Ocampo, 26°33′N, 109°15.5′W, *S. Friedman & J. Zittere 025-95* (ARIZ); 277 km S of Nogales toward Hermosillo, *T. Frye & E. Frye 2283* (DS, GH, MO, NY, UC, US); N edge of Hermosillo, near Ganadero Motel, *A. Gentry 552* (MO); Cocorit, Yaqui Valley, *H. Gentry 885* (DS), *885M* (ARIZ); Salitral, Río Mayo, *H. Gentry 1291* (ARIZ, F); Cerro de Bavájori, 12 mi W of Navojoa, *H. Gentry 7953* (ARIZ, US); Algodones Bay, *D. Goldberg s.n.* (ARIZ); E end of bay at Port Libertad, *E. Graham 3810* (DS); 20 mi N of Port Libertad, *H. Green s.n.* (PH); ca. 30 mi S of Hermosillo on Hwy. 15, *B. Hansen et al. 1375* (MEXU, WIS); 2.1 mi NW of Bahía Kino, *J. Hastings & R. Turner 64-32* (ARIZ, DS); 2 mi N of Tastiota, *J. Hastings & R. Turner 65-168* (ARIZ); 3 mi SSE of Rancho Las Peñitas, 29.8°N, 111.8°W, *J. Hastings & R. Turner 69-112* (ARIZ); Islas Melisas in N part of Guaymas Bay, *J. Hastings et al. 61-39* (ARIZ); Punto Cirio, ca. 7 mi S of Puerto Libertad, *J. Hastings et al. 63-7* (ARIZ); "Catch 22" ca. 5 mi N of San Carlos, 27°57′N, 111°05′W, *A. Johnson 5013* (DAV); "Playas del Sol" ca. 10 mi S of Guaymas, 27°55′N, 110°45′W, *A. Johnson 5052* (DAV); Tiburón Island, Freshwater Bay, *I. Johnston 3250* (CAS); Tiburón Island, 3 mi N of Willards Point, *I. Johnston 4245* (CAS); 5 mi NW of Caborca on road to Tajitos, *D. Keck 4052* (C); 2 mi N of Horcasitas, *M. Kimnach & Lyons 596* (UC, US); 70 mi S of Hermosillo, *G. Lindsay 1133* (DS); Isla San Esteban, SE de la isla, *E. Lott & T. Atkinson 2458* (MEXU); 3 mi S of Mesquite, *F. Long 13* (US); Picu, *D. MacDougal & F. Shreve 15* (US); Kino Pt., *D. MacDougal & F. Shreve 27* (US); Arroyo Desemboque, 20 mi N of Sargento, *T. Mallery & W. Turnage s.n.* (DS); mouth of Salitral Creek at Río Mayo, Rancho Salitral near San Bernardo, *P. Martin 12* (ARIZ); 35 km SSW of Caborca on road to Libertad, ca. 30°28′N, 112°20′W, *P. Martin & S. Nilsson 9* (S); 7 km S of Libertad at Punta Cirio, ca. 29°50′N, 112°39′W, *P. Martin & S. Nilsson 13* (S); Estero Santa Barbara, W of Huatabampito, 26°42′N, 109°38′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Sonoyta River, *E. Mearns 2790* (DS, NY, US); Sierra Seri, ca. 21°17′N, 112°08′W, *E. Moser et al. 18157* (ARIZ); Quitovac between Sonoyta and Caborca, *G. Nabhan et al. 249* (ARIZ); without locality, *E. Palmer s.n.* in 1869 (US); near Guaymas, *W. Palmer 1213* (US); 1/4 mi W of Condominios Pilar, 1 mi S of hwy. to San Carlos, ca. 4 mi W of Hwy. 15, *B. Parfitt & T. Reeves 2398* (ENCB); along Mex. Hwy. 8, near KM 19, S of US-Mexico border at Lukeville/Sonoyta, *L. Parker s.n.* (ARIZ); 6 mi N of Obregón, *K. Parker 8209* (ARIZ); 6 km WNW of San Carlos, 27°57′N, 111°06′W, *M. Quinn & P. Sudt 046* (ARIZ); 6.5 mi W of Río Yaqui along Hwy. 16 near La Barranca, ca. 28°28', 109°32′W, *A. Rea 1200* (ARIZ); Ensenada Chica, 15.1 mi W of Hermosillo to Guaymas Hwy. by dirt road, 6 mi S of San Augustin Beach turnoff, 28°07′N, 111°17′W, *F. Reichenbacher 230* (ARIZ); Mpio. San Pedro de la Cueva, Canada La Pila, 1 km N of Río Moctezuma, ca. 9.5 km NE of San Pedro de la Cueva, 29°18′N, 109°43′W, *A. Reina G. & T. Van Devender 99-255* (CAS); Mpio. Cd. Obregón, 0.5 km S of Estación Corral junction on Mex. 15 on road to Cocorit, 27°37′N, 109°58′W, *A. Reina G. & T. Van Devender 2001-178* (CAS); Mpio. Huatabampo, 6 km NW of Camahuiroa on road to Las Bocas, near Bachomojaqui, ca. 26°34′N, 109°18′W, *A. Reina G. et al. 98-2138* (MEXU); Mpio. Caborca, SE of Puerto Lobos, Ejido Manuel Avila Camacho, 30°16′N, 112°49′W, *A. Reina G. et al. 2000-166* (CAS); Mpio. Altar, Rancho El Rincón, 3.5 km S of Sásabe, 31°26′N, 111°34′W, *A. Reina G. et al. 2003-1291* (CAS); vicinity of Hermosillo, *J. Rose et al. 12374* (GH, NY, US); Kino Bay, *V. Rudd et al. 3042* (ENCB, MEXU); ca. 0.5 km S of Carnegie Peak, Sierra Pinacate, *N. Sakaki et al. 19881* (ARIZ, ENCB); Cañón del Coyote, ca. 4 mi NE of Desemboque, *C. Saravia T. s.n.* (ARIZ); near Port Libertad, *H. Shantz s.n.* (WIS); E trail of Pinacate Peak, 31°45′N, 113°30′W, *W. Sherbrooke s.n.* (ARIZ); inland from San Carlos Bay, Guaymas, *P. Sherwin 215* (DUKE); 5 mi NW of Caborca, *F. Shreve 7535* (ARIZ, F, MO); Cañón Palma, Sierra Libre, *F. Shreve s.n.* (MEXU); E of Pinacate Peak, Pinacate Mountains, *J. Soule s.n.* (ARIZ); Nacopuli Canyon, off road to San Carlos Bay, 28°01′N, 111°03.5′W, *G. Starr & C. Starr 204* (ARIZ); carretera Bahía Kino–Puerto Libertad, 40 km N de intersección con carretera a Hermosillo, 29°30′N, 112°15′W, *H. Suzán 315* (MEXU); Isla Tiburón, NW 20 km de la playa, Sierra Kunkaac, *F. Torres 4* (ENCB); Punto Cirio, ca. 6 mi S of Puerto Libertad, *R. Turner & C. Lowe 60-31* (ARIZ); ca. 12 mi S of Hermosillo, *T. Van Devender s.n.* (ARIZ); 29 mi S of Hermosillo on Hwy. 15, *T. Van Devender s.n.* (ARIZ); 3.2 mi S of Sásabe, *T. Van Devender s.n.* (ARIZ, GH, MEXU); Puerto Los Mochos, Rancho Los Mochos, ca. 20 mi NNE of Desemboque del Río San Ignacio on road to La Ciénega, *T. Van Devender & M. Kearns s.n.* (ARIZ, TEX); Sierra Bacha, Punto Cirio, near Libertad, *T. Van Devender & M. Kearns s.n.* (ARIZ); Mpio. Hermosillo, Cerrito de la Virgen, 5.4 km S of Hermosillo, 28°59′N, 110°58′W,

T. Van Devender & A. Reina G. 2004-2 (CAS); 8 km E of Tecoripa on MEX 16, ca. 28°37′N, 109°50′W, *T. Van Devender & A. Reina G. 2004-27* (CAS); 29.4 mi N of Hermosillo on Hwy. 15, *T. Van Devender et al. 88-838* (ARIZ); mouth of Arroyo Masiaca, Las Bocas on Gulf of California, ca. 52 km S of Navojoa, 26°36′N, 109°20′W, *T. Van Devender et al. 94-386* (ARIZ, CAS); Mpio. Navojoa, Teachive de Masiaca, Arroyo Masiaca, 26°47′N, 109°14′W, *T. Van Devender et al. 94-956* (ARIZ); Mpio. Hermosillo, Bahía de Kino, *T. Van Devender et al. 96-238* (ARIZ, MEXU); Sierra Bacha, SE of Punta Cirio, ca. 29°50′N, 112°37-38′W, *G. Webster 22457* (DAV, MEXU); near Ures, *J. Whitehead M152* (ARIZ); KM 101 on Hermosillo–Moctezuma road, 38.6 mi E of Moctezuma, ca. 29°28′N, 110°15′W, *A. Whittemore et al. 83-100* (CAS, MEXU, TEX); 2 mi W of Libertad, *I. Wiggins 6085* (DS, US); 10 mi N of Hermosillo, *I. Wiggins 6251* (DS, F, UC, US); 5 mi SE of Torres, *I. Wiggins 6286* (DS, UC, US); 17 mi NE of Cajeme toward Tesopaco, *I. Wiggins 6390* (DS, UC, US); 5.7 mi NW of Caborca toward Sonoyta, *I. Wiggins 8257* (DS, UC, US); Sierra Bacha, S of Punta Cirio, *F. Wiseman & W. Spaulding s.n.* (ARIZ).

Justicia candicans (Nees) L.D. Benson in L.D. Benson and R.A. Darrow, Trees and Shrubs of the Southwestern Deserts, ed. 3, 218. 1981. *Adhatoda candicans* Nees in A. de Candolle, Prodr. 11:396. 1847. *Dianthera candicans* (Nees) Hemsl., Biol. Cent.-Amer., Bot. 2:517. 1882. *Jacobinia candicans* (Nees) B.D. Jacks., Index Kew. 1:1246. 1893. TYPE: MEXICO. Oaxaca: "Cordillerae Mexicanae," 5000 ft., November–April 1840, *H. Galeotti 911* (holotype: K ex hb. Hook.!; isotypes: BR!, G!, P!, see discussion).

Jacobinia mexicana Seem., Bot. Voy. *Herald*, 325, t. 66. 1856. TYPE. MEXICO. State undetermined (see discussion): "Sierra Madre," *B. Seemann 2115* (lectotype, designated here, see discussion below: K ex herb. Hook.!).

Jacobinia ovata A. Gray, Proc. Amer. Acad. Arts 21:405. 1886. TYPE: MEXICO. Chihuahua: near Batopilas, Aug-Nov 1885, *E. Palmer 220* (holotype: GH!, photo at DS!; isotypes: G!, NY, US!).

Jacobinia ovata var. *subglabra* S. Wats., Proc. Amer. Acad. Arts 24:67. 1889. *Jacobinia candicans* var. *subglabra* (S. Watson) L.D. Benson in L.D. Benson and R.A. Darrow, Trees and Shrubs of the Southwestern Deserts, ed. 2, 413. 1954. *Justicia candicans* var. *subglabra* (S. Wats.) L.D. Benson in L.D. Benson and R.A. Darrow, Trees and Shrubs of the Southwestern Deserts, ed. 3, 218. 1981. TYPE: MEXICO. Sonora: rocky ravines, Guaymas, Oct 1887, *E. Palmer 264* (holotype: GH!; isotypes: C!, DS!, NY!, UC!, US).

Justicia mexicana Rose, Contr. U.S. Natl. Herb. 1:348. 1895. TYPE: MEXICO. Sonora: Agiabampo, 3-15 Oct 1890, *E. Palmer 788* (holotype: US!; isotypes: GH!, NY!, US!).

Phenology. Flowering: throughout the year, with peaks in March and November (Fig. 1); fruiting: September–April.

Distribution and habitats. Southwestern United States (Arizona), Mexico (Baja California Sur, Chihuahua, Colima, Durango, Guanajuato, Guerrero, Jalisco, Michoacán, Nayarit, Oaxaca, Puebla, Querétaro, Sinaloa, Sonora); Sonoran plants occur on rocky slopes and along watercourses in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Plains of Sonora), palm oases, thornscrub, tropical deciduous forests, and grasslands at elevations from sea level to 1330 m.

Illlustrations. Figure 6; *The Botany of the Voyage of H.M.S.* Herald, t. 66. 1856; *Trees and Shrubs of the Southwestern Deserts*, 3rd. ed., 218. 1981; *Flora del Valle de Tehuacán-Cuicatlán* 23:53. 1999.

Local names. "Ciática" (fide Yetman and Van Devender 2002); "flor de chuparosa" (*Gentry 861*); "maso o'ota" (Mayo, *Van Devender et al. 93-1437*); "muicle cimarrón" (fide Van Devender et al. 2000); "palo de venado" (*Van Devender et al. 93-1437*); "rama venado" (*Van Devender et al. 93-1437*); "vipsumar" (Pima Bajo, *Rea 1262*).

Use. Yetman and Van Devender (2002) noted that the Mayo sometimes brew the leaves into a tea that is drunk as a treatment for malaria.

Locality data on the holotype of *Justicia candicans* at K is as noted above. The first set of Galeotti's collections is at BR, however, and locality information on the presumed isotype there indicates that the plants were collected in Tehuacán, Puebla at an elevation of 5250 ft. in August 1840. *Galeotti 911* at P indicates collection at 5000 ft. in Oaxaca but gives the date as August. Whether these collections represent duplicates of the same gathering in either Oaxaca or Puebla, or whether they represent different gatherings (and thus not duplicates) remains undetermined.

Based on information provided by McVaugh (1972), Seemann's type collection of *Jacobinia mexicana* was likely made in Sinaloa, Durango, or Nayarit. There are two specimens of *Seemann 2115* in Hooker's herbarium at Kew of about equal quality. The one selected as lectotype has original drawings on the sheet similar to those in the protologue. Plants of the type specimen have triangular bracteoles shorter than (i.e., not surpassing) the calyx thereby resembling the Gentry, Krizman & Soule, and Sanders et al. collections from Sonora noted below. *Jacobinia mexicana* was treated as a synonym of *Justicia candicans* by Daniel and Acosta (2003). By citing *Galeotti 911* under *Jacobinia mexicana* Hemsley (1882) also apparently felt that the types of *Jacobinia mexicana* and *Justicia candicans* represented the same taxon. Bentham and Hooker (1876) noted that "Adhatoda sericea Nees" was also a name that applied to *Jacobinia mexicana*; however, I can find no evidence that such a name was ever published by Nees.

Daniel (1997, 1999a) and Daniel and Acosta (2003) provided descriptions of *Justicia candicans*. The species is both widely distributed and morphologically variable. It occurs throughout much of Sonora (Fig. 23), but is especially common in regions of thornscrub and tropical deciduous forest. It occurs in three subdivisions of the Sonoran Desert, but is apparently very rare in the Arizona Upland and entirely absent from the Lower Colorado River Valley. In Sonora, some plants, especially some from near Guaymas, have stems and leaves either glabrous or very sparsely pubescent (e.g., *Brandegee s.n.*, *Felger & Thomas 11837*, *Palmer 264*, *Phillips et al. 75-152*). These have been treated taxonomically as *J. candicans* var. *subglabra*. Other plants, including the type of *Jacobinia ovata* from southwestern Chihuahua and several collections from Sonora (e.g., *Abrams 13218*, *Daniel 3348*, *Joyal 1562*, *Landrum et al. 5436*, *Wiggins 7151*) are densely and evenly pubescent with flexuose eglandular trichomes. Most Sonoran collections have a pubescence intermediate between these extremes. Because there appears to be a continuum in vegetative vesture from glabrous (or with very few trichomes) to densely pubescent, no formal taxonomic status is here accorded the various "pubescence forms" of this species. Few Sonoran plants of *J. candicans* show the well-developed clusters of cobwebby trichomes in axils of major veins on the abaxial surfaces of the leaves that were noted by Daniel and Acosta (2003) for representatives of the species in south-central Mexico. These are evident only in *Gentry 4879* and *Sanders et al. 4619*.

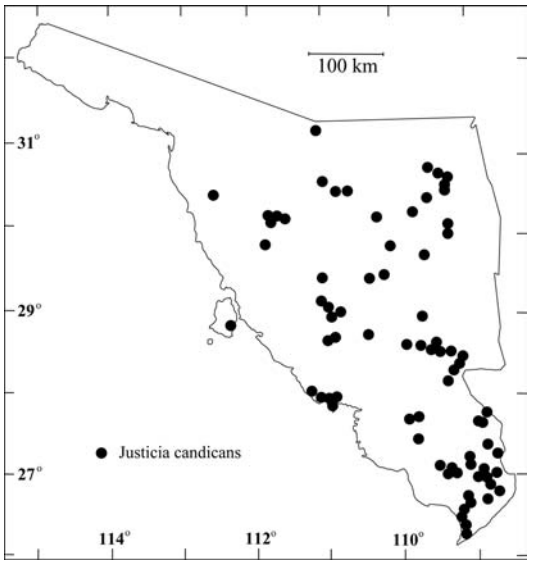


FIGURE 23. Sonoran distribution of *Justicia candicans*.

The types of *Jacobinia ovata, J. ovata* var. *subglabra*, and *Justicia mexicana* resemble the majority of Sonoran plants by having bracteoles lance-subulate to linear to oblanceolate and longer than (or overtopping) the calyx. Several specimens from Sonora (e.g., *Gentry 4879*, *Krizman & Soule s.n.*, and *Sanders et al. 4619*) have triangular to subulate to linear bracteoles that are shorter than the calyx. In this respect, they resemble the type of *Jacobinia mexicana*. Among the presumed type specimens of *J. candicans*, bracteoles vary in length from shorter than (or at least not surpassing) the calyx to equaling the calyx to slightly surpassing it and they vary in shape from lance-linear to linear to linear-elliptic. *Landrum et al. 5425* from Sonora also appears intermediate with its somewhat linear bracteoles that are slightly shorter than to nearly equal to the calyx. Because of the overlap in bracteolar form evident among plants occurring outside of Sonora, all of these plants are treated as comprising a single variable species.

The inflorescence of *Justicia candicans* consists of solitary dichasia in the leaf axils or of condensed dichasiate spikes in the leaf axils. The distal leaves bearing axillary infloresceces sometimes become reduced in size and bractlike, thereby resulting in a terminal, compound inflorescence. This is especially evident in *Felger 397*.

Sonoran collections: 6 mi S of Magdalena, *L. Abrams 13218* (DS); 12 mi NW of Hermosillo, *L. Abrams 13307* (DS); 3 km SSE of El Chinal Road toward Río Cuchujaqui, ca. 22.5 km SSE of Alamos, 26°51′N, 108°54′W, *M. Baker et al. 10371* (TEX); Hotel Playa, Guaymas, *R. Barr & W. Brewer 63-653* (ARIZ, MEXU); Cerro Bocochibampo, Guaymas, *E. Blakley B-1639* (DS); ca. 16 mi S and 6.5 mi W of Trincheras, 30.2°N, 111.6°W, *J. Bowers & R. Turner 2194B* (ARIZ); Guaymas, *T. Brandegee s.n.* (UC); San Javier, microondas on el Cerro El Durazno, 28°37′N, 109°45′W, *A. Búrquez 94-019* (MEXU); Cañón de Nacapule, Sierra el Aguaje, ca. 20 km N de Guaymas 28°01′N, 111°03′W, *A. Búrquez 94-251* (MEXU); 2.5 km S de Hermosillo, 29°01′N, 110°57′W, *A. Búrquez & A. Quijada 92-84* (MEXU); W of Magdalena, *O. Clark 12642* (GH); village 8 mi W of Torres, between Guaymas and Hermosillo, *F. Coville 1643* (US); "Microondas mountain" overlooking Guaymas, along road which is 1.8 mi from Mex. Hwy. 15 on paved road to airport, N of Guaymas, *T. Daniel 1957* (ASU); between Hwy. 16 E of Tonichi and Onavas, 0.5 mi S jct. Hwy. 16, *T. Daniel 3348* (CAS); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Daniel & M. Butterwick 3192* (ASU, CAS); Nacapuli Canyon, 6.3 mi W of Hwy. 15 toward San Carlos, then 4.4 mi N, *T. Daniel et al. 1997* (ASU, CAS), *2336* (ASU, CAS); Mpio. Yécora, Arroyo La Quema, 0.3 km SE of Tepoca on Hwy. 16, ca. 28°26′N, 109°15′W, *T. Daniel et al. 8644* (CAS); Bahía San Carlos, *E. Dawson 1065* (DS); Magdalena, *F. Drouet & D. Richards 3810* (F, US); mountain on E side of Guaymas, *F. Drouet & D. Richards 3853* (F, US); Guaymas, *F. Drouet & D. Richards 3893* (F); mountain W of Alamos, *F. Drouet & D. Richards 3939* (F); Río de Sonora near Unión, Hermosillo, *F. Drouet et al. 3442* (F); 11 mi NE of Baviácora, *F. Drouet et al. 3663* (A, DS, F, MO, US); Palm Canyon, 25 km SSE of Magdalena on road to Cucurpe, 30°28′N, 110°48′W, *D. Ducote et al. 76-6* (ARIZ, MEXU-245739); near Navojoa, *C. Erlanson & M. Souviron 29* (US); Cañón de los Chapotes, E side of Sierra de Alamos, *R. Felger 397* (ARIZ, CAS, MEXU); Tiburón Island, Sierra Kunkaa, ca. 4 mi W of Punta Narragansett, SE part of island, *R. Felger 6972* (ARIZ, ENCB); Cerro Tetas de Cabra, Bahía San Carlos, *R. Felger 85-365* (ARIZ, MEXU); La Sorpresa, SW of Trincheras, ca. 30°10′N, 111°43′W, *R. Felger & A. Russell 6768* (ARIZ); Rancho San Jorge, W of Hermosillo, 29°44′N, 111°51′W, *R. Felger & A. Russell 6920* (ARIZ), *6943* (ARIZ); Cerro del Vigía, Guaymas, *R. Felger & R. Thomas 11837* (ARIZ, CAS, MEXU); 1.6 km W of Estero Solado, ca. 4.5 mi W of Mex. 15 on road to Bahía San Carlos, *R. Felger & D. Valdez Z. 84-541* (ARIZ); Ensenada Grande (= San Pedro Bay, north of San Carlos Bay), *R. Felger et al. 11576* (ARIZ, TEX); Cañón de Nacapules, ca. 6 km NE of Bahía San Carlos, *R. Felger et al. 84-92* (ARIZ, MEXU, TEX); El Novillo, *R. Felger et al. 84-232* (ARIZ); Arroyo Guajaráy, between Los Aguaros and Cajón del Ardilla, 27°39′N, 108°58′W, *R. Felger et al. 94-58A* (ARIZ); Cañón Las Barajitas, Sierra El Aguaje, ca. 18 km NW of San Carlos, ca. 28°03′N, 111°11′W, *R. Felger et al. 95-193* (ARIZ); El Reparo–Middle, old road to Bermudez, 28°21′N, 109°05′W, *G. Ferguson & C. Moore s.n.* (MEXU); ca. 8 mi N of Guaymas on San Carlos Bay, *R. Ferris 8724* (DS); 14.5 mi E of Río Yaqui on Mex. 16, *P. Fischer & G. Yatskievych 6887* (ARIZ); Rancho La Colorada, ca. 1.5 mi SW of Alamos, *J. Fish 189* (UC); 21 mi NE of Los Tanques at jct. with road to La Vinateria, 27°15′N, 108°42′W, *M. Fishbein et al. 96* (ARIZ); El Naranjo, Arroyo Taymuco,

27°15′N, 108°46′W, *M. Fishbein et al. 216* (ARIZ); N of Guaymas on Hwy. 15, *M. Fishbein et al. 221* (ARIZ); Mpio. Guaymas, Sierra El Aguaje, Aguaje Robinson, ca. 10 km NW de San Carlos, 28°03.5′N, 111°07′W, *A. Flores M. & O. Gutierrez R. 5089* (ARIZ, MEXU); Mpio. La Colorada, 4 km antes de San José de Pimas, carr. Hermosillo–Yécora, 28°46′N, 110°37′W, *A. Flores M. & J. Sánchez E. 4871* (ARIZ, MEXU); Mpio. Hermosillo, La Pintada, 50 km S de Hermosillo, 28°35′N, 110°58′W, *A. Flores M. & J. Sánchez E. 5452* (IEB); 9.5 km S on Mex. 15 from Las Bocas Road turnoff, 3.5 km W on Sirebampo Road, 11.5 km S of San José de Masiaca, 26°39′N, 109°15′W, *S. Friedman & J. Zittere 90-95* (ARIZ); 9.8 km W of Mex. 15 on Las Bocas Road, 37 km SE of Huatabampo, 5.6 km E of Las Bocas, 26°39′N, 109°19.5′W, *S. Friedman & J. Zittere 149-95* (ARIZ); Distr. Alamos, Quiricoba, *H. Gentry 743* (DS); Distr. Alamos, Cuchuhacki Arroyo, *H. Gentry 861* (DS); Agua Caliente, Distr. Alamos, *H. Gentry 905M* (ARIZ); Canyon Sapopa, Río Mayo, *H. Gentry 1029* (ARIZ, MO, US); Caramechi, Río Mayo, *H. Gentry 1206* (A, ARIZ, F, MEXU, MO, WIS, S, UC, US); near Las Guásimas, Navojoa–Alamos road, *H. Gentry 4879* (ARIZ, MEXU, MO); Los Cerritos, ca. 40 mi N of Navojoa, *H. Gentry 14393* (ARIZ, US); Sierra Bojihuacame SE of Cd. Obregón, *H. Gentry 14499* (ARIZ, LL, US); Ures, *D. Gold 756* (MEXU, MO); ca. 6 mi W of Santa Ana de Yécora, *D. Goldberg 77-78* (ARIZ); 4.3 km SW of Santa Ana de Yécora, 28°23′N, 109°19′W, *D. Goldberg & R. Frye 77-271* (ARIZ); Las Cuevas, *C. Hartman 159* (GH); Oputo, *C. Hartman 211* (A, GH, PH, US); 11 mi S of Nacozari, *J. Hastings & R. Turner 65-110* (ARIZ); Lo de Campo Ranch, 6 km S of San Javier on Río San Javier, S of Hwy. 16, 28°32.1′N, 109°44.6′W, *P. Holm s.n.* (ARIZ); Mpio. Alamos, Río Cuchujaqui, 27°02′N, 108°42′W, *P. Jenkins 89-430* (ARIZ); Santa Ana de Yécora, *P. Jenkins s.n.* (ARIZ); Guaymas, *I. Johnston 3095* (CAS); San Pedro Bay, *I. Johnston 4312* (CAS); Guaymas, *M. Jones 23264* (CAS, MO, UC); between cerros El Cucurucho and El Aguaje from Alamos to La Higuera, 27°04–05′N, 108°58′W, *E. Joyal 1344* (CAS, MEXU, TEX); Puenta La Pila, above "El Palmar," ca. 20 km E of Onavas, 28°29′N, 109°22′W, *E. Joyal 1562* (CAS, MEXU); 1 mi E of Navojoa, *R. Kirzman & O. Soule s.n.* (ARIZ); road to Sahuaripa, ca. 22 mi E of Hwy. 15 bypass, *L. Landrum et al. 5425* (CAS); 2.6 mi E of bridge at Huásabas, *L. Landrum et al. 5436* (CAS, GH); Arroyo Gochico, ca. 8 km E of San Bernardo, 27°24′N, 108°47′W, *G. Levin et al. 2018* (CAS); Tres Marias limestone quarry, 27°07′N, 109°10′W, *P. Martin s.n.* (ARIZ, C); 8 km E of Alamos on road to Sabinito Sur, *P. Martin & G. Ferguson s.n.* (ARIZ); Cerro Verde, 28°34′N, 109°44′W, *P. Martin & G. Ferguson s.n.* (ARIZ); Puerto El Chino, 26°41.3′N, 108°57.8′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Guaymas, Microwave Mountain, 27°57′N, 110°54′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); NE of Alamos toward Cuchujaqui, 27°01–06′N, 108°53–55′W, *P. Martin et al. s.n.* (ARIZ, CAS); Estación Margarita, 10 km NW of Navojoa, *P. Martin et al. s.n.* (ARIZ); Jorinabo, along Río El Naranjo, 27°15.5′N, 108°46.4′W, *P. Martin et al. s.n.* (ARIZ); Palm Canyon, 17 mi SE of Magdalena on road to Cucurpe, Sierra Baviso, *N. McCarten & R. Bittman 2712* (ARIZ); 30 mi N of Nuri, *S. McLaughlin & M. Karpiscak 518* (ARIZ); Río Yaqui drainage, Cerro Verde to San Javier, 28°35′N, 109°44′W, *K. Moore s.n.* (ARIZ, CAS); San Pedro Bay, 28°03.5′N, 111°17′W, *R. Moran 4038* (DS, UC); Mpio. Guaymas, Cañón Los Anegados, ca. 2.8 km del Rancho El Aguaje de Robinson, 28°02′N, 111°08′W, *L. Moreno M. et al. 41* (ARIZ); Río Moctezuma, 10 mi SW Nacozari, 30°15′N, 109°40′W, *T. Nash et al. L19447* (CAS, US); ca. 43 mi N of Guaymas along Hwy. 15 near microwave station, *D. Norris et al. 20041* (DS, MEXU, MO); 6 mi W of Nuri on road to Movas, *M. O'Rourke & P. Martin s.n.* (ARIZ); Guaymas, *E. Palmer 264* (US); Mpio. Hermosillo, Predio Ranchito de la Sierra, *A. Peinado et al. A-05* (MEXU); S of Magdalena, *F. Pennell 20265* (PH); Nacopuli Canyon, 3.5 mi N of San Carlos Bay, *A. Phillips et al. 75-152* (ARIZ, UC); region of Río Bavispe, Valle de Teras, *E. Phillips 755* (GH); Onavas, ca. 28°28′N, 109°32′W, *A. Rea 1262* (ARIZ); 2.3 mi E of Río de Bavispe by Huásabas to El Coyote and Huachinera Road, 29°56′N, 109°16′W, *F. Reichenbacher 216* (ARIZ); Palm Canyon, 15.5 mi toward Cucurpe from Mex. 15 in Magdalena, *F. Reichenbacher 913* (CAS); 2 mi E of Santa Rosa and 17 mi W of Yécora, *F. Reichenbacher & L. Toolin 1373* (ARIZ); Mpio. Moctezuma, Río Moctezuma at San Clemente de Terapa, 29°41′N, 109°39′W, *A. Reina & T. Van Devender 2003-576* (CAS); Mpio. Soyopa, vicinity of Río Yaqui bridge on Mex. 16, just S of Tonichi, ca. 28°34′N, 109°33′W, *A. Reina et al. 97-09* (ARIZ); Mpio. Nacozari de Garcia, Rancho Agua Caliente (Río Bavispe drainage), 23.2 km SE of Esqueda, 30°39′N, 109°25′W, *A. Reina G. et al. 2004-376* (CAS); Guaymas, *H. Ripley 14294* (CAS); vicinity of Hermosillo, *J. Rose et al. 12481* (F); Sierra de Alamos, *J. Rose et al. 12780* (NY, US); Mpio. Alamos, vic. of Presa Mocuzari, 27 km SW of Alamos, ca. 27°14′N, 109°05′W, *A. Sanders & G. Helmkamp 13319* (CAS); N end of Sierra El Viejo, 25 mi SW of Caborca, ca. 30°22′N, 112°22′W, *A. Sanders et al. 3530* (ARIZ); near Mina Sahuarito, 20 mi

SW of Trincheras, ca. 30°09′N, 111°43′W, *A. Sanders et al. 3582* (ARIZ, CAS, UC); Cerro Prieto (= Cerro Colorado), near summit, 8.6 mi E of Navojoa toward Alamos, ca. 27°15′N, 109°17′W, *A. Sanders et al. 4619* (CAS); near Santa Rosa, 25 mi S of Trincheras, *F. Shreve 6049* (ARIZ, F); 37 mi NE of Cajeme on road to Tesopaco, *F. Shreve 6153* (ARIZ, MEXU); 7 mi S of Magdalena, *F. Shreve 10039* (ARIZ); La Pintada Canyon, Hwy. 15, 32.5 mi S of Hermosillo, *E. Smith 3973* (CAS, MEXU, TEX); Palm Canyon, 17.7 mi SE of Magdalena, road to Curcupe, Cerro Cinta de Plata, 30°29′N, 110°48′W, *G. Starr & K. Birgy 157* (ARIZ); 1.8 mi E of Alamos on road to Guadalupe, 27°02′N, 108°54.5′W, *G. Starr & D. Palzkill 317* (ARIZ); Cerro Dos Negritos, 1.8 mi N of Alamos, 27°03′N, 108°56′W, *G. Starr & D. Palzkill 380* (ARIZ); Microondas hill, Guaymas, *G. Starr & C. Starr 196* (ARIZ); Nacopuli Canyon, 28°01′N, 111°03.5′W, *G. Starr & C. Starr 205* (ARIZ); Canyon de la Bota, N end of Sierra El Tigre, ca. 36 mi E of Esqueda, ca. 30°36′N, 109°13′W, *G. Starr et al. 31* (ARIZ); Mpio. de Alamos, Sierra de Alamos along Arroyo El Huirotal, ca. 26°57′N, 108°57′W, *V. Steinmann 1295* (CAS); Cerro La Salada, 29.4°N, 111.0°W, *R. Turner & D. Brown 85-131* (ARIZ); Bahía San Pedro, 28.1°N, 111.2°W, *R. Turner et al. 79-292* (ARIZ); Sierra Alamos, ca. 4 mi SSW of Alamos, 26°59′N, 108°57′W, *R. Van Devender & T. Van Devender 83-126* (ARIZ); 5.2 mi ENE of Cucurpe on road to Rancho Agua Fria, *T. Van Devender s.n.* (ARIZ); 17 mi SE of Magdalena in Sierra Babiso (= Cerro Cinta de Plata), *T. Van Devender s.n.* (TEX); 8.2 mi E of Restaurante La Pintada on Mex. 15, Cañón La Pintada, Sierra Libre, *T. Van Devender s.n.* (ARIZ); Cañón Babiso, Rancho Babiso, 2.5 mi W of San Carlos Bay, *T. Van Devender & M. Kearns s.n.* (ARIZ); Palm Canyon, Cerro Cinta de Plata, 17.7 mi SE of Magdalena, *T. Van Devender & C. Miksicek s.n.* (ARIZ); Playa La Manga, N of San Carlos Bay, *T. Van Devender & F. Nishida s.n.* (ARIZ); 8.7 km E of Tecoripa on MEX 16, 28°37′N, 109°48′W, *T. Van Devender & A. Reina G. 2004-26* (CAS); ca. 8 mi E of turnoff of Son. Hwy. 12 at Esqueda on road to El Tigre, 30°39′N, 109°25′W, *T. Van Devender et al. 82-32a* (ARIZ); Cañón de la Bota, N end of Sierra El Tigre, ca. 34 km ESE of Esqueda, ca. 30°36′N, 109°13′W, *T. Van Devender et al. 82-52* (ARIZ); Guaymas Microwave Tower road (Microondas El Vigia), *T. Van Devender et al. 84-227* (ARIZ); El Guayabo crossing of Río Cuchujaqui, 2.6 km NE of Sabinito Sur, 14 km ESE of Alamos, 27°00′N, 108°47′W, *T. Van Devender et al. 92-1265* (ARIZ); 8.9 mi ESE of Alamos, Río Cuchujaqui, 26°59′N, 108°49′W, *T. Van Devender et al. 92-1333* (ARIZ); El Rancheria crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos toward El Chinal, 26°51′N, 108°55′W, *T. Van Devender et al. 93-29* (ARIZ, CAS); Mocuzari Dam on Río Mayo, 27°13′N, 109°07′W, *T. Van Devender et al. 93-223* (ARIZ, CAS, MO, TEX); canyon N of Los Aguaros on Arroyo Guajaray, 27°38.5′N, 108°58′W, *T. Van Devender et al. 93-490* (ARIZ, in part); Laguna Barochipa, ca. 3.3 km SSE of Camahuiroa, 26°31′N, 109°16′W, *T. Van Devender et al. 93-1272* (ARIZ, CAS); Saucito Canyon, Rancho La Sierrita, 6 km SSW of Alamos, 26°58.5′N, 108°58′W, *T. Van Devender et al. 93-1366* (ARIZ, CAS); Mpio. Alamos, Cerro El Chorro, 4 km NW of Yocogigua, 26°49′N, 109°03.5′W, *T. Van Devender et al. 93-1437* (ARIZ, CAS); El Rincon Viejo, ca. 4 km N of Alamos, Sierra de Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 93-1509* (ARIZ); 4.3 km SW of Huasaguari on Masiaca–San Antonio de Las Ibarras road, 26°47.5′N, 109°11′W, *T. Van Devender et al. 95-275A* (ARIZ, TEX); 1.5 km SW of Santa Ana on road to Guadalupe Tayopa, 28°23′N, 109°09.5′W, *T. Van Devender et al. 97-213* (ARIZ, MEXU); Ejido Francisco Solis, 7 km ENE of Est. Luis (SE of Navojoa on Mex. 15), 26°35′N, 109°06′W, *T. Van Devender et al. 98-2113* (MEXU); Mpio. Nogales, 3.8 km NE of El Correo (La Arizona), Rancho Las Boregas, Arroyo Planchas de Plata, 31°11.5′N, 111°10′W, *T. Van Devender et al. 2004-214* (CAS); 20.4 mi SE of Magdalena on Cucurpe road, *T. Van Devender et al. s.n.* (ARIZ); E of Restaurante La Pintada (ca. 78 km N of Guaymas on Mex. 15), Cerro Bola in Sierra Libre, *T. Van Devender et al. s.n.* (ARIZ); 3.9 mi SW of Mazocahui, *T. Van Devender et al. s.n.* (ARIZ); San Javier, puerto San Juan a 1.5 km S del poblado, 28°35′N, 109°45′W, *L. Varela & E. Cuamea 97-7* (MEXU); near Bahía San Carlos, W of Guaymas, ca. 27°57′N, 111°04′W, *G. Webster 19725* (ARIZ, MEXU); 39 mi E of San José de Pimas, 28°38′N, 110°00′W, *G. Webster 23808* (MEXU); Cañada Motepori, ca. 9 mi NW of Banamichi crossing, ca. 30°04′N, 110°20′W, *G. Webster & R. Murphey 21475* (ARIZ, GH, MEXU); above Aduana, Sierra de Alamos, 8 km ESE of Alamos, 27°02′N, 109°02′W, *J. Weins et al. 93-092* (ARIZ, CAS); 2 mi E of Rancho San Carlos, on road to Norio, *I. Wiggins 6142* (DS); 23 mi NE of Cajeme on road to Tesopaco, *I. Wiggins 6402* (DS, UC, US); E of La Palma, 5 mi N of Guaymas in Sierra Libres, *I. Wiggins 6478* (DS, F, UC, US); SW side of Babiso Mts., 18 mi SE of Magdalena, *I. Wiggins 7151* (A, ARIZ, DS, UC, US); N of Los Aguaros on Arroyo Guajaray, 27°38′N, 108°58′W, *D. Yetman et al. s.n.* (CAS).

Justicia caudata A. Gray, Proc. Amer. Acad. Arts 21:405. 1886. TYPE: MEXICO. Chihuahua: near Batopilas, Aug-Nov 1885, *E. Palmer 189* (holotype: GH!; isotypes: K!, US).

Phenology. Flowering: March–April, August–November; fruiting: March–April, September–November.

Distribution and habitats. Mexico (Chihuahua, Chiapas, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, Sinaloa, Sonora, Zacatecas), Guatemala; Sonoran plants occur on rocky slopes, along watercourses, and in disturbed areas in tropical deciduous forests and oak woodlands at elevations from 240 to 805 m.

Illustration. *Flora Fanerogámica del Valle de México*, 716. 2001.

Daniel (1995a, 1999a) and Daniel and Acosta (2003) provided descriptions of *Justicia caudata* and discussed some of its variation. The species reaches its northwestern distributional limit in east-central Sonora (Fig. 24). Plants from Sonora are rather homogeneous with the young stems usually sparsely pubescent with retrorse or downward pointing (rarely flexuose) eglandular trichomes 0.2–1 mm long, the abaxial surfaces of the petioles conspicuously glandular pubescent, and the corollas pink-purple with white markings on the lower lip and 18–31 mm long.

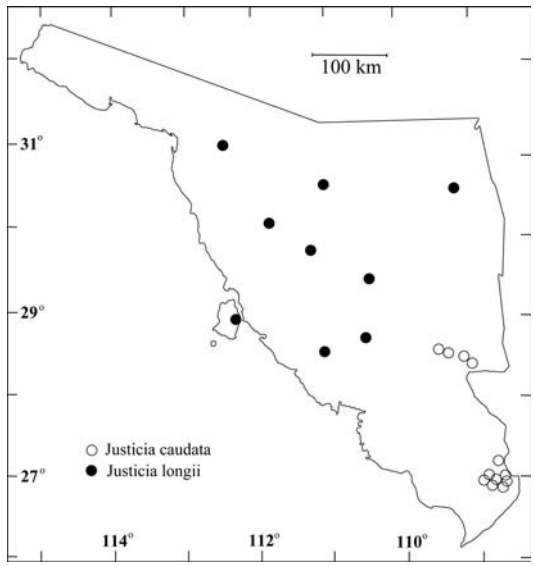


FIGURE 24. Sonoran distributions of *Justicia caudata* and *J. longii*.

SONORAN COLLECTIONS: ca. 3 km N de Tepoca sobre Mex. 16, 28°27′N, 109°16′W, *A. Búrquez M. 94-138* (CAS); southeastern border of Alamos (road to mirador), ca. lat. 27°01′N, long. 108°56′W, *T. Daniel 9771* (CAS); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Daniel & M. Butterwick 3195* (CAS); Alamos area, road to Río Cuchujaqui, *A. Faivre et al. 64* (ARIZ); Arroyo La Barranca de Tonichi, 8.1 mi E of Río Yaqui along Hwy. 16, *M. Fishbein et al. 2448* (ARIZ); 4.3 km SW of Santa Ana de Yécora on road to Nuri, 28°23′N, 109°19′W, *D. Goldberg & S. McLaughlin 77-178* (ARIZ, TEX); Río El Naranjo crossing N of Taymuco, 27°15′N, 108°43′W, *P. Jenkins & P. Martin 88-252* (ARIZ); Mpio. Alamos, upper Río Cuchujaqui, Palmarito Canyon, 27°04′N, 108°45′W, *P. Jenkins et al. 92-82* (ARIZ); Rancho las Uvalamas near Alamos, 26°58′N, 108°55–56′W, *P. Martin & M. McWhorter s.n.* (ARIZ, CAS); Arroyo el Mentidero at El Chinal road, 11.3 km S of Alamos, 26°55′N, 108°55′W, *S. Meyer s.n.* (CAS); Alamos, *E. Palmer 402* (US); 2.5 mi W and 3/4 mi S of Alamos, *R. Perrill & V. Phelps 5168* (ARIZ); 12 km E of Alamos toward upper crossing of Río Cuchujaqui, ca. 27°00′N, 108°50′W, *A. Sanders et al. 9423* (ARIZ, CAS, TEX); Mpio. Alamos, Arroyo Mentidero, from Alamos–El Chinal road to Río Cuchujaqui, 12 km S of Alamos, 26°55′N, 108°55′W, *A. Sanders et al. 12575* (CAS, MEXU); 1 km W of Son. 12 on road to La Quema, 28°22′N, 109°16′W, *T. Van Devender & A. Reina G. 97-1029* (ARIZ, CAS, MEXU, TEX); Mpio. Yécora, Arroyo El Pilladito, near Tepoca, 28°26′N, 109°15′W, *T. Van Devender & A. Reina G. 98-1058* (CAS, MO); Mpio. Yécora, ca. 1.5 km SE of San Nicolas on Mex. 16, *T. Van Devender & A. Reina G. 2000-670* (MO); Arroyo El Cobre, near Choquincahui, 26°59′N, 108°41′W, *T. Van Devender & D. Yetman 94-741* (ARIZ); Arroyo Guirocoba, 2.3 km NE of El Cajón de Sabino, 4.8 km S of Guirocoba, 26°51.5′N, 108°42′W, *T. Van Devender & D. Yetman 94-763* (ARIZ); Arroyo el Mentidero at El Chinal road, 11.3 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender et al. 92-968* (ARIZ), *93-838* (ARIZ, CAS); El Guayabo crossing of Río Cuchujaqui, 2.6 km NE of Sabinito Sur, 14 km ESE of Alamos, 27°00′N, 108°47′W, *T. Van Devender et al.*

92-1224 (ARIZ); El Rincon Viejo, ca. 4 km N of Alamos, Sierra de Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 94-625* (ARIZ, TEX).

Justicia hilsenbeckii T.F. Daniel, nom. nov.

Siphonoglossa mexicana Hilsenb., Madroño 36:198. 1989. TYPE: MEXICO. Sinaloa: Imala, 29 Nov 1939, *H. Gentry 5099* (holotype: CAS!; isotypes: GH, MO, NY, US), non *Justicia mexicana* Rose (1895).

Phenology. Flowering: December; fruiting: December.

Distribution and habitats. Endemic to Mexico (Durango, Guerrero, Jalisco, Michoacán, Morelos, Puebla, Sinaloa, Sonora, and Veracruz); Sonoran plants occur in tropical deciduous forests at an elevation of 500 m.

Illustration. *Madroño* 36:199. 1989.

Local name. "Cordoncillo" (fide Yetman and Van Devender 2002).

Use. The Mayo make a tea from the branches that is used as a wash for rheumatism (Yetman and Van Devender 2002).

A description of this species, as *Siphonoglossa mexicana*, was provided by Hilsenbeck (1989). Daniel (1995a, 1999b) noted that this species, as well as other species of *Siphonoglossa* recognized by Hilsenbeck (1989, 1990a), would appear to be best treated in *Justicia*. Graham (1988) also included the type of *Siphonoglossa* within *Justicia*. A new name is necessary for *S. mexicana* when it is treated in the latter genus. The distinctions among *J. canybi* Greenm., *J. ramosa* (Oerst.) Graham, and *J. hilsenbeckii* do not appear to be substantial. Indeed, Hilsenbeck (1989) noted overlap in morphological traits between *J. canbyi* (as *S. canbyi* (Greenm.) Hilsenb.) and *J. hilsenbeckii* (as *S. mexicana*) and between *J. ramosa* (as *S. ramosa*) and *J. hilsenbeckii* (as *S. mexicana*). As a result, plants treated by Hilsenbeck as *S. mexicana* exhibit considerable variation in many quantitative characters and in pubescence. The entire complex warrants thorough restudy from throughout its range. Morphological data used above in the key to species of *Justicia* in Sonora is derived from the only known Sonoran collection and the type, which greatly resemble one another. The species reaches the northern extent of its distribution in southern Sonora (Fig. 22).

Among Sonoran Acanthaceae, this species might be confused with the morphologically similar one, *J. sonorae*. Sonoran representatives of these two species can be distinguished by the following couplet:

1. Corolla (15–) 19–24 mm long, tube cylindric (expanded only near mouth), 11–19 mm long, 0.6–0.8 mm in diameter at midpoint, lower lip 4–6.5 mm long; thecae 0.9–1.2 mm long, unequally inserted (overlapping by 0.6–0.8 mm); capsule 7–10 mm long. . . . . *J. hilsenbeckii*
1. Corolla 23–35 mm long, tube gradually expanded from near base to apex, 18–23.5 mm long, 1.8–2.7 mm in diameter near midpoint, lower lip 8–17 mm long; thecae 1.2–2.2 mm long, subequally inserted (overlapping by 1–1.5 mm); capsule 10–13.5 mm long. . . . . *J. sonorae*

Sonoran collection: Sierra de Alamos, El Rincón Viejo, Arroyo El Aguaje, ca. 4 km N of Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 93-1508* (ARIZ, CAS).

Justicia longii Hilsenb., Pl. Syst. Evol. 169:231. 1990. *Siphonoglossa longiflora* (Torr.) A. Gray, Syn. Fl. N. Amer. 2(1): 328. 1878. *Adhatoda longiflora* Torr. in W.H. Emory, Rep. U.S. Mex. Bound. 2(1):125. 1859, non *Justicia longiflora* Vis. (1839, 1840). TYPE: MEXICO. Sonora: road between Zuñi and Altar, Sep 1855, *A. Schott III no. 3 (Mex. Bound. Surv. 726*) (holotype: NY!; isotypes: F!, US).

Perennial herbs to 3.5 (–8) dm tall. Young stems subquadrate to multi-striate, evenly pubescent with retrorse to retrorsely appressed eglandular trichomes 0.05-0.8 mm long. Leaves subsessile to petiolate, petioles to 10 mm long, blades linear-lanceolate to lanceolate to elliptic to ovate, 5–70 mm long, 2–12 (–18) mm wide, 2–10 times longer than wide, (rounded to) acute to acuminate to subfalcate at apex, acute to subattenuate at base, surfaces pubescent with mostly antrorse eglandular trichomes 0.05-0.8 mm long, trichomes sometimes becoming restricted to major veins on mature leaves. Inflorescence of axillary sessile to subsessile (i.e., borne on peduncles to 1 mm long) dichasia; dichasia opposite at distal leaf nodes, 1 per axil, 1–3 (or more)-flowered. Bracteoles often subfoliose, linear to lance-elliptic, 4–24 mm long, 0.5–4.7 mm wide, abaxial surface pubescent like leaves; secondary bracteoles, if present, usually similar to bracteoles except smaller (sometimes becoming ± subulate). Flowers sessile. Calyx 5-lobed, 4–9 (–12) mm long, lobes linear to lance-elliptic, 3.5–8 (–10.5) mm long, 0.7–2.1 mm wide, narrowed proximally (i.e., widest above base), abaxially puberulent with antrorse eglandular trichomes 0.05 mm long. Corolla entirely white, 31–55 mm long, externally pubescent with flexuose to retrorse eglandular trichomes 0.1–0.3 mm long, tube cylindric, 23–43 mm long, 1–1.5 mm in diameter near midpoint, upper lip 5–12 mm long, 2-lobed at apex, lobes 0.5–1 mm long, 0.8–1.2 mm wide, lower lip 6–13 mm long, lobes 4–12 mm long, 3–5.6 mm wide. Stamens 4–7 mm long, filaments glabrous; thecae 1–2 mm long (including basal appendage), equal to subequal in size, parallel to subparallel, unequally inserted (overlapping by 0.6–1 mm), glabrous, both with a basal appendage or the upper theca lacking an appendage, basal appendages 0.2–0.3 mm long; pollen (Fig. 21) 3-aperturate, apertures flanked on each side by 2 (–3) rows of insulae. Style (23–) 32–41 mm long, pubescent with eglandular trichomes, stigma 0.2–0.3 mm long, subhemispheric to ± equally 2-lobed. Capsule 6.5–10 mm long, glabrous, stipe 2.5–4 mm long, head ovoid to ellipsoid to subglobose. Seeds 4, lenticular, 2–2.7 mm long, 2–2.5 mm wide, surface and margin bubbly-tuberculate.

Phenology. Flowering: March, August–December; fruiting: March, September–December.

Distribution and habitats. Southwestern United States (Arizona, Texas), northwestern Mexico (Sonora); Sonoran plants occur on rocky slopes in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Plains of Sonora) and thornscrub at elevations from 380 to 910 m.

Illustrations. Figure 25; *Plant Systematics and Evolution* 169:228. 1990.

In the protologue of *Adhatoda longiflora* Torrey cited: "road between Zuñi and Alta Sonora, September; *Schott*." Hilsenbeck annotated the sole specimen in Torrey's herbarium at NY with this information as the lectotype. It is here regarded as the holotype. On a sheet at F, there are four Schott labels (road between Zuñi and Altar, 1855, III.3.; near Pozo de Marias, no date, no number; Sta. Magdalena, no date, 1; near Sta. Gertruda del Altar, no date, no number) and seven shoots (all pertaining to *J. longii*), but with no correlation of labels and shoots. Hilsenbeck annotated the "specimen" as an isolectotype of *Adhatoda longiflora*. Because at least one of these labels agrees with information on what is here considered to represent the holotype at NY, an isotype is present among the various collections on this sheet.

Although Hilsenbeck (1990b) provided a recent description of *Justicia longii*, his circumscription of the species included *J. masiaca* as well. Thus, a description of *J. longii* based on plants from throughout its range is provided here. The species is nearly endemic to the Sonoran Desert region and reaches the southern limit of its distribution in central Sonora (Fig. 24). Because the species has been collected in Chihuahuan desertscrub in western Texas, it should be sought in the isolated region of that community in northeastern Sonora.

The distinctions between *J. longii* and *J. masiaca* are apparently all associated with the flowers; as a result, non-flowering collections can be difficult to identify. For example, *Daniel 981* lacks flowers and is tentatively treated as the former species primarily on the basis of the location where

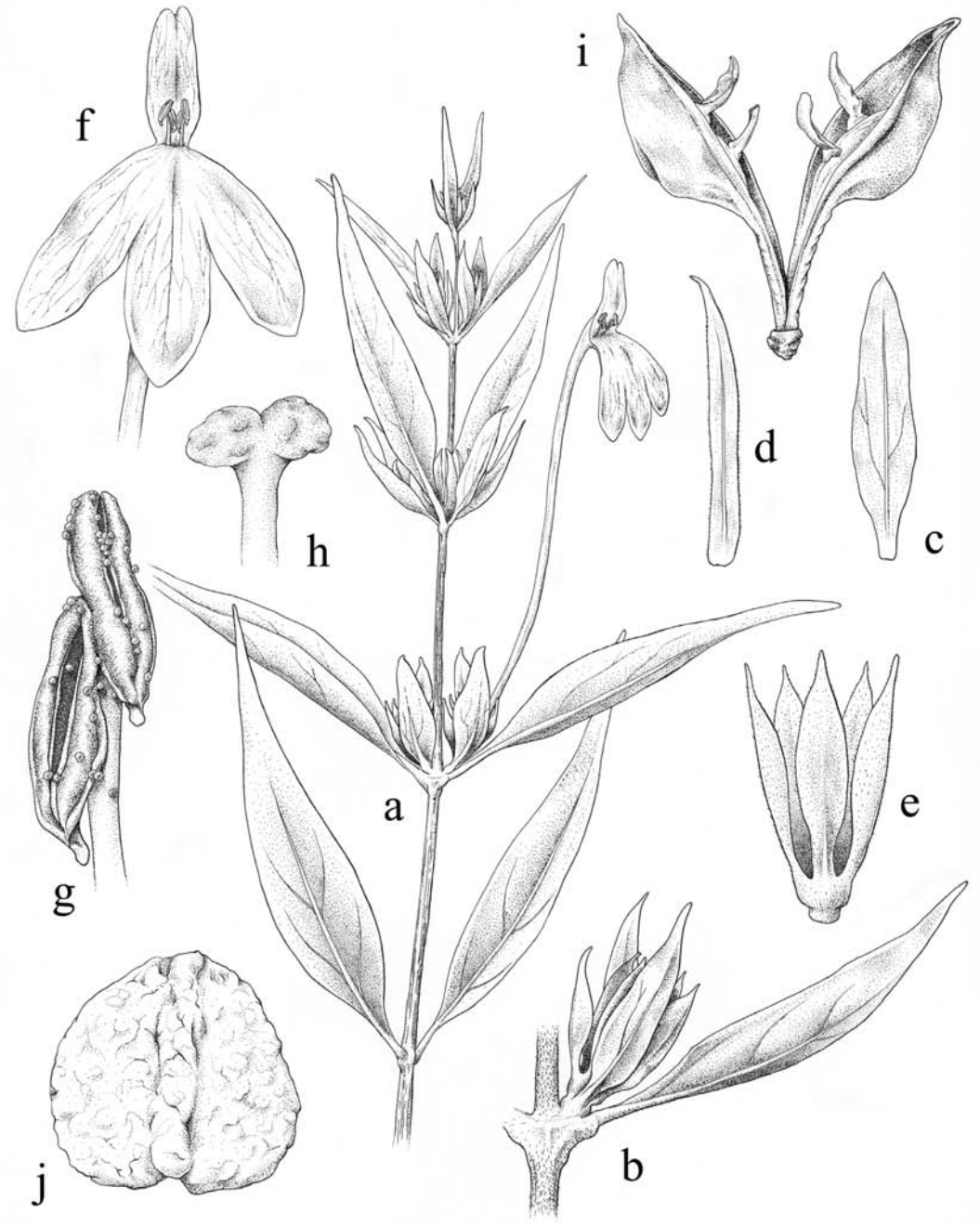


FIGURE 25. *Justicia longii*. a. Habit (*Jenkins & McLaughlin 1016*), ×1.2. b. Node (*Daniel 159*), ×4.5. c. Bracteole (*Jenkins & McLaughlin 1016*), ×2.7. d. Secondary bracteole (*Jenkins & McLaughlin 1016*), ×5.6. e. Calyx (*Turner et al. 78-45*), ×5.6. f. Distal portion of corolla and stamens (*Jenkins & McLaughlin 1016*), ×1.9. g. Anther (*Butterwick & Hillyard 7384*), ×29. h. Stigma (*Gould et al. 2799*), ×42. i. Capsule (*Daniel 159*), ×5.9. j. Seed (*Daniel 119*), ×15. Drawn by Alan Chou.

it was collected (which is nearer to populations of *J. longii* than to those of *J. masiaca*).

SONORAN COLLECTIONS: between La Colorada and Tecoripa, 12.6 mi E of La Colorada, *T. Daniel 981* (CAS); Isla Tiburón, NE [NW fide Felger, pers. comm.] of Santa Rosa, *R. Felger 9349* (ARIZ, MEXU); S end of Sierra Libre, 12.3 mi S of La Palma on Hwy. 15 (at KM 190), then 4.9 mi E of Hwy. to 0.1 mi below summit of Microondas Avispas, 28°29′N, 111°02′W, *R. Felger & F. Reichenbacher 85-1099* (ARIZ, MEXU, TEX); La Sorpressa, SW of Trincheras, 3010′N, 11143′W, *R. Felger & A. Russell 6756* (ARIZ); 12.3 mi W of Mex. 15 on Tecolote Road (1.2 mi N of El Oasis), 29°47′N, 111°15′W, *R. Reichenbacher 1060* (ARIZ); Mpio. Ures, 4 km NNW of Ures on road to Rayón, Río Sonora drainage, 29°27′N, 110°25′W, *A. Reina G. & T. Van Devender 2001-07* (ARIZ, MEXU, CAS); Mpio. Nacozari de García, Rancho Agua Caliente (Río Bavispe drainage), 23.2 km SE of Esqueda, 30°39′N, 109°25′W, *A. Reina G. et al. 2004-379* (CAS); near Mina Sahuarito, S of Cerro San Luis on road from Mina San Ignacio, 20 mi SW of Trincheras, ca. 30°09′N, 111°43′W, *A. Sanders et al. 3583* (ARIZ, CAS, UC); 7 mi S of Magdalena, *F. Shreve 6657* (ARIZ); 36 mi NW of Caborca and 16.5 mi NW of Tajitos, 31.2°N, 112.5°W, *R. Turner & J. Hastings 72-36* (ARIZ, MEXU); between Magdalena and Santa Ana, 7 mi S of Magdalena, *I. Wiggins 7190* (DS, F, GH, MICH, UC, US).

Justicia masiaca T.F. Daniel, Brittonia 47:408. 1995. TYPE: MEXICO. Sonora: between Masiaca and Alamos, 1.6 mi NE of Masiaca and 7.1 mi NE of Hwy. 15, ca. 26°47′N, 109°14′W, ca. 60 m, 14 Jan 1983, *T. Daniel et al. 2546* (holotype: CAS!; isotypes: ARIZ!, ASU!, ENCB!, MEXU!, MICH!, NY!, US!).

Phenology. January–March; August–October; fruiting: January–March; August–October.

Distribution and habitats. Northwestern Mexico (Sonora, Sinaloa); Sonoran plants occur in thornscrub and desert grasslands at elevations from 60 to 1100 m.

Illustration. *Brittonia* 47:409. 1995.

Daniel (1995c) provided a description of this species, which reaches its northern distributional extent in the grasslands of northeastern Sonora (Fig. 26).

SONORAN COLLECTIONS: Mpio. Navojoa, ca. 2 km N of Teachive, SW end of Cerro Terucuchi, 26°48′N, 109°14′W, *A. Reina et al. 96-581* (CAS, MEXU); ca. 1 mi SW of Mesa Masiaca, E side of Hwy. 15, 8.8 mi S of jct. with Hwy. 176 near KM 116 (S of Navojoa), *T. Van Devender & A. Sanders 92-1058* (ARIZ, CAS, MO, TEX); 1.3 km W of Hwy. 15 on Huatabampo Rd, ca. 22 km S of Navojoa, 26°49′N, 109°23′W, *T. Van Devender et al. 93-257* (ARIZ, ASU, CAS, DAV, MO, SD, TEX, UCR); 9.3 km E of Masiaca on road to Yocojigua, 26°45′N, 109°08′W, *T. Van Devender et al. 93-827* (ARIZ, CAS); region of the Río de Bavispe, Cañón de las Bellotas, *S. White 3590* (GH); region of the Río de Bavispe, Cañón del Agua Amarga, *S. White 3590* (ARIZ, US).

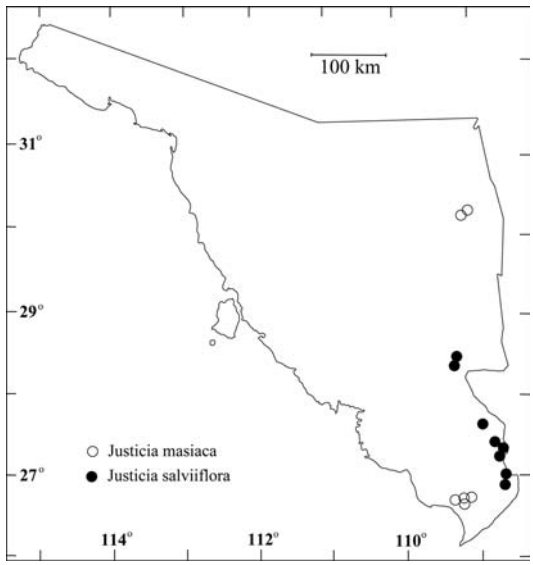


Figure 26. Sonoran distributions of *Justicia masiaca* and *J. salviiflora*.

Justicia phlebodes Leonard & Gentry, Brittonia 6:327. 1948. TYPE: MEXICO. Sinaloa: Sierra Tacuichamona, between Culiacán and Mazatlán and S of the Río San Lorenzo, near Africa, 17 Feb 1940, *H. Gentry 5652* (holotype: US; isotypes: DS!, GH!, MICH).

Perennial herbs to 1 m tall. Younger stems subterete to subquadrate, pubescent with flexuose to retrorse to retrorsely appressed eglandular trichomes 0.3–1 (–1.5) mm long, trichomes concen-

trated in or restricted to 2 lines or ± evenly disposed. Leaves petiolate, petioles to 30 mm long, blades ovate-elliptic to elliptic to subcircular, 29–122 mm long, 12-70 mm wide, 1.1–2.7 times longer than wide, acute to subacuminate at apex, (truncate-subattenuate to) attenuate at base, surfaces pubescent (trichomes sometimes restricted to major veins) with flexuose to antrorse eglandular trichomes to 1 mm long, margin entire to subsinuate, usually ciliate. Inflorescence of axillary (in axils of leaves or inflorescence bracts distally) or terminal dichasiate spikes (or panicles of spikes), rachises (of both panicles and spikes) evenly pubescent with erect eglandular (sometimes inconspicuous) and glandular trichomes 0.05–0.3 mm long (glandular pubescent); dichasia opposite (to alternate), sessile, 1 per axil, 1-flowered. Bracts (including those subtending spikes and dichasia) elliptic to obovate, 4–7 mm long, 1.2–3 mm wide, abaxial surface glandular pubescent. Bracteoles lance-linear to linear, 4.8–6.5 mm long, 0.5–0.7 mm wide, abaxial surface glandular pubescent. Flowers sessile. Calyx 4-lobed, (5–) 6.5–9 mm long, lobes linear, (4.5–) 5.2–7.5 mm long, equal to subequal in length, 0.4–0.7 mm wide, abaxially glandular pubescent. Corolla 19–28 mm long, pink-purple, externally glandular pubescent, tube cylindric (expanded slightly only near apex), 13-23 mm long, 0.9–1.2 mm in diameter near midpoint, upper lip 4–6 mm long, entire to 2-fid at apex, lobes to 0.6 mm long, lower lip 4–7 mm long, lobes 3–4.5 mm long, 2–3.5 mm wide. Stamens inserted near apex of corolla tube, 3.5–5 mm long, filaments glabrous, thecae pink-purplish, subparallel to parallel, superposed (gap 0.4–0.7 mm long), unequal in size, upper theca 1.3–1.5 mm long, glabrous, lacking a basal appendage, lower theca 1–1.2 mm long (including basal appendage), glabrous, with a basal appendage 0.2 mm long; pollen (Fig. 20) 2-aperturate, apertures flanked on each side by 2–2.5 rows of insulae (to peninsulae). Style pink-purplish, 16.5–22 mm long, pubescent (at least proximally) with eglandular (and sometimes a few glandular) trichomes, stigma 0.4–0.5 mm long, only 1 lobe evident. Capsule 7–8 mm long, externally glandular pubescent (or with some of the eglandular trichomes retrorse), stipe 2–2.5 mm long, head subellipsoid with a slight medial constriction. Seeds 4 per capsule, sublenticular, 1.5–1.7 mm long, 1–1.3 mm wide, surface and margin tuberculate.

Phenology. Flowering: March, October–November; fruiting: March, October–November.

Distribution and habitats. Northwestern Mexico (Chihuahua, Durango, Sinaloa, Sonora); Sonoran plants occur in canyons and along watercourses in tropical deciduous forests and oak-pine forests at elevations from 320 to 1250 m.

Illustration. Figure 27.

Local name. “Cordoncillo” (*Fishbein et al. 178*).

Justicia phlebodes is endemic to northwestern Mexico and reaches the northwestern extent of its distribution in southern Sonora (Fig. 28).

Sonoran collections: trail to Tepopa from El Chiribo, 27°19′N, 108°44′W, *M. Fishbein et al. 178* (ARIZ), *199* (ARIZ); Mpio. Alamos, upper Río Cuchujaqui, Arroyo Santa Bárbara, 27°06.5′N, 108°43′W, *P. Jenkins et al. 92-99* (ARIZ, CAS, MO); Rancho San Pedro, El Cajón along Río Cuchujaqui, *P. Martin s.n.* (ARIZ); Rancho San Pedro, 23 km E, 4 km N of Alamos, 27°03′N, 108°42′W, *P. Martin et al. s.n.* (ARIZ); canyon N of Los Aguaros on Arroyo Guajaráy, 27°38.5′N, 108°58′W, *T. Van Devender et al. 93-483* (ARIZ, CAS).

Justicia salviiflora H.B.K., Nov. Gen. Sp. 2:233. 1818. *Sarotheca salviiflora* (H.B.K.) Nees in A. de Candolle, Prodr. 11:382. 1847. TYPE: cultivated in a Mexican botanical garden (fide protologue) (holotype: P-Bonpl.!; isotype: P!).

Justicia paniculata Rose, Contr. U.S. Natl. Herb. 1:348. 1895, non Burm f. (1768) nec Forsk. (1775) nec Sessé & Moc. (1887). TYPE: MEXICO. Colima: vicinity of Colima, 9 Jan–6 Feb 1891, *E. Palmer 1143* (holotype: US!; isotypes: K!, US!).

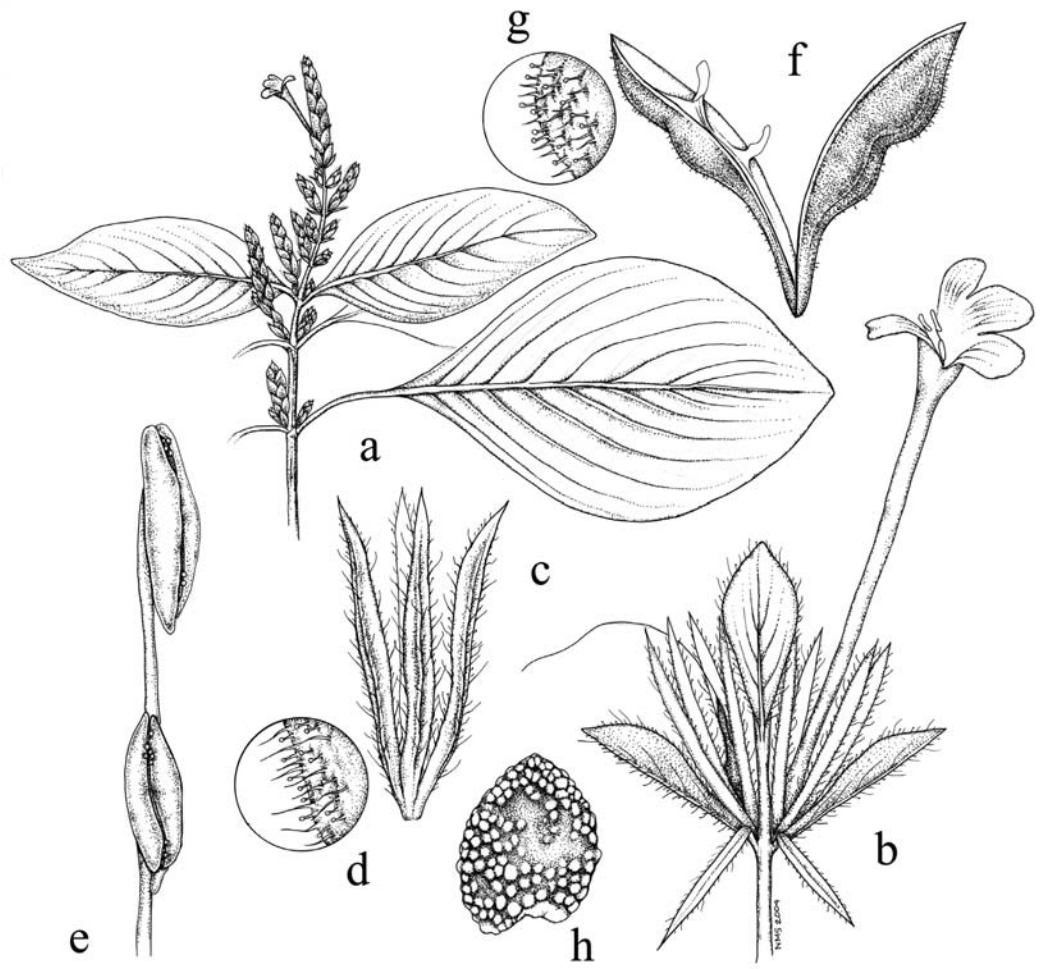


FIGURE 27. *Justicia phlebodes*. a. Habit (*Gentry 5652*), × 0.5. b. Inflorescence node with flower (*Van Devender et al. 93-483*), × 3.2. c. Calyx (*Van Devender et al. 93-483*), × 5.3. d. Trichomes on abaxial surface of calyx (*Van Devender et al. 93-483*), × 18. e. Distal portion of stamen with anther (*Van Devender et al. 93-483*), × 24. f. Capsule (*Jenkins et al. 92-99*), × 5.7. g. Trichomes on outer surface of capsule (*Jenkins et al. 92-99*), × 25. h. Seed (*Van Devender et al. 93-483*), × 17. Drawn by Nadia Strasser.

Phenology. Flowering: March–April; fruiting: March–April.

Distribution and habitats. Mexico (Chiapas, Chihuahua, Colima, Durango, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Sinaloa, Sonora); Sonoran plants occur along watercourses, on rocky slopes, and in disturbed areas in tropical deciduous forests and oak woodlands at elevations from 310 to 580 m.

Illustrations. Figure 9; *The Botany of the Voyage of H.M.S.* Herald, t. 67. 1856; *Flora of Chiapas* 4:78. 1995.

Daniel (1995a) provided a detailed description of this species, which reaches the northern and western extents of its distribution in southeastern Sonora (Fig. 26). Sonoran plants are perennial herbs or shrubs that sometimes appear somewhat vinelike with secondary rooting at the nodes. Corollas are whitish with a green upper lip and purple striped ridges on the lower lip.

SONORAN COLLECTIONS: Arroyo Guajaráy, between Los Aguaros & Cajón del Ardilla, 27°39′N, 108°58′W, *R. Felger et al. 94-58A* (ARIZ); Río Mayo Region, Agua Salado, 15 mi NE of Los Tanques, 27°15′N, 108°46′W, *M. Fishbein et al. 85* (ARIZ); Río Mayo Region, Arroyo Guajaráy, just N of Los Aguaros, 27°38′N, 108°58′W, *M. Fishbein et al. 1565* (ARIZ, CAS); Río Mayo Region, Tepopa, *H. Gentry 1433* (A, ARIZ, F, MEXU, MO, UC, WIS), *1435* (MEXU); Río Mayo Region, Arroyo Gochico, *H. Gentry 3624* (ARIZ, F, GH, MEXU, MO, UC, US); Mpio. Alamos, Upper Río Cuchujaqui, cajón of the Cuchujaqui, 27°02′N, 108°42′W, *P. Jenkins 89-438* (ARIZ, CAS); Mpio. Yécora, Arroyo del Pilladito, near Tepoca, 28°26′N, 109°15′W, *A. Reina G. & T. Van Devender 97-337* (ARIZ, CAS, MEXU, TEX); Mpio. Alamos, 9.5 km N of Güirocoba along road to Choquincahui (El Cobre), ca. 26°58′N, 108°41′W, *V. Steinmann et al. 616* (ARIZ, MEXU); 1 km W of Son. 12 (Tepoca-Cd. Obregón Hwy.) on road to La Quema, 28°22′N, 109°16′W, *W. Trauba 216-98* (CAS).

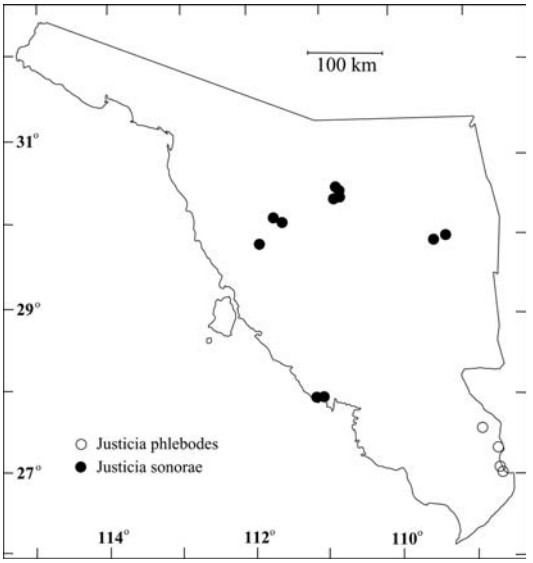


FIGURE 28. Sonoran distributions of *Justicia phlebodes* and *J. sonorae*.

Justicia sonorae Wassh., Phytologia 49:65. 1981. TYPE: MEXICO. Sonora: 17.2 mi SSE of Magdalena, palm canyon in Cerro Cinta de Plata (= Sierra Babiso), 13 Feb 1977, *T. Van Devender s.n.* (holotype: US!; isotypes: ARIZ!, GH!, UC!).

Ascending to erect perennial herbs to 4.5 dm (–1 m) tall. Young stems subterete to quadrate-sulcate to hexagonal, glabrous or evenly to bifariously to unifariously pubescent with flexuose to retrorse (to retrorsely appressed) eglandular trichomes 0.2–1 mm long, sometimes also with scattered glandular trichomes (usually restricted to distal few internodes) 0.05–0.3 mm long. Leaves (plants sometimes leafless during anthesis) petiolate, petioles to 5 (–7) mm long, blades lance-ovate to ovate (to cordate), 7–55 mm long, 3–22 mm wide, 1.3–2.8 times longer than wide, acute to acuminate at apex, truncate to rounded to acute at base, surfaces pubescent with mostly erect to flexuose eglandular trichomes to 1 mm long. Inflorescence of axillary or terminal dichasiate spikes to 15 cm long, these sometimes basally branched (and thus becoming a panicle of spikes), spikes (when several) collectively forming a terminal ± leafy panicle, spike rachises evenly pubescent with erect to flexuose to retrorse eglandular and glandular trichomes 0.05–0.3 mm long (glandular pubescent); dichasia (alternate to) opposite (sometimes opposite a fertile branch), sessile, 1 per axil, 1-flowered. Bracts opposite, triangular-subulate to lance-subulate, 1–4.8 mm long, 0.8–1.5 mm wide, abaxial surface glandular pubescent (or the glandular trichomes sometimes absent). Bracteoles lance-subulate, 1.2–3.2 mm long, 0.3–0.8 mm wide, abaxial surface pubescent like bracts. Flowers sessile. Calyx 4–5-lobed, 3–6 mm long, 4 lobes equal, lanceolate, 2.5–5 mm long, 0.4–0.7 mm wide, abaxially glandular pubescent, posterior 5th lobe (if present) filiform, 0.3–2 mm long. Corolla pinkish purple with white markings on lower lip, 23–37 mm long, externally glandular pubescent, tube funnelform (gradually expanded distally), 18–25 mm long, 1.8–2.7 mm in diameter near midpoint, upper lip 6.5–12 mm long, entire, lower lip 8–17 mm long, lobes elliptic, 4–9 mm long, 3–6 mm wide. Stamens inserted near apex of corolla tube, 7–11 mm long, filaments glabrous, thecae 1.2–2.2 mm long, subequal, parallel to subparallel, subequally inserted, lacking

basal appendages, glabrous (or sometimes the upper theca dorsally pubescent with eglandular trichomes to 0.1 mm long); pollen (Fig. 20) 2-aperturate, apertures flanked on each side by 2 rows of insulae. Style 19–34 mm long, proximally pubescent with eglandular trichomes, stigma 0.3–0.4 mm long, 1 lobe 0.3–0.4 mm long, other lobe not evident or up to 0.2 mm long. Capsule 10–13.5 mm long, externally glandular pubescent, stipe 3–5.5 mm long, head ellipsoid with a slight medial constriction. Seeds 4, 1.8–2.5 mm long, 1.4–2.3 mm wide, surfaces and margin bubbly tuberculate. (n = 11).

Phenology. Flowering: September–April; fruiting: November–April.

Distribution and habitats. Southwestern United States (Arizona) and northwestern Mexico (Sinaloa, Sonora); Sonoran plants occur along watercourses and on slopes in Sonoran desertscrub (Central Gulf Coast, Plains of Sonora), palm oases, and thornscrub at elevations from near sea level to 1230 m.

Illustration. Figure 6; *Phytologia* 49:67. 1981.

Justicia sonorae is known from relatively few collections, but appears to have a broad distribution in Sonora (Fig. 28). The species shares several morphological features (e.g., inflorescence form and pubescence, corolla shape and pubescence, pollen, capsule shape and pubescence) with *J. hians* (Brandegee) Brandegee of Baja California Sur. These species can be distinguished by the following couplet:

1. Single-flowered dichasia alternate along rachis; calyx with 5 conspicuous lobes (posterior lobe only slightly shorter than other four lobes); corolla orange red, upper lip 12.5–16.5 mm long, 2-lobed at apex, lobes of lower lip 1.8–3.5 mm wide; young stems evenly and densely pubescent with trichomes 0.05–0.1 (–0.2) mm long; Baja California Sur. . . . . *J. hians*
1. Single-flowered dichasia mostly opposite along rachis; calyx with 4 conspicuous lobes (posterior fifth lobe, if present, inconspicuous and less than 1/2 as long as other 4 lobes); corolla pinkish purple, upper lip 6.5–11 mm long, entire at apex, lobes of lower lip 4–8 mm wide; young stems glabrous or evenly to bifariously to unifariously pubescent with trichomes 0.2–1 mm long; Arizona, Sonora, and Sinaloa. . . . . *J. sonorae*

Justicia sonorae is also similar to the Oaxacan species *J. santelisiana* Acosta & T.F. Daniel. The latter species differs by the eglandular (only) trichomes on the external surface of the corollas and capsules, smaller (2–3.7 mm long and 1.8–3.3 mm wide) lobes of the lower lip of the corolla, longer (12–16 mm) stamens, longer (13.5–15 mm) capsules, and longer (2.7–3 mm) seeds.

Other plants that resemble *J. sonorae* are represented by two collections from the vicinity of Bahía Topolobampo in northwestern Sinaloa (e.g., *Reina G. et al. 98-2070* at ARIZ, ASU, CAS, MEXU, NY; *Gentry 14312* at US). These plants have red corollas and few glands on the inflorescence rachis, but appear otherwise indistinguishable from pink-purple-flowered individuals of *J. sonorae*, in which species they are tentatively included as a red-flowered form. *Rose et al. 13291* (US) was also collected from the vicinity of Topolobampo. Color of the corolla is neither noted nor preserved on this specimen, but it more closely resembles the majority of collections of *J. sonorae* by having a conspicuously glandular rachis.

Sonoran collections: 0.8 mi W of abandoned mine in pass between Cerro San Luis and Sierra Santa Rosa, 30.1°N, 111.6°W, *J. Bowers & R. Turner 2196* (ARIZ); Palm Canyon, 17 mi SE of Magdalena in Cerro Cinta de Plata (Sierra Babiso), *M. Fay 714* (ARIZ); Cerro Tetas de Cabra, Bahía San Carlos, *R. Felger 85-366* (ARIZ, MEXU, TEX); Rancho San Jorge, W of Hermosillo, ca. 29°44′N, 111°51′W, *R. Felger & A. Russell 6909* (ARIZ); Cañón Nacapules, ca. 4 km N of Bahía San Carlos, *R. Felger & B. Straub 85-1301* (ARIZ); Bahía San Carlos, *H. Gentry 11341* (ARIZ, LL); 2.6 mi E of bridge at Huásabas, *L. Landrum et al. 5435* (CAS, GH, MO, NY); Algadones Bay area, 4 mi W of San Carlos Bay, *P. Martin s.n.* (ARIZ); Palm

Canyon, 17 mi SE of Magdalena on road to Cucurpe, Sierra Baviso, *N. McCarten & R. Bittman 2693* (ARIZ); 7.7 mi S of Cucurpe, *L. McGill et al. 6534* (ENCB); Palm Canyon, 15.5 mi SE of Mex. 15 at Magdalena toward Cucurpe, *F. Reichenbacher 916* (ARIZ, CAS); N end of Sierra Santa Rosa, 22 mi SSW of Trincheras, ca. 30°06′N, 111°39′W, *A. Sanders et al. 3600* (CAS, UC); 10 mi N of San Carlos, *D. Shaw 30* (MO); Palm Canyon, 17 mi SE of Magdalena, Cerro Cinta de Plata (Sierra Babiso), *D. Steadman & K. Schmidt s.n.* (ARIZ); near Palm Canyon, 17 mi E of Magdalena, *R. Thompson & O. Davis 82-44* (ARIZ); Mpio. Santa Ana, Rancho El Otate, Arroyo Los Otates, 30°18′N, 110°53′W, *T. Van Devender & A. Reina G. 98-434* (ARIZ, CAS, MEXU, NY, TEX); 20.4 mi SE of Magdalena on Cucurpe road, *T. Van Devender et al. s.n.* (ARIZ); KM 101 on Hermosillo-Moctezuma road, 38.6 mi E of Moctezuma, 29°28′N, 110°15′W, *A. Whittemore et al. 83-099* (TEX).

Justicia spicigera Schltdl., Linnaea 7:395. 1832. *Jacobinia spicigera* (Schltdt.) L.H. Bailey, Standard Cyclopedia of Horticulture, 1715. 1915. TYPE: MEXICO. Veracruz: Jalapa, May 1829, *A. Schiede s.n.* (syntype: B, destroyed; isosyntypes: BR!, GH; probable isosyntypes: E!, P!); Veracruz: cultivated at Hacienda de la Laguna, Jul 1829, *A. Schiede s.n.* (syntypes: B, destroyed, P!; isosyntype: BM!).

See Daniel (1995a) for a complete list of synonyms.

Phenology. Flowering: March, July; fruiting: unknown.

Distribution and habitats. Mexico (Baja California Sur, Chiapas, Guerrero, Hidalgo, Jalisco, México, Michoacán, Nayarit, Oaxaca, Puebla, Querétaro, Veracruz, Yucatán), Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica; Sonoran plants are cultivated (and possibly persisting after or escaping from cultivation) at elevations from 330 to 700 m.

Illustrations. *Fieldiana, Botany* 24(10):401. 1974; *Flora of Baja California*, 193. 1980; *Flora of the Bahama Archipelago*, 1352. 1982; *Mexican Roadside Flora*, 25. 1987.

Local name. “Niple” (*Joyal 2059*).

Use. Leaves are boiled with cinnamon to yield a clear, red tea that is taken for stomach pain (*Joyal 2059*).

Daniel (1995a) and Daniel and Acosta (2003) provided descriptions of this species. *Rose et al. 13020* was noted to have been “apparently” cultivated and *Joyal 2059* was noted to be planted in a “house garden.” *Justicia spicigera* is widely cultivated throughout Mexico such that the actual native distributional range of the species is not known with certainty. It is undoubtedly considerably smaller than suggested by the states listed above.

Sonoran collections: Mpio. Onavas, Rancho El Palmar, 20 km E of Onavas, 28°29–30′N, 109°23′W, *E. Joyal 2059* (CAS); vicinity of Alamos, *J. Rose et al. 13020* (US).

Odontonema Nees

Odontonema Nees, Linnaea 16:300. 1842, nom. cons. TYPE: garden specimen without date or collector (GZU), type cons.

Thyrsacanthus Nees in Martius, Fl. Bras. 9:97. 1847, nomen superfl. (= *Odontonema*).

Diateinacanthus Lindau, Bull. Herb. Boissier, ser. 2, 5:369. 1905. TYPE: *Diateinacanthus hondurensis* Lindau (≡ *Odontonema hondurense* (Lindau) D.N. Gibson).

Erect perennial herbs or shrubs (sometimes clambering) with cystoliths. Leaves opposite. Inflorescence of mostly terminal and sometimes basally branched dichasiate spikes, racemes, or thyrses; dichasia alternate to opposite to whorled, 1-many (i.e., 18 or more)-flowered, variously contracted or expanded, sessile or pedunculate, subtended by a bract. Flowers homostylous or heterostylous, usually pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes equal in length. Corolla infundibular, white, yellow, purple, pink, or red, tube usually expand-

ed distally into a prominent throat, limb subactinomorphic to 2-labiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 2, thrum stamens exserted from mouth of corolla, pin stamens usually included in corolla tube, anthers 2-thecous, thecae equal in size, parallel, equally inserted on filament, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); pollen oblate spheroidal to spherical to euprolate, 3(–4)-colporate, 6(–8)-pseudocolpate, pseudocolpi 2 per mesocolpium, exine foveolate to rugulate to reticulate to bireticulate; staminodes 2. Thrum style included in corolla tube, pin style exserted from mouth of corolla, stigma ± funnelform or 2-lobed, lobes equal or unequal in length. Capsule stipitate, head obovoid to subellipsoid (often with a medial constriction), retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 4, homomorphic, lenticular, lacking trichomes. ($x = 21$).

This genus of 29 species is restricted to the New World tropics and subtropics with eight species in Mexico (Daniel 1995d). Species with tubular, red corollas (like ours) are visited, and appear to be well adapted for pollination, by hummingbirds (see Daniel 1995d).

Odontonema cuspidatum (Nees) Kuntze, Revis. Gen. Pl. 2:494. 1891. *Thyrsacanthus cuspidatus* Nees in A. de Candolle, Prodr. 11:323. 1847. TYPE: MEXICO. Oaxaca: Sierra S. Pedro Nolasco, Talea, etc., 1843–1844, *C. Jürgensen 985* (lectotype designated by Daniel, 1995a: K!; isolectotype: BM!).

Phenology. Flowering: November; fruiting: unknown.

Distribution and habitats. Mexico (Chiapas, Guanajuato, Hidalgo, Morelos, Oaxaca, Querétaro, San Luis Potosí, Tabasco, Veracruz), Honduras, West Indies; Sonoran plants are cultivated and likely escaped (see below).

Illustration. *Contributions from the University of Michigan Herbarium* 20:157. 1995.

Daniel (1995a, 1995d) provided descriptions of *Odontonema cuspidatum*. This species of shrubs with red flowers is often cultivated for ornament. The sole Sonoran specimen from a natural habitat is rather fragmentary, but it does permit a tentative species identification. On the basis of the color of the corolla noted on the label (red) and the pubescence of the inflorescence rachis (mostly erect and evenly disposed eglandular trichomes 0.05–0.2 mm long) this collection resembles *O. cuspidatum*, a species of eastern and southern Mexico (Daniel 1995d). It differs from that species, and resembles *O. glaberrimum* (M.E. Jones) V.M. Baum, by its mostly sessile to subsessile dichasia (although some dichasia are borne on peduncles 0.5–1 mm long). *Odontonema glaberrimum* is known from northern Sinaloa, but differs from *Jenkins & Yetman 91-115* by its rachises that vary from glabrous to pubescent with flexuose to antrorse eglandular trichomes 0.05-0.5 mm long. The number of apertures on pollen grains can be used to distinguish *O. cuspidatum* (pollen 4-aperturate; Fig. 18) from other Mexican species of the genus (all of which have 3-aperturate pollen; see palynological information in Daniel 1995d). Examination of pollen from *Jenkins & Yetman 91-115* (Fig. 18) reveals somewhat aberrant grains with four or more apertures. I suspect that *Jenkins & Yetman 91-115* represents an escaped occurrence of *O. cuspidatum* (with somewhat unusual sessile to subsessile dichasia and slightly deformed pollen), which is known to be cultivated for ornament in Sonora. Although *Jenkins & Yetman 91-115* was not collected near human dwellings, Jenkins (pers. comm.) indicates that there is a small settlement upstream from which propagules of this species could have washed downstream.

Sonoran collections: cultivated grounds of La Ciudadela just off Plaza de Armas in Alamos, ca. lat. 27°01′N, 108°56′W, *T. Daniel 9774* (CAS); near jct. of Arroyo Santa Bárbara with Arroyo Verde, 27°05′N, 108°43′W, *P. Jenkins & D. Yetman 91-115* (ARIZ, CAS).

Pseuderanthemum Radlk.

Pseuderanthemum Radlk., Sitzungsber. Math.-Phys. Kl. Akad. Wiss. München 13:282. 1883. LECTOTYPE (Leonard, Contr. U.S. Natl. Herb. 31(2):292. 1953; see J. Adelaide Bot. Gard. 9:141. 1986): *Pseuderanthemum alatum* (Nees) Radlk. (≡ *Eranthemum alatum* Nees).

Siphoneranthemum (Oerst.) Kuntze, Revis. Gen. Pl. 2:494. 1891. *Eranthemum* L. subg. *Siphoneranthemum* Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854:166. 1855. TYPE: *Siphoneranthemum fasciculatum* (Oerst.) Kuntze (≡ *Eranthemum fasciculatum* Oerst.).

Buceragenia Greenm., Proc. Amer. Acad. Arts 32:303. 1897. TYPE: *Buceragenia minutiflora* Greenm.

Decumbent to erect herbs or shrubs with cystoliths. Leaves opposite. Inflorescence of dichasia in leaf axils or of axillary or terminal dichasiate spikes, racemes, thyrses, or panicles; dichasia opposite or alternate, 1–many-flowered, sessile or pedunculate, subtended by a leaf or bract. Flowers chasmogamous and/or cleistogamous, homostylous or heterostylous, sessile or pedicellate, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes homomorphic. Corolla white, pink, blue, purplish, or red, the lower lip sometimes with colored markings, ± salverform (i.e., with a prominent slender tube and a rotate limb), tube cylindric, sometimes ± expanded distally into a short throat, limb subactinomorphic to bilabiate, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud, corollas of cleistogamous flowers remaining budlike. Stamens 2, included in corolla tube or exserted from mouth of corolla, anthers 2-thecous, thecae equal to subequal in size (or in cleistogamous flowers becoming unequal or with 1 theca suppressed), parallel, subequally inserted, lacking basal appendages, dehiscing introrsely toward lateral lobes of corolla (i.e., flower pleurotribal); pollen (Fig. 18) oblate spheroidal to euprolate, 3-colporate (sometimes syncolpate), 6-pseudocolpate, pseudocolpi 2 per mesocolpium, the 2 sometimes fused near poles into pseudocolpal ellipses, exine (rugulate to) reticulate; staminodes 0 or 2. Style included in corolla throat or exserted from mouth of corolla, stigma 2-lobed, lobes equal. Capsule stipitate, head ellipsoid with a medial constriction, retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 4, homomorphic, plano-convex to lenticular, lacking trichomes. ($x = 21$)

This genus of 40-60 species occurring in the tropics worldwide is in need of considerable study. Its relationships to *Odontonema, Chileranthemum, Pulchranthus* and *Oplonia* are especially problematic in the New World. Cleistogamy and heterostyly are both present in *Pseuderanthemum* and have added to taxonomic confusion in the genus. Species previously treated in *Buceragenia* represent plants of *Pseuderanthemum* with cleistogamous flowers (Daniel 1995b). There are 10–15 species in Mexico. Sonoran plants of *Pseuderanthemum* are indicative of the problems involved in delimiting and identifying Mexican species of the genus.

Pseuderanthemum praecox (Benth.) Leonard, J. Wash. Acad. Sci. 31:99. 1941. *Eranthemum praecox* Benth., Pl. Hartweg. 291. 1848-1849. *Siphoneranthemum praecox* (Benth.) Kuntze, Revis. Gen. Pl. 2:497. 1891. TYPE: MEXICO. Guanajuato: Santa Rosa near Guanajuato, 1837, *T. Hartweg 1614* (holotype: K!).

Perennial herbs to 5.5 dm tall. Young stems subquadrate to ± compressed, sometimes ± multistriate, glabrous or ± evenly (to ± bifariously) pubescent with retrorse to flexuose eglandular trichomes 0.05–0.2 (–0.3) mm long. Leaves generally absent when chasmogamous flowers present in spring, present along with cleistogamous flowers in late summer, membranaceous, sessile to

petiolate, petioles to 3 (–12) mm long, blades either linear to lanceolate, 66–200 mm long, 4–15 mm wide, 7.7–23 times longer than wide, acute to attenuate at base, attenuate at apex, or blades narrowly elliptic to elliptic to lance-ovate to ovate to obovate, 37–100 mm long, (7–) 16–37 mm wide, mostly 1.7–4.7 (–5.7) times longer than wide, acute to attenuate at base, attenuate to acute to rounded at apex, surfaces of all blades glabrous or pubescent (especially along veins) with flexuose to retrorse to retrorsely appressed eglandular trichomes 0.05–0.2 mm long, margin flat, entire to subsinuate. Inflorescence of ± congested dichasia in axils of leaves and sometimes also in axils of bracts distally, the latter forming a terminal spikelike raceme or thyrse, rachis (if present) glabrous or pubescent like young stems; dichasia opposite or alternate, sessile to pedunculate, 1–4-flowered, peduncles to 3 (–50) mm long. Bracts (if present) subulate to linear, 2–14 (–43) mm long, 1–1.2 (–2) mm wide, abaxial surface glabrous or pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.05–0.1 mm long. Bracteoles and secondary bracteoles usually triangular to subulate, 1.2–5 mm long, 0.7–1.2 mm wide (sometimes foliose, lanceolate to linear to elliptic to ovate, to 36 mm long and 17 mm wide), abaxial surface glabrous or pubescent with flexuose to antrorse to retrorse eglandular trichomes 0.05–0.1 mm long. Flowers subsessile to pedicellate, pedicels 0.05–3.5 (–5) mm long. Calyx 3.5–7 (–9.3 in fruit) mm long, lobes subulate, 2.5–5.5 (–8.5) mm long, 2.5–4.5 (–5.5) times longer than tube, abaxially nearly glabrous or pubescent like bracteoles (occasionally with a few sessile or stipitate inconspicuous glands to 0.1 mm long as well), or pubescent with erect to flexuose eglandular trichomes and conspicuous glandular trichomes 0.05–0.2 mm long. Corolla of chasmogamous flowers salverform, pink to light purplish with white area on lower lip near mouth, 20–35 mm long, externally sparsely pubescent near apex of lobes with flexuose eglandular trichomes, otherwise glabrous, tube subcylindric, 19–21 mm long, 0.9–1.1 mm in diameter near midpoint, expanded slightly above middle into a ± inconspicuous throat, limb subactinomorphic (lobes similar, elliptic to ovate-elliptic), 17–24 mm in diameter, upper lip 7–13 mm long, lobes 7–13 mm long, 3.5–5.7 mm wide, lower lip 10–14 mm long, lobes 8.7–13 mm long, (4–) 4.7–7 mm wide; corolla of cleistogamous flowers budlike, white with purple at apex, 2–2.5 mm long, apically pubescent with flexuose eglandular trichomes 0.05–0.1 mm long. Stamens of chasmogamous flowers included, 3.5–4 mm long, thecae 2–2.5 mm long; staminodes up to 0.6 mm long. Style of chasmogamous flowers included (or with stigma barely exserted from mouth), 17–18 mm long, glabrous, stigma lobes 0.2–0.3 mm long, equal; style of cleistogamous flowers 1–1.2 mm long, glabrous, curved to recurved apically, stigma subequally 2-lobed, 0.2 mm long. Capsule 13–18 mm long, glabrous, stipe 5–7 mm long, head 8–11 mm long. Seeds planoconvex to concavo-convex, 2.9–4.5 mm long, 2.5–3.6 mm wide, surfaces irregularly reticulate-ridged, ridges sometimes reduced to knoblike projections on mature seeds.

Phenology. Flowering March–May (chasmogamous flowers), August–September (cleistogamous flowers); fruiting: March–May, August–October.

Distribution and habitats. Mexico (Chiapas, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Querétaro, Sinaloa, Sonora, Tamaulipas, Zacatecas), Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica; in Sonora plants occur in along watercourses and on rocky slopes in oak woodlands, oak forests, oak-pine woodlands, and oak-pine forests at elevations from 1100–1580 m.

Illustrations. Figures 15, 29; *Flora de Valle de México*, fig. 297B. 1979; *Flora del Valle de Tehuacán-Cuicatlán* 23:66. 1999; *Flora del Bajío* 117:118. 2003.

Descriptions of this species from other regions of Mexico have been provided by Daniel (1995a, 1999a) and Daniel and Acosta (2003). A description based exclusively on Sonoran plants is presented here because they exhibit morphological variation not observed in these other regions. All Sonoran plants of *Pseuderanthemum* are interpreted as pertaining to a single species, *P. prae-*

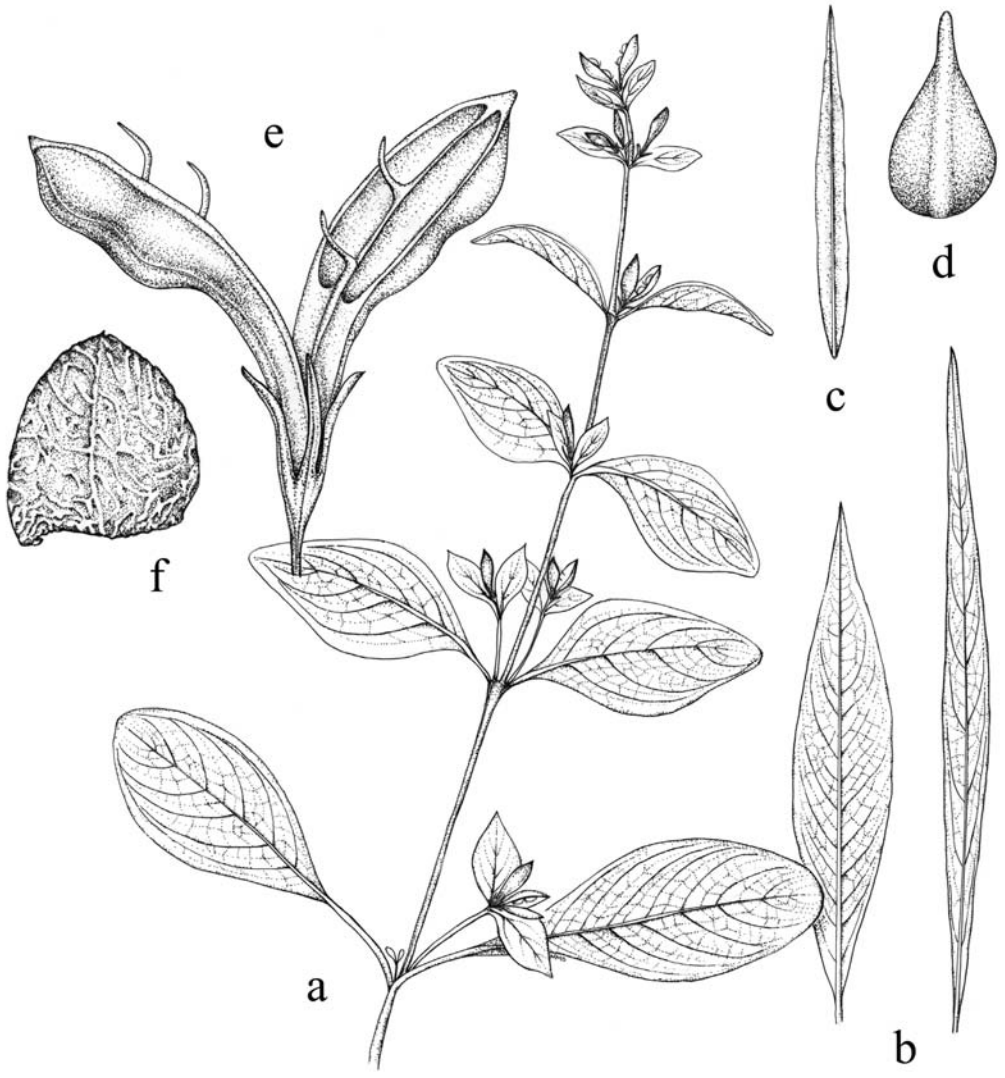


FIGURE 29. *Pseuderanthemum praecox*. a. Habit (*Reina G. & Van Devender 99-529*), × 0.58. b. Leaves, × 0.58: narrow leaf on right (*Reina G. & Van Devender 98-1700*), wider leaf on left (*Reina G.& Van Devender 99-527*). c. Bracteole from lower node (*Reina G. & Van Devender 99-666*), × 7.5. d. Bracteole from upper node (*Reina G. & Van Devender 99-666*), × 10.4. e. Capsule (*Reina G. & Van Devender 99-666*), × 4.1. f. Seed (*Reina G. & Van Devender 99-666*), × 8.1. Drawn by Nadia Strasser.

cox. It is evident from the above description that *P. praecox* in Sonora exhibits considerable morphological diversity. This variation appears to be attributable to seasonality, cleistogamy, and morphological plasticity.

Generally leafless plants with chasmogamous flowers have been collected in the spring (March–May) whereas leafy plants with only cleistogamous flowers have been collected only during the late summer (August–September). Based on the many collections of plants from riparian communities in a region of oak-pine woodland and forest (between Yécora and the Chihuahua border) and the summary of climatic data for the region by Van Devender et al. (2003), the life cycle

of *P. praecox* there can by hypothesized as follows: new, leafy shoots appear from the underground caudex in the late summer in response to the summer (June–October) rains; these shoots bear cleistogamous flowers that self-pollinate and yield fruits that mature prior to winter; the leaves are deciduous and fall sometime during the winter months when extended periods of freezing temperatures are common; following the winter rains (November–February) and the end of freezing temperatures in the spring, the old (and now leafless) shoots bear new growth from the axillary buds that bears chasmogamous flowers; these flowers are potentially available for cross-pollination, but likely self-pollinate as the corolla falls from the flower if pollination has not been otherwise effected; fruits mature prior to the death (and collapse) of these shoots during the dry period of late spring and summer. The two seasonal phases of Sonoran plants of *P. praecox* can be distinguished by the following couplet:

1. Chasmogamous flowers present, corollas salverform 20–35 mm long; leaves mostly or entirely absent; calyx pubescent with eglandular and conspicuous glandular trichomes. . spring phase
1. Chasmogamous flowers absent, only cleistogamous flowers present, corollas budlike, 2–2.5 mm long; leaves present; calyx nearly glabrous or pubescent with eglandular (and often inconspicuous glandular) trichomes . . . . . late summer phase

I have not observed the late summer phase in other portions of the range of *P. praecox* in Mexico (for example, 41 of the 42 Mexican (non-Sonoran) specimens of *P. praecox* at MEXU are entirely or nearly leafless, have chasmogamous flowers, and were collected between December and June-but mostly in March and April; the other collection was leafless, but lacked corollas), but it may be represented by one or more species previously treated under *Buceragenia* (see Daniel 1995b).

Sonoran plants of *Pseuderanthemum praecox* are unusual in having two foliar forms (although with some intermediacy between them) and two pubescence forms, all growing together. Most collections have the leaf blades either very narrow, linear, and 7.7–23 times longer than wide (e.g., *Gentry et al. 19402*; *Reina G. & Van Devender 98-1700*, *99-666*, *2000-629*; *Reina G. et al. 2000-379*) or wider, elliptic to obovate, and 1.3–5.7 times longer than wide (e.g., *Reina G. & Van Devender 98-1863*, *99-529*, *2000-623*; *Reina G. et al. 2000-380*; *Van Devender & Reina G. 98-1832*). Plants with both types of leaf blades or with the blades somewhat intermediate between the two forms occur in a population west of Maycoba. For example, *Reina G. & Van Devender 99-525* has both linear (22.5 times longer than wide) and lance-ovate (4.9 times longer than wide) leaf blades. *Reina G. & Van Devender 99-527* has leaves varying from 3.3–6.1 times longer than wide. It is not known whether plants with linear leaves represent a riverine morphological form, with the broader leaved plants occurring on somewhat drier sites. Plants with narrow, linear leaves appear to have been first collected by Howard Gentry in October 1961 from the Sierra Tecurahui in southeastern Sonora (east of Alamos, near the Chihuahua border) at an elevation between 1200 and 1360 meters. In their explorations in the Municipio de Yécora, Ana Lilia Reina G. and Tom Van Devender located similar plants in a tributary of Arroyo Pilares (west of Maycoba) at 1300 meters elevation, and recollected it there many times in efforts to document the foliar variation and flower type. Some plants from both of these populations have stems, leaves, and bracteoles glabrous (e.g., *Gentry et al. 19402* at ARIZ, *Reina G. et al. 99-525* at CAS), whereas other plants at these sites have these organs conspicuously pubescent (e.g., *Gentry et al. 19420* at US, *Reina G. et al. 99-525* at CAS).

The structure of the inflorescence is somewhat variable in *P. praecox*. In most individuals, the reduced dichasia form a dense cluster of flowers in the axils of the leaves. Sometimes the leaves are replaced by bracts distally, resulting in a terminal spikelike raceme to thyrse. The transition

from leaves to bracts is either abrupt or gradual. On some individuals, especially at the proximal nodes of plants with the broader leaf blades, dichasia are borne on elongate peduncles (to 50 mm long) and bear foliose bracteoles. It is sometimes difficult to interpret whether such lateral growth consists of long-pedunculate dichasia (that sometimes continue to elongate sympodially) or lateral branches bearing lateral dichasia. Both appear to be present.

Pseuderanthemum praecox reaches the northwestern extent of its range in southeastern Sonora (Fig. 30), from the vicinity of Yécora southward to the vicinity of Alamos. It undoubtedly occurs in nearby regions of Chihuahua, but it has not yet been collected in that state. The entirety of variation described above for this species in Sonora has been documented at only a single site (i.e., 24.7 km W of Maycoba). The species is also somewhat difficult to circumscribe in other portions of its range. I have taken various approaches to treating *Pseuderanthemum praecox* and its relatives (e.g., *P. fasciculatum* (Oerst.) Leonard and *P. hispidulum* (Nees) Radlk.) in Chiapas (Daniel 1995a), south-central Mexico (Daniel and Acosta 2003), El Salvador (Daniel 2001), and Honduras (Daniel 2004a); none of them seems very satisfactory.

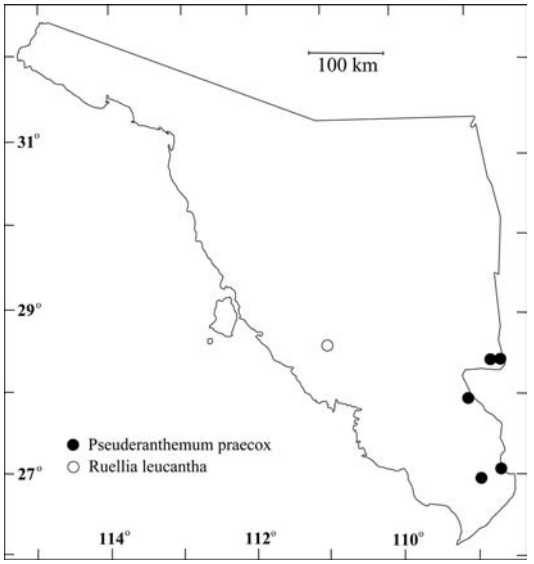


FIGURE 30. Sonoran distributions of *Pseuderanthemum praecox* and *Ruellia leucantha*.

SONORAN COLLECTIONS: Mpio. Yécora, Ciénega de Camilo, ca. 14 km E of Maycoba near Hwy. 16, ca. 28°26′N, 108°34′W, *T. Daniel et al. 8617* (CAS, K, MEXU); Rcho. Agrimincor, Río Mayo, *H. Gentry 3041* (ARIZ); Sierra Tecurahui, *H. Gentry et al. 19420* (ARIZ, US); Mpio. Alamos, Santa Bárbara, 27°07′N, 108°43′W, *P. Martin s.n.* (ARIZ); Mpio. Yécora, tributary of Arroyo Los Pilares near bridge, 24.7 km W of Maycoba on Mex. 16, 28°24′N, 108°48′W, *A. Reina G. & T. Van Devender 98-1700* (ARIZ, CAS), *98-1863* (CAS), *99-525* (ARIZ, CAS), *99-527* (CAS), *99-529* (CAS), *99-666* (CAS), *2000-623* (CAS), *2000-629* (CAS), *A. Reina G. et al. 2000-379* (CAS), *2000-380* (CAS); Mpio. Yécora, Arroyo Los Pilares, 21 km E of Yécora, 28°24′N, 108°47′W, *A. Reina G. et al. 96-59* (ARIZ, MEXU); Mpio. Alamos, Sierra de Alamos, ca. 4 km SW of Alamos at La Huerta, ca. 26°59′N, 108°58′W, *V. Steinmann 94-35* (ARIZ, CAS); Mpio. Yécora, Río Maycoba at Mex. 16 (20.5 km W of Maycoba, 28.6 km E of Yécora), 28°22.5′N, 108°45′W, *T. Van Devender & A. Reina G. 95-458* (ARIZ); Mpio. Yécora, Ciénega de Camilo, 6.3 km E of El Kípor, 11.2 km W of Chihuahua border, 28°25.5′N, 108°34′W, *T. Van Devender & A. Reina G. 97-402* (ARIZ, CAS), *98-1832* (CAS).

Ruellia L.

Ruellia L., Sp. Pl. 634. 1753. LECTOTYPE (Britton and Brown, Ill. Fl. N. U.S., ed. 2, 3:241. 1913): *Ruellia tuberosa* L.

Dipteracanthus Nees in Wallich, Pl. Asiat. Rar. 3:75, 81. 1832. LECTOTYPE (Bremekamp and Nannenga Bremekamp, Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Sect. 45(1): 15. 1948): *Dipteracanthus prostratus* (Poiret) Nees (≡ *Ruellia prostrata* Poiret).

Aphragmia Nees in Lindley, Intr. Nat. Syst. Bot., ed. 2, 444. 1836. TYPE: *Aphragmia haenkei* Nees (≡ *Ruellia inundata* H.B.K.).

Decumbent to erect subcaulescent to caulescent perennial herbs, shrubs, or (rarely) trees with

cystoliths, vegetative and floral surfaces sometimes beset with sessile lenticular glands mostly 0.05–0.2 mm in diameter (glandular punctate). Leaves opposite. Inflorescence of reduced or expanded dichasia in axils of leaves or bracts, sometimes forming dichasiate spikes, thyrses, or panicles; dichasia alternate or opposite, 1–many-flowered, 1 or more per axil, sessile or pedunculate, subtended by a leaf or a bract. Flowers chasmogamous and/or cleistogamous, homostylous, usually subtended by 2 homomorphic bracteoles (sometimes absent or vestigial). Calyx deeply 5-lobed, lobes homomorphic or heteromorphic. Corolla of chasmogamous flowers blue to blue-purple (in ours, elsewhere also pink, red, white, yellow, or blackish), generally concolorous, tube usually funnelform, often curved, gradually or abruptly expanded distally into a ± distinct throat (rarely saccate), limb 2-labiate (often appearing subactinomorphic), upper lip 2-lobed, lower lip 3-lobed, corolla lobes contorted in bud, corolla of cleistogamous flowers (if present) small and bud-like or tubular, often whitish. Stamens 4, (homodynamous to) didynamous, included in corolla tube or exserted from mouth of corolla, anthers 2-thecous, thecae equal in length, parallel to subsagittate, equally inserted, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); pollen (Fig. 31) spherical to subspheroidal, 3-porate, exine coarsely reticulate; staminodes 0 or 1. Style included in corolla tube or exserted from mouth of corolla, stigma 2-lobed, lobes equal or unequal, often with 1 lobe greatly reduced, rudimentary, or not evident. Capsule substipitate or stipitate, retinacula present, septa with attached retinacula usually remaining attached to inner wall of mature capsule (separating from inner wall in *R. erythropus*). Seeds 4–28 per capsule, lenticular, pubescent with hygroscopic trichomes (sometimes restricted to margin). (x = 17).

Ruellia comprises approximately 250 species worldwide. Species occur primarily in the tropics and subtropics. It is the second largest genus of Acanthaceae in Mexico with about 65 species in the country. The generic synonymy given above only includes genera in which Sonoran species have been treated previously. Ezcurra (1993) provided a more complete list of generic synonyms in which American species have been treated.

1. Corolla white; young stems, leaves, bracteoles, calyx, corolla, and capsule with conspicuous sessile patelliform glands (glandular punctate). . . . . *R. leucantha*
1. Corolla blue; young stems, leaves, bracteoles, calyx, corolla, and capsule lacking sessile patelliform glands (stipitate glands sometimes present, however).
    2. Leaves with at least some trichomes branched or stellate; plants of northeastern Sonora in Chihuahuan desertscrub. . . . . *R. parryi*
    2. Leaves lacking any branched or stellate trichomes; plants not restricted to Chihuahuan desertscrub in northeastern Sonora.
        3. Limb of corolla 10–15 mm in diameter; calyx lobes linear to oblanceolate, unequal with one conspicuously longer and wider than others; thecae 1.7–2.4 mm long; capsule often spotted with red, 7.5–10 mm long, glabrous. . . . . *R. inundata*
        3. Limb of corolla 17–46 mm in diameter; calyx lobes subulate to lance-subulate to linear, equal to subequal; thecae 2.8–5 mm long; capsule never spotted with red, 11–29 mm long, pubescent (sometimes only at apex and inconspicuously so).
            4. Plants woody throughout (shrubs); stipe of capsule 4.5–7.5 mm long; seeds 4 per capsule. . . . . *R. californica*
            4. Plants woody only at or near base (perennial herbs); stipe of capsule 2–4 mm long; seeds 8–20 per capsule.
                5. Those dichasia in axils of distal leaves or leaflike bracts collectively forming a terminal glandular-pubescent paniculiform thyrse; peduncles of distal dichasia, abaxial surface of bracteoles, pedicels, and capsules pubescent with conspicuous glandu-

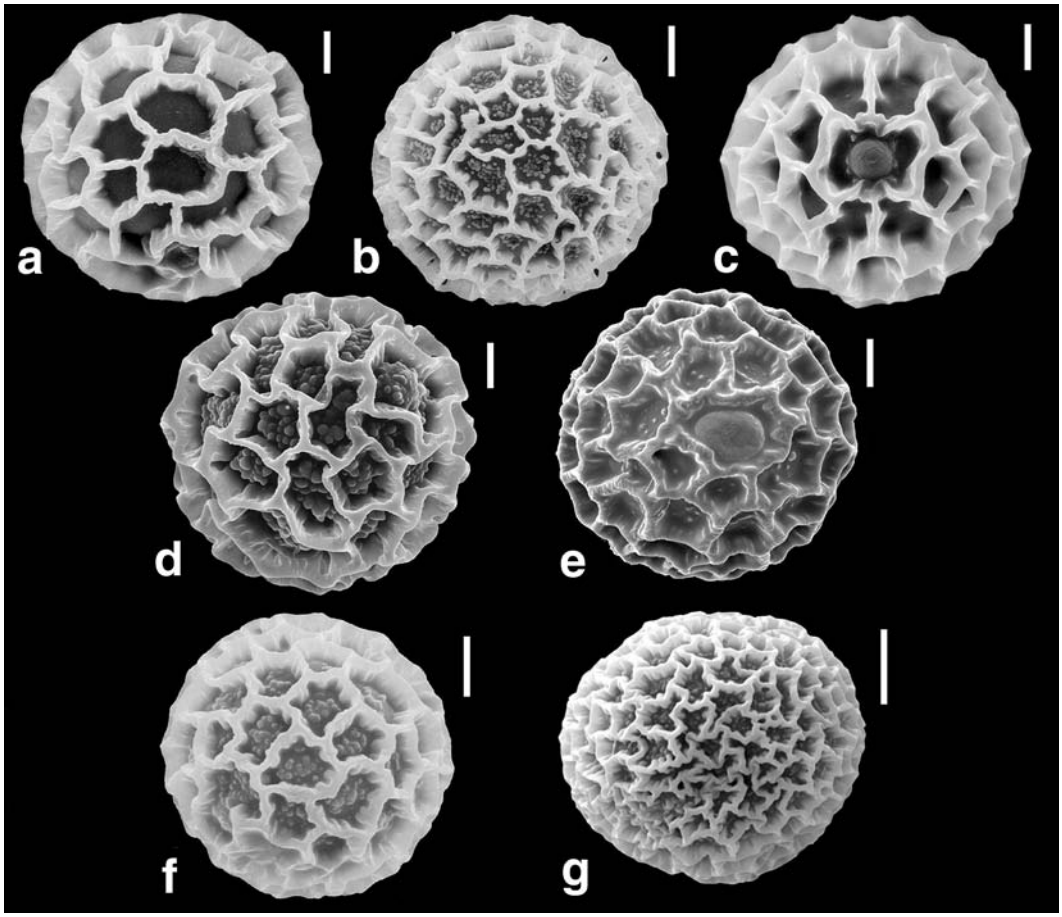


FIGURE 31. Pollen of Sonoran *Ruellia*. a. *R. californica* (*Wiggins 11411*). b. *R. intermedia* (*Jenkins et al. s.n.*). c. *R. inundata* (*Daniel & Butterwick 6952*). d. *R. leucantha* (*Brandegee s.n.*). e. *R. malacosperma* (*Daniel 9773*). f. *R. nudiflora* (*Wiggins & Rollins 136*). g. *R. parryi* (*Reina G. et al. 2003-957*). Scales = 10 μm.

lar trichomes, at least some of which are longer than 0.2 mm; capsule pubescent proximally. . . . . *R. nudiflora*

5. Dichasia pedunculate in axils of leaves, never forming a terminal glandular paniculiform thyrse; peduncles of dichasia, abaxial surface of bracteoles, pedicels, and capsules glabrous or inconspicuously glandular with glandular trichomes up to 0.2 mm long; capsule glabrous proximally.
   6. Leaves 1.1–1.9 times longer than wide, corolla externally pubescent with eglandular trichomes only; style essentially glabrous (sometimes with 1–3 scattered trichomes present); capsule 12–23 mm long, stipe 2–2.5 mm long.. . *R. intermedia*
   6. Leaves 2.3–5.8 times longer than wide; corolla externally pubescent with glandular and eglandular trichomes; style proximally pubescent with eglandular trichomes; capsule 24–29 mm long; stipe 4 mm long. . . . . *R. malacosperma*

Ruellia californica (Rose) I.M. Johnst., Proc. Calif. Acad. Sci., ser. 4, 12:1171. 1924. *Calophanes californica* Rose, Contr. U.S. Natl. Herb. 1:85. 1890. TYPE: MEXICO. Baja California Sur: Santa Rosalía, 24 Feb-3 Mar 1889, *E. Palmer 190* (holotype: US; isotypes: F!, GH!, NY, UC!).

Phenology. Flowering: throughout the year, with a peak in March (Fig. 1); fruiting: throughout the year.

Distribution and habitats. Northwestern Mexico (Baja California, Baja California Sur, Sonora); Sonoran plants occur on slopes and flats in Sonoran desertscrub (Central Gulf Coast, Plains of Sonora), palm oases, and thornscrub at elevations from sea level to 300 m.

Illustrations. Figure 9; *Flora of Baja California*, 194. 1980; *People of the Desert and Sea*, 219. 1985; *Proceedings of the California Academy of Sciences* 49:382. 1997.

Local names. "Hupa chumi" (Yaqui, fide Felger 1999); "rama parda" (fide Felger 1999; Felger and Moser 1985); "satóoml" (Seri, fide Felger and Moser 1985); "stoms" (Seri, *Whiting 9067*).

Uses. A poultice made from the plant is used as a remedy for headache (*Whiting 9067*). Felger and Moser (1985) noted a diversity of uses by the Seri, including: food (nectar sucked from the base of the corolla), medicine (tea made from the leaves ingested for dizziness or headache, put on the face of one who is "tired out" or for dizziness, applied to the eyes as eye drops, and used as a shampoo to relieve headache; tea made from boiling the root (after removal of the epidermis) ingested as a remedy for colds or stuffy nose), and smoking (leaves or corollas dried and smoked in clay pipe to induce hallucinations).

Daniel (1997) provided a description of *Ruellia californica*, which is endemic to northwestern Mexico and attains the northern and eastern extents of its distribution in central and southern Sonora, respectively (Fig. 32). Within the Sonoran Desert of Sonora, the species is especially common in the Central Gulf Coast subdivision near Guaymas. It has been less frequently collected in the Plains of Sonora subdivision. A collection from near Magdalena, about 150 kilometers north of its occurrences in that subdivision, appears to be from the Arizona Upland subdivision. The species is sometimes cultivated, and until *R. californica* is recollected in the Arizona Upland subdivision, its native occurrence there is treated as suspect.

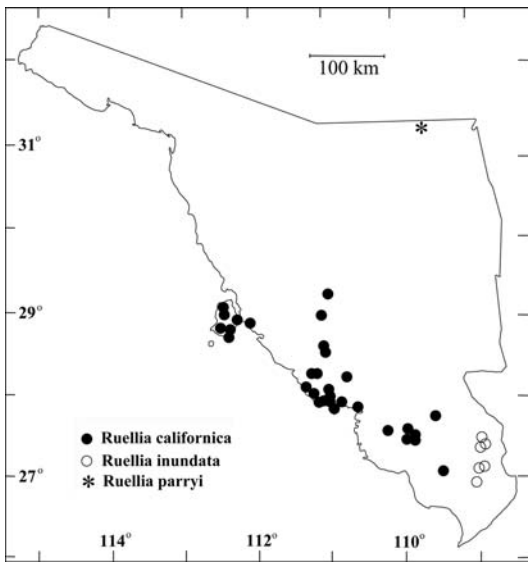


FIGURE 32. Sonoran distributions of *Ruellia californica*, *R. inundata*, and *R. parryi*.

Plants from Sonora are all referable to subspecies *californica* as delimited by Daniel (1997). *Coville 1672* from near Guaymas greatly resembles subsp. *peninsularis* (central and southern Baja California Sur) by the length of its corolla (32 mm), length of its calyx (7 mm), and its glutinous herbage. In this specimen (and similar specimens from this region) there are sparse stipitate glands on the stems and leaves and conspicuous glands on the calyx. These latter characteristics confirm the placement of these plants into subspecies *californica*. An apparently rare occurrence of white corollas among Sonoran plants of this species has been noted (e.g., *Phillips et*

al. 76-183). The herbage is often somewhat viscid and typically mephitic (somewhat skunklike) in odor.

Sonoran collections: Isla Tiburón, *J. Alcocer F. & C. Sosa R. 10* (ENCB); San Carlos Bay, *R. Barr 61-107* (ARIZ); San Francisco Bay near Guaymas, *R. Barr 66-3* (ARIZ); Cerro Bocochibampo, Guaymas, *E. Blakley B-1640* (DS); Guaymas, *T. Brandegee s.n.* (UC); Mpio. Guaymas, 6.5 mi N of road to Bahía San Carlos, ca. 10 mi N of Guaymas on Mex. 15, *D. Breedlove 1464* (DS); Mpio. Hermosillo, 7 mi W of Hwy. 15 along southern paved road to Bahía Kino, *D. Breedlove 15950* (DS, ENCB); Isla Melliza Oeste, near SW end of Guaymas Bay, 27°54′N, 110°54′W, *T. Burgess et al. 6903* (ARIZ); N of Estero El Rancho, 3.9 km N and 1.4 km W of E end of Empalme causeway, 27°59′N, 110°50′W, *T. Burgess et al. 9885* (ARIZ); Sierra Libre, Cañada Tetabejo, S de Hermosillo por la Carr. Fed. 15, 28°33′N, 110°58′W, *A. Búrquez 95-128* (MEXU); La Pintada, 49 km S de Hermosillo, por Carr. Fed. 15, 28°35′N, 110°58′W, *A. Búrquez & D. Yetman 97-431* (MEXU); near San Juan de Guaymas, *A. Carter & D. Noack 4362* (UC); 5 mi S of Guaymas, *G. Chan & J. Folkner s.n.* (ARIZ, MEXU); S Merimar, *O. Clark 14978* (UNM); Guaymas, *F. Coville 1672* (US); ca. 4 mi N of San Carlos at movie site "Catch-22," *T. Daniel 120* (CAS); "Microondas mountain" overlooking Guaymas, *T. Daniel 1963* (ASU, CAS); Nacapuli Canyon, 6.3 mi W of Hwy. 15 toward San Carlos then 4.4 mi N, *T. Daniel 2548* (CAS); W base of Sierra Bojihuacame E of Cd. Obregón, 1.2–2.2 mi SE of Bachoco, *T. Daniel 3366* (CAS, MEXU, NY); ca. 2 mi E of San Carlos, NW of Guaymas, *T. Daniel 3978* (CAS); between San Carlos Bay and Catch-22 airstrip NW of Guaymas, *T. Daniel 3987* (CAS); Guaymas, *E. Dawson 1002* (DS); Isla Tiburón, *R. Delgado B. s.n.* (ENCB); Isla Tiburón *C. Díaz L. 2247* (ENCB); Guaymas, *F. Drouet & D. Richards 3816* (DS, F, US); Isla Tiburón, Ensenada de la Cruz, S end of island, *R. Felger 2589* (ARIZ); Isla Tiburón, SE base of Sierra Kunkaak, *R. Felger 9328* (ARIZ, CAS); Las Guásimas, *R. Felger & R. Devine 85-277* (ARIZ, MEXU); E end, Bahía San Carlos, *R. Felger & C. Lowe 2471* (ARIZ); Isla Tiburón, vic. of Palo Fierro landing field, Punta Tortuga, *R. Felger & A. Russell 8933* (ARIZ, CAS), *Felger et al. 11075* (CAS); road to Bahía San Carlos, 4 mi W of Hwy. 15, *R. Felger & R. Thomas 11917* (ARIZ); ca. 0.5 mi SE of mouth of Nacapule Canyon, ca. 4 mi NE of Bahía San Carlos, *R. Felger & R. Thomas 11954* (ARIZ); Sierra El Aguaje, ca. 18 km NW of San Carlos, ca. 28°03′N, 111°13′W, *R. Felger & M. Wilson 95-238* (ARIZ, CAS); E end of Bahía San Carlos, *R. Felger et al. 10308* (ARIZ); Isla Tiburón, Tecomate, NW part of island, *R. Felger et al. 11126* (ARIZ); Ensenada Grande (= Bahía San Pedro), *R. Felger et al. 12099* (ARIZ); San Carlos Bay, ca. 8 mi N of Guaymas, *R. Ferris 8721* (DS, NY, US); Bahía de Guásimas, just W of Cerro El Bachoco, 15 km E of Empalme, 4.6 mi S of Hwy. 15, 27°54′N, 110°40′W, *M. Fishbein et al. 921* (ARIZ, CAS); Mpio. Guaymas, Sierra El Aguaje, Aguaje Robinson, ca. 10 km NW de San Carlos, 28°03.5′N, 111°07′W, *A. Flores M. & O. Gutierrez R. 5090* (ARIZ, MEXU); N of Magdalena toward Cucurpe, ca. 0.6 mi W of fork, *J. Fryxell 78024A* (TEX); Ciudad Obregón, *H. Gentry 276* (DS, US); Mutica, Río Yaqui, *H. Gentry 2193* (F, MO); Bachoco, 12 mi E of Cajeme, *H. Gentry 2973* (ARIZ, MEXU, S); Guaymas, *H. Gentry 4710* (ARIZ); Isla Tiburón, *D. Gold 386* (MEXU); 1 mi E of Bahía San Carlos, ca. 12 mi N of Guaymas, *B. Hansen et al. 1389* (LL, MEXU, US, WIS); 10.2 mi N of turnoff to Bahía San Carlos, *J. Hastings & R. Turner 64-18* (ARIZ, DS); ca. 35 mi N of Guaymas and 7 mi W of Hwy. 15 toward Kino Bay, *J. Hastings & R. Turner 65-160* (ARIZ, DS); 2 mi N of San Carlos Bay, *P. Hutchison 2447* (MEXU, US); ca. 18 mi N of Hermosillo, *E. Jaeger 5* (DS); island in bay near Guaymas, *I. Johnston 3088* (CAS); Tiburón Island, *I. Johnston 4268* (CAS, NY, UC, US); Ensenada Grande (San Pedro Bay), *O. Kleine et al. 11588* (ARIZ); Tiburón Island, *Knight et al. 1101* (UNM); 70 mi S of Hermosillo, *G. Lindsay 1134* (DS); Isla Tiburón, *E. Lott & T. Atkinson 2513* (CAS), *2514* (CAS); road to Bahía San Carlos, *C. Lowe & R. Felger 1671* (ARIZ); Algodones Bay area, 4 mi WNW of San Carlos Bay, *P. Martin s.n.* (ARIZ); Guaymas, Microwave Mountain, 27°57', 110°54′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); N de Guaymas, *F. Miranda 8945* (MEXU); Ardilla Island, Guaymas Harbor, 27°55′N, 110°54′W, *R. Moran 4020* (DS); Tiburón Island, 28°46′N, 112°18′W, *R. Moran 4059* (DS, UC); Tiburón Island, Arroyo de la Cruz, 28°46′N, 112°22′W, *R. Moran 13005* (ARIZ, CAS); Isla Tiburón, Arroyo Sauzal, S end of island, *E. Moser & M. Moser s.n.* (ARIZ); ca. 18 mi S of Guaymas, *D. Norris et al. 20057* (CAS, MEXU); Guaymas, *E. Palmer 196* (C, NY, UC, US); near Guaymas, *W. Palmer 1222* (US); 6–8 mi NE of Cajeme (Cd. Obregón), *F. Pennell 19470* (MEXU, PH, US); entrance to Nacopuli Canyon, 3 mi N of San Carlos Bay, *A. Phillips et al. 75-175* (UC); Nacopuli Canyon road, 4.5 mi N of San Carlos Bay, *A. Phillips et al. 76-183* (ARIZ, CAS); Rte. 15, ca. 5 mi N of Navojoa, *D. Pinkava et al. P12928* (ARIZ); Ensenada Chica, 15.1 mi W of Hermosillo to Guaymas Hwy., 28°07′N, 111°17′W, *F. Reichenbacher 224* (ARIZ); Mpio. Empalme, Rancho las

Trincheras, ca. 6 km NW of Empalme, 28°01′N, 110°50′W, *A. Reina G. & T. Van Devender 2001-182B* (CAS); camino Bahía de Kino–Punta Chueca, KM 16.3, 28°55′N, 112°02′W, *A. Reina et al. 95-62* (ARIZ, CAS); Mpio. Guaymas, 27.4 km S of Restaurant Los Arrieros, KM 143 on Mex. 15, 28°05′N, 110°57′W, *A. Reina G. et al. 98-01* (CAS, MEXU, TEX); Guaymas, Colonia Peninsular, *H. Ripley 14266* (NY); Tiburón Island, *J. Rose 16790* (US); vicinity of Guaymas, *J. Rose et al. 12585* (US); vicinity of Empalme, *J. Rose et al. 12626* (NY, US); vicinity of Bahía San Carlos, *J. Russell s.n.* (ARIZ); near Rancho El Valiente, Hwy. 15 at jct. with bypass to Cd. Obregón, 3.8 mi N of turnoff to San Carlos Bay, ca. 28°02′N, 110°56′W, *A. Sanders et al. 8766* (CAS, MO); Isla Tiburón, 3 km W Punta Tormenta, *N. Scott P5* (UNM); near Ortiz, *F. Shreve 6104* (ARIZ, F); San Carlos Bay, W of Guaymas, *F. Shreve 6408* (ARIZ, F); 17 mi S of Guaymas on Mex. 15, *W. Spaulding 75-3-32* (ARIZ); 3 mi E of Mex. 15 on road to La Pintada Canyon, 28°35.5′N, 110°58.5′W, *G. Starr 754* (ARIZ); 5.8 mi N of turnoff to Bahía San Carlos on Mex. 15, *G. Starr & D. Palzkill 290* (ARIZ); Nacopuli Canyon near Bahía San Carlos, *G. Starr & C. Starr 713* (ARIZ); entrance to Nacopuli Canyon, *G. Starr et al. 27* (ARIZ); near Hwy. 15 ca. 12.2 mi E of Vicum Station, *W. Stevens 1506* (ENCB, MO); Isla Tiburón, Ensenada de Perros, 28°46′N, 112°16′W, *P. Tenorio L. et al. 9523* (F, MEXU); Tiburón Island, Sau Sal drainage, S side of island, *Tewksbery et al. s.n.* (ARIZ); Isla Tiburón, *F. Torres s.n.* (ENCB); 2.3 mi NW of Guaymas, *R. Turner & C. Lowe 148* (ARIZ); 7.5 mi W of jct. with Mex. 15, along Kino Bay Road cutoff, 28°17′N, 110°08′W, *R. Van Devender & T. Van Devender 83-116* (ARIZ); Cañón Babiso, Rancho Babiso, 2.5 mi W of San Carlos Bay, *T. Van Devender & M. Kearns s.n.* (ARIZ); Nacopuli Canyon, ca. 4 mi N of San Carlos Bay, *T. Van Devender et al. 84-238* (ARIZ); 10.2 mi W of Mex. 15 toward El Sahuaral (southern road to Bahía Kino), 28°19′N, 110°12′W, *T. Van Devender et al. 92-11* (ARIZ, CAS); Canada El Tetabejo, Sierra Libre, 28°32.5′N, 110°59′W, *T. Van Devender et al. 95-1042* (ARIZ); 75 mi S of Hermosillo on Hwy. 15, *J. Walker 98* (TEX); 1 mi N of Las Guásimas, 19 mi S of Guaymas along Mex. 15, 27°55′N, 110°34′W, *R. Warren & D. Goldberg s.n*. (ARIZ); ca. 15 mi SE of Guaymas, *G. Webster & S. Lynch 17003* (MEXU, MO); Tiburón Island, vicinity of Tecomate on N shore of island, *A. Whiting 9067* (ARIZ); 3 mi S of Ortiz toward Guaymas, *I. Wiggins 6324* (DS, UC, US); Isla Tiburón, La Sauzal, 28°49′N, 112°35′W, *I. Wiggins 17174* (DS, MEXU); Coralitos, shore at S side of Isla Tiburón, *R. Wilkinson 193* (MEXU); 10 mi NW of Bahía San Carlos, *N. Yensen 740319-1* (ARIZ).

Ruellia intermedia Leonard, J. Wash. Acad. Sci. 17:512. 1927. TYPE: MEXICO. Jalisco: Bolaños, 10–19 Sep 1897, *J. Rose 2915* (holotype: US!; isotype: NY!).

Phenology. Flowering: July–September; fruiting: August–October, February–March.

Distribution and habitats. Mexico (Baja California Sur, Chiapas, Chihuahua, Colima, Guerrero, Jalisco, México, Michoacán, Morelos, Nayarit, Sinaloa, Sonora); Sonoran plants occur in Sonoran desertscrub (Plains of Sonora), thornscrub, tropical deciduous forests, and in mesquite bosques along streams at elevations from 120 to 1000 m.

Illustration. *Journal of the Washington Academy of Sciences* 17:513. 1927.

Local names. “Conivari” (Pima, *Pennington 249*); “papachili” (Mayo, fide Van Devender et al. 2000); “rama del toro” (*Salmon s.n.*); “suspinda” (Pima, *Pennington 249*); “trikis sípunim” (Pima Bajo, *Rea 1154*); “tronando” (*Rea 1154*); “yerba del toro” (fide Gentry 1942, as *R. tuberosa*).

Use. The seeds are used in preparing a “refreshing drink-soak” (*Pennington 249*).

Daniel (1995a, 1997) provided descriptions of this species, which reaches the northern and western extents of its distribution in north-central Sonora (Fig. 33). Although most collections were made in thornscrub and tropical deciduous forest, a few collections have been made in regions of Sonoran desertscrub. Among Sonoran plants, the calyces are pubescent with mostly glandular trichomes (e.g., *Van Devender et al. 98-1276*), pubescent with exclusively eglandular trichomes (e.g., *Reina G. et al. 98-862* and most collections), or nearly glabrous (e.g., *Van Devender et al. 94-654A*). *Trauba s.n*. contains a shoot with glandular pubescent calyces and other shoots with calyces lacking glandular trichomes; *Daniel 993* shows both glandular- and eglandular-pubescent calyces on the same plant.

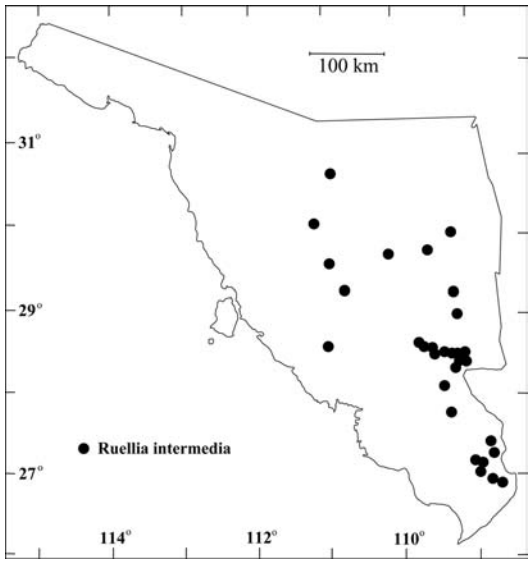


FIGURE 33. Sonoran distribution of *Ruellia intermedia*.

SONORAN COLLECTIONS: Mpio. San Javier, 2.7 km E of La Barranca on Mex. 16, 28°34′N, 109°40′W, *A. Búrquez M. 96-261* (CAS); between Onavas and hwy. between Esperanza and Rosario de Tezopaco, 5 mi S of Movas, *T. Daniel 993* (CAS); El Coyote, E-central Sonora, *R. Felger 3571* (ARIZ); Mpio. Guaymas, Sierra Libre, Cañón Tetabejo, 28°32′N, 110°59′W, *R. Felger et al. 02-292* (CAS); ca. 1 km S of El Tabelo on Alamos–San Bernardo road, 27°09′N, 108°58′W, *M. Fishbein et al. 1872* (ARIZ, CAS); Arroyo Seco, SW of Los Camotes along Los Tanques–Las Chinacas road, 27°16′N, 108°51′W, *M. Fishbein et al. 1880* (ARIZ); Dist. Alamos, Canyon Estrella, *H. Gentry 353* (DS); highway between Alamos and Navojoa, *A. Gibson & L. Gibson 2081* (ENCB, TEX); 4.3 km SW of Santa Ana de Yécora on road to Nuri, 28°23′N, 109°19′W, *D. Goldberg & S. McLaughlin 77-173* (ARIZ); Lo de Campo, near San Xavier mine turnoff on Hwy. 16, Río Mayo region, *P. Martin et al. s.n.* (ARIZ); Arroyo Gochico, E of San Bernardo, *F. Pennell 19516* (GH); Onavas, *C. Pennington 249* (TEX); NE of Onavas at mine, 28°28′N, 109°32′W, *A. Rea 1154* (ARIZ); Mpio. Onavas, Rancho la Mula, 5 km W of Agua Amarilla, 28.2 km SE of Río Yaqui on Mex. 16, 28°29′N, 109°22′W, *A. Reina G. 97-576* (CAS); Mpio. Yécora, Arroyo Santa Ana at SON. 12, 8.5 km W of Guadalupe Tayopa, 28°21′N, 109°16′W, *A. Reina G. et al. 98-862* (CAS); Mpio. Yécora, Arroyo La Quema, near Tepoca, 28°26′N, 109°15′W, *A. Reina G. et al. 98-871* (CAS, MEXU); Mpio. Soyopa, near Arroyo Garambullo on NE side of Río Yaqui bridge on Mex. 16, just S of Tonichi, ca. 28°34′N, 109°33′W, *A. Reina G. et al. 99-33* (CAS); Mpio. Yécora, base of Cerro El Pilar, above Arroyo Santa Ana, 5.5 km N of Curea on Son. 12, 28°20′N, 109°15′W, *A. Reina G. et al. 99-797* (CAS); Mpio. Sahuaripa, 8 km N of Río Yaqui, 25.5 km N of Sahuaripa on road to Tepache, 29°15′N, 109°19′W, *A. Reina G. et al. 2003-933* (CAS); 7 mi N of Guirocoba, *J. Salmon s.n.* (ARIZ, CAS); Mpio. Alamos, Rancho Esmeralda, NW outskirts of Alamos toward San Bernardo, 27°02′N, 108°56′W, *A. Sanders et al. 12501* (CAS); 7 mi S of Baviácora, *F. Shreve 6734* (ARIZ, UC); 190 km E of Hermosillo on Yécora, *P. Sundt s.n.* (ARIZ); Rancho El Carrizo, 100 mi S of Nogales, *R. Tomelson s.n.* (ARIZ); Mpio. Yécora, 1.6 km E of Rancho Viejo toward Santa Ana, ca. 28°20′N, 109°15′W, *W. Trauba s.n.* (CAS); Alamos, 27°01′N, 108°50′W, *T. Van Devender 94-619* (ARIZ); Mpio. Onavas, Rancho La Mula, 28.2 km SE of Río Yaqui on Mex. 16 (KM 195 E of Hermosillo), 28°28.5′N, 109°22′W, *T. Van Devender & A. Reina G. 2000-509* (ARIZ); Mpio. Soyopa, Loma Maderista, 3.5 km S of Tonichi, ca. 28°34′N, 109°33′W, *T. Van Devender & A. Reina G. 2001-200* (CAS); Mocuzari (Adolfo Ruiz Cortinez) Dam on Río Mayo, WNW of Alamos, 27°13′N, 109°06.5′W, *T. Van Devender & R. Van Devender 92-1385* (ARIZ, CAS); Las Lajitas crossing of the Río Cuchujaqui, 8.9 mi ESE of Alamos, 26°59′N, 108°49′W, *T. Van Devender et al. 92-1377* (CAS); El Rincon Viejo, ca. 4 km N of Alamos, Sierra de Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 94-654* (ARIZ), *94-654A* (ARIZ, TEX); Mpio. Yécora, Curea, 28°19′N, 109°17′W, *T. Van Devender et al. 98-1276* (CAS); Mpio. Arivechi, Arroyo Agua Caliente, 10.2 km (air) WNW of Arivechi, 28°57′N, 109°17′W, *T. Van Devender et al. 99-880* (CAS); Mpio. Yécora, Rancho La Palma Agujerada, 7.1 km N of Mex. 16 on road to Sahuaripa, 28°28.5′N, 109°11′W, *T. Van Devender et al. 2000-359* (ARIZ); Mpio. Moctezuma, 20.5 km SSE jct. with Moctezuma–Huasabas hwy. on road to Tepache (Son. 117), 29°39′N, 109°35′W, *T. Van Devender et al. 2004-413* (CAS); Mpio. San Javier, Cerro el Halcon, near San Javier, 28°37′N, 109°43′W, *L. Varela E. 96-209B* (CAS); ca. 1 mi E of RR on road to Horcasitas, *I. Wiggins 7275* (ARIZ, DS, GH, MICH, US); E slope of Sierra Batuc, several mi NW of Batuc, *I. Wiggins & R. Rollins 292* (ARIZ, DS, GH, MO, UC, US), *292a* (DS).

Ruellia inundata H.B.K., Nov. Gen. Sp. 2:239. 1817. *Aphragmia inundata* (H.B.K.) Bremek., Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk., Tweede Sect. 45:10. 1948. TYPE: COLOMBIA. "In ripa fluminis Magdalenae prope Mompox et Badillas," May, (fide protologue), *A. von Humboldt & A. Bonpland mss. n. 3711* (holotype: P-Bonpl.!).

Ruellia albicaulis Bertero ex Spreng., Syst. Veg. 2:822. 1825. TYPE: COLOMBIA. "Ad fl. Magdalen." (fide protologue), no specimens have been seen.

Aphragmia haenkei Nees in Lindley, Intr. Nat. Syst. Bot., ed. 2, 444. 1836. *Dipteracanthus haenkei* (Nees) Nees in A. de Candolle, Prodr. 11:141. 1847. TYPE: MEXICO. Guerrero: Acapulco, 1791, *T. Haenke s.n.* (no type designated nor place of deposition noted; probable type material: K, PR!, PRC!).

Ruellia galeottii Leonard, Kew Bull. 1938:59. 1938. TYPE: MEXICO. Oaxaca: Sola, Oct 1844, *H. Galeotti 510J* (holotype: US!; isotypes: NY!, W!).

Phenology. Flowering: October–April; fruiting: October–April.

Distribution and habitats. Mexico (Baja California Sur, Campeche, Chiapas, Colima, Guerrero, Jalisco, México, Michoacán, Morelos, Oaxaca, Puebla, Quintana Roo, Sinaloa, Sonora, Veracruz, Yucatán), Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, and Brazil; Sonoran plants occur in canyons and disturbed sites in tropical deciduous forests at elevations from 260 to 740 m.

Illustrations. *Carnegie Institution of Washington Publication* 461:210. 1936; *Fieldiana, Botany* 18:17. 1986.

Descriptions of *Ruellia inundata* were provided by Daniel (1995a, 1997). Sonoran plants are noted as having bluish corollas. Vegetative organs of plants of this species are usually viscid and have a mephitic odor (similar to that of *Dyschoriste hirsutissima*). The species reaches the northern extent of its distribution in southern Sonora (Fig. 32).

Sonoran collections: San Bernardo, Río Mayo, *H. Gentry 1068* (ARIZ, F, MO, S, US); near Tojibampo, 19.5 km NNW of San Bernardo toward Mesa Colorada, 27°02′N, 108°47′W, *T. Van Devender et al. 93-369* (ARIZ, CAS, TEX), *93-1495* (ARIZ, CAS, MO, NY, TEX), *93-1495A* (ARIZ); ca. 4 km NNW of Nahuibampo, W slopes of Cordón Topiyecas, 27°24′N, 108°55′W, *T. Van Devender et al. 94-353* (ARIZ); western Sierra de Alamos, 7.7 km S of Tetajiosa toward Las Rastras, 26°56′N, 109°04′W, *T. Van Devender et al. 95-158* (ARIZ, CAS); Cerro las Tátemas, below Microondas La Luna, 13.8 km NW of Alamos, 27°07′N, 109°02′W, *T. Van Devender et al. 95-1158* (ARIZ, CAS); 4.7 km SSE of Piedras Verdes toward Tepustete, ca. 12 km NNW of Alamos, 27°08′N, 108°56′W, *T. Van Devender et al. 95-1180* (CAS).

Ruellia leucantha Brandegee subsp. ***postinsularis*** (Gentry) T.F. Daniel, Polibotanica 2:7. 1996. *Ruellia leucantha* var. *postinsularis* Gentry, Brittonia 6:323. 1948. TYPE: MEXICO. Sinaloa: Cerro Tecomate, W of Pericos, 28 Feb 1940, *H. Gentry 5739* (holotype MICH!; isotypes ARIZ, DS!, GH, MEXU!, MO, NA, NY, RSA!, UC!, US).

Dyschoriste candida Brandegee, Zoe 5:242. 1906. *Ruellia candida* (Brandegee) Kobuski, Ann. Missouri Bot. Gard. 15:60. 1928. TYPE: MEXICO. Sinaloa: vicinity of Culiacán, Yerba Buena near Altata, 10 Oct 1904, *T. Brandegee s.n.* (holotype UC!; isotypes GH!, US!).

Shrubs to 8 dm tall. Young stems quadrate to quadrate-sulcate, evenly puberulent with erect to flexuose to retrorse eglandular trichomes 0.05–0.2 mm long and sessile patelliform glands (glandular punctate), the trichomes sometimes very dense and ± obscuring epidermis. Leaves petiolate, petioles to 7 mm long, blades ovate to elliptic, 22–57 mm long, 11–33 mm wide, 1.7–2.2 times longer than wide, rounded to acute at apex, rounded to subattenuate at base, surfaces glandular punctate and pubescent (sometimes very densely so) with erect to flexuose to antrorse eglandular

trichomes 0.1–0.5 mm long, margin ciliate with similar trichomes. Inflorescence of axillary dichasia; dichasia sessile, 1 (–2) per axil, 1-flowered, alternate or opposite at vegetative nodes; flowers sessile to subsessile (i.e., borne on pedicels to 1 mm long). Bracteoles prominent to inconspicuous (to obsolete), sometimes caducous, petiolate and linear-elliptic to linear or sessile and triangular to triangular-subulate, 0.2–23 mm long, 0.2–5 mm wide, pubescent like young stems. Calyx 5-lobed, (5–) 7–14 mm long, tube 1–2 mm long, lobes subulate to linear-subulate, subequal to unequal in length (i.e., 1 lobe up to 1 mm longer than others), (4–) 6.5–13 mm long, 4–8.3 times longer than tube, abaxially pubescent like young stems. Corolla white, 38–68 mm long, externally glandular punctate and pubescent with erect to flexuose to retrorse eglandular trichomes 0.1–0.3 mm long, tube funnelform, 40–52 mm long, 2.2–3 mm in diameter near midpoint, narrow proximal portion of tube 17–30 mm long, distally abruptly expanded into a throat 13–23 mm long, limb (22–) 37–40 mm in diameter, lobes 7–16 mm long, 8–16 mm wide. Stamens included to ± exserted, didynamous, longer pair 12–18 mm long, shorter pair 10–16 mm long, filaments proximally pubescent with eglandular trichomes and glandular punctate, distally glabrous, thecae (3–) 4.5–5.5 mm long. Style (25–) 33–47 mm long, pubescent with erect to antrorse eglandular trichomes and glandular punctate; stigma unequally 2-lobed, 1 lobe 2–2.8 mm long, other lobe 0.2–0.4 mm long. Capsule 8–12 mm long, externally glandular punctate and pubescent with erect to flexuose to retrorse eglandular trichomes 0.05–0.2 mm long, stipe 2 mm long, head ovoid ellipsoid to ellipsoid-subcircular, 8–10 mm long. Seeds 4 (–6) per capsule, 3.5–4.5 mm long, 3.2–4.5 mm wide, surfaces and margin covered with appressed hygroscopic trichomes to 0.3 mm long, margin ± swollen.

Phenology. Flowering: August; fruiting: April, October.

Distribution and habitats. Northwestern Mexico (Sinaloa, Sonora); Sonoran plants occur in desert oases in riparian Sonoran desertscrub (Plains of Sonora) at elevations from 250 to 300 m.

Illustration. None found.

The collections cited below represent the first records of this species in Sonora. Daniel (1996, 1997) recognized two subspecies of *Ruellia leucantha*. Plants from Sonora pertain to *R. leucantha* subsp. *postinsularis* and greatly resemble the type from Sinaloa. The description of that subspecies provided by Daniel (1996) has been augmented with data from Sonoran plants and is provided above. The nominate subspecies is restricted in distribution to the Cape Region of Baja California Sur (Daniel 1997). The subspecies of *R. leucantha* can be distinguished by the following couplet:

1. Cauline trichomes erect to flexuose, 0.3–1.5 mm long; capsules 12–15 mm long; Baja California Sur. . . . . subsp. *leucantha*
1. Cauline trichomes erect to retrorse, 0.05–0.2 mm long; capsules 9–12 mm long; Sonora and Sinaloa. . . . . subsp. *postinsularis*

The northern distributional extents of both the species and subspecies *postinsularis* are in west-central Sonora (Fig. 30). The collector of all known Sonoran plants of *R. leucantha* noted that the desert oasis in which the species occurs in that state is located in a region of deep canyons (with permanent water) in which numerous tropical species occur. Its occurrence within the Sonoran Desert, like that of *Aphanosperma sinaloensis*, is restricted to riparian corridors in which more tropical elements extend their ranges. According to T. Van Devender (pers. commun.), the canyon slopes are dominated by thornscrub.

Some confusion with respect to corolla color is present among the label data on Sonoran collections of this species. The sole flowering specimen (*Búrquez & Yetman 97-431*), identified as *R. californica*, notes that corollas were purple (i.e., as in *R. californica*). A fruiting collection (*Búrquez et al. 97-497*), identified as *Justicia candicans*, noted that corollas were red (i.e., as in *J. candicans*). I suspect that corolla colors as provided on the labels of these collections pertain to the

species as identified, not to the plants collected. If I am incorrect, and Sonoran representatives of *R. leucantha* do not have white corollas like their counterparts in Sinaloa and Baja California Sur, then the glandular punctate pubescence still distinguishes this species from other Sonoran *Ruellia*.

Sonoran collections: La Pintada, 49 km S de Hermosillo por la Carr. Fed. 15, 28°35′N, 110°58′W, *A. Búrquez & R. Felger 93-32* (MEXU), *A. Búrquez & D. Yetman 97-431* (MEXU); Sierra Libre, Cañada Prieta, S de Hermosillo por la Carr. Fed. 15, 28°34′N, 110°58′W, *A. Búrquez et al. 97-497* (MEXU).

Ruellia malacosperma Greenm., Proc. Amer. Acad. Arts 34:572. 1899. TYPE: MEXICO. Tamaulipas: Tampico, 30 Apr 1898, *C. Pringle 6806* (lectotype, designated here, see discussion below: GH, photo at CAS!; isolectotypes: BM!, F!, L!, LL, MEXU, MIN!, NSW!, NY, PR!, PRC!, S!, UC!, US).

Perennial herbs to 1 m tall. Young stems quadrate to quadrate-sulcate to ± flattened, internodes mostly glabrous or sometimes ± evenly pubescent with flexuose eglandular trichomes 0.5–2 mm long, nodes pubescent with flexuose eglandular trichomes 0.5–2 mm long. Leaves petiolate, petioles to 20 mm long, blades narrowly elliptic to elliptic, 45–163 mm long, 8–38 mm wide, 2.3–5.8 times longer than wide, (rounded to) acute to attenuate at apex, acute to attenuate at base, surfaces sparsely pubescent with a few scattered flexuose eglandular trichomes along midvein, midvein conspicuously caniliculate on adaxial surface (at least near proximal portion of blade), margin subsinuate to crenate-undulate. Inflorescence of pedunculate ascending expanded dichasia to 120 mm long from leaf axils; dichasia (opposite to) alternate, 1 per axil, (1–) 3–many-flowered, peduncles 26–70 mm long, subquadrate to quadrate, glabrous or sparsely pubescent with inconspicuous glandular trichomes 0.05–0.1 mm long (glandular-puberulent). Bracteoles sometimes caducous, lanceolate to lance-linear, 5–10 mm long, 1–1.5 mm wide, abaxial surface glabrous, secondary bracteoles similar to bracteoles except smaller. Flowers pedicellate, pedicels 4–12 mm long, ± densely glandular-puberulent. Calyx 13–21 mm long, tube 2–3 mm long, lobes lance-subulate, subequal (i.e., longest lobe 1.1–1.3 times longer than shortest lobe), 10.5–18 mm long, 3.8–7.5 times longer than tube, 1.2–1.5 mm wide, abaxially glandular-puberulent (glands up to 0.2 mm long), margin ciliate with antrorse eglandular trichomes 0.05–0.6 mm long and/or glandular-puberulent. Corolla blue-purple, 45–60 mm long, externally pubescent with flexuose eglandular and glandular (sometimes sparse) trichomes 0.1–0.2 mm long, tube 33–38 mm long, narrow proximal portion 9–15 mm long, ± abruptly expanded into throat, throat 18–25 mm long, longer than narrow proximal portion, 6.5–14 mm in diameter near midpoint, limb 32–46 mm in diameter, lobes 12–17 mm long, 14–18 mm wide. Stamens included, longer pair 12–15 mm long, shorter pair 8–10 mm long, thecae 3.7–4 mm long. Style 20–21 mm long, pubescent (at least proximally) with upward-pointing eglandular trichomes, stigma unequally 2-lobed, 1 lobe 0.2 mm long, other lobe 1.5–2.2 mm long. Capsule 24–29 mm long, proximally glabrous, inconspicuously pubescent near apex with erect to antrorse glandular and eglandular (sometimes absent) trichomes 0.05–0.2 mm long, stipe 4 mm long, head linear-ellipsoid. Seeds 16–20 per capsule, 3.1–3.2 mm long, 2.4–2.5 mm wide, surfaces and margin covered with appressed hygroscopic trichomes.

Phenology. Flowering: June, October; fruiting: March, June, October.

Distribution and habitats. Presumably native to Mexico where it has been recorded from Guerrero, Nuevo León, San Luis Potosí, Sinaloa, Tamaulipas, and Veracruz (reports from some of these states undoubtedly are based on cultivated plants); Sonoran plants are cultivated or occur in margins of dried pools in coastal thornscrub with *Prosopis, Acacia, Cyperus*, and *Lycium* at elevations near sea level (naturalized or possibly native plants) or up to 415 m (cultivated plants).

Illustration. *Carnegie Institution of Washington Publication* 461:208. 1936.

Three collections, from three Mexican states, were cited by Greenman in the protologue:

Pringle 6806 (Tamaulipas), *Palmer 570* (Guerrero), and *Botteri s.n* (Veracruz). The latter collection was cited somewhat incidentally, and it was noted to be at GH. Although their herbaria of deposit were not noted in the protologue, specimens of both *Palmer 570* and *Botteri s.n.* have been located to date only at GH. Pringle's collection was widely distributed with a printed label bearing Greenman's name for this taxon. It remains unknown, however, whether Greenman actually studied all of the duplicates. Therefore, only the specimens at GH of these three collections are here considered to be syntypes. Tharp and Barkley (1949) indicated that the "type" of *R. malacosperma* was *Pringle 6806*. This would appear to be sufficient under the current International Code of Botanical Nomenclature (Greuter 2000) to effectively lectotypify the species (i.e., with the only syntype of *Pringle 6806* being at GH). If it is argued, or can be demonstrated, that Greenman used duplicates of this collection in composing his protologue, then this would not appear to have constituted a valid lectotypification under Article 7.11 of the ICBN because the "type element" is not clearly indicated (i.e., there are numerous syntypes of *Pringle 6806*). To avoid further confusion, *Pringle 6806* at GH, a complete specimen with flowers and fruits, is here designated as the lectotype for this species. It is likely that Tharp and Barkely's "lectotypification" was unintentional and that mine is superfluous, but neither rationale would prevent the lectotypification of this name under the ICBN.

This species is cultivated in Sonora (e.g., *Daniel 9773*) and either escapes/naturalizes or is also native to the state (e.g., *Sanders et al. 13579*). There is no indication on *Rose 1288* whether the plant was cultivated or not in Guaymas. The above description is based on the type and other Mexican collections resembling it. *Sanders et al. 13579*, consisting of fruiting rhizomatous plants collected in March in thorn scrub, resembles *R. malacosperma* in most respects and is tentatively treated in that taxon. Corollas are not present on this collection, however, and it differs from others of *R. malacosperma* by its lower stature (2 vs. up to 10 dm tall), shorter leaves (20–50 vs. 45–135 mm long), shorter inflorescences (e.g., peduncles 2–7 vs. 30–65 mm long), and shorter capsules (15–18 mm long). Although the distinctions between *R. malacosperma* and *R. coerulea* Morong are not great (Daniel 1995a; Turner 1991-with *R. coerulea* treated as *R. brittoniana* Leonard), specimens from Sonora more closely resemble the former rather than the latter taxon by their relatively wider (2.9–6.2 times longer than wide) leaf blades (vs. 5.6–30 times longer than wide in *R. coerulea*). Both species are widely cultivated, and their origins and/or native distributional ranges are not known with certainty.

SONORAN COLLECTIONS: garden of La Ciudadela just off Plaza de Armas in Alamos, ca. 27°01′N, 108°56′W, cultivated, *T. Daniel 9773* (CAS); Mpio. Huatabampo, roadside ca. 1 km N of Maroncarit, 10 km NW of Yavaros, ca. 26°44′N, 109°37′W, *A. Sanders et al. 13579* (ARIZ, CAS, MO); Guaymas, *J. Rose 1288* (US).

Ruellia nudiflora (Engelm. & A. Gray) Urb., Symb. Antill. 7:382. 1912. *Dipteracanthus nudiflorus* Engelm. & A. Gray, Boston J. Nat. Hist. 5:229. 1845. TYPE: UNITED STATES. Texas: Sim's Bayou near Houston, May–Jul (fide protologue) 1843, *F. Lindheimer 157* (lectotype, designated here, see discussion below: GH!; isolectotypes: GH!, UC!).

Ruellia tuberosa L. var. *occidentalis* A. Gray, Syn. Fl. N. Amer. 2(1):325. 1878. *Ruellia nudiflora* var. *occidentalis* (A. Gray) Leonard, J. Wash. Acad. Sci. 17:516. 1927. *Ruellia occidentalis* (A. Gray) Tharp & F.A. Barkley, Amer. Midl. Naturalist 42:25. 1949. TYPE: collections of Berlandier, Wright, Rothrock, and Coulter from the southwestern United States were cited by Gray; Leonard (J. Wash. Acad. Sci. 17:516. 1927) indicated that the type was collected in Texas by Berlandier; it will require study of these collections to determine whether Leonard effectively lectotypified the species at that time.

Ruellia nudiflora var. *glabrata* Leonard, J. Wash. Acad. Sci. 17:518. 1927. *Ruellia glabrata* (Leonard) Tharp & F.A. Barkley, Amer. Midl. Naturalist 42:13. 1949. TYPE: MEXICO. Sonora: Ciénega, Aug 1874, *J. Rothrock 560* (holotype: US; isotypes: GH!, NY).

Ruellia gooddingiana A. Nelson, Amer. J. Bot. 18:437. 1931. TYPE: MEXICO. Sonora: La Ciénega, 18 Jul 1911, *L. Goodding 959* (holotype: RM!).

See Daniel (1995a) for a complete listing of synonyms for this species.

Phenology. Flowering: March, July–October; fruiting: July–October.

Distribution and habitats. United States (Arizona, Louisiana, Texas), Mexico (Baja California Sur, Campeche, Chiapas, Chihuahua, Coahuila, Colima, Durango, Morelos, Nuevo León, Oaxaca, Puebla, Querétaro, Quintana Roo, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz, Yucatán), Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, and West Indies; Sonoran plants occur in swampy meadows, flats, swales, along watercourses, and in disturbed areas in Sonoran desertscrub (Arizona Upland, Central Gulf Coast, Lower Colorado River Valley, Plains of Sonora), Chihuahuan desertscrub, palm oases, thornscrub, mesquite grasslands, mesquite bosques, and tropical deciduous forests at elevations from near sea level to 1180m.

Illustrations. Figure 34; *Carnegie Institution of Washington Publication* 461:211. 1936; *Flora of Texas* 1(3):240. 1966; *Desert Plants* 5:172. 1984; *Fieldiana, Botany* 18:18. 1986.

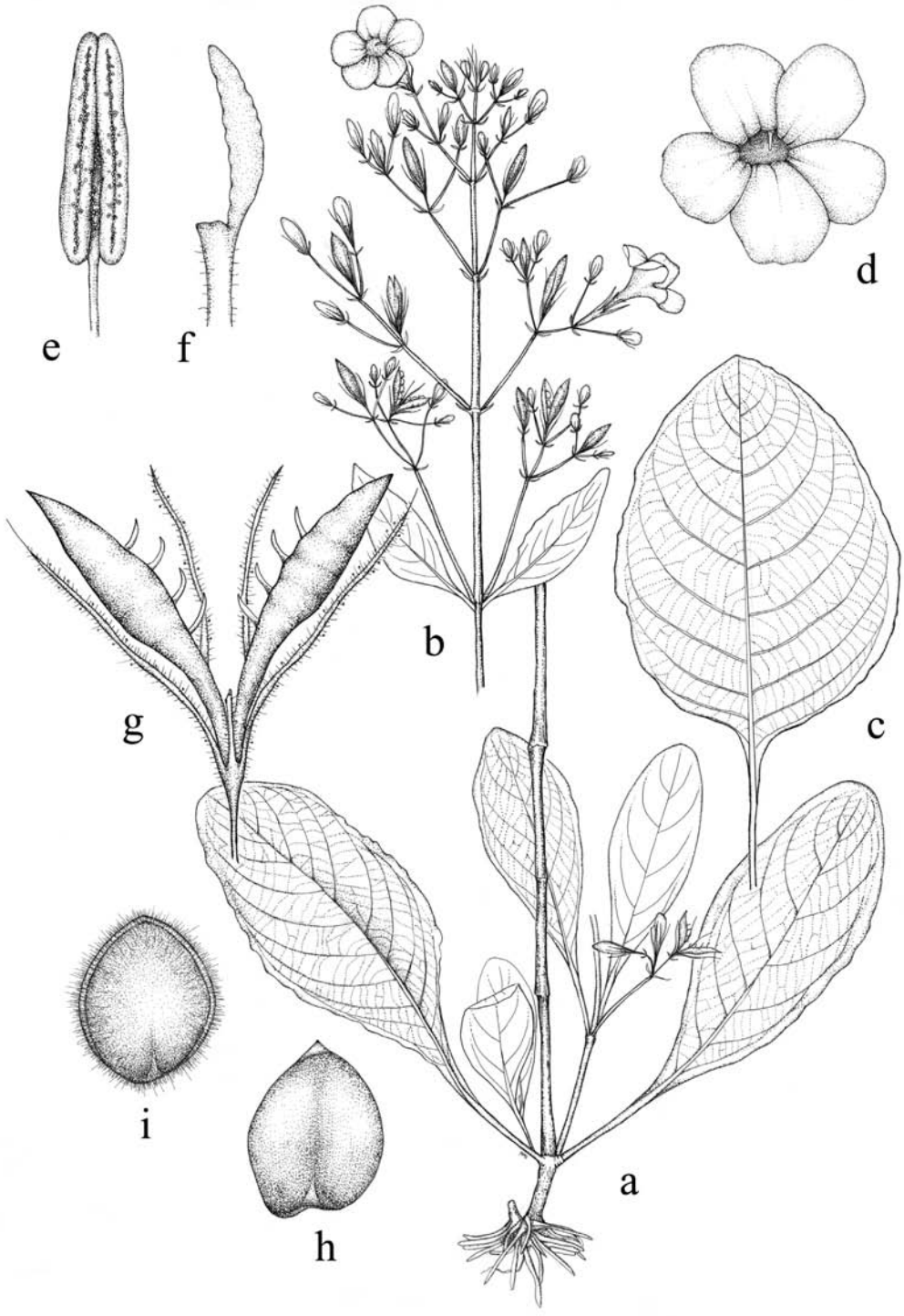
Local names. “Cuetito” (fide White 1949); “papachili” (fide Yetman and Van Devender 2002); “rama del toro” (*Van Devender et al. 95-1074*); “tronador” (fide Yetman and Van Devender 2002).

Use. Yetman and Van Devender (2002) noted that the Mayo use the leaves to brew a tea that is taken to alleviate fever.

Dipteracanthus nudiflorus was based primarily on *Lindheimer 157* from Sims Bayou (the locality does not appear on syntypes at GH or UC, but is noted by Engelmann and Gray in the protologue). In the protologue Engelmann and Gray also cited *Drummond coll. 2, no. 221* (seen at GH and K) and *Drummond coll. 3, no. 257* (seen at GH and K), both from unknown localities in Texas. Leonard (1927) indicated that Lindheimer had collected the type at Sim’s Bayou. Because he did not cite a specific specimen, and as there appear to be multiple syntypes, his choice would not appear to constitute a lectotypification. Potential syntypes of *Lindheimer 157* include a specimen at GH with the plant name in Gray’s handwriting, a specimen now at GH that came from the Boston Society of Natural History (in whose journal the species was published), and a specimen at UC with the name written apparently by Gray. All of these specimens bear the number “157” which was likely assigned to Lindheimer’s plants as they were studied. The three potential syntypes noted above were all collected in 1843 as part of Lindheimer’s “fasc. I.” Other specimens of this species bearing the number “157” were noted to have been collected by Lindheimer as “fasc. III” in 1846 (e.g., at UC). It is unknown to me whether the specimens of Lindheimer’s no. 157 from 1846 were also collected at Sim’s Bayou, but because they were collected subsequent to the publication of this name, they would not figure in its typification. To firmly establish a type for this species, a lectotype is here designated for *Dipteracanthus nudiflorus*: *Lindheimer* (*Fasc. I*) *157* (GH-Harvard University Herbaria no. 00093956). The lectotype was collected in 1843 and is mounted on a sheet with a Drummond collection.

Daniel (1995a, 1997, 1999a) and Daniel and Acosta (2003) provided descriptions of this species. Some collections note the presence of white corollas. While it is possible that some plants

FIGURE 34 (right). *Ruellia nudiflora*. a. Habit of base of plant (*Wiggins & Rollins 136*), × 0.49. b. Habit of apex of plant (*Mearns 737*), × 0.43. c. Leaf (*Wiggins & Rollins 136*), × 0.51. d. Corolla (*Daniel & Butterwick 2980*), × 1.3. e. Distal portion of stamen with anther (*Felger et al. 01-459*), × 11.3. f. Distal portion of style with stigma (*Felger et al. 01-459*), × 17.8. g. Capsule with calyx (lobe in front partially removed) (*Mearns 1999*), × 3.1. h. Dry seed (*Daniel & Marrs 1808*), × 6.9. i. Moistened seed (*Daniel & Marrs 1808*), × 6.9. Drawn by Nadia Strasser.


e
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a

may be albinic in corolla color, most collections purporting to have white corollas also indicate that mature flowers were not present or lack them on the specimens. Corolla buds of *R. nudiflora* appear whitish but are invariably blue internally when opened.

This species occurs nearly throughout Sonora (Fig. 35), including occurrences in each subdivision of the Sonoran Desert in the state. Flowering of *Ruellia nudiflora* mostly coincides with the summer rains, but occasional plants have been collected in flower during the spring. Plants are usually found associated with watercourses (i.e., on stream banks, in arroyo bottoms, or in riparian flood zones) or flats or swales where water accumulates following rains.

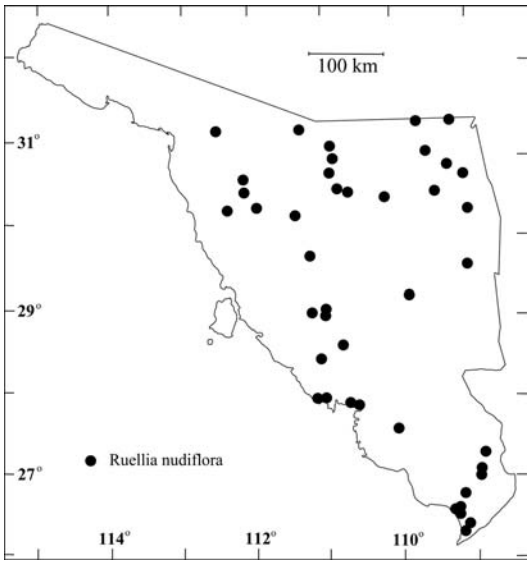

FIGURE 35. Sonoran distribution of *Ruellia nudiflora*.

SONORAN COLLECTION: 2.5 km S de Hermosillo, 29°01′N, 110°57′W, *A. Búrquez & A. Quijada 91-14* (MEXU); from Hwy. 15 to Bahía Agiabampo, ca. 5 km NE of Bahía Agiabampo, ca. lat. 26.41°N, long. 109.20° W, *T. Daniel 9768* (CAS); 4.6 mi N of Fronteras, *R. Felger 4039* (ARIZ, ENCB); 10.2 mi S of La Pintada (between Hermosillo and Guaymas) on Mex. 15, *R. Felger 8364* (ARIZ), *R. Felger & C. Lowe 8364* (ARIZ, MEXU); ca. 7 mi S of Pitiquito, *R. Felger & E. Abbey 20271* (ARIZ); Bahía Algadones, ca. 2 km N of Club Med, *R. Felger & R. Devine 85-333* (ARIZ); 0.8 km E of Las Guásimas, *R. Felger & N. Gonzales 85-382* (ARIZ, MEXU); 9 mi E of Empalme end of Douglas Bridge on Hwy. 15, then 2.5 mi S of Hwy. on Playa del Sol Road, 27°54′N, 110°41′W, *R. Felger & F. Reichenbacher 85-1106* (ARIZ, CAS, MEXU, TEX); road to Bahía San Carlos, 4 mi W of Hwy. 15, *R. Felger & R. Thomas 11941* (ARIZ); SW of Los Camotes on Arroyo Seco, along Los Tanques-Las Chinacas road, 27°16′N, 108°51′W, *M. Fishbein et al. 1880* (ARIZ); Mpio. Magdalena de Kino, Rancho La Tinaja Colorada, ca. 15 km NE de Magdalena de Kino, 30°42′N, 110°48′W, *A. Flores M. et al. 4584* (ARIZ, IEB, MEXU); Mpio. San Pedro de la Cueva, 3 km SW de San José de Batuc, carr. Mazatán–San Pedro de la Cueva, 29°18′N, 109°54′W, A. Flores M. & J. León 5276 (MEXU); Mpio. La Colorada, 2.5 km S de El Pilar, 28°39′N, 110°52′W, *A. Flores M. & J. León G. 5356* (IEB, MEXU); 15 mi S of Hermosillo, *H. Gentry 4562* (ARIZ); Ciénega on the Río Saracahi, 1.7 mi NW of Agua Fria, 30°22′N, 110°35′W, *D. Goldberg 77-126* (ARIZ, MEXU); La Ciénega, *L. Goodding 959* (ARIZ); Logulea [?] to Altar, *D. Griffiths 6895* (MO); vic. of San Pedro, *C. Hartman 955* (MO, UC, US); Nacori Chico drainage, E of Buena, 29°37′N, 108°59′W, E. Joyal 1722 (MEXU); 5.1 mi NW of San Carlos Yacht Club on road to Algadones, *R. Krizman & O. Soule s.n.* (ARIZ); without locality, *E. Palmer 98* (C, MEXU, NY, US); Bacum Station, near Río Yaqui, *F. Pennell 20202* (MEXU, PH, US); 14 mi by Tecolote road W of Mex. 15 (1.4 mi N of El Oasis), 29°48′N, 111°16′W, *F. Reichenbacher 1017* (ARIZ); Mpio. Imuris, Agua Caliente, 19 km N of Imuris, 30°57′N, 110°51′W, *A. Reina G. et al. 2001-657* (CAS); Mpio. Agua Prieta, Rancho San Bernardino, 29 km E of Agua Prieta on Mex. 2, 31°20′N, 109°17′W, *A. Reina G. et al. 2003-1005* (CAS); Mpio. Huatabampo, Camahuiroa, 27 km SE of Yavaros, 26°31′N, 109°16′W, *A. Sanders et al. 12713* (CAS); Distr. Altar, Bahio de Aquituni, between Pitiquito and Rancho Verruga, *F. Shreve 6023* (ARIZ); Ejido Manual Caudillo, 7.4 mi S of Luis (ca. 10 mi N of Sinaloa border), *O. Soule & R. Krizman s.n.* (ARIZ); Palm Canyon, SE of Magdalena in Cerro Cinta de Plata, *L. Toolin & T. Van Devender 435* (ARIZ); across Río Bacanuchi from Tauichopa (2.7 mi N of Arispe), *R. Turner & C. Lowe 185* (ARIZ); Alamos, 27°01′N, 108°50′W, *T. Van Devender 94-619* (ARIZ); Ciénega near Rancho Agua Fria on Río Saracachi, E of Cucurpe, *T. Van Devender & C. Miksicek s.n.* (ARIZ, ENCB); Mpio. Sáric, Rancho Los Nogales, Arroyo El Silencio, 19.5 km N of Sáric on old road to Sásabe, 31°15′N, 111°21′W, *T. Van Devender & A. Reina G. 2002-915* (CAS); Mpio. Navojoa, Teachive de Masiaca, Arroyo

Masiaca, 26°47′N, 109°14′W, *T. Van Devender & D. Yetman 94-665* (ARIZ); Mouth of Arroyo Masiaca, Las Bocas on Gulf of California, ca. 52 km S of Navojoa, 26°36′N, 109°20′W, *T. Van Devender & D. Yetman 94-703* (ARIZ); Palm Canyon, 17.7 mi SE of Magdalena in Cerro Cinta de Plata, *T. Van Devender et al. s.n.* (ARIZ); Mpio. Navojoa, Arroyo Masiaca, ca. 0.5 km N of Teachive de Masiaca, 26°48′N, 109°14′W, *T. Van Devender et al. 93-968* (ARIZ, CAS); El Rincon Viejo, ca. 4 km N of Alamos in Sierra de Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 94-654* (ARIZ); 1 km SSW of Sirebampo, 26°37′N, 109°15′W, *T. Van Devender et al. 95-1074* (CAS); 28 mi SE of Guaymas, *U. Waterfall 12830* (TEX, UC, US); 65 mi SE of Sonoita, ca. 31°10′N, 112°20′W, *G. Webster & G. Breckon 15572* (GH, MEXU); near Colonia Oaxaca, Arroyo del Pulpito, *S. White 759* (GH, US); region of the Río de Bavispe, Cañón de las Bellotas, *S. White 3565* (ARIZ, GH, MEXU); 9 mi W of La Angostura, *S. White 4023* (ARIZ, NY, US); Colonia Morelos, *S. White 4111* (ARIZ, NY, US); 7 mi W of Pozo Cerna, *I. Wiggins 6040* (DS); 20 mi W of Norio, *I. Wiggins 6173* (DS, US); along Río de los Alisos, 31 mi S of Nogales, *I. Wiggins 7016* (DS, US); 27 mi W of Hermosillo, *I. Wiggins & R. Rollins 136* (ARIZ, DS, MO, NY, UC, US).

Ruellia parryi A. Gray, Syn. Fl. N. Amer. 2(1):326. 1878. *Dipteracanthus suffruticosus* Torr. in W.H. Emory, Rep. U.S. Mex. Bound. 2(1):122. 1859, non *Ruellia suffruticosus* Roxb. (1814). TYPE: MEXICO. Chihuahua: "Presidio del Norte," 7 Jul 1852, *C. Parry* "*722*" (lectotype, designated here, see discussion below: NY [plant at lower right on sheet], photo at http://sidsite.nybg.org/herbim/2970/v-297-00311935big.jpg!).

Erect subshrubs to 6 dm tall. Young stems quadrate-sulcate, internodes glabrous or evenly pubescent with retrorse eglandular trichomes 0.05–0.2 mm long, nodes often with a cluster of flexuose eglandular trichomes to 1.3 mm long. Leaves petiolate, petioles to 8 mm long, blades ovate to lance-elliptic to elliptic to oblanceolate to obovate, 9–25 (–35) mm long, 3–15 mm wide, 1.7–2.8 (–7) times longer than wide, acute to rounded at apex, acute to attenuate at base, surfaces pubescent (sometimes sparsely so) with erect to flexuose (and with at least some branched or stellate) trichomes to 0.8 mm long, margin entire to undulate, usually conspicuously ciliate with trichomes like those of leaf surfaces (or these usually somewhat longer, i.e., to 1.2 mm long). Inflorescence of pedunculate dichasia in leaf axils; dichasia alternate or opposite, 1 per axil, 1 (–3)-flowered, peduncles 0.5–6 mm long, glabrous or pubescent like young stems. Bracteoles subfoliose, petiolate, ovate to lanceolate to elliptic to obovate, 6.5–18 mm long, 2–6.5 mm wide, pubescent like leaves. Flowers sessile. Calyx 5–11 mm long, abaxially pubescent with erect to flexuose (sometimes branched or stellate) eglandular trichomes 0.05–0.2 mm long, tube 1–2 mm long, lobes unequal in size, anterior segment lanceolate to elliptic, 4–9 mm long, 1–1.8 mm wide, apically 2-lobed, lobes ovate to subulate (sometimes asymmetric), 2–7 mm long (sometimes divided nearly to or to the tube), lateral lobes lance-subulate to lanceolate, 2.5–7 mm long, 0.5–0.7 mm wide, posterior lobe lanceolate, 3.5–9 mm long, 0.7–1.2 mm wide, entire. Corolla blue, 20–41 (–50) mm long, externally pubescent with erect to flexuose to retrorse eglandular trichomes 0.05–0.2 mm long, tube 16–38 mm long, narrow proximal portion 8–23 mm long, abruptly expanded distally into throat, throat obconic, 7–13 mm long, shorter than tube or ± equal in length to tube, 2.3–7 mm in diameter near midpoint, limb 12–32 mm in diameter, lobes 5–13 mm long, 5–14 mm wide. Longer stamens 7–9 mm long, shorter stamens 5–6 mm long, thecae 1.8–2 mm long. Style 19–26 mm long, proximally pubescent with eglandular trichomes, distally glabrous; stigma unequally 2-lobed, 1 lobe 0.5 mm long, other lobe 1.2 mm long. Capsule ellipsoid, 9–11 (–13) mm long, (glabrous or) entirely or distally pubescent with retrorse eglandular trichomes 0.1–0.2 mm long. Seeds 6 (or more) per capsule, lenticular, 2.5–3 mm long, 1.9–2.2 mm wide, surfaces and margin pubescent with appressed trichomes.

Phenology. Flowering: August; fruiting: August.

Distribution and habitat. Southwestern United States (Arizona, New Mexico, Texas) and

northern Mexico (Chihuahua, Coahuila, Durango, Nuevo León, Sonora, Zacatecas); Sonoran plants occur on limestone in Chihuahuan desertscrub at an elevation of 1287 m.

Illustrations. *Trees, Shrubs and Woody Vines of the Southwest*, 934. 1960; *Flora of Texas* 1(3):247. 1966; *Trees and Shrubs of Trans-Pecos Texas*, 396. 1988.

In the protologue of *Dipteracanthus suffruticosus*, Torrey cited the following collection data: "Presidio del Norte; July–August; *Parry*. Sides of rocky hills, valley of the Pecos. No. 1461, *Wright*." A lectotype is designated above from among the syntypes in Torrey's protologue. In Torrey's herbarium at NY, there are three pertinent collections: *Wright 1461* from the valley of the Pecos, a collection made by Parry at Presidio del Norte on 7 July 1852 (with "722" also written on the label), and another collection (without the name of the collector) made at Presidio del Norte in August of 1852. The two collections from Presidio del Norte are mounted on the same sheet. Because Torrey referred to unspecified collection(s) by Parry from July and August, he undoubtedly attributed both of these collections to Parry and was including both in his citation of syntypes. Thus there are three syntypes and all of them pertain to what is now treated as *R. parryi*. Tharp and Barkley's (1949) indication of the type as "at Presidio del Norte, *Parry s.n.*" would not appear to constitute lectotypification (either intentional or unintentional) because it does not distinguish between the two syntypes presumably collected by Parry at that locality. The lectotype designated above possesses an open and intact flower (unlike the other syntypes). The type locality, Presidio del Norte, was noted in the protologue to be at the junction of the Río Conchos and Río Grande and is today called Ojinaga.

Ruellia parryi is here reported for the first time from Sonora where it reaches the western extent of its distribution (Fig. 31). It is one of at least three Mexican species of *Ruellia* known to have stellate or dendritic trichomes on mature organs (e.g., leaves, bracteoles, calyx). The other two, *R. hirsutoglandulosa* (Oerst.) Hemsl. and *R. lanatoglandulosa* (Nees) Lindau, occur to the south of the Chihuahuan Desert and differ from *R. parryi* by their longer calyces ((8–) 11–34 mm), usually longer corollas ((32–) 42–85 mm) with the external pubescence including glandular trichomes, and capsular pubescence that includes glandular trichomes. Branched trichomes are sometimes present on the youngest vegetative growth in other Mexican *Ruellia* (e.g., *R. leucantha* Brandegee).

Most plants of *Ruellia parryi*, including those of the sole Sonoran collection, are pubescent more or less throughout. In some (e.g., *Breedlove & Mahoney 71916* from Coahuila) the internodes are glabrous and trichomes on the leaves and bracteoles are largely restricted to the midvein and margin.

Sonoran collection: Mpio. Agua Prieta, NE of Sierra Anibácachi, Rancho La Calera, ca. 10 km SW of Agua Prieta, 31°14′N, 109°38′W, *A. Reina G. et al. 2003-957* (CAS).

Stenandrium Nees

Stenandrium Nees in Lindley, Intr. Nat. Syst. Bot., ed. 2, 444. 1836, nomen cons. TYPE: *Stenandrium mandioccanum* Nees.

Gerardia L., Sp. Pl. 610. 1753, pro parte, nomen rej. vs. *Stenandrium* Nees (1836). LECTOTYPE (Pennell, Bull. Torrey Bot. Club 40:120. 1913): *Gerardia tuberosa* L.

Acaulescent (arising from a woody rhizome or caudex) or caulescent erect to spreading perennial herbs lacking cystoliths. Leaves opposite or quaternate. Inflorescence of axillary or terminal elongate or headlike usually pedunculate dichasiate spikes; dichasia opposite or alternate, 1-flowered, sessile, subtended by a bract. Flowers homostylous, sessile, subtended by 2 homomorphic bracteoles. Calyx deeply 5-lobed, lobes equal or subequal in size. Corolla pink, purple, or white,

tube expanded distally into a short throat, limb 2-labiate or appearing subactinomorphic, upper lip 2-lobed, lower lip 3-lobed, corolla lobes imbricate in bud. Stamens 4, subdidynamous, included in corolla tube, anthers 1-thecous, pubescent, lacking basal appendages, dehiscing toward lower lip (i.e., flower nototribal); pollen (Fig. 18) euprolate to perprolate (to spherical), 3-colpate (rarely inaperturate), exine psilate to foveolate to fossulate to verrucate to gemmate; staminode 0–1, borne between posterior pair of stamens, usually shorter than filaments. Style included in corolla tube, stigma asymmetrically funnelform. Capsule estipitate to substipitate, ellipsoid to obovoid, retinacula present, septa with attached retinacula remaining attached to inner wall of mature capsule. Seeds 4, homomorphic, lenticular, often with barbed or branched trichomes. (x = 13).

Stenandrium has traditionally been treated as a New World genus with some 40 to 50 species. Vollesen (1992) included *Stenandriopsis* S. Moore from Africa and Madagascar within *Stenandrium*. Although *Stenandriopsis* in the Old World appears morphologically indistinguishable from *Stenandrium* in the New World, recent molecular studies (McDade et al. 2003) show the former genus to be the basal member of an otherwise New World clade that includes *Stenandrium*. These studies do not support the inclusion of *Stenandriopsis* within *Stenandrium*, but additional research will be necessary to resolve generic boundaries between these and among other genera of tribe Acantheae. Daniel (1985) recognized nine species of *Stenandrium* in Mexico. Concentrations of species are also found in the West Indies (ca. 15 species) and South America (15–25 species).

Stenandrium pilosulum (Blake) T.F. Daniel, Ann. Missouri Bot. Gard. 71:1039. 1984. *Gerardia pilosula* Blake, Contr. Gray Herb. 52:101. 1917. TYPE: MEXICO. Chihuahua: vicinity of Madera, 27 May-3 Jun 1908, *E. Palmer 317* (holotype: GH!; isotypes: MO!, US!).

Acaulescent perennial herbs to 7.5 cm tall from a ± woody caudex or rhizome, the caudex or rhizome bearing numerous fleshy roots along its length. Leaves (plants often leafless or nearly so during anthesis) ascendant, petiolate, petioles to 18 mm long, glabrous or pubescent with a few eglandular trichomes to 0.3 mm long, blades oblanceolate to narrowly elliptic to lanceolate (to ovate), 11–55 mm long, 3–7 (–11) mm wide, 2.8–6.9 (–11) times longer than wide, attenuate to decurrent at base, acute to rounded at apex, surfaces glabrous (although the lower surface inconspicuously glandular along the basal portion) and punctate-pitted, margin red, entire, eciliate. Inflorescence of pedunculate spikes to 30 mm long, peduncles 5–45 mm long, nearly glabrous or pubescent with retrorse to erect trichomes 0.05–0.2 mm long; dichasia opposite to subopposite along spike axis, sessile. Bracts ovate to narrowly elliptic to obovate, 6–12 mm long, 1.5–4.5 mm wide, abaxial surface pubescent like peduncles although with trichomes more numerous, margin inconspicuously ciliate with trichomes 0.05–0.3 mm long. Bracteoles linear to linear-lanceolate, 6–11.5 mm long, 0.5–1.1 mm wide, abaxial surface pubescent like bracts. Calyx 7–14 mm long, lobes linear-subulate to linear-lanceolate, subequal, 6.5–13.5 mm long, pubescent like bracts. Corolla pink with tube and proximal portions of lobes of lower lip white, 10–23 mm long, tube 6–15 mm long, upper lip 3–10 mm long, lower lip 4–10 mm long, lobes subequal, 3–10 mm long, lobes and tube glabrous or sparsely pubescent on external surface, lower-central lobe often densely pubescent on external surface. Stamens 2.5–3 mm long, anthers 1.5 mm long. Capsule 9–12 mm long, pubescent over the entire surface. Seeds 3–4 mm long, 3–3.5 mm wide, densely pubescent with long bristlelike trichomes bearing lateral barbs or branches.

Phenology. Flowering: March–July; fruiting: March.

Distribution and habitats. Sierra Madre Occidental of northwestern Mexico (Chihuahua, Sonora); Sonoran plants occur on gravely slopes, in pastures, and along watercourses in oak-pine communities at elevations from 1540 to 2250 m.

Illustration. Figures 15, 36.

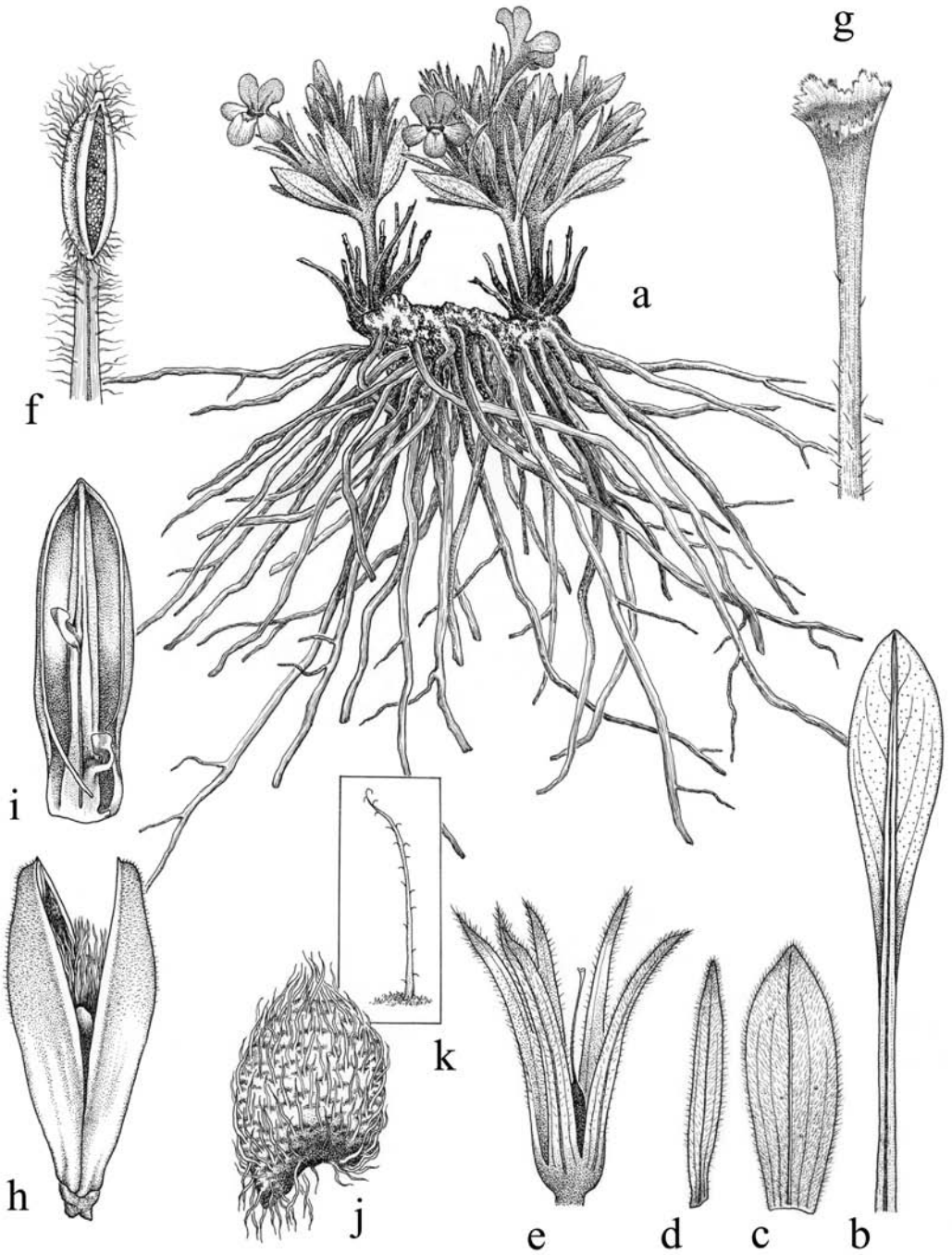

FIGURE 36. *Stenandrium pilosulum*. a. Habit (*Daniel et al. 8614*), × 1. b. Leaf (*Laferriere 439*), × 2. c. Bract (*Daniel et al. 8607*), × 4.3. d. Bracteole (*Daniel et al. 8607*), × 4.3. e. Calyx (*Daniel et al. 8607*), × 3.4. f. Distal portion of stamen with anther (*Daniel et al. 8607*), × 15.8. g. Distal portion of style with stigma (*Daniel et al. 8614*), × 22.7. h. Capsule (*Correll & Johnston 21612*), × 4.4. i. Capsule valve (*Correll & Johnston 21612*), × 4.4. j. Seed (*Correll & Johnston 21612*), × 8.4. k. Trichome from seed (*Correll & Johnston 21612*), × 24. Drawn by Jenny Speckels.

Although Daniel (1985) provided a description of this species, sufficient additional collections from Sonora have become available in the intervening years to warrant an augmented, and more complete one. The species is endemic to the highlands of eastern Sonora (Fig. 37) and western Chihuahua. Corollas are pink with the internal surfaces of the tube and proximal portions of the lobes of the lower lip white. The ventral portion of the tube near its mouth is densely pubescent with yellowish gold trichomes.

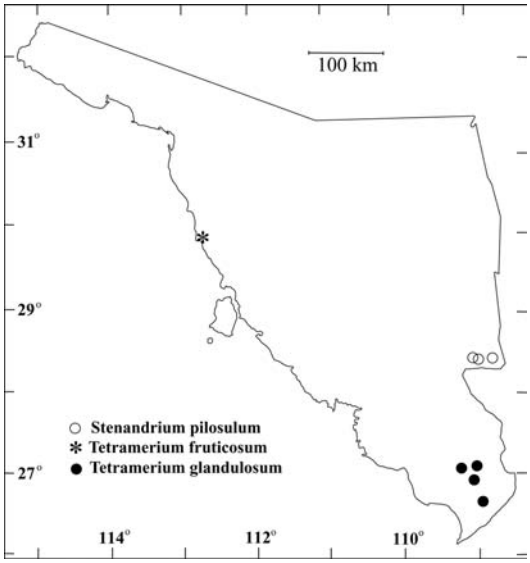

FIGURE 37. Sonoran distributions of *Stenandrium pilosulum, Tetramerium fruticosum*, and *T. glandulosum*.

Sonoran collections: Mpio. Yécora, ca. 0.5 km NW of cemetery in Yécora, ca. 28°23′N, 108°50′W, *T. Daniel et al. 8607* (CAS, MEXU); Mpio. Yécora, El Kípor, 7.4 km E of Maycoba along Hwy. 16, ca. 28°24′N, 108°35′W, *T. Daniel et al. 8614* (CAS, MICH); Rancho La Pinosa, 5.9 mi W of Maycoba on Hwy. 16, 28°25′N, 108°43.5′W, *M. Fishbein et al. 1839* (ARIZ); Yécora, just NW of cemetery, *M. Fishbein et al. 1859* (ARIZ); 28°22.5′N, 108°55.5′W, ca. 5 mi W of Yécora, *P. Hubbell s.n.* (ARIZ); 7 mi NW of Yécora, ca. 28°26′N, 109°00′W, *R. Moran 21965* (CAS, ENCB); Mpio. Yécora, El Kípor (Quipur), Arroyo El Kípor, 28°24′N, 108°36′W, *T. Van Devender & A. Reina G. 95-364* (ARIZ, CAS, MEXU), *97-434* (MO, TEX); Mpio. Yécora, 3–4 km NNW of El Kípor (Quipur), 28°25.5′N, 108°36′W, *T. Van Devender & A. Reina G. 95-405* (ARIZ); ca. 5 mi W of Maicova, 28°22′N, 108°44′W, *G. Webster 23849* (CAS).

Tetramerium Nees

Tetramerium Nees in G. Bentham, Bot. Voy. *Sulphur*, 147. 1846, nom. cons., non C.F. Gaertn. (1806). TYPE: *Tetramerium polystachyum* Nees (= *Tetramerium nervosum* Nees).

Averia Leonard, J. Wash. Acad. Sci. 30:501. 1940. TYPE: *Averia longipes* (Standl.) Leonard (≡ *Drejerella longipes* Standl.; = *Tetramerium nemorum* Brandegee).

Decumbent to erect perennial herbs or shrubs with cystoliths. Leaves opposite (rarely ternate). Inflorescence of terminal conspicuously and usually densely bracteate 4-sided unbranched dichasiate spikes; dichasia opposite, 1–3-flowered, sessile, subtended by a bract. Flowers homostylous, sessile, subtended by 2 homomorphic bracteoles. Calyx deeply 4- or 5-lobed, lobes homomorphic or, if 5, 1 usually ± reduced in size. Corolla white, cream, yellow, blue, or red, often with maroon and purplish markings on upper lip, tube subcylindric or gradually expanded distally, throat indistinct or distinct only near mouth, limb pseudopapilionaceous, upper lip comprising 2 fused lobes, entire to emarginate at apex, lower lip 3-lobed, lower-central lobe (in ours) conduplicate and enclosing stamens and often style during anthesis, corolla lobes imbricate in bud. Stamens 2, exserted from mouth of corolla, anthers 2-thecous, thecae equal to subequal in size, parallel to subsagittate, equally inserted, lacking basal appendages, dehiscing toward upper lip (i.e., flower stenotribal); pollen (Fig. 38) subprolate to perprolate, 3-colporate, 6-pseudocolpate, pseudocolpi 2 per mesocolpium, exine (rugulate to) reticulate to bireticulate; staminodes 0. Style exserted from mouth of corolla, stigma 2-lobed, lobes equal. Capsule stipitate, head ellipsoid to obovoid, retinacula present, septae with attached retinacula slightly separating from inner wall of mature capsule.

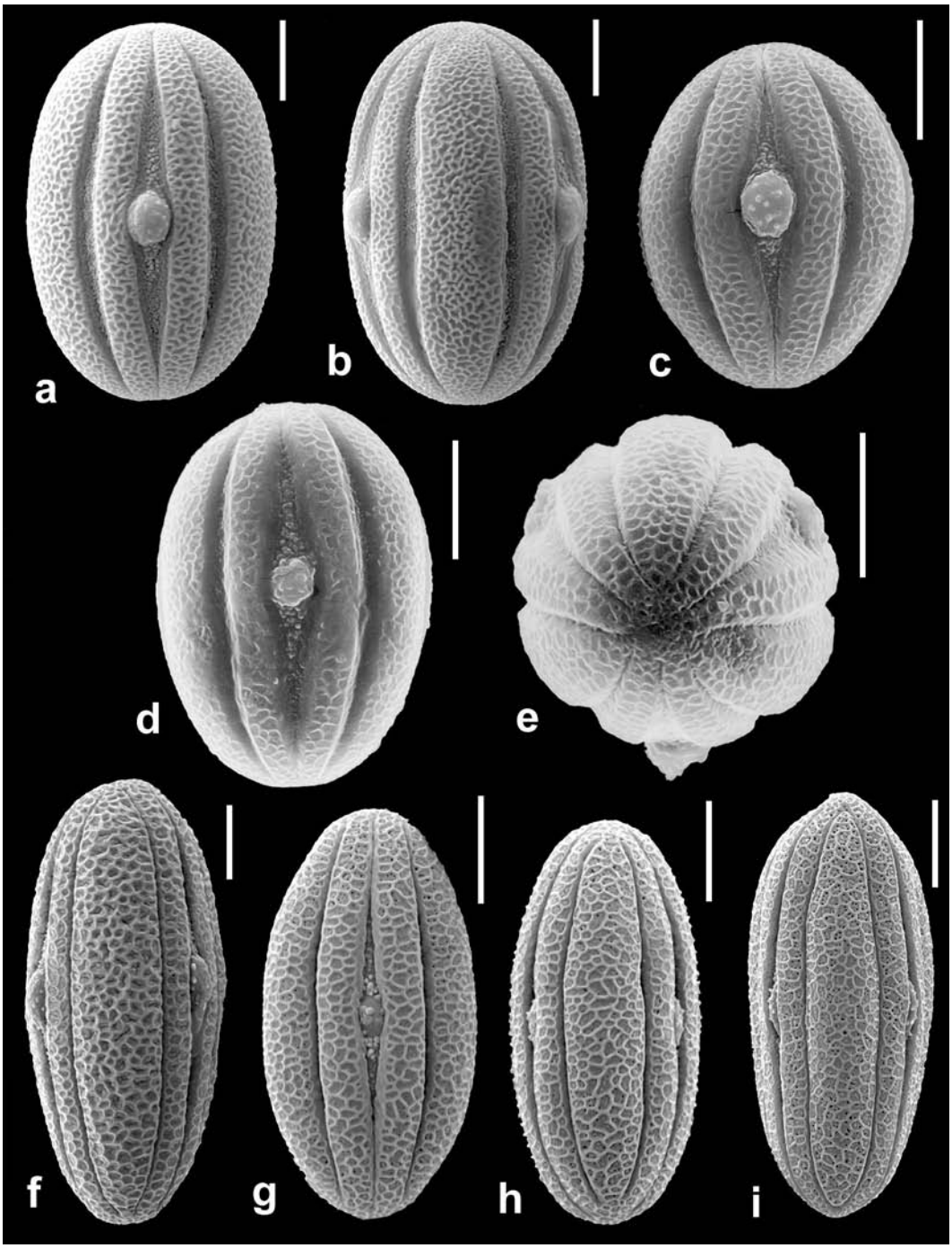

FIGURE 38. Pollen of Sonoran *Tetramerium*. a. *T. abditum* (*Daniel 3364*), apertural view. b. *T. abditum* (*Daniel 3364*), interapertural view. c. *T. fruticosum* (*Daniel & Butterwick 6869*), apertural view. d. *T. nervosum* (*Carter & Moran 5324*), apertural view. e. *T. nervosum* (*Carter & Moran 5324*), polar view. f. *T. glandulosum* (*Van Devender et al. 94-946*), interapertural view. g. *T. tenuissimum* (*Jenkins et al. 88-320*), apertural view. h. *T. tenuissimum* (*Jenkins et al. 88-320*), interapertural view. i. *T. yaquianum* (*Van Devender et al. 92-1109*), interapertural view. Scales = 10 μm.

Seeds 4, homomorphic, plano-convex to concavo-convex), lacking trichomes. (x = 18).

This genus of 29 species occurs from the southwestern United States southward throughout most of Mexico, Central America, and northwestern South America to southeastern Bolivia (Daniel 1986). With 22 species, Mexico is the center of diversity of *Tetramerium.*

1. Corollas red to reddish orange, 29–42 mm long, upper lip lacking maroon markings, tube funnelform, 18–25 mm long, 2.8–4.8 mm in diameter at apex; thecae 2.9–3.6 mm long; style 26–37 mm long. . . . . *T. abditum*
1. Corollas white, cream, or yellow, 7–26 mm long, upper lip with maroon markings, tube subcylindric, 2.5–9 mm long, 1–2.5 mm in diameter at apex; thecae 0.6–2.6 mm long; style 4–26 mm long.
   2. Viscid shrubs to 3 m tall; herbage conspicuously glandular with glands up to 1 mm long (at least some glands longer than 0.3 mm); corollas bright yellow with 2 maroon stripes on upper lip, 17–26 mm long; thecae 1.7–2.6 mm long; capsules 6–9 mm long. . . . . *T. glandulosum*
   2 Perennial herbs to 5 dm tall; herbage eglandular or ± inconspicuously glandular with glands to 0.3 mm long; corollas white, cream, or creamy yellow and with a maroon (and usually purple) chevron on upper lip, 7–17.5 mm long; thecae 0.6–1.5 mm long; capsules 4.5–6.5 mm long.
      3. Calyces 4-lobed; apical portion of bract usually conspicuously twisted. . . . *T. nervosum*
      3. Calyces 5-lobed; apical portion of bract straight (sometimes slightly twisted in *T. yaquianum*).
         4. Capsules glabrous; bracteoles 5–10 mm long. . . . . *T. fruticosum*
         4. Capsules pubescent; bracteoles 3–6.5 mm long.
            5. Bracts usually widely spreading (to horizontal or nearly so) from rachis, pubes cence of abaxial surface includes glandular trichomes 0.2–0.3 mm long, margin ciliate with at least some trichomes longer than 0.5 mm; calyx 3.5–4.5 mm long; corolla 13–16 mm long, tube 6-8 mm long. . . . . *T. yaquianum*
            5. Bracts erect, closely appressed to rachis, pubescence of abaxial surface includes glandular trichomes 0.05–0.2 mm long, margin ciliate with trichomes to 0.5 mm long; calyx 2–3 mm long; corolla 7-13.5 mm long, tube 2.5–5 mm long. . . . . *T. tenuissimum*

Tetramerium abditum (Brandegee) T.F. Daniel, Syst. Bot. Monogr. 12:113. 1986. *Anisacanthus abditus* Brandegee, Zoe 3:348. 1893. TYPE: MEXICO. Sonora: Las Durasnillas, 14 May 1892, *T. Brandegee s.n.* (holotype: UC!; isotypes: F!, GH!).

Phenology. Flowering: November–May; fruiting: November–May.

Distribution and habitats. Western Mexico (Chihuahua, Durango, Michoacán, Nayarit, Sinaloa, and Sonora); Sonoran plants occur on slopes and along watercourses in mesquite scrub, tropical deciduous forests, and oak-pine woodlands at elevations from 230–1360 m.

Illustrations. *The Botany of the Voyage of H.M.S.* Herald, t. 68. 1856; *Systematic Botany Monographs* 12:115. 1986.

Local names. “Rama del toro” (fide Yetman and Van Devender 2002); “viipsumar u’us” (Pima Bajo, *Rea 1069*).

Daniel (1986) provided a description of this species and discussed (2004b) its distribution and distinctions from the morphologically similar *T. rubrum* Happ. *Tetramerium abditum* attains the

northern extent of its distribution in east-central Sonora (Fig. 39). The location of the type locality is discussed above under *Henrya*.

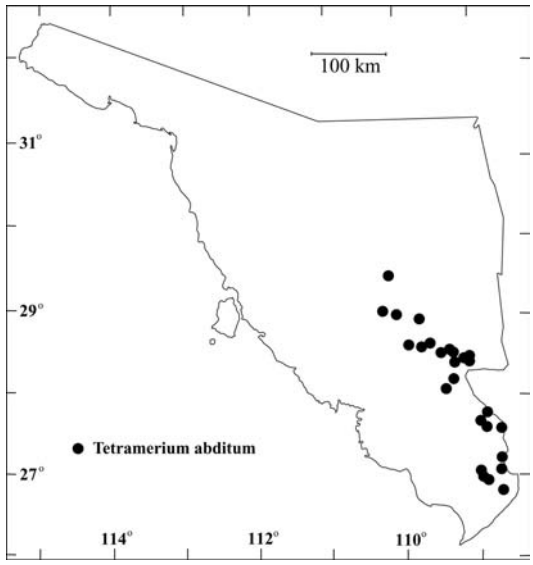

FIGURE 39. Sonoran distribution of *Tetramerium abditum.*

SONORAN COLLECTIONS: San Javier, microondas en el Cerro El Durazno, 28°37′N, 109°45′W, *A. Búrquez 94-019[a]* (MEXU); Cerro El Verde, San Javier, 28°33–34′N, 109°43–44′W, *A. Búrquez et al. 96-066* (MEXU), *96-088* (MEXU); Mpio. Yécora, Santa Rosa, 28°28′N, 109°06′W, *A. Búrquez M. 96-228* (CAS); between Hwy. 16 E of Tonichi and Onavas, 0.5 mi S jct. Hwy. 16, *T. Daniel 3347* (ASU, CAS, MEXU); between Rosario de Tezopaco and Nuri, 7.1 mi S of turnoff to Nuri, *T. Daniel 3364* (ASU, CAS, ENCB, MEXU, MICH, MO, NY, US); Río Cuchujaqui, 7.4 mi SE of Alamos toward Guiricoba, *T. Daniel 3378* (CAS), *T. Daniel 3998* (CAS); Mpio. Yécora, between San Nicolás and Nuri, ca. 6.4 km SW jct. Hwy. 16, ca. 28°24′N, 109°14′W, *T. Daniel et al. 8570* (BR, CAS, K, MEXU, MO); Sierra de Alamos, Arroyo Uvalama (Igualamas), 27°01′N, 108°59′W, *M. Fishbein et al. 1095* (ARIZ, CAS); Arroyo Guajaráy, upstream from village of Guajaráy, 27°37′N, 108°57′W, *M. Fishbein et al. 1553* (ARIZ, CAS); 21.5 mi E of Tecoripa, *P. Gallagher et al. 287* (ASU); Distr. Alamos, Agua Caliente, *H. Gentry 898* (ARIZ, DS, MICH); Caramechi, Río Mayo, *H. Gentry 1178* (A, ARIZ, F, K, MEXU, MICH, MO, NY, UC, US); vicinity of Alamos, *H. Gentry 4801* (ARIZ, DS, GH, MEXU, MICH, MO, NY, UC); 5 mi W of El Novillo Dam, *D. Goldberg 76-66* (ARIZ); 10 mi W of Nuri, *D. Goldberg s.n.* (ARIZ); W of Piedras Verdes near Mocuzari Reservoir, 15 km NW of Alamos, *P. Jenkins 89-127-A* (ARIZ); Naranjo, 27°14′N, 108°43′W, *P. Jenkins 89-316* (ARIZ); Mpio. Alamos, Arroyo Verde, 27°06′N, 108°43′W, *P. Jenkins 90-313* (ARIZ); Hwy. 16 E of Onavas turn-off, 28°35′N, 109°30′W, *E. Joyal 1674* (CAS, MEXU); Río Cuchujaqui, cave next to Mesa Redonda, 27°05′N, 108°45′W, *P. Martin & G. Ferguson s.n.* (ARIZ, CAS); Mpio. Alamos, 3.5 mi SW of Rancho Santa Barbara, 27°06′N, 108°45′W, *P. Martin & G. Ferguson s.n.* (ARIZ); 6 mi NNW of Alamos, *P. Martin & M. O'Rourke s.n.* (ARIZ); cajón of Cuchujaqui, 27°03', 108°44′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); above Las Animas, 27°31.5′N, 108°42′W, *P. Martin et al. s.n.* (ARIZ); El Reparo near Santa Ana de Yécora, *G. Monson s.n.* (ARIZ); near Onavas, 15–20 km NE along Hwy. 16, *A. Rea 1069* (ARIZ); 4 km W of Agua Amarilla, 18.9 km NNW of Tepoca on Mex. 16, 28°29′N, 109°22′W, *A. Reina G. & T. Van Devender 97-371* (ARIZ, CAS, MEXU, TEX); Arroyo El Mentidero at El Chinal road, 11.3 km S of Alamos, 26°55′N, 108°55′W, *A. Reina G. et al. 98-24* (ARIZ); Mpio. Onavas, 4.3 km SE of Onavas junction on Mex. 16, 28°31′N, 109°28′W, *A. Reina G. et al. 2001-155* (ARIZ, MO); Hwy. 16, ca. 8 km E of Tecoripa, Rancho San Juanico, *R. Rondeau 89-82* (ARIZ); Cerro Redondo, 27°05′N, 108°45′W, *R. Rondeau & G. Rodda s.n.* (ARIZ); ca. 5 mi below Minas Nuevas, *J. Rose et al. 12669* (US); vicinity of Alamos, *J. Rose et al. s.n.* (F, GH); Mpio. Mazatán, Sierra de Mazatán, Cañada El Carrizo, N de Rancho El Carrizo, 29°03′N, 110°12′W, *J. Sánchez E. et al. 04-045* (CAS); Mpio. Alamos, Cañón Algoroba, Sierra de Alamos, ca. 27°00′N, 108°57′W, *A. Sanders & L. Lubinsky 13452* (TEX); lower crossing of Río Cuchujaqui, 8 mi SE of Alamos, ca. 26°56′N, 108°53′W, *A. Sanders et al. 2636* (CAS, TEX); 2.2 mi E of San Nicolás, ca. 8 mi NE of Curea, *A. Sanders et al. 2679* (ASU); vicinity of Alamos, *E. Smith 3960* (CAS, MEXU, TEX); 18.5 mi SE of Río Yaqui crossing at Mex. 16, *G. Starr & C. Starr 184* (ARIZ), *Starr et al. 44* (ARIZ); Mpio. Alamos, Sierra de Alamos, Arroyo El Huirotal, ca. 26°57.5′N, 108°57.5′W, *V. Steinmann 95-04* (ARIZ, MEXU); above El Novillo, 83 mi E of Hermosillo, *L. Toolin & K. Roever 576* (ARIZ); 4 mi S of Mazocahui, *R. Turner et al. 59-72* (ARIZ, CAS, UC); 12 mi S of Soyopa, *R. Turner et al. 71-89* (ARIZ, UC); Arroyo Hondo, 10 mi N of Nuri, *R. Turner et al. 75-33* (ARIZ, SD, UC); Río Cuchujaqui at Rancho El Conejo, 12.4 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender 92-563* (ARIZ); crossing of Río Cuchujaqui on road to Guirocoba, ca. 8 mi SE of Alamos, *T. Van Devender et al. 84-144*

(ARIZ); SE slopes of Sierra de Alamos, Arroyo El Mentidero, Rancho Uvalama, 11 km WSW of Alamos, 26°55′N, 108°55′W, *T. Van Devender et al. 92-53* (CAS); El Guayabo crossing of Río Cuchujaqui, 1.1 mi NE of Sabinito Sur, 14 km ESE of Alamos, 27°00′N, 108°48′W, *T. Van Devender et al. 92-228* (ARIZ, CAS); Río Cuchujaqui at Rancho El Conejo, 13.4 km S of Alamos, 26°54′N, 108°55′W, *T. Van Devender et al. 92-615* (ARIZ); Arroyo El Mentidero at crossing of El Chinal road, 11.5 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender et al. 93-73* (ARIZ, CAS); below Guajaray on Arroyo Guajaray, 6.5 km WNW of jct. with Río Mayo, 27°36′N, 108°56′W, *T. Van Devender et al. 93-464* (ARIZ); canyon N of Los Aguaros on Arroyo Guajaray, 27°38.5′N, 108°58′W, *T. Van Devender et al. 93-490* (ARIZ, in part); Mpio. Yécora, Agua Amarilla (Los Pinitos), 15 km WNW of Tepoca, 24.7 km WNW of San Nicolas on Mex. 16, ca. 28°08′N, 109°20′W, *T. Van Devender et al. 96-25* (ARIZ, CAS); San Javier, Arroyo San Javier, 1 km S del poblado y 1.5 km N del Cerro El Verde, 28°35′N, 109°44′W, *L. Varela E. 96-51* (MEXU); N side of Sierra de Alamos, *S. Walker 73H34* (DES); Rancho La Sierrita, E slopes of Sierra de Alamos, ca. 6 km SSW of Alamos, 26°58′N, 108°57′W, *J. Weins et al. 93-027* (ARIZ).

Tetramerium fruticosum Brandegee, Zoe 5:171. 1903. TYPE: MEXICO. Baja California Sur: San José del Cabo, Jan-Mar 1901, *C. Purpus 489* (holotype: UC!; isotypes: CAS!, GH!, MO!, NY!, US!).

Phenology. Flowering: October; fruiting: October.

Distribution and habitats. Northwestern Mexico (Baja California Sur, Sonora); Sonoran plants occur in Sonoran desertscrub (Central Gulf Coast) at an elevation between 500 and 600 m.

Illustration. *Proceedings of the California Academy of Sciences* 49:399. 1997.

Daniel (1986, 1997) provided descriptions of this species. *Tetramerium fruticosum* is widespread in Baja California Sur, but known from the Mexican mainland only by a single collection (Fig. 37) from the Central Gulf Coast subdivision of the Sonoran Desert near Puerto Libertad (i.e., the northern extent of its geographic range). Daniel (1986) discussed its distribution in some detail.

Sonoran collection: Tinaja Picu in Picu Mts., 2 mi N of concrete monument set on N side of Libertad Road, *I. Wiggins 6055* (DS).

Tetramerium glandulosum Oerst., Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn 1854:171. 1854. TYPE: MEXICO. Oaxaca: Río de las Vueltas, Dec 1842, *Liebmann 10751* (holotype: C!).

Tetramerium aureum Rose, Contr. U.S. Natl. Herb. 1:349. 1895. *Justicia aurea* (Rose) Lindau, Bull. Herb. Boissier 5:675. 1897. TYPE: MEXICO. Colima: without specific locality, 9 Jan-6 Feb 1891, *E. Palmer 1302* (holotype: US!; isotypes: GH!, K!, NY!, US!).

Cardiacanthus fragrans Lindau, Bull. Herb. Boissier 7:577. 1899. TYPE: MEXICO. Oaxaca: Distr. Nochixtlán, El Parián, 15 Dec 1895, *C. Seler & E. Seler 1565* (holotype: B, destroyed; lectotype, designated by Daniel, 1986: K!; isolectotypes: A!, CAS!, GH!, MEXU!, NY!, POM!).

Anisacanthus stramineus Barneby, Rhodora 72:70. 1970. TYPE: MEXICO. Puebla: near Coxcatlán, 18 Nov 1966, *H. Ripley 14731* (holotype: NY!; isotype: US!).

Phenology. Flowering: April, December; fruiting: April, December.

Distribution and habitats. Western and southern Mexico (Chihuahua, Colima, Durango, Guerrero, Jalisco, Michoacán, Morelos, Oaxaca, Puebla, Sinaloa, and Sonora); Sonoran plants occur along watercourses in tropical deciduous forests at elevations from 350 to 400 m.

Illustrations. Figure 9; *Systematic Botany Monographs* 12:64. 1986.

Daniel (1986) provided a description of this species, which attains the northern and western extents of its distribution in southern Sonora (Fig. 37).

Sonoran collections: La Calera, 5.5 km N of Alamos Hwy. at El Carrizal, 27°07′N, 109°01.5′W,

P. Martin & M. O'Rourke s.n. (ARIZ); 23 km E of Navojoa, *R. Moran 4033* (DS, SD, US); Mpio. Alamos, Arroyo Las Rastras, SW edge of Sierra de Alamos, 26°57′N, 109°03′W, *T. Van Devender et al. 93-1457* (ARIZ, CAS); Cerro Huacharibi, 4 km SW of Basiroa, 26°41′N, 108°55′W, *T. Van Devender et al. 94-946* (ARIZ, CAS).

Tetramerium nervosum Nees in G. Bentham, Bot. Voy. *Sulphur*, 148. 1846. TYPE: ECUADOR. Guayas: Puna, 1836-1839, *A. Sinclair s.n.* (holotype: K!).

Tetramerium hispidum Nees in A. de Candolle, Prodr. 11:468. 1847. TYPE: MEXICO. Hidalgo: prope las Ajuntas ad flumen Montezuma, Jan, *C. Ehrenberg 1072* (lectotype, designated by Happ, 1937: B, destroyed; isolectotypes: GH!, PR!; probable isolectotype: P!).

Tetramerium nervosum var. *hispidum* Torr. in W.H. Emory, Rep. U.S. Mex. Bound. 2(1):125. 1859. TYPE: MEXICO. Sonora: Santa Cruz, Sep 1851, *G. Thurber 918* (lectotype, designated by Daniel, 1986: NY!; isolectotypes: F!, GH!, NY!).

Dianthera sonorae S. Watson, Proc. Amer. Acad. Arts 24:67. 1889. TYPE: MEXICO. Sonora: vicinity of Guaymas, Sep 1887, *E. Palmer 240* (holotype: GH!; isotypes: C!, K!, NY, US!).

Tetramerium scabrum Happ, Ann. Missouri Bot. Gard. 24:532. 1937. TYPE: MEXICO. Sonora: Fronteras, Jun 1851, *G. Thurber 432* (holotype: NY!; isotypes: CAS!, GH!).

See Daniel (1995a) for a complete listing of synonyms for this species.

Phenology. Flowering: throughout the year, with peaks in March and October (Fig. 1); fruiting: throughout the year.

Distribution and habitats. Southwestern United States (Arizona, New Mexico, Texas), Mexico (Baja California Sur, Campeche, Chiapas, Chihuahua, Coahuila, Colima, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Querétaro, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, Veracruz, Yucatán, Zacatecas), Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Ecuador, and Peru; Sonoran plants occur on slopes, along watercourses, and in disturbed areas in Sonoran desertscrub (Arizona Upland, Central Gulf Coast), palm oases, thornscrub, tropical deciduous forests, grasslands, oak woodlands, and oak-pine woodlands at elevations from 20 to 1450 m.

Illustrations. *Botany of the Voyage of H.M.S.* Sulphur, t. 48. 1845; *Acta Botanica Venezuelica* 8:165. 1973; *Fieldiana, Botany* 24 (10):455. 1974; *Flora of Baja California*, 196. 1980; *Systematic Botany Monographs* 12:58. 1986; *Flora of Chiapas* 4:146. 1995; *Flora del Valle de Tehuacán-Cuicatlán* 23:88. 1999.

Local names. "Abahaca del monte" (*Reina G. et al. 2001-653*); "cola de víbora" (Yetman 2002); "tapa chorro" (*Mexican, Rea 1260*); "saya huehuásira" (Guarijío, Yetman 2002); "tapachorro" (*Varela E. 96-309, 96-456*); "tóskonig" (Pima Bajo, *Rea 1260*).

Uses. Remedy for diarrhea (*Rea 1260*; *Varela E. 96-309*, *96-456*); treatment for stomach ache (*Reina G. et al. 2001-653*).

Descriptions of this widespread and morphologically variable species were provided by Daniel (1986, 1995a, 1997, 1999a) and Daniel and Acosta (2003). The morphological diversity throughout its range was discussed in detail by Daniel (1986). Sonoran plants exhibit both white and yellow corollas and have 4-calyx lobes (see Daniel 1986 for discussion of the variation in calyx lobe number in *T. nervosum*). The species is widespread throughout the eastern half of Sonora (Fig. 40), but is largely absent from the drier western half. Indeed, its occurrences in the Sonoran Desert are very rare and may be restricted to riparian sites. In northern Sonora, the species is especially common in desert grasslands and in southern Sonora it is abundant in both thornscrub and tropical deciduous forests.

One collection from Sonora (*Van Devender & Reina G. 2001-184*) that resembles *T. nervosum*

by its relatively long (to 1.5 mm) trichomes on the bracteal margins and lack of glandular trichomes in the inflorescence differs from that species by its five calyx lobes, ± antrorse (vs. straight) trichomes on the bracteal margins, and by the generally flat and straight apical portions of the bracts. Whether it represents a hybrid (e.g., between *T. nervosum* and *T. tenuissimum*), an undetected species, or an unusual form of *T. nervosum* remains undetermined. *Tetramerium nervosum* and *T. tenuissimum* sometimes grow within several centimeters of one another (e.g., *Daniel et al. 8636* and *8637*), but no evidence of hybridization was noted within this or other Sonoran populations of the species. Daniel (1986) discussed the results of attempted artificial crosses between these and between these and other species of the genus.

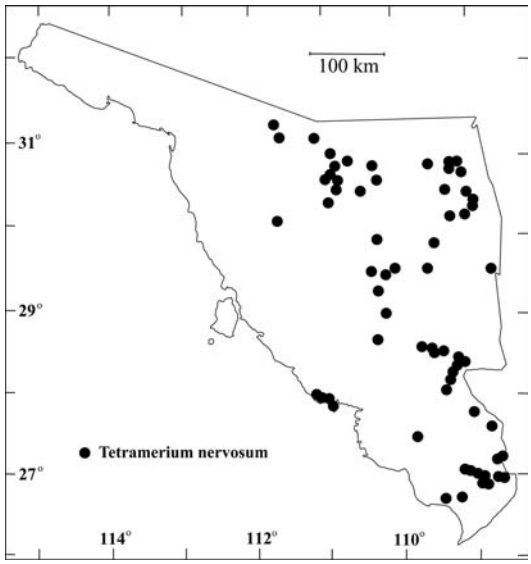

FIGURE 40. Sonoran distribution of *Tetramerium nervosum.*

SONORAN COLLECTIONS: near Guaymas, *L. Bailey 267* (F); Agua María, along Hwy. 16 at KM 200 W of Tepoca, ca. 28°17.5′N, 109°20′W, *G. Boyer et al. s.n.* (ARIZ); 8 km NW of Trigo on road from Yécora to Suarahipo, *D. Breedlove 61074* (CAS, MEXU, MO); near Magdalena, *C. Carter s.n.* (MICH); San Pedro Bay, *T. Craig 680* (POM); between Cananea and Arizpe, 27.7 mi N crossing of Río Bacanuchi, ca. 30°50′N, 110°20′W, *T. Daniel 921* (CAS, ENCB, MEXU, MICH); between Cananea and Arizpe, 16.1 mi S of Río Bacanuchi, *T. Daniel 927* (MICH); between Hermosillo and Sahuaripa, 3 mi W of Mazatán, *T. Daniel 953* (MICH); between Navojoa and Alamos, 24.6 mi E jct. Hwy. 15 in Navojoa, *T. Daniel 1000* (CAS, MICH); Nacapuli Canyon, ca. 4.4 mi N of San Carlos, *T. Daniel 1968* (ASU); along Hwy. 16 between Tecoripa and Tonichi, 13.4 mi W of Río Yaqui, *T. Daniel 3343* (CAS); between Hwy. 16 E of Tonichi and Onavas, 0.5 mi S jct. Hwy. 16, *T. Daniel 3349* (ASU, CAS); between Rosario de Tezopaco and Nuri, 8.1 mi S of turn to Nuri, *T. Daniel 3362* (ASU); Sierra Bojihuacame E of Cd. Obregón, 1.2–2.2 mi SE of Bachoco, *T. Daniel 3369* (CAS); road to El Tezal, 0.2 mi N of hwy. between Navojoa and Alamos, 2.6 mi W of Alamos, *T. Daniel 3375* (ASU), *3385* (ASU, CAS, ENCB, MICH, NY); Río Cuchujaqui, 7.4 mi SE of Alamos toward Guiricoba, *T. Daniel 3380* (ASU, CAS, MEXU, NY, US), *3989* (CAS); 0.2 mi N of Navajoa–Alamos hwy. toward El Tezal, 2.6 mi W of Alamos, *T. Daniel 3385* (CAS, MEXU); southeastern border of Alamos (road to mirador), ca. lat. 27°01′N, long. 108°56′W, *T. Daniel 9772* (CAS); Río Cuchujaqui, ca. 8 mi SE of Alamos, *T. Daniel & M. Butterwick 3193* (CAS, MEXU); Mpio. Yécora, between San Nicolás and Nurí, just S of Curea, ca. 24 km SW jct. Hwy. 16, ca. 28°19′N, 109°17′W, *T. Daniel et al. 8573* (CAS); Mpio. Yécora, Arroyo La Quema, 0.3 km SE of Tepoca on Hwy. 16, ca. 28°26′N, 109°15′W, *T. Daniel et al. 8636* (BR, CAS, K, MEXU, MICH); mountain W of Alamos, *F. Drouet & D. Richards 3956* (F); 20 mi NE of Ures, *F. Drouet et al. 3598* (F); ca. 5 km W of Pilares de Nacozari, *F. Drouet et al. 3672* (F); 21 mi SE of Ures, *F. Drouet et al. 3729* (F); Rancho la Brisca, 3.5 mi N of Agua Fria, 30°24′N, 110°33′W, *J. Duek s.n.* (ARIZ); 35.6 mi NE of Nuri, *D. Dunn 9064* (RSA); Hwy. 2, Imuris, *J. Dwyer 14131* (CAS, MO); ca. 1 km N of Bahía San Carlos on old road to Bahía Algadones, *R. Felger & R. Devine 85-330C* (ARIZ), *R. Felger et al. 84-193* (ARIZ, MEXU); Arroyo Nacapules, ca. 0.5–0.8 km E of mouth of Cañón Nacapules, 6 km N of Bahía San Carlos Road, 28°00′N, 111°02′W, R. *Felger & F. Reichenbacher 85-1178* (ARIZ, CAS, TEX); Cañón Nacapuli, 4.7 mi N of San Carlos Road, 28°00′N, 111°02–03′W, *R. Felger & F. Reichenbacher 85-1222* (ARIZ, CAS, MO, TEX), *R. Felger & R. Thomas 11862* (ARIZ, CAS, MEXU); ca. 1 mi N of Bahía San Carlos toward Bahía Algadones, *R. Felger & A. Russell 9598* (ARIZ, CAS, MEXU); El Baviso, ca. 2.5 km NE of Bahía San Carlos, *R. Felger & D. Valdez Z. 84-517* (ARIZ); Sierra el Aguaje, Cañón las Barajitas, ca. 18 km NW of San Carlos, ca. 28°03′N, 111°10′W, *R. Felger*

& M. Wilson 95-237 (ARIZ, CAS, MEXU); Mpio. Guaymas, Cañón La Balandrona N side of Sierra El Aguaje, 28°06′N, 111°04′W, *R. Felger et al. 01-719* (CAS); 4.1 mi E of Alamos, *J. Fish 158* (UC); Las Camotes, 6 mi NE of Los Tanques, 27°17′N, 108°50′W, *M. Fishbein et al. 80* (ARIZ); Conejos, Río Mayo, *H. Gentry 1121A* (F); Alamos, Río Fuerte, *H. Gentry 2926* (ARIZ, GH, MEXU, MO, S); KM 75 on Hwy. 15, N of Guaymas, *A. Gibson & L. Gibson 2028* (RSA); 4.3 km SW of Santa Ana de Yécora on road to Nuri, 28°23′N, 109°19′W, *D. Goldberg & S. McLaughlin 77-183* (ARIZ); Cohuto, *C. Hartman 76* (F, GH, PH, UC, US); 4 mi N of Colonia Oaxaca, *J. Hastings & R. Turner 65-28* (ARIZ, DS, SD); 16 mi E of Moctezuma, *J. Hastings & R. Turner 65-101* (ARIZ, DS, SD); Río El Naranjo crossing N of Taymuco, 27°15′N, 108°43′W, *P. Jenkins & P. Martin 88-174* (ARIZ); 20 km W of Alamos, 27°07′N, 109°10′W, *P. Jenkins et al. 88-65* (ARIZ); San Carlos Bay, *I. Johnston 4362* (CAS, GH, UC); Las Cabras, ESE of Alamos, 26°50′N, 108°55′W, *E. Joyal 1422A* (CAS); Rancho El Aguilar Noria, N of Ures, 29°33′N, 110°25–26′W, *E. Joyal 1817* (MEXU, TEX); 72 mi E of Hermosillo, *E. Lehto et al. L19299* (ASU); El Guayabo along Río Cuchujaqui, 27°00′N, 108°47′W, *P. Martin s.n.* (ARIZ); 8 km E of Alamos on road to Sabinito Sur, *P. Martin s.n.* (ARIZ); 16 km SE of Alamos, *P. Martin s.n.* (ARIZ); Río Santo Domingo (2 km N of Rancho La Brisca), 30°25.5′N, 110°33′W, *P. Martin s.n.* (ARIZ); 1 km NE of Bachoco, 26°44′N, 109°21′W, *P. Martin & M. O'Rourke s.n.* (ARIZ); Las Chinacas and vicinity of road to Chinipas, 27°14′N, 108°39′W, *P. Martin et al. s.n.* (ARIZ); "Agua Amarilla," ca, 28°27′N, 109°20′W, *P. Martin et al. s.n.* (TEX); Canyon de las Palmas, Sierra Baviso, 16 mi SE of Magdalena, *N. McCarten 2300* (ENCB); Rte. 15, 18.7 mi N of Imuris, *L. McGill & D. Pinkava 6595* (ASU); Mpio. Guaymas, 3 km NE del Aguaje de Robinson, Cañón Los Anegados, 28°02′N, 111°10′W, *L. Moreno et al. 16* (ARIZ); Mpio. Nacore Chico, El Río Bonito near La Nopalera, *C. Muller 3683* (GH, LL, UC, US); Magdalena, *C. Orcutt 1922:1352* (US); Nacopuli Canyon, N of San Carlos, *B. Perrill 5658* (ARIZ); Valle de Teras (just E of La Angostura), *E. Phillips 761* (MICH); Horconcitas, *E. Phillips 837* (MICH); between Horconcitos and Bacerac, *E. Phillips 852* (GH, MICH); near Onavas, *A. Rea 491* (ARIZ); Onavas graphite mine, ca. 28°28′N, 109°32′W, *A. Rea 1260* (ARIZ); northern Sierra Aconchi, 7 mi W of San Felipe, 29°52′N, 110°21′W, *F. Reichenbacher 1172* (ARIZ); Mpio. Santa Ana, Arroyo El Papago, 13 km ENE of Benjamin Hill, 30°16′N, 110°52′W, *A. Reina G. & E. Reina G. 97-1609* (CAS); Mpio. Yécora, base of Cerro El Pilar, above Arroyo Santa Ana, 5.5 km N of Curea on Son. 12, 28°20′N, 109°15′W, *A. Reina G. et al. 99-803* (CAS); Mpio. Guaymas, old road to Algodones, San Carlos, 27°58′N, 111°04′W, *A. Reina G. & T. Van Devender 2000-915* (CAS); Mpio. Yécora, 1.5 km SW of Santa Ana on road to Guadalupe Tayopa, 28°23′N, 109°09.5′W, *A. Reina G. et al. 96-521* (ARIZ); Mpio. Imuris, Agua Caliente, 19 km N of Imuris, 30°57′N, 110°51′W, *A. Reina G. et al. 2001-653* (CAS); ca. 5 mi below Minas Nuevas, *J. Rose et al. 12672* (NY, US); vicinity of Alamos, *J. Rose et al. 12741* (NY, US); vicinity of Puerta de Mano, 26°59′N. 108°39′W, *J. Salmon s.n.* (ARIZ); 5–7 mi E of Alamos toward upper crossing of Río Cuchujaqui, ca. 26°59′N, 108°50′W, *A. Sanders et al. 8833* (CAS); Mpio. Villa Pesqueira, Sierra Pinta, ca. 33 mi S of Moctezuma, ca. 29°35′N, 110°01′W, *J. Shortman & M. Wilson 96-65* (ARIZ); Distr. of Altar, near Los Molinos, *F. Shreve 6014* (F); 10 mi SE of Magdalena, *F. Shreve 6628* (ARIZ, F, GH, MICH, MO); Cerro las Campas, 2.6 mi ESE of Alamos on road to Río Cuchujaqui crossing near Sabinito Sur, 27°01′N, 108°54′W, *G. Starr & D. Palzkill 329* (ARIZ); 7.5 mi W of Alamos, road to Navojoa, *G. Starr & C. Starr 242* (ARIZ); Mpio. Imuris, microondas 14 km S de Imuris, 30°52′N, 110°50′W, *P. Tenorio L. & C. Romero de T. 13495* (CAS); Mpio. Yécora, La Concepción, 29°19′N, 109°02′W, *W. Trauba s.n.* (CAS); Guirocoba crossing of Río Cuchujaqui, 12.3 km SSE of Alamos, 26°56′N, 108°53′W, *T. Van Devender 92-532* (ARIZ); Río Cuchujaqui at Rancho el Conejo, 12.4 km S of Alamos, 26°55′N, 108°55′W, *T. Van Devender 92-564* (ARIZ); 59 km ESE of Hermosillo on Sonora 16, *T. Van Devender & V. Markgraf s.n.* (ARIZ); Mpio. Soyopa, Loma Maderista, 3.5 km S of Tonichi, ca. 28°34′N, 109°33′W, *T. Van Devender & A. Reina G. 2001-184* (ARIZ, CAS); El Rancheria crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos on road to El Chinal, 26°51′N, 108°55′W, *T. Van Devender et al. 92-1190* (ARIZ); near Tojibampo, 19.5 km NNW of San Bernardo toward Mesa Colorada, 27°02′N, 108°47′W, *T. Van Devender et al. 93-368* (ARIZ, CAS); Mpio. Navojoa, Teachive de Masiaca, 26°47′N, 109°14′W, *T. Van Devender et al. 95-105* (ARIZ); 1.5 km SW of Santa Ana on road to Guadallupe Tayopa, 28°23′N, 109°09.5′W, *T. Van Devender et al. 97-215* (MEXU); Mpio. Nogales, Sierra Las Avispas, 14.6 km W of MEX 15 on SON 43 (to Sáric), 31°07′N, 111°04'E, *T. Van Devender et al. 2002-745* (CAS); Palm Canyon, 17.7 mi SE of Magdalena in Cerro Cinta de Plata, *T. Van Devender et al. s.n.* (ARIZ); San Javier, cañón entre los cerros El Potrerito y Los Amoles, 7 km S del poblado, 28°32′N, 109°45′W, *L. Varela E. 96-309* (MEXU); San Javier, cerro El

Verde, 3 km de la carr. 16, 28°34′N, 109°44′W, *L. Varela E. 96-456* (MEXU); Puerto de Huépari, NW of Aribabi, *S. White 2773* (GH, MICH, US); Cañón de la Petaquilla (just W of Bavispe), *S. White 3333* (GH, MICH); Cañón del Agua Amarga (E of Oputo), *S. White 3612* (MICH); Horconcitos, Río Huachinera, *S. White 3727* (ARIZ, MICH, GH); Colonia Morelos, *S. White 4420* (MICH), *4455* (ARIZ, GH, MICH, NY, US); western foothills of Sierra de la Cabellera, ca. 10 mi E of Colonia Morelos, *S. White 4470* (ARIZ, GH, MICH, US); 4 mi N of Nuri, 28°10′N, 109°19′W, *A. Whittemore et al. 83-085* (CAS, TEX); 5 mi S of San Rafael, *I. Wiggins 5942* (DS, US); 2 mi E of Rancho San Carlos toward Norio, *I. Wiggins 6147* (DS, US); 1 mi W of jct. Cananea and Remedios roads on upper ford of Río Magdalena, *I. Wiggins 7096* (DS, MICH, US); Río Sásabe, 10 mi E of Magdalena, *I. Wiggins 7115* (DS, F, LL, MICH, UC, US); ca. 14 mi S of Divisaderos, *I. Wiggins 7466* (DS, MICH, US).

Tetramerium tenuissimum Rose, Contr. U.S. Natl. Herb 1:349. 1895. TYPE: MEXICO. Colima: vicinity of Colima, 27-28 Feb 1891, *E. Palmer 1297* (holotype: US!; isotypes: GH!, K!, NY!, US!).

Tetramerium leptocaule Happ, Ann. Missouri Bot. Gard. 24:516. 1937. TYPE: MEXICO. Michoacán: Distr. Huetamo, Tacupa, 17 Jan 1934, *G. Hinton et al. 5494* (holotype: K!; isotypes: DES!, GH!, MO!, NY!, US!).

Phenology. Flowering: September–March; fruiting: September–March.

Distribution and habitats. Mexico (Campeche, Chiapas, Chihuahua, Colima, Guanajuato, Guerrero, Jalisco, Michoacán, Morelos, Nayarit, Sinaloa, Sonora, Veracruz, Yucatán); Sonoran plants occur on slopes, along streams, and in disturbed areas in thornscrub and tropical deciduous forests at elevations from 200 to 920 m.

Illustration. None found.

Local names. "Rama del toro" (fide Van Devender et al. 2000); "rama toro" (*Gentry 1084*); "tau-i-we toro" (Guarijío, *Gentry 1084*).

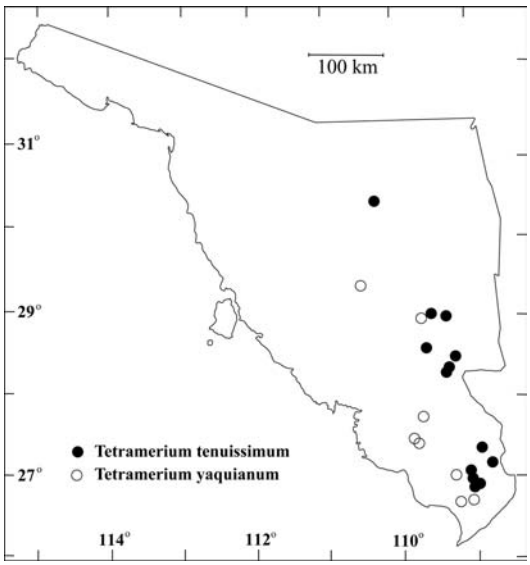

FIGURE 41. Sonoran distribution of *Tetramerium tenuissimum* and known distribution of *T. yaquianum*.

Daniel (1986, 1995a) and Daniel and Acosta (2003) provided descriptions of this species. Until recently, *Tetramerium tenuissimum* was thought to be quite rare. It is now being found in regions of dry forest throughout Mexico and Central America. It reaches the northern and western extents of its distribution in north-central Sonora (Fig. 41). Sonoran plants of *T. tenuissimum*, which often grow in close proximity to *T. nervosum* and which are often mistaken for it, can be distinguished from that species by the characters in the following couplet:

1. Calyx 4-lobed; margin of bracts conspicuously ciliate with at least some (usually most) trichomes 1–4 mm long; bracteal apex usually twisted. . . . . *T. nervosum*
1. Calyx 5-lobed; margin of bracts ± inconspicuously ciliate with trichomes 0.05–0.5 mm long; bracteal apex not twisted.. . . . . *T. tenuissimum*

SONORAN COLLECTIONS: along road to El Tezal, 2.6 mi W of Alamos, *T. Daniel 3374* (CAS, ENCB, MEXU); *3384* (ASU, NY, US); Mpio. Yécora, along Hwy. 16, 2.6 km NW of Tepoca, ca. 28°27′N, 109°16′W,

T. Daniel et al. 8565 (CAS); Mpio. Yécora, between San Nicolás and Nuri, just S of Curea, ca. 24 km SW jct. Hwy. 16, ca. 28°19′W, 109°17′W, *T. Daniel et al. 8575* (CAS); Mpio. Yécora, Arroyo La Quema, 0.3 km SE of Tepoca on Hwy. 16, ca. 28°26′N, 109°15′W, *T. Daniel et al. 8637* (CAS, MEXU); Canyon Sapopa, Río Mayo, *H. Gentry 1084* (ARIZ, F, GH, MO); Río El Naranjo crossing N of Taymuco, 27°15′N, 108°43′W, *P. Jenkins et al. 88-320* (ARIZ, CAS); Mpio. Arizpe, Puente Caliente, Rancho Agua Caliente, ca. 3 km S of Arizpe on Son. 89, 30°20′N, 110°12′W, *A. Reina G. & T. Van Devender 2000-738* (ARIZ, CAS); Mpio. Yécora, Curea, 28°19′N, 109°17′W, *A. Reina G. et al. 2001-79* (CAS, MEXU, MO), *2001-80* (CAS); Mpio. Yécora, Arroyo Santa Ana at SON 12 (Tepoca-Cd. Obregón Hwy.), 2.3 km SW of La Quema turnoff, 8.5 km (air) W of Guadalupe Tayopa, 28°21′N, 109°16′W, *A. Reina G. et al. 2001-98* (CAS); Mpio. Alamos, Arroyo Mentidero at crossing of Alamos-El Chinal road and down arroyo to Río Cuchujaqui, ca. 12 km S of Alamos, ca. 26°55′N, 108°55′W, *A. Sanders et al. 12617* (CAS); Mpio. Yécora, Arroyo Santa Ana at Son. 12, 2.3 km SW of turn to La Quema, 28°21′N, 109°16′W, *T. Van Devender & A. Reina G. 97-1060* (ARIZ, CAS, MEXU); Mpio. Soyopa, Loma Maderista, 3.5 km S of Tónichi, ca. 28°34′N, 109°33′W, *T. Van Devender & A. Reina G. 2001-199* (CAS, MO); ca. 8 mi SE of Alamos near Río Cuchujaqui, *T. Van Devender & R. Van Devender 83-142* (ARIZ, CAS), *84-142* (ASU); *T. Van Devender et al. 84-153* (ASU); ca. 13.5 mi S of Alamos, *T. Van Devender et al. 84-191* (ASU); El Guayabo crossing of Río Cuchujaqui, 14 km ESE of Alamos, 27°00′N, 108°47′W, *T. Van Devender et al. 92-257* (ARIZ, CAS), *92-1291* (ARIZ, CAS, TEX); El Ranchería crossing of Río Cuchujaqui, ca. 22.5 km S of Alamos toward El Chinal, 26°51′N, 108°55′W, *T. Van Devender et al. 92-1192* (ARIZ, CAS, MO, TEX); Cerro las Tatemas below Microondas La Luna, 13.8 km NW of Alamos, 27°07′N, 109°02′W, *T. Van Devender et al. 93-338* (ARIZ, CAS); Sierra de Alamos, El Rincón Viejo, Arroyo El Aguaje, ca. 4 km N of Alamos, 27°04′N, 108°56′W, *T. Van Devender et al. 93-1507* (ARIZ, CAS); Mpio. Soyopa, NE side of Río Yaqui bridge on Mex. 16, just S of Tónichi, ca. 28°34′N, 109°33′W, *T. Van Devender et al. 97-1471* (CAS); Mpio. Bacanora, jct. of Cañada Jiropa on road from Bacanora to Tónichi, 5.4 km (air) SSW of Bacanora, 28°56′N, 109°25′W, *T. Van Devender et al. 99-861* (CAS, TEX); Mpio. Arivechi, Arroyo Agua Caliente, 10.2 km (air) WNW of Arivechi, 28°57′N, 109°17′W, *T. Van Devender et al. 99-886* (ARIZ, CAS); Mpio. Yécora, 1.9 km W of Tepoca on Mex. 16, 28°27′N, 109°16′W, *T. Van Devender et al. 2000-61* (CAS); Mpio. Yécora, Curea, 28°19′N, 109°17′W, *T. Van Devender et al. 2001-100* (CAS).

Tetramerium yaquianum T.F. Daniel, Syst. Bot. Monogr. 12:102. 1986. TYPE: MEXICO. Sonora: along rd. to Micro. Cerro Prieto, between Navojoa and Alamos, 9.7 mi E of jct. Hwy. 15 in Navojoa, 13 Mar 1984, *T. Daniel 3372* (holotype: CAS!; isotypes: ASU!, MEXU!, MICH!, NY!, US!).

Phenology. Flowering: July–December, March; fruiting: September–December, March.

Distribution and habitats. Endemic to Sonora where plants occur on slopes and along streams in thornscrub and tropical deciduous forests at elevations from 110–400 m.

Illustration. *Systematic Botany Monographs* 12:76. 1986.

Daniel (1986) provided a description of *Tetramerium yaquianum*. It is the only species of Acanthaceae known to be restricted in distribution to Sonora (Fig. 41), where it can be distinguished from the morphologically similar *T. nervosum* by the characters in the following couplet:

1. Calyx 5-lobed; bracts widely spreading (usually ± horizontal), glandular pubescent with glandular trichomes 0.2–0.3 mm long, (acute to) rounded to truncate to emarginate at apex, the apical portion usually flat and not twisted. . . . . *T. yaquianum*
1. Calyx 4-lobed; bracts mostly erect (± appressed to rachis), not glandular pubescent (or if glandular trichomes, if present, these up to 0.1 mm long), acute to acuminate at apex, the apical portion usually ± recurved and twisted. . . . . *T. nervosum*

Sonoran collections: between Ures and Hermosillo, 17.1 mi SW of Ures, *T. Daniel 940* (MICH); between Esperanza and Rosario de Tezopaco, 33.3 mi NE jct. Hwy. 15, *T. Daniel 3361* (ASU, CAS, MICH, MEXU, NY, US); western base of Sierra Bojihuacame, 1.2-1.1 mi SE of Bachoco, *T. Daniel 3365* (ASU, CAS,

ENCB, K, MEXU, MICH, NY, UC, US); El Novillo (E-central Sonora), *R. Felger et al. 84-298* (ARIZ); Sierra Bajihuacame, SE of Cd. Obregón, *H. Gentry 14530* (ARIZ, LL); summit of Cerro Prieto, 15 km E of Navojoa toward Alamos, ca. 27°15′N, 109°17′W, *A. Sanders et al. 9279* (CAS); 37 mi NE of Cajeme on road to Tesopaco, *F. Shreve 6158* (ARIZ, F); 1.5 mi downstream from La Estrella on Río Yaqui, *T. Van Devender et al. s.n.* (ARIZ, ASU); Mesa Masiaca along road to microwave tower, 6.5 km WNW of San José de Masiaca, 26°46′N, 109°18′W, *T. Van Devender et al. 92-1109* (ARIZ, CAS, MO, TEX); Mpio. Alamos, Cerro El Chorro, 4 km NW of Yocogigua, 26°49′N, 109°03′W, *T. Van Devender et al. 93-1445* (ARIZ, CAS).

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