

# The Acanthaceae of the Southwestern United States

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## Abstract

The predominantly tropical family Acanthaceae are represented in the southwestern United States by 25 species in 11 genera. Within this region, species of Acanthaceae are found primarily in the Sonoran and Chihuahuan Desert regions. Name changes, changes in taxonomic status, and range extensions update the treatments of Acanthaceae in state floras which cover the region. In addition, six species not previously included in state floristic manuals are documented from the Southwest. Keys to and descriptions of each genus and species are provided. Information on synonymy, distribution, habitat preference, and phenology of each species is also given.

## Introduction

The Acanthaceae are a predominantly tropical family comprising some 250 genera with about 3000 species. Although 18 species are indigenous to the southeastern United States (Long, 1970), the family is best represented in this country in the arid Southwest where 25 species in 11 genera are presently known to be native. The family is not considered to be of major economic importance, however, numerous alien species are commonly cultivated in the Southwest for their attractive flowers (e.g. species of *Acanthus*, *Justicia*, and *Ruellia*). In addition, most of the southwestern species provide excellent browse.

In this study, the 25 naturally occurring species in the southwestern United States are treated. The Southwest is defined as comprising southern California (south of 35° N latitude), Arizona, New Mexico, and the trans-Pecos region of western Texas. This region includes those portions of the Sonoran and Chihuahuan Deserts occurring in the United States. Indeed it is these arid deserts in which the majority of species of southwestern Acanthaceae are found.

Although treatments of the Acanthaceae are provided in each of the state floras covering this region (Munz, 1959; Kearney and Peebles, 1960; Martin and Hutchins, 1981; Correll and Johnston 1970), numerous name changes, several changes in taxonomic status, and range extensions for most taxa make an updated and regional treatment desirable. In addition, six species not treated in the state floras are now known to occur in this region and are considered here.

Although Gray (1880) listed four species of Acanthaceae as potentially occurring in California, only one (*Justicia californica*) has been documented from that state. The species occurs in passes and on the eastern slopes of the peninsular ranges, eastward through the Sonoran Desert (cf. Colorado Desert) to the Colorado River. Two other species of the family, *Carlowrightia arizonica* and *Anisacanthus thurberi*, will likely be found along the southeastern border of the state.

Twelve species were recognized by Kearney and Peebles (1960) as occurring in Arizona. One of those, *Dichiptera pseudoverticillaris* Gray, is no longer maintained as a distinct species and two additional species have been discovered in the state, for a total of 13 species. Within Arizona, species of Acanthaceae are restricted in distribution to the southern and central part of the state. The rapid rise in elevation in central Arizona and the resulting changes in vegetation type and winter temperatures apparently form a natural boundary to the northward migration of the family.

The recent flora of New Mexico (Martin and Hutchins, 1981) lists 10 species of Acanthaceae as occurring in that state. Three species cited in that work (*Ruellia metzae*, *Carlowrightia torreyana*, and *Dyschoriste linearis*) are not presently known from New Mexico and four others are (*Siphonoglossa pilosella*, *C. texana*, *Tetramerium nervosum*, and *Justicia wrightii*.) Thus in this treatment, 11 species are recognized as occurring in the state. Within New Mexico, species of Acanthaceae are restricted to the southern part of the state. Their range is bounded by high mountains to the northwest and grassland communities to the east. The Acanthaceae flora of New Mexico is enriched by incursions of species from both the Sonoran and Chihuahuan Desert regions. Other species which should be sought in the state include: *Carlowrightia arizonica*, *C. serpyllifolia*, and *Ruellia nudiflora*.

Wasshausen (1966) reported 14 species of Acanthaceae from the trans-Pecos region of Texas. With several additions to the Acanthaceae flora of western Texas, 18 species are now known to occur there. The Chihuahuan Desert is considerably richer in taxa of Acanthaceae than is the Sonoran Desert and this fact is emphasized by the comparatively large number of species in this region of Texas which encompasses only nine counties.

No species of Acanthaceae are endemic to the region covered by this treatment, however 17 of the 25 species are either endemic or largely restricted to one of the major desert regions of the southwestern United States and northern Mexico. Thirteen species (*Anisacanthus linearis*, *A. puberulus*, *Stenandrium barbatum*, *Siphonoglossa pilosella*, *Carlowrightia parvifolia*, *C. linearifolia*, *C. serpyllifolia*, *C. mexicana*, *C. texana*, *C. torreyana*, *Justicia warnockii*, *J. wrightii*, and *Ruellia parryi*) can be considered as either entirely or largely Chihuahuan in distribution. In the Southwest, these species occur primarily in trans-Pecos Texas and southeastern New Mexico. Four species are primarily Sonoran in distribution (*Anisacanthus thurberi*, *Justicia californica*, *J. sonora*, and *Siphonoglossa longiflora*). They occur in southern California, Arizona, and southwestern New Mexico (although *S. longiflora* has been reported from one locality in trans-Pecos Texas). The eight remaining species (*Carlowrightia arizonica*, *Dicliptera resupinata*, *Dyschoriste decumbens*, *Elytraria imbricata*, *Henrya insularis*, *Justicia candicans*, *Ruellia nudiflora*, and *Tetramerium nervosum*) have considerable ranges outside of these desert regions. They are widely distributed species and most of them show a great deal of morphological variation throughout their ranges.

The region of southeastern Arizona and southwestern New Mexico (Fig. 1a), which lies between the two major deserts and just north of the Sierra Madre Occidental in Mexico, contains isolated pockets of Chihuahuan Desert vegetation and large tracts of desert grassland. This region apparently serves as both a filter and a barrier with respect to the migration of Acanthaceae. Some Chihuahuan Desert species (e.g. *Carlowrightia linearifolia*) reach their westernmost outposts here and certain Sonoran Desert species (e.g. *Siphonoglossa longiflora*) have undoubtedly traversed this region in their migration into the Chihuahuan Desert.

In this treatment, a key to the eleven genera of southwestern Acanthaceae is followed by a short diagnosis of each genus, a key to the species, and a description of each species. Pertinent synonymy, habitat information, and flowering times are also provided for each species. Nomenclatural, taxonomic, and distributional notes are provided where this treatment differs from other accounts. Maps showing the distribution by county of each species are also included.

#### Key to Genera of Southwestern Acanthaceae

1. Fertile stamens 4.
  2. Anthers monothealous; plants dwarf perennial herbs to 10 cm tall with leaves clustered at or near ground level ..... **Stenandrium**
  2. Anthers bithealous; perennial herbs or shrubs to 5 dm tall with leafy stems.
    3. Corolla 15 - 25 mm long; thecae with pointed basal spurs; seeds 4 or fewer per capsule ..... **Dyschoriste**
    3. Corolla 25 - 50 mm long; thecae lacking basal spurs; seeds 6 or more per capsule ..... **Ruellia**
1. Fertile stamens 2.
  4. Leaves alternate or clustered; inflorescences borne on long, scaly peduncles, the scales coriaceous and imbricate; bracts 3-toothed at apex; retinacula papilliform; seeds minute, 0.5 - 0.7 mm long ..... **Elytraria**
  4. Leaves opposite (rarely subopposite in some individuals); inflorescences not borne on scaly peduncles; bracts (if present) not 3-toothed; retinacula well-developed, hook-like; seeds large, 1.5 - 7 mm long.
    5. Stems hexagonal-ridged; flowers and bractlets subtended by 2 conspicuous cordate to deltate to reniform, sometimes basally fused bracts; lower lip of corolla entire; placenta separating from mature capsule valves ..... **Dicliptera**
    5. Stems terete to quadrate (often striate); flowers and bractlets not subtended by bracts as described above; lower lip of corolla shallowly to deeply trilobed; placenta remaining attached to mature capsule valves.
      6. Stamens more or less appressed to upper lip of corolla, the anthers opening toward the lower lip; thecae usually conspicuously unequally inserted on filament, at least the lower one apiculate or prominently spurred.
        7. Corolla tube slender and cylindrical, ampliate only at apex if at all ..... **Siphonoglossa**
        7. Corolla tube not cylindrical, ampliate from below the middle ..... **Justicia**
      6. Stamens more or less appressed to lower lip of corolla, the anthers opening toward the upper lip; thecae equally or subequally inserted on filament, rounded to acute at base, lacking any basal appendages.
        8. Corolla somewhat fleshy, concolorous, red, orange, or pinkish, 30 - 57 mm long, the lobes of the lower lip similar in form ..... **Anisacanthus**
        8. Corolla not fleshy, white, blue or purplish with yellow and/or maroon markings on the upper lip, 5.5 - 18 mm long, the central lobe of the lower lip dissimilar in form from the lateral lobes (except in *Carlowrightia linearifolia* and *C. parvifolia* in which the three lobes are nearly identical).
          9. Inflorescence of densely bracteate, 4-sided spikes; bracts 3.5 - 5 mm wide, the surfaces prominently veined, the margin hirsute-ciliate, the apex falcate-mucronate; calyx 4-lobed ..... **Tetramerium**
          9. Inflorescence of lax to dense spikes or racemes (not 4-sided) or the flowers axillary; bracts (if present) 0.3 - 2 (- 4) mm wide, the surfaces, margin, and apex not as above; calyx 5-lobed.
    10. Bractlets oblanceolate, fused along one side from the base to the apex; capsule 5 - 7 mm long; seeds pubescent ..... **Henrya**
    10. Bractlets subulate to linear to lanceolate to ovate to triangular, not fused; capsule 7 - 12.5 mm long; seeds lacking trichomes ..... **Carlowrightia**

**Anisacanthus** Nees

Shrubs; calyx 5-lobed; corolla usually reddish or orange, relatively large, with an ampliate tube and a bilabiate limb comprising an entire to emarginate upper lip and a 3-lobed lower lip; stamens 2, anthers bithecous, the thecae equally to subequally inserted, lacking basal appendages; seeds 4 or fewer per capsule.

Approximately 20 species, centered in Mexico but reported from South America.

1. Leaves sessile, linear to lance-linear, 1 - 3 (- 6) mm wide, the surfaces glabrous. . . . . 1. *A. linearis*
1. Leaves subsessile to petiolate, lanceolate to ovate to oblanceolate, 2 - 35 mm wide, the surfaces pubescent.
  2. Corolla pinkish, 37 - 57 mm long; capsule 20 - 22 mm long; plants of Texas. . . . . 2. *A. puberulus*
  2. Corolla orange-red, 30 - 40 mm long; capsule 12 - 16 mm long; plants of Arizona and New Mexico. . . . .
- . . . . . 3. *A. thurberi*

**1. *Anisacanthus linearis*** (Hagen) Henrickson & Lott, *Brittonia* 34: 175. 1982.

*A. insignis* Gray var. *linearis* Hagen, *Ann. Missouri Bot. Gard.* 28: 396. 1941.

Erect shrub to 2 m tall. Younger stems terete, glabrous or sparsely pubescent in 2 lines with retrorse trichomes to 0.2 mm long. Leaves sessile, linear to lance-linear, 10 - 50 mm long, 1 - 3 (- 6) mm wide, cuneate at base, acute at apex, the surfaces glabrous. Flowers in axils of reduced upper leaves or bracts along upper portions of stems. Bracts linear to lanceolate to ovate, 1.5 - 8 mm long, 0.8 - 1.5 (- 2.5) mm wide, glabrous to sparsely pubescent with trichomes 0.05 mm long, often glandular. Bractlets linear-subulate, 1.5 - 3 mm long, 0.5 - 1 mm wide, pubescent like bracts. Calyx 4 - 7 mm long, the lobes subulate, glandular. Corolla red or orange-red, 38 - 50 mm long, upper lip 18 - 25 mm long, lower lip 22 - 30 mm long. Stamens 28 - 32 mm long, the thecae 3.8 - 4 mm long. Capsule stipitate, 16 - 22 mm long, glabrous. Seeds 5 - 6 mm long. (June - September).

A species restricted in distribution to the Chihuahuan Desert region of trans-Pecos Texas and north-central Mexico where it occurs along arroyos in desert scrub at elevations from 1000 to 1600 meters (Fig. 1b).

Representative specimen examined: Texas: Brewster Co.: Chisos Mts., Painted Gap, *Warnock 905* (ARIZ, SRSC, TEX).

**2. *Anisacanthus puberulus*** (Torr.) Henrickson & Lott, *Brittonia* 34: 172. 1982.

*Drejera puberula* Torr. in Emory, *Rep. U.S. & Mex. Bound. Surv.* 2(1): 123. 1859.

*A. insignis* Gray, *Syn. Fl. N. Amer.* 2(1): 457. 1886.

Erect shrub to 3 m tall. Younger stems subquadrate, evenly pubescent with flexuose trichomes 0.2 - 0.7 mm long, becoming pubescent in 2 lines with age. Mature leaves petiolate, the petioles to 17 mm long, the blades lance-ovate to ovate, 21 - 87 mm long, 5 - 30 mm wide, rounded to acute at base, acute to acuminate-falcate at apex, the surfaces pubescent. Flowers usually appearing before the leaves in axillary clusters or short spicate racemes at the nodes of the previous season along the upper portion of the stems. Bracts of axillary racemes elliptic, 2 - 5 mm long, 1 mm wide, densely glandular. Bractlets lance-subulate to linear to oblanceolate, 2 - 4 mm long, 0.5 - 1.5 mm

wide, pubescent like bracts. Calyx 5 - 8 (- 10) mm long, the lobes lance-subulate, glandular. Corolla pinkish, 37 - 57 mm long, upper lip 18 - 25 mm long, lower lip 20 - 27 mm long. Stamens 22 - 30 mm long, the thecae 2.5 - 3.8 mm long. Capsule stipitate, 20 - 22 mm long, glabrous. Seeds 5.5 - 6 mm long. (March - June and October).

A species with very much the aspect of *A. thurberi*, but differing in habit, corolla length and color, and capsule length. Restricted in distribution to the Chihuahuan Desert region of trans-Pecos Texas and north-central Mexico where it occurs along arroyos (or on alluvial fans or flats) in desert scrub at elevations of 925 to 2100 meters (Fig. 1b).

Representative specimens examined: Texas: Brewster Co.: near Marathon, *Texas Hwy. Dept. T377* (ARIZ, SRSC, TEX); Presidio Co.: 5 mi SSW of Shafter, *Muller 5004* (ARIZ).

**3. *Anisacanthus thurberi*** (Torr.) Gray, *Syn. Fl. N. Amer.* 2(1): 328. 1878.

*Drejera thurberi* Torr. in Emory, *Rep. U.S. & Mex. Bound. Surv.* 2(1): 124. 1851.

Shrub to 1.5 m tall. Younger stems subquadrate, the internodes pubescent with flexuose to appressed eglandular trichomes to 0.8 mm long, these mostly concentrated in 2 lines, the flower bearing apex of the younger stems pubescent with an understory of eglandular and glandular, straight to flexuose trichomes to 0.2 mm long and usually with an overstory of scattered to dense eglandular, straight to flexuose trichomes to 1 mm long (hirsute), the nodes pubescent with the latter type trichomes. Leaves usually forming dense clusters along the older stems, subsessile to petiolate, the petioles to 3 (- 14) mm long, the blades lanceolate to ovate to narrowly elliptic to oblanceolate, 7 - 22 (- 65) mm long, 2 - 8 (- 35) mm wide, acute to attenuate at base, acuminate to acute at apex, the surfaces hirsute. Flowers usually borne in the axillary leaf clusters or rarely in leaf axils along the younger stems. Bractlets subulate to linear-lanceolate or becoming foliose, 2 - 15 (- 20) mm long, 0.5 - 1.5 (- 6) mm wide, pubescent with trichomes 0.05 - 0.5 mm long, often glandular. Calyx (at anthesis) 6.5 - 13 mm long (12 - 16 mm long in fruit), the lobes subulate, the outer surface pubescent like the younger stems although the glands more numerous. Corolla orange-red, 30 - 40 mm long, upper lip 10 - 20 mm long, lower lip 11 - 20 mm long. Stamens 20 - 35 mm long, the thecae 3 - 3.5 mm long. Capsule 12 - 16 mm long, glabrous. Seeds 5 - 7 mm long. (February - November).

Restricted in distribution to the southwestern United States and adjacent regions of northwestern Mexico where it occurs on rocky slopes and especially along arroyos and streams in Sonoran Desert scrub and desert grassland at elevations from 550 to 2200 meters (Figs. 1b, 2a).

Representative specimens examined: Arizona: Apache Co.: White Mts., *Schroeder s.n.* (ARIZ); Cochise Co.: 1.4 mi NW of Portal, *Daniel 174* (ASU); Graham Co.: Goat Mtn., *McGill 2372* (ASU); Gila Co.: Three Bar Game Mgt. Area, Tonto Natl. Forest, *Pase s.n.* (ASU); Greenlee Co.: Dix Creek, *Niles and Bostick 985* (ARIZ); Maricopa Co.: 0.8 mi. SW of Canyon Lake Lookout, *Keil 1149* (ASU); Mohave Co.: 40 mi. S of Kingman, *Denton 1435* (ASU); Pima Co.: 5 mi. W of Arivaca, *Lehto and Broome 22707* (ASU); Pinal Co.: ca. 2 mi. S of Roger's Trough, *McGill 1307* (ASU); Santa Cruz Co.: 4 mi. W of Patagonia, *Carufel 15* (ASU); Yavapai Co.: 6 mi. NE Seven Springs, *Lehto and Reeves 20145* (ASU); Yuma Co.: Kofa Mts., Tunnel Springs Canyon, *Lehto and*

*Reeves 20075* [ASU]. New Mexico: Grant Co.: Mangas Springs, 18 mi. NW of Silver City, *Metcafe 113* (ARIZ, NMC); Hidalgo Co.: Guadalupe Canyon, 15 mi. E of jct. rd. to Douglas, *Hess 1817* (ARIZ, NMC); Luna Co.: 13 mi. S of Deming, *Hess and Tyznik 3244* (ARIZ, NMC).

### **Carlowrightia** Gray

Suffrutescent herbs or shrubs; calyx 5-lobed; corolla white, blue, or pinkish, relatively small, with a slender, scarcely ampliate tube and a bilabiate limb comprising an emarginate upper lip and a 3-lobed lower lip; stamens 2, anthers bithecous, the thecae equally to subequally inserted, lacking basal appendages; seeds 4 or fewer per capsule.

Twenty species are recognized in this predominantly Mexican genus.

1. Corollas blue, subactinomorphic, the lower-central lobe not conduplicate; anthers yellow; leaves 4 - 35 times longer than wide.
2. Young stems strigillose, the trichomes recurved, 0.2 - 0.6 (- 1) mm long; corollas 6.5 - 9 mm long; capsules 7 - 9 mm long; seed margin dentate . . . . . 1. *C. parvifolia*
2. Young stems puberulent, the trichomes straight, less than 0.2 mm long; corollas 9 - 11 mm long; capsules 10.5 - 12.2 mm long; seed margin entire . . . 2. *C. linearifolia*
1. Corollas blue or white, bilabiate, the lower-central lobe conduplicate; anthers maroon; leaves 0.8 - 8 times longer than wide.
3. Shoots glandular pubescent (glands inconspicuous in *C. arizonica*); corolla 9 - 15 mm long.
4. Glandular trichomes conspicuous, 0.1 - 0.7 mm long; eglandular trichomes disposed in 2, narrow, vertical lines along stems; leaves ovate to orbiculate; corollas blue . . . . . 3. *C. serpyllifolia*
4. Glandular trichomes inconspicuous, 0.1 mm long or less; eglandular trichomes evenly disposed along stems; leaves lanceolate to narrowly ovate; corollas white . . . . . 4. *C. arizonica*
3. Shoots eglandular (or with glandular inflorescence axes only in *C. torreyana*); corollas 6 - 10 mm long.
5. Leaves elliptic-lanceolate to obovate, to 9 mm wide; corollas blue . . . . . 5. *C. mexicana*
5. Leaves ovate to orbiculate, to 30 mm wide; corollas white.
6. Cauline trichomes recurved; inner bractlets ovate to lanceolate; corolla white with distinct maroon veins on each petal lobe; seed margin entire . . . . . 6. *C. texana*
6. Cauline trichomes straight; inner bractlets subulate; corolla white with a yellow eye fringed with maroon on upper lip; seed margin denticulate . . . . . 7. *C. torreyana*

#### **1. Carlowrightia parvifolia** Brandege, Univ. Calif. Pub. Bot. 4: 190. 1911.

Spreading to erect, spindly subshrub to 5 dm tall. Younger stems gray-canescens, quadrate to terete, evenly pubescent, the trichomes eglandular, retrorse, (0.1 -) 0.2 - 0.6 (- 1) mm long. Leaves sessile, the blades linear to narrowly lanceolate, 3 - 24 mm long, 0.5 - 3 mm wide, acute at base, acuminate to acute at apex, upper surface glabrous, lower surface sparsely pubescent.

Flowers solitary or several, pedunculate from leaf axils, especially along the upper portion of the stem. Bractlets linear, 1 - 8 mm long, 0.2 - 0.8 mm wide. Calyx 3 - 5 mm long, the lobes subulate. Corolla light purple with dark purple lines in a whitish eye on the upper lip, 6.5 - 9 mm long, the upper lip 4.5 - 7 mm long, the lower lip 4.5 - 7 mm long. Stamens 4 - 6 mm long, the thecae yellowish, 0.8 - 1 mm long. Capsules 7 - 9 mm long, glabrous or sparsely pubescent at apex. Seeds usually 2 per capsule, concavoconvex, 3 - 3.9 mm long, testa tuberculate on concave side, margin dentate. (May - October).

Known only from the Chihuahuan Desert region of trans-Pecos Texas and Coahuila where it occurs in limestone crevices and along rocky washes in desert scrub at elevations from 1200 to 1500 meters (Fig. 1c).

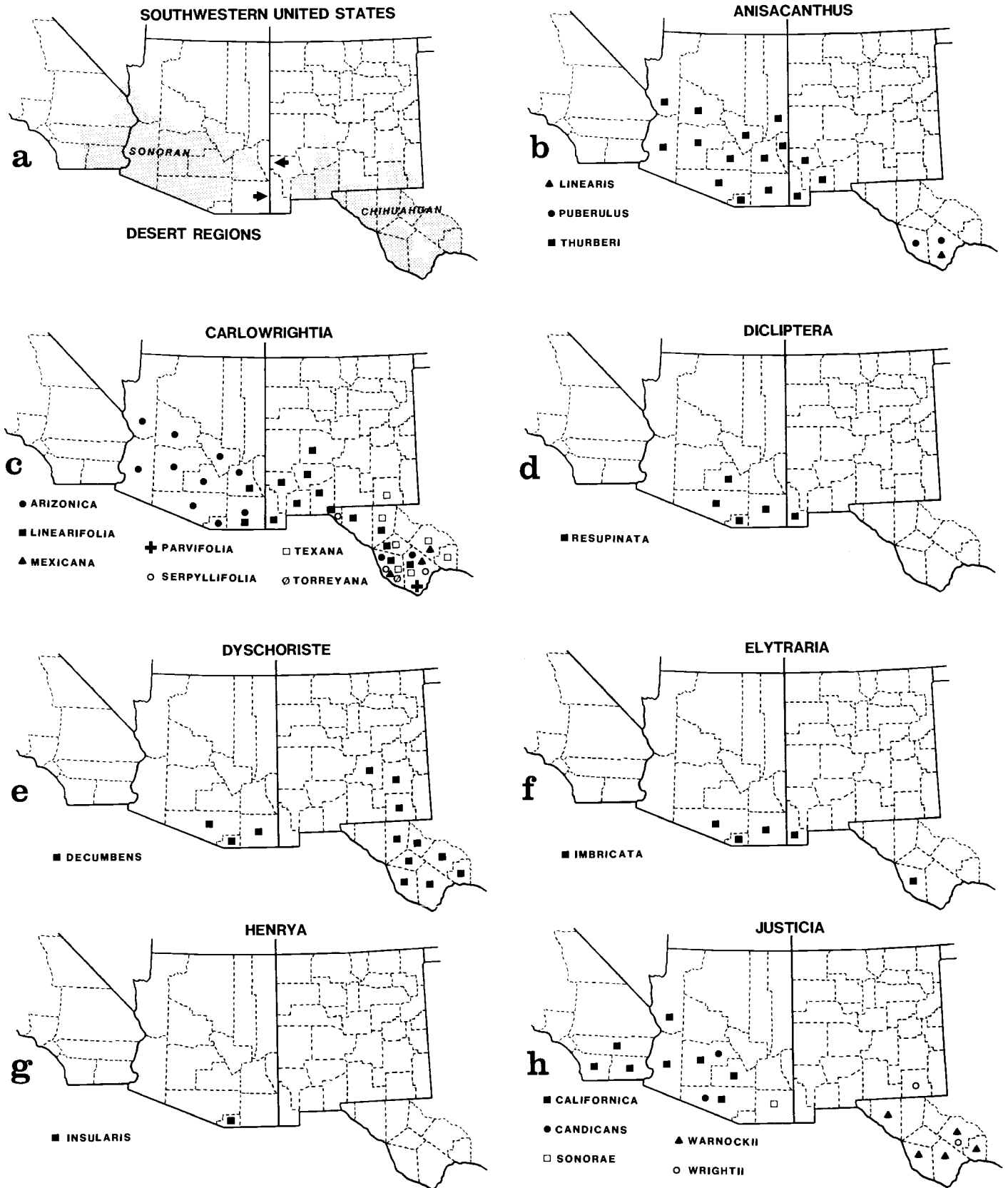
Representative specimens examined: Texas: Brewster Co.: locality not specified, *Warnock 44392* (TEX); Pecos Co.: Sierra Madera, 22 mi. S of Ft. Stockton, *Warnock and McVaugh 8706* (SRSC).

#### **2. Carlowrightia linearifolia** (Torr.) Gray, Proc. Amer. Acad. Arts 13: 364. 1878. Not *C. linearifolia* Lindau (1897). *Schaueria linearifolia* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 123. 1859.

Erect, openly branched shrub to 2 m tall. Younger stems terete, evenly pubescent with erect trichomes 0.02 - 0.10 mm long. Leaves often subopposite, sessile (rarely sessile with petioles 0.5 mm long), the blades linear, 10 - 55 mm long, 0.5 - 2 (- 3) mm wide, attenuate to acute at base, rounded to acute at apex, surfaces pubescent. Flowers in bract axils in racemose or thyrsoid axes, collectively forming a terminal, leafy panicle or thyrsoid. Bracts linear, (1.5 -) 3 - 20 (- 35) mm long, 0.4 - 1 mm wide. Bractlets linear, 0.5 - 10 mm long, 0.2 - 0.6 mm wide. Calyx 1.5 - 5.2 mm long, the lobes linear to triangular. Corolla lavender blue with faint yellow eye streaked with purple on the upper lip, (7.5 -) 9 - 12 mm long, upper lip 4.5 - 8 mm long, lower lip 5 - 8 mm long. Stamens 5.5 - 6 mm long, the thecae golden yellow, 1.1 - 1.9 mm long. Capsules 10.5 - 12.2 mm long, glabrous. Seeds 4 per capsule, 3.8 - 4.5 mm long, testa papillose, margin entire. (July - December).

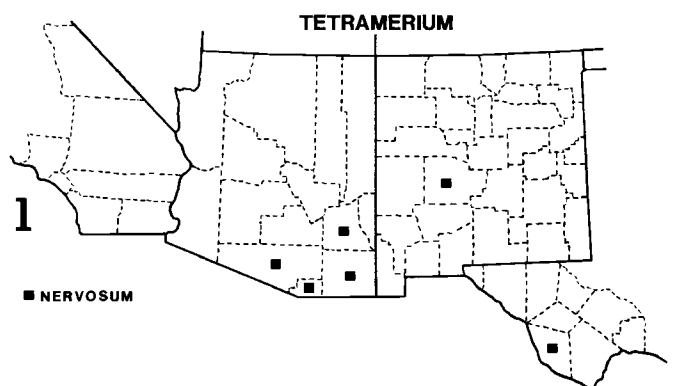
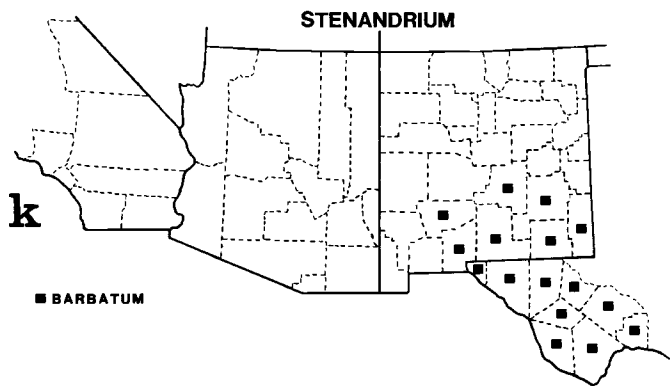
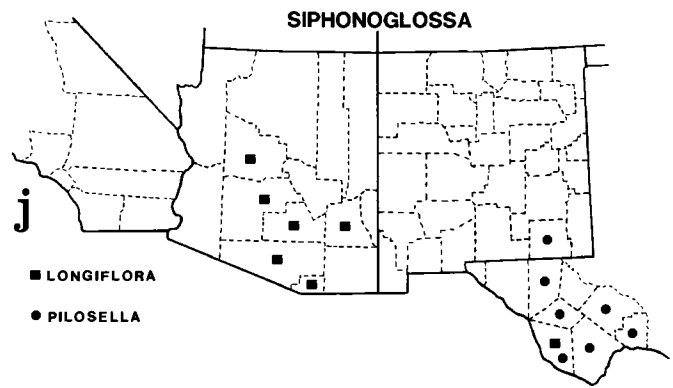
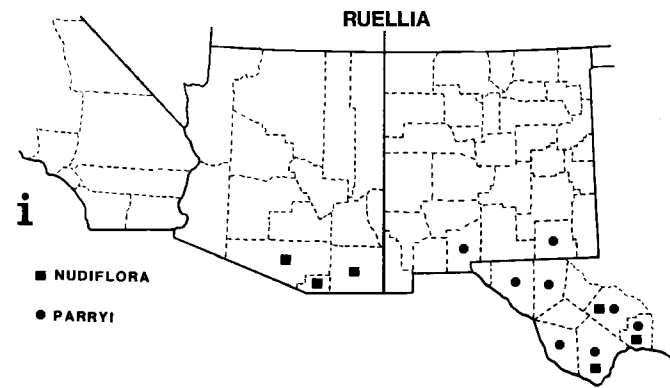
Restricted in distribution to the Chihuahuan Desert region of the southwestern United States and adjacent regions of north-central Mexico where it occurs in rocky washes and in the gravelly or sandy alluvium of arroyos in desert associations from 900 to 1750 meters (Fig. 1c).

Representative specimens examined: Arizona: Cochise Co.: ca. 2 mi. N of Portal, *Barr 62-841* (ARIZ); Graham Co.: near Matthews, *Shreve 4388* (ARIZ). New Mexico: Doña Ana Co.: mesa W of Organ Mts., *Wooten s.n.* (NY, US); Grant Co.: ca. 3 mi. N of Howell's Ridge, Little Hatchet Mts., *Van Devender and Spaulding s.n.* (ARIZ); Hidalgo Co.: Dog Mts., *Mearns 2398* (DS, NY, US); Luna Co.: Florida Mts., *Barneby 2478* (NY); Sierra Co.: 20 mi. N of Rincon, *Metcalfe 1281* (A, CAS, F, GH, MO, NMC, NY, UC, US); Socorro Co.: Socorro, *Eggleston 16256* (F, MO). Texas: Brewster Co.: Chisos Mts., *Daniel 565* (CAS, DUKE, ENCB, F, GH, MICH, MO, NY, TEX, UC, US); Culberson Co.: E slopes of Van Horn Mts., *Warnock and Turner 8989* (LL, MICH, SMU, SRSC, TEX); El Paso Co.: W edge of El Paso, *Correll 22619* (LL, MO, NCU, SMU, UC, US); Hudspeth Co.: 10 mi. W of Sierra Blanca, *Warnock 13600* (LL, SRSC, TEX); Jeff Davis Co.: 5 mi. W of Bloys encampment, *Warnock 15970* (SRSC); Presidio Co.: ca. 3.5 mi. NW of Presidio, *Correll 33896* (LL, UC, US).



**Figure 1.** Maps of the southwestern United States showing: a, Sonoran and Chihuahuan Desert regions and filter-barrier region between them; b, distribution of *Anisacanthus*; c, distribution of *Carlowrightia*; d, distribution of *Dicliptera*; e, distri-

bution of *Dyschoriste*; f, distribution of *Elytraria*; g, distribution of *Henrya*; h, distribution of *Justicia*; i, distribution of *Ruellia*; j, distribution of *Siphonoglossa*; k, distribution of *Stenandrium*; l, distribution of *Tetramerium*.



**3. *Carlowrightia serpyllifolia* Gray, Proc. Amer. Acad. Arts 21: 405. 1886.**

Decumbent to erect, globose and intricately branched or lax and openly branched subshrub to shrub to 5 dm tall. Younger stems quadrate to terete, pubescent with a mixture of eglandular and glandular trichomes, the eglandular trichomes sparse to dense, usually concentrated in 2 vertical lines, retrorse to erect, 0.05 - 0.90 mm long, the glandular trichomes usually evenly disposed, (.05 -) 0.1 - 0.7 mm long. Leaves subsessile to petiolate, the petioles 0.1 - 7 (- 14) mm long, the blades (lanceolate) ovate to deltate to orbicular to elliptic to obovate, 2 - 24 mm long, 1.5 - 10 (- 16) mm wide, attenuate to acute to rounded to truncate at base, acute to rounded at apex, surfaces sparsely to densely pubescent. Flowers usually borne in glandular spicate axes. Bracts (lanceolate) ovate to orbicular-obovate (triangular), 0.5 - 2 (- 6) mm long, 0.5 - 1.5 (- 4) mm wide. Bractlets ovate to subulate, 0.6 - 2.1 (- 4) mm long, 0.4 - 0.8 mm wide. Calyx (1.5 -) 2 - 4 (- 6) mm long, the lobes subulate. Corolla (pink-purple) blue-purple with a yellow eye streaked with purple veins on the upper lip, 9 - 15 mm long, the upper lip 7 - 11 (- 14) mm long, the lower lip 7 - 14 mm long. Stamens 6.5 - 8 (- 10.5) mm long, the thecae maroon (turning black), 0.9 - 1.2 mm long. Capsules 8.7 - 12 mm long, glabrous. Seeds 4 per capsule, 3.5 - 5 mm long, testa papillose (rarely only minutely so), margin dentate. (February - December).

Restricted in distribution to the Chihuahuan Desert region of trans-Pecos Texas and north-central Mexico where it occurs in washes, on rocky or gravelly hills, and along arroyos in desert scrub at elevations from 1000 to 1900 meters (Figs. 1c, 2b).

Representative specimens examined: Texas: Brewster Co.: Oak Canyon, *Correll and Correll 30621* (GH, LL, MO, SMU); El Paso Co.: W edge of El Paso, *Correll 22602A* (LL, MO, SMU, UC, US); Presidio Co.: ca. 5 mi. W of Shafter, *Hinckley 3220* (GH, NY, US).

**4. *Carlowrightia arizonica* Gray, Proc. Amer. Acad. Arts 21: 406. 1878.**

Erect, much-branched subshrub to 1 m tall. Younger stems terete, evenly pubescent with erect to retrorse trichomes 0.05 - 0.50 mm long and with an inconspicuous understory of glands 0.1 mm long or less. Leaves sessile to petiolate, the petioles 0.2 - 8 mm long, the blades frequently conduplicate, lanceolate to narrowly ovate to cordiform to elliptic, 3 - 33 mm long, 1 - 9 mm wide, cordate to truncate to acute at base, acute at apex, the surfaces pubescent. Flowers solitary or clustered in leaf axils or in bract axils in spicate axes. Bracts narrowly lanceolate to linear-subulate to triangular, 1 - 7 mm long, 0.3 - 1 mm wide. Bractlets subulate to triangular, 0.8 - 8 mm long, 0.3 - 1.3 mm wide. Calyx 1.5 - 5 mm long, the lobes subulate. Corolla white with a yellow eye streaked with maroon on the upper lip, 9 - 18 mm long, the upper lip 6 - 12 mm long, the lower lip 7 - 14 mm long. Stamens 5 - 8 mm long, the thecae maroon, 1 - 1.3 mm long. Capsules 7.5 - 11 mm long, glabrous. Seeds 4 per capsule, 3 - 4 mm long, testa papillose, margin dentate. (November - May).

*Carlowrightia arizonica* is a widely distributed (southwestern United States to northern Costa Rica) and taxonomically complex species with numerous diverse morphological

forms. Two forms are recognizable in our region; one has short (0.05 - 0.20 mm) retrorse to retrorse-appressed eglandular cauline trichomes, inflorescences of slender spicate axes with bracts 1 - 3 mm long, calyces 1.5 - 3.5 mm long, corollas 9 - 13 mm long, and capsules 7.5 - 10 mm long; the other has generally longer (0.1 - 0.5 mm) erect to retrorse eglandular cauline trichomes, inflorescences of stout, leafy spicate axes with bracts 3.5 - 7 mm long, calyces 2.5 - 5 mm long, corollas 10 - 18 mm long, and capsules 9 - 11 mm long. The forms are frequently encountered growing near one another. In our region, the species occurs on rocky slopes and in washes in both Sonoran and Chihuahuan Desert scrub at elevations from 350 to 1300 meters (Fig. 1c).

Representative specimens examined: Arizona: Cochise Co.: ca. 17 mi. E of Douglas, *Daniel 1792* (ASU); Gila Co.: below Whitlow Dam on Queen Creek, *Getz and Engard 453* (DES); Graham Co.: Redfield Canyon, *Haughey 546* (ASU); Maricopa Co.: South Mtn. S of Phoenix, *Keil 178* (ASU); Mohave Co.: Artillery Mts., *Butterwick and Hillyard 4365A* (ASU); Pima Co.: Box Canyon in Santa Rita Mts., *Daniel 173* (ARIZ, ASU, GH, K, MICH, NCU, NY, UTEP); Pinal Co.: Aravaipa Canyon, ca. 10 mi. N of Mammoth, *Daniel 170* (ARIZ, ASU, CAS, DUKE, F, GH, MICH, MO, NY, US); Santa Cruz Co.: near Patagonia, *Harrison 7176* (ARIZ, NY, US); Yavapai Co.: S side of Harcuvar Mts., *Fischer 6666* (ASU); Yuma Co.: Kofa Mts., *Lehto and Reeves 20025* (ASU, US). Texas: Brewster Co.: Sierra Quemada, *Warnock and Wallmo 12304* (SRSC, TEX); Presidio Co.: ca. 25 mi. E of Presidio, *Correll and Rollins 23682* (LL, NCU, UC).

**5. *Carlowrightia mexicana*** Henrickson & Daniel, *Madrono* 26: 32. 1979.

Prostrate to erect, suffrutescent perennial to 3.5 dm tall. Younger stems quadrate to terete, pubescent with closely appressed or retrorse trichomes 0.1 - 0.2 (- 0.5) mm long, concentrated in 2 lines or evenly disposed. Leaves sessile to petiolate, the petioles 1 - 3 (- 6) mm long, the blades elliptic-lanceolate to obovate, (4 -) 8 - 19 mm (- 29) mm long, 0.5 - 7 (- 9) mm wide, attenuate at base, acute to rounded at apex, surfaces sparsely pubescent. Flowers arising from leaf axils or from axils of bracts in a helicoid or scorpioid spicate axis. Bracts (if present) narrowly elliptic to linear, 2 - 7 mm long, 0.3 - 1 mm wide. Bractlets subulate to narrowly lanceolate, 0.8 - 3.5 mm long, 0.2 - 0.6 mm wide. Calyx 3 - 5 mm long, the lobes subulate. Corolla light or dark blue with a yellow eye streaked with purple on the upper lip, 6.5 - 10 mm long, upper lip 3.5 - 6.5 mm long, lower lip 4.5 - 6.5 mm long. Stamens 3.8 - 6 mm long, the thecae maroon turning black, 0.5 - 0.8 mm long. Capsules 9 - 12 mm long, glabrous. Seeds 4 per capsule, 3.5 - 5 mm long, testa smooth or papillose, margin entire to crenulate. (May - October).

Restricted in distribution to central and eastern portions of the Chihuahuan Desert in trans-Pecos Texas and Coahuila where it occurs on dry, rocky flats and in consolidated arroyo gravel in desert scrub and oak chaparral at elevations of 1050 to 1410 meters (Fig. 1c).

Representative specimens examined: Texas: Brewster Co.: 17 mi. E of Marathon, *Correll 34082* (GH, LL US); Pecos Co.: 25 mi. SW of Ft. Stockton, *Warnock 20002* (SRSC); Presidio Co.: North Chinati Mts., *Warnock 19218* (SRSC).

**6. *Carlowrightia texana*** Henrickson and Daniel, *Madrono* 26: 27. 1979.

Erect to decumbent, suffrutescent perennial to 3.5 dm tall. Younger stems quadrate to terete, evenly and more or less

densely pubescent, the trichomes retrorse, 0.1 - 0.5 (- 1) mm long. Leaves petiolate, the petioles (1 -) 3 - 7 (- 20) mm long, the blades (deltate) broadly ovate to orbicular when larger, narrowly ovate to elliptic when smaller, (2.5 -) 6 - 16 (- 42) mm long, (1.5 -) 3 - 11 (- 33) mm wide, truncate to rounded to acute (or oblique) at base, acuminate to acute (to rounded) at apex, surfaces pubescent, especially along the veins. Flowers solitary or clustered in leaf axils, rarely borne in axils of bracts on elongate, terminal, eglandular, spicate axes. Bractlets foliaceous, narrowly ovate to elliptic-lanceolate to linear, 2 - 12 mm long, (0.5 -) 2.5 - 5 mm wide. Calyx (2.5 -) 3 - 6 mm long, the lobes subulate. Corolla white with maroon veins on the lobes, 5.5 - 7 mm long, upper lip 3.5 - 5 mm long, lower lip 4 - 6 mm long. Stamens 3.3 - 5 mm long, the thecae maroon turning black, 0.5 - 1 mm long. Capsules 7.5 - 12.5 mm long, glabrous. Seeds 4 per capsule, 4.2 - 6 mm long, testa (smooth) papillose, margin entire. (March - November).

The species ranges from the Chihuahuan Desert region of the southwestern United States and adjacent north-central Mexico eastward into central and southern Texas. It occurs on limestone flats and hills or in the calcareous alluvium of arroyos in Chihuahuan Desert scrub, and in disturbed habitats at elevations from 1000 to 1700 meters (Fig. 1c).

Representative specimens examined: New Mexico: Eddy Co.: Carlsbad, *McKechnie 15* (MO, UNM); Texas: Brewster Co.: Gilliland Canyon, Glass Mts., *Warnock W324* (GH, MO, UC); Culberson Co.: near N end of Van Horn Mts., *Waterfall 4560* (GH); Jeff Davis Co.: Davis Mts., *Earle and Tracy 153* (NY); Pecos Co.: 24 mi. NW of Sheffield, *McVaugh 8204* (DS, F, GH, MICH, SMU, US); Presidio Co.: ca. 2.5 mi. N of Shafter, *Hinckley 1389* (F, LL, NY); Terrell Co.: ca. 18 mi. S of Sheffield, *Webster 330* (MICH, TEX).

**7. *Carlowrightia torreyana*** Wasshausen, *Phytologia* 12: 427. 1965.

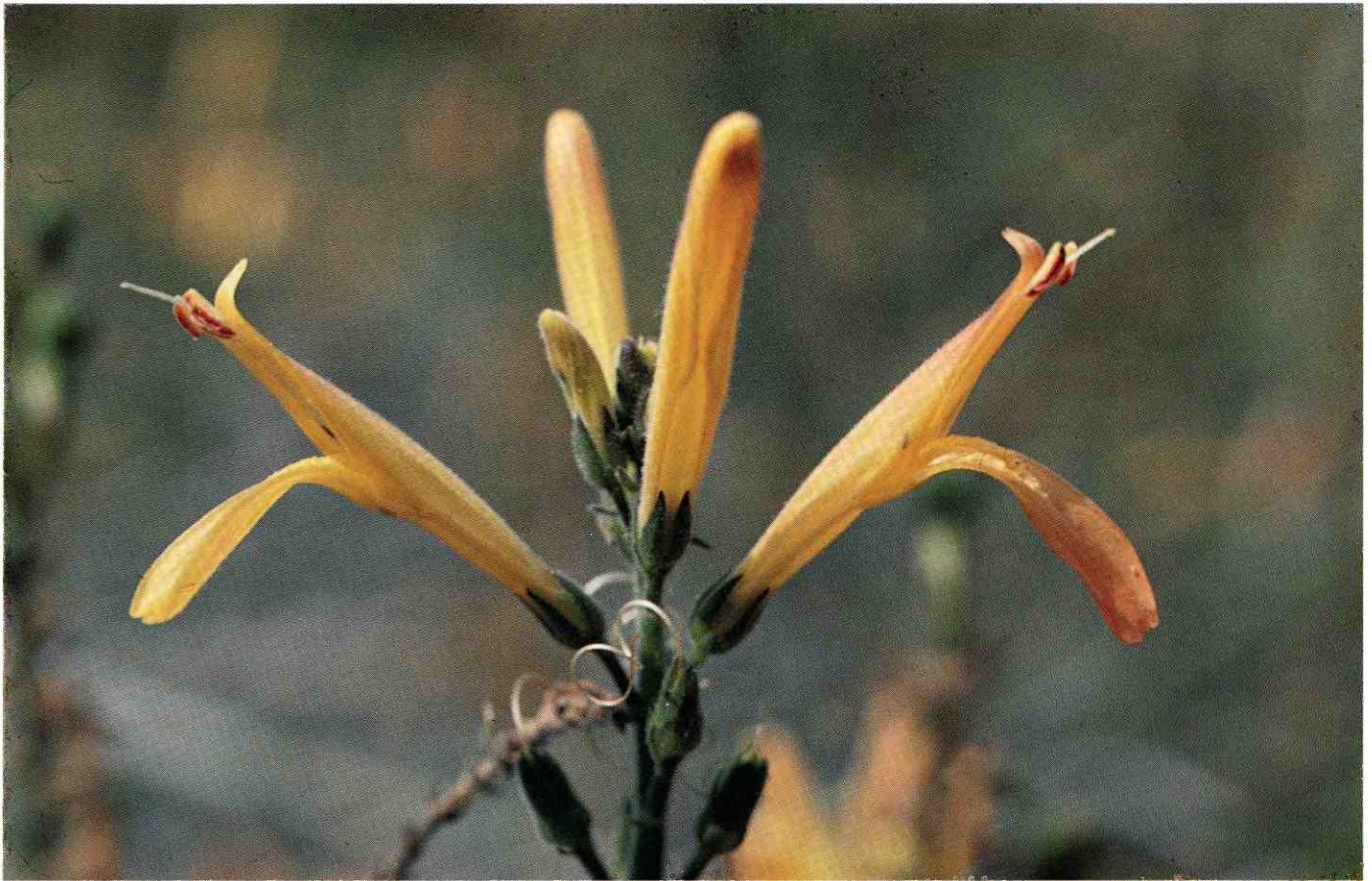
*Schaueria parvifolia* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 122. 1859.

*Dianthera parvifolia* (Torr.) Gray, Syn. Fl. N. Amer. 2: 330. 1878.

*Croftia parvifolia* (Torr.) Small, Fl. Southeast. U.S. 1088, 1338. 1903.

Decumbent to erect, suffrutescent perennial to 5 dm tall. Younger stems often gray-canescens, quadrate to terete, evenly and densely pubescent, the trichomes erect to flexuose, (0.2 -) 1 - 1.5 (- 1.9) mm long, often with an understory of erect to retrorse trichomes, 0.2 - 0.3 mm long as well. Leaves petiolate, the petioles 2 - 7 (- 15) mm long, the blades broadly ovate to orbicular when larger, ovate-elliptic when smaller, (5 -) 10 - 20 (- 40) mm long, (3 -) 7 - 13 (- 27) mm wide, truncate to rounded to acute (or oblique) at base, rounded to acute at apex, surfaces pubescent. Flowers solitary or clustered in leaf axils, or more commonly in the axils of bracts in glandular spicate axes. Bracts subulate to narrowly ovate, 1.5 - 4.9 mm long, 0.5 - 1.6 mm wide. Bractlets subulate, 1.2 - 3 mm long, 0.3 - 0.7 mm wide (bractlets subtending flowers in the leaf axils often larger). Calyx 2.5 - 4 (- 5.8) mm long, the lobes subulate. Corolla white with a yellow eye streaked with maroon on the upper lip, 7 - 9 mm long, upper lip 4 - 5.5 mm long, lower lip 4.5 - 6 mm long. Stamens 4 - 5.5 mm long, anthers maroon turning black, thecae 0.6 - 0.8 mm long. Capsules 8 - 12 mm long, glabrous. Seeds 4 per capsule, 4 - 4.8 mm long, testa papillose, margin crenulate to dentate. (February - November)

The range of *C. torreyana* extends from trans-Pecos Texas



*A yellow-flowered form of Chuparosa (Justicia californica) at Rancho Santa Ana Botanic Garden, Claremont, California.*



*Dyschoriste decumbens* growing in the Canelo Hills, Santa Cruz County, Arizona. Photo by M. Butterwick.



eastward to southern Texas and southward into adjacent regions of north-central Mexico. In our region, it occurs on slopes and along arroyos in Chihuahuan Desert scrub at about 1000 to 1200 meters elevation (Fig. 1c).

Representative specimen examined: Texas: Presidio Co.: Cibolo of the Rio Grande, Parry *et al.* 4276 (NY, US).

### Dicliptera Jussieu

Herbs or shrubs; calyx 5-lobed; corolla with an ampliate tube and a bilabiate limb comprising an entire or emarginate upper lip and an entire or shallowly trilobate lower lip; stamens 2, anthers bithecos, the thecae unequally inserted, with or without basal appendages; placentae separating from mature capsule walls; seeds 4 or fewer per capsule.

Several hundred species have been described from temperate and tropical regions of both Old and New Worlds.

#### 1. *Dicliptera resupinata* (Vahl) Juss. Ann. Mus. Paris 9: 268. 1807.

*Justicia resupinata* Vahl, Enum. Pl. 1: 114. 1804.

*D. pseudoverticillaris* Gray, Proc. Amer. Acad. Arts 20: 308. 1885.

*D. torreyi* Gray, Proc. Amer. Acad. Arts 20: 309. 1885.

*Diapedium torreyi* (Gray) Heller, Cat. N. Amer. Pl. 7. 1898.

*Diapedium torreyi* (Gray) Woot. & Standl. Contr. U.S. Natl. Herb. 19: 598. 1915.

Suffrutescent herb to 6 dm tall. Stems hexagonal-ridged, essentially glabrous to sparsely pubescent at nodes. Leaves petiolate, the petioles to 20 mm long, the blades lanceolate to ovate, 20 - 50 (- 80) mm long, 4 - 25 (- 35) mm wide, acute to subattenuate at base, acute to acuminate at apex, surfaces glabrous to sparsely pubescent. Flowers clustered in cymules in axillary, subsessile or pedunculate cymes. Bracts subtending the cymes subulate to oblanceolate, 2 - 6 mm long. Cymules subtended by cordate to deltate to reniform (sometimes basally fused) bracts, 7 - 15 mm long, 6 - 13 mm wide. Bractlets scarios, lance-subulate to oblanceolate, 1.5 - 3 (- 7) mm long. Calyx scarios, 2.5 - 3 mm long, the lobes lance-subulate. Corolla rose-purple with white area spotted with rose-purple on upper lip, (8 -) 13 - 19 mm long, the upper lip (3.5 -) 7 - 10 mm long, emarginate, the lower lip (5 -) 8 - 10 mm long, entire. Stamens (3.5 -) 8 - 10 mm long, the thecae pinkish, inserted one above the other at filament apex. Capsules obovoid, 4 mm long, glabrous. Seeds 4 per capsule, reniform, 1.5 - 2 mm long, testa spinose-papillate. (April - October).

It was into the synonymy of this species that Torrey (1859) and Gray (1878, 1880) included *D. thlaspioides* Nees, a species described from southern Mexico. In the supplement to his Synoptical Flora of North America, Gray (1886) later rejected this inclusion. Examination of a photograph of the type of *D. thlaspioides* reveals that it is identical with *D. pringlei* Greenman, a species also described from Morelos. It differs from *D. resupinata* by its circular to widely elliptic cymule bracts and longer (3.5 - 6 mm) calyx. This treatment is similar to that of Leonard in Shreve and Wiggins (1964) in which *D. pseudoverticillaris* was included in *D. resupinata*. Specimens identified as the former taxon from Arizona usually have sessile to subsessile cymes, truncate to acute, basally fused cymule bracts, and smaller flowers than specimens recognized as the latter taxon. Specimens of *D. resupinata* from other parts

of Mexico are extremely variable with respect to most of these characters and in the absence of a thorough systematic study of this genus, they are here considered as part of one variable and widely distributed species.

The species is distributed from the southwestern United States southward through western and west-central Mexico to Guerrero. The species was reported from New Mexico by Wootton and Standley (1915) and Martin and Hutchins (1981); both treatments cited *Mearns 2037* from Guadalupe Canyon. I have been unable to locate the Mearns collection although the species occurs in the Arizona portion of Guadalupe Canyon and likely occurs in the New Mexico portion as well. Charles Wright collected the species in Guadalupe Canyon (*Wright 1465* at GH! and NY!) on 4 October 1851 (fide E. Shaw, in litt.) but it is not known if he was in Arizona or New Mexico at the time. In Arizona, the species occurs in the rocky soils of slopes and washes in desert scrub and grassland habitats at elevations from 1000 to 2000 meters (Figs. 1d, 3a).

Representative specimens examined: Arizona: Cochise Co.: Guadalupe Canyon, *Walker s.n.* (Southwestern Research Sta., Portal); Pima Co.: 3.5 mi. below Molino Basin Campground, Sta. Catalina Mts., *Keil 4308* (ASU); Pinal Co.: Triangle Y Camp near Oracle, *Hesselberg s.n.* (ARIZ); Santa Cruz Co.: Sanford Butte, Circle Z Ranch, *Van Devender and Koppinger s.n.* (ARIZ).

### Dyschoriste Nees

Suffrutescent herbs; calyx 5-lobed; corolla with an ampliate tube and a bilabiate to subactinomorphic, 5-lobed limb; stamens 4, didynamous, anthers bithecos, the thecae equally inserted, appendaged at base; seeds 4 or fewer per capsule.

About 100 species have been described, primarily from the tropics and subtropics of both Old and New Worlds.

#### 1. *Dyschoriste decumbens* (Gray) Kuntze, Rev. Gen. Pl. 2: 486. 1891.

*Calophanes decumbens* Gray, Syn. Fl. N. Amer. 2(1): 325. 1878.

*C. oblongifolius sensu* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 122. 1859. *pro parte*. Not *D. Don* (1833).

Erect to sprawling suffrutescent herb to 3 dm tall. Younger stems subquadrate (and often strongly bisulcate), pubescent with straight to flexuose to retrorse to ascendant-appressed trichomes 0.1 - 0.5 (- 1) mm long, sometimes gray-canescens. Leaves subsessile to short petiolate, the petioles to 5 mm long, the blades narrowly elliptic to oblanceolate to obovate, 10 - 37 mm long, 3 - 13 mm wide, attenuate at base, acute to rounded at apex, surfaces pubescent. Flowers solitary or clustered in leaf axils (to the base of plant). Bractlets usually petiolate, oblanceolate to narrowly elliptic, 10 - 30 mm long, 2 - 6 mm wide, pubescent like leaves. Calyx 10 - 16 mm long (at anthesis), accrescent in fruit (to 20 mm), pubescent like leaves, the lobes subulate-filiform. Corolla blue-purple, 15 - 25 mm long, the tube ampliate above, the lobes subequal, 5 - 7.5 mm long. Stamens in 2 basally fused pairs, the longer stamens 6 - 7 mm long, the shorter stamens 4.5 - 6 mm long, the thecae bluish, 1.1 - 1.5 mm long, with a pointed spur at the base. Capsule 10 - 12 mm long, glabrous. Seeds 4 per capsule, subtriangular, 3 mm long, covered with appressed, silky trichomes (appearing glabrous when dry). (April - October).

The taxonomy of and keys to species of *Dyschoriste* are not

very satisfying. It is evident that Kobuski (1928) recognized too many ill-defined species in his monograph of the genus. All of the specimens examined from our region appear to be part of the same species, *D. decumbens*. The relationships of this species with other related species, especially *D. linearis* (Torr. & Gray) Kuntze, need to be worked out in detail. In *D. linearis* of eastern and central Texas the stems have stiff, flexuose to recurved trichomes 0.2 - 1.3 mm long, mostly concentrated in two vertical lines and the leaves are mostly linear. In *D. decumbens* the stems are evenly cinerous puberulent and the leaves are mostly oblanceolate to obovate. Specimens of *D. decumbens* from Texas and New Mexico tend to be erect in stature and often have longer trichomes (to 1 mm) whereas those from Arizona tend to be sprawling-decumbent in stature and have shorter trichomes. There is overlap, however, in both of these features with respect to plants in both geographic regions. It is not known whether these tendencies are part of the natural variability of the species or represent intergradation (caused by hybridization) with other species of *Dyschoriste*.

The species ranges from the southwestern United States southward through central Mexico. In our region, it occurs on rocky slopes in grassland communities and chaparral with oaks, junipers, and pines at elevations from 1000 to 2350 meters (Figs. 1e, 3b).

Representative specimens examined: Arizona: Cochise Co.: Huachuca Mts., near Parker Canyon Lake, *McGill et al.* 213 (ASU); Pima Co.: Ophir Gulch, 4 mi. N and 2 mi. W of Sonoita, *Tramontano T36* (ARIZ); Santa Cruz Co.: Papago Springs Cave, 6 mi. S of Sonoita, *Van Devender s.n.* (ARIZ, ASU). New Mexico: Chaves Co.: jct. Hwys. 82 and 13, W of Artesia, *Higgins 10265* (NMC); Eddy Co.: 6 mi. S of White's City, *Hitchcock et al.* 4323 (DS, UC, WTU); Lincoln Co.: 5 mi. W of Lincoln, *Hitchcock et al.* 4280 (DS, UC, WTU). Texas: Brewster Co.: Sul Ross Hill, Alpine, *Warnock 21465* (DS); Culberson Co.: US Hwy. 62, N of Pine Springs, 3.4 mi. SW of New Mexico line, *Burgess 2388* (ARIZ); Jeff Davis Co.: Davis Mts., Ft. Davis, *Ferris and Duncan 2657* (DS); Pecos Co.: Valleys, *Tharp 43-853* (CAS); Presidio Co.: ca. 12 mi. S of Marfa, *Correll and Wasshausen 27900* (UC); Reeves Co.: Hwy. 290 1 mi. E jct. Hwy. 80, *Johnston 3289* (SRSC); Terrell Co.: Sanderson, *Crockatt s.n.* (NMC).

### **Elytraria** Michaux

Cauliscent or acaulescent suffrutescent herbs; calyx 4-lobed, the anterior lobe bidentate; corolla with a cylindrical tube and a bilabiate limb comprising a bilobed upper lip and a trilobed lower lip; stamens 2, anthers bitheous, the thecae equally inserted, lacking basal appendages; retinacula papilli-form; seeds minute, up to 14 per capsule.

Approximately 15 species occurring primarily in the tropics and subtropics of both Old and New Worlds.

1. **Elytraria imbricata** (Vahl) Pers. Syn. Pl. 1: 23. 1805.  
*Justicia imbricata* Vahl, Ecol. Amer. 1: 1. 1796.  
*Verbena squamosa* Jacq. Pl. Hort. Schoenbr. 1: 3. 1797.  
*Elytraria tridentata* Vahl, Enum. Pl. 1: 107. 1804.  
*Tubiflora squamosa* (Jacq.) Kuntze, Rev. Gen. Pl. 2: 500. 1891.  
*Elytraria squamosa* (Jacq.) Lindau, Anal. Inst. Fisico-Geogr., Costa Rica 8: 299. 1958.

Herb from woody caudex. Stems (if present) glabrous or very sparsely pubescent. Leaves (often absent at anthesis) alternate

or commonly in whorl-like clusters, subsessile to short-petiolate, the petioles to 3 mm long, the blades lanceolate to oblanceolate, 17 - 80 mm long, 4 - 23 mm wide, attenuate at base, acute to acuminate at apex, surfaces and margin nearly glabrous to sparsely pubescent. Flowers in densely bracteate spikes, these usually clustered and borne on and intergrading into long scaly peduncles. Peduncles often bearing clusters of leaves in acaulescent individuals. Scales lance-subulate, 2.5 - 5 mm long, slightly overlapping one another. Bracts lance-ovate, 4 - 6 mm long, 1.5 - 2 mm wide, 3-toothed at apex, the lateral teeth hyaline, wing-like, the margin hyaline. Bractlets subsessile, lance-subulate, 3.5 - 4.5 mm long, margin hyaline. Calyx scarious, 3.5 - 5 mm long, segments 4, dissimilar, the anterior bidentate. Corolla blue with a white eye spotted with orange on the lower lip, 7 - 11 mm long, upper lip 1.5 - 2 mm long, lower lip 4 - 5 mm long with the lobes divided at apex. Stamens 1.5 mm long, the thecae 0.7 mm long. Capsule subconic, 3 - 4 mm long, glabrous. Seeds subconic, 0.5 - 0.7 mm long, covered with minute projections. (April - October).

A common and widely distributed species ranging from the southwestern United States southward throughout western Mexico and Central America to South America and the West Indies and introduced into the Old World tropics. In our region it occurs on rocky hillsides and in washes in grasslands and oak woodlands at elevations from 1150 to 1650 meters (Figs. 1f, 3c, d).

Representative specimens examined: Arizona: Cochise Co.: ca. 2.5 mi. E of Bisbee, *McGill and Keil 8540* (ASU); Pima Co.: Rincon Mts., near Vail, *Thorner 7136* (ARIZ); Santa Cruz Co.: 0.3 mi. past Harshaw jct., SE of Patagonia, *Pinkava et al.* 14688 (ASU). New Mexico: Hidalgo Co.: Maverick Spring Canyon, Peloncillo Mts., *Wahl 83* (UNM). Texas: Presidio Co.: Cienega Ranch near Capote Falls, *Hinckley 1700* (ARIZ).

### **Henrya** Nees

Herbs, subshrubs, or shrubs; bractlets fused along one side; calyx 5-lobed, one lobe conspicuously reduced in size; corolla with a slender tube and a bilabiate limb comprising an entire or emarginate upper lip and a 3-lobed lower lip; stamens 2, anthers bitheous, the thecae equally to subequally inserted, lacking basal appendages; seeds 2 per capsule.

Fewer than 20 species occurring mostly in Mexico and Central America.

1. **Henrya insularis** Nees in Benth. Bot. Voy. Sulphur 148. 1844.

*H. brevifolia* Happ, Ann. Missouri Bot. Gard. 24: 547. 1937.

Suffrutescent perennial herb to 3 dm tall. Stems viscid, more or less densely pubescent with glandular trichomes 0.1 - 0.8 mm long. Leaves subsessile to petiolate, the blades ovate to elliptic, 10 - 65 mm long, 8 - 44 mm wide, rounded to acute at base, acute to rounded at apex, surfaces glandular pubescent, becoming glabrate. Inflorescence of lax spicate axes to 20 cm long. Bracts (linear) oblanceolate, 3 - 4.5 mm long, 0.8 - 2 mm wide, glandular. Bractlets oblanceolate, 7 - 10 mm long, glandular. Calyx 1 - 2 mm long. Corolla whitish with yellow and reddish markings on upper lip, 10 - 13 mm long, upper lip 5 - 7 mm long, lower lip 6.5 - 9 mm long. Stamens 7 mm long, the thecae 1.5 - 2 mm long. Capsule 5 - 7 mm long, glabrous or sparsely pubescent at apex. Seeds 2 mm in diameter, smooth to



*Carlowrightia linearifolia*.



*Carlowrightia arizonica*. Photo by F. Young.



*Ruellia nudiflora*.



*Stenandrium barbatum*. Photo by T. Van Devender.

papillose on one side, densely pubescent with appressed trichomes on the other. (June).

A weedy species ranging from the southwestern United States southward throughout most of Mexico to Panama. It is known only from one locality in the United States, a canyon bottom in Arizona at an elevation of 1150 meters (Figs. 1g, 2c,d). The above description has been augmented by information from specimens from nearby Sonora.

Representative specimen examined: Arizona: Santa Cruz Co.: Parajito Mts., Sycamore Canyon, *Toolin s.n.* (ARIZ).

### **Justicia L.**

Herbs or shrubs; calyx 4 or 5-lobed; corolla with an ampliate tube and a bilabiate limb comprising an entire, emarginate or bilobed upper lip and a trilobate lower lip; stamens 2, anthers bithecous, the thecae subequally or unequally inserted, one or both appendaged at base; seeds 4 or fewer per capsule.

More than 300 species distributed in temperate and tropical regions of both Old and New Worlds.

1. Leaves sessile, linear to oblanceolate, 0.4 - 4 mm wide; corolla 7 - 12 mm long; capsule 6.5 - 8 mm long.
2. Young stems more or less evenly strigillose, the trichomes recurved-appressed; leaves pubescent; bractlets 0.5 - 2 mm wide; lower theca 1 - 1.3 mm long . . . . . 1. *J. wrightii*
2. Young stems strigillose in 2 vertical lines, the trichomes recurved; leaves glabrous; bractlets 0.2 - 0.4 mm wide; lower theca 0.7 - 0.8 mm long . . . . . 2. *J. warnockii*
1. Leaves petiolate, the blades lance-ovate to ovate to suborbiculate, 3 - 40 mm wide; corolla 21 - 40 mm long; capsule 10 - 22 mm long.
3. Calyx 4-lobed; suffrutescent herb to 4.5 dm tall; corolla pinkish purple, glandular on outer surface; capsule glandular . . . . . 3. *J. sonorae*
3. Calyx 5-lobed; shrubs to 2 m tall; corolla red (rarely yellow in *J. californica*), not glandular on outer surface; capsule not glandular.
4. Stems pallid, pubescent with trichomes 0.05 - 0.10 mm long; bractlets 1.5 - 4.5 mm long; corolla entirely red (or yellow), lobes of lower lip 1 - 4 mm long; capsule 16 - 22 mm long, pubescent. . . . . 4. *J. californica*
4. Stems not pallid, pubescent with trichomes 0.2 - 1 mm long; bractlets 5 - 12 mm long; corolla red with white markings on lower lip, lobes of lower lip 5 - 10 mm long; capsule 10 - 14 mm long, glabrous . . . . . 5. *J. candicans*

#### **1. Justicia wrightii** Gray, Syn. Fl. N. Amer. 2: 329. 1878.

Erect, basally branched, suffrutescent perennial, 8 - 15 cm tall, arising from a woody caudex. Younger stems terete-striate, the ridges frequently brownish, the grooves green, more or less evenly strigillose, the trichomes recurved-appressed, 0.1 - 0.2 mm long. Leaves sessile, linear to oblanceolate, (5 -) 10 - 15 mm long, 1.5 - 4 mm wide, acute to rounded at apex, pubescent like young stems or the trichomes mostly restricted to margin. Flowers solitary, sessile in leaf axils. Bractlets linear-subulate to oblanceolate, 2.5 - 11 mm long, 0.5 - 2 mm wide, pubescent like leaves. Calyx 4-lobed, 2.5 - 4.5 mm long. Corolla purplish, 8.5 - 12 mm long, pubescent on outer surface, upper lip 4.5 - 6.5 mm long, lower lip 4 - 6 mm long with lobes 3 - 4 mm long. Stamens 3 - 5 mm long, the thecae subparallel, unequal

inserted, unequal in size, the lowermost longer and with a basal spur. Capsule 7 - 8 mm long, glabrous or sparsely pubescent at apex. Seeds subcircular, 2.5 - 3.5 mm in diameter, puberulent with apically barbed trichomes. (April - July).

Presently known only from western Texas and southeastern New Mexico, this species undoubtedly occurs in adjacent regions of Mexico. It occurs on limestone flats at elevations from 1050 to 1450 meters (Fig. 1h).

Representative specimens examined: New Mexico: Eddy Co.: Carlsbad, *McKechnie 29* (MO, UNM); Texas: Pecos Co.: 22 mi. S of Ft. Stockton, *Warnock and McVaugh 8707* (LL, SRSC).

#### **2. Justicia warnockii** Turner, Field & Lab. 19: 100. 1951.

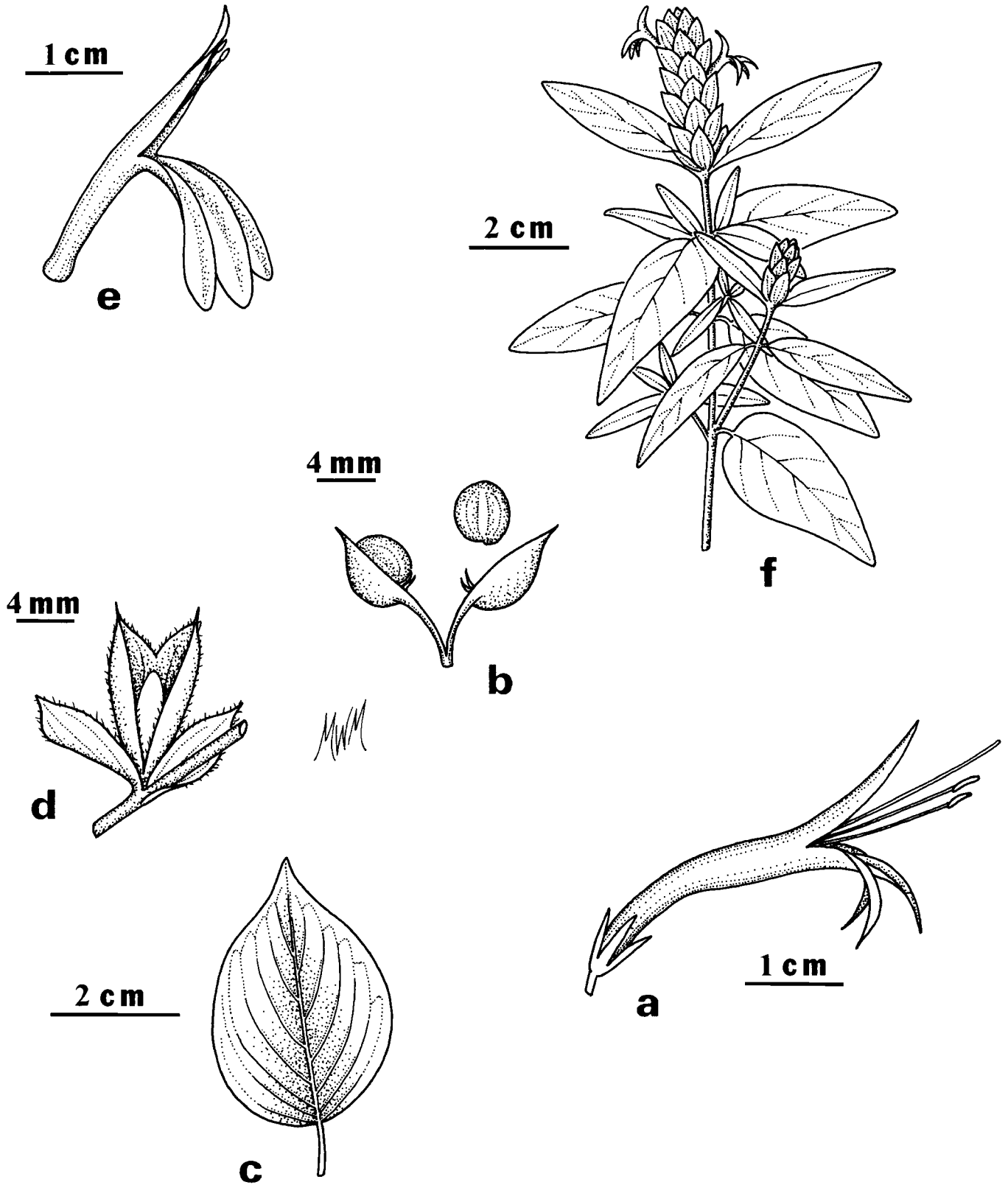
Erect, basally branched, broom-like to globose suffrutescent perennial to 40 cm tall, arising from a woody caudex. Younger stems terete-striate, strigillose (rarely only slightly so) in 2 vertical lines, the trichomes recurved, 0.05 - 0.20 mm long. Leaves sessile, strongly ascendant, linear to narrowly oblanceolate, 2.5 - 25 mm long, 0.4 - 1.3 (- 2) mm wide, acute at apex, glabrous. Flowers solitary, sessile in leaf axils or sessile in the axils of reduced leaves or bracts along the upper portion of the stem, forming a spicate axis to 8 cm long. Bractlets linear-subulate to filiform, 1.5 - 4.5 mm long, 0.2 - 0.4 mm wide, glabrous. Calyx 4-lobed, (2 -) 3 - 4 mm long. Corolla whitish or lavender with purplish markings in throat, 7 - 12 mm long, pubescent on outer surface, upper lip 4 - 5.5 mm long, lower lip 6 mm long with lobes 2 - 4 mm long. Stamens 3.5 mm long, the thecae subparallel, unequal inserted, unequal in size, the lower longer and with a basal spur. Capsule 6.5 - 8 mm long, glabrous. Seeds round to oval, 2 - 2.5 mm long, granulate, the margin fringed with glandular trichomes to 0.1 mm long. (December - July).

Restricted to the Chihuahuan Desert region of western Texas and adjacent Mexico (Coahuila and Chihuahua) where it occurs on limestone slopes in desert scrub at elevations from 600 to 1650 meters (Fig. 1h).

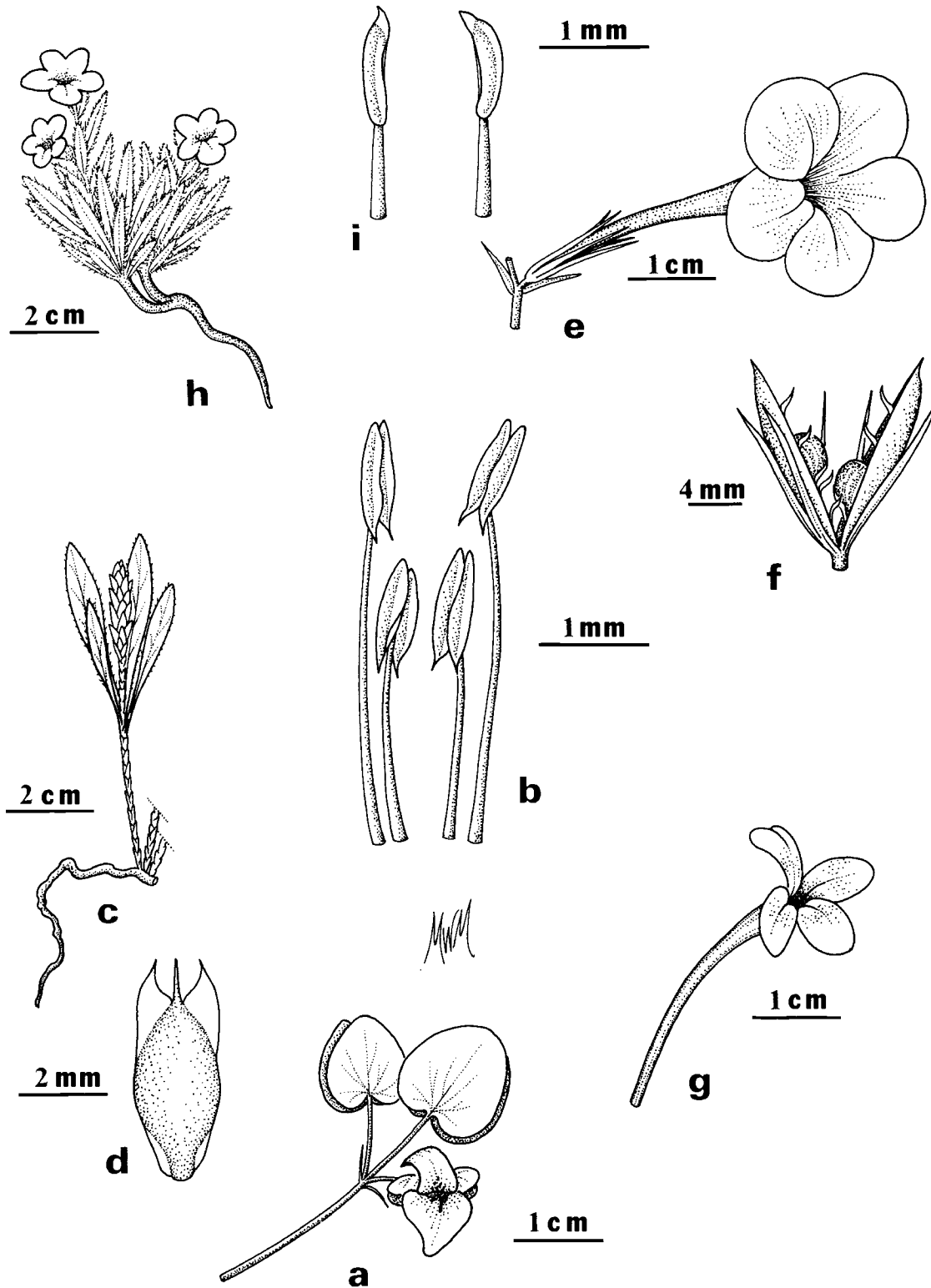
Representative specimens examined: Texas: Brewster Co.: Old Blue, Glass Mts., *Warnock W325* (DS, F, GH, NCU, NY, PH, SRSC, TEX, UC); Hudspeth Co.: Quitman Mts., S of Sierra Blanca, *Warnock et al. 18061* (SRSC); Pecos Co.: ca. 25 mi. S of Ft. Stockton, *McVaugh 10654* (DS, DUKE, ENCB, LL, MICH, MO, NY, PH, SRSC, UC); Presidio Co.: 0.25 mi. N of Solitario Peak, *Johnston 3430* (US); Terrell Co.: along Rio Grande between Reagan Canyon and Sanderson Canyon, *Warnock 15855* (SRSC).

#### **3. Justicia sonorae** Wasshausen, Phytologia 49: 65. 1981.

Suffrutescent herb to 4.5 dm tall. Stems terete to subquadrate, glabrous or pubescent with eglandular, flexuose trichomes 0.2 - 1 mm long below and with scattered glands 0.1 - 0.3 mm long above. Leaves short petiolate, the petioles to 5 mm long, the blades lance-ovate to ovate, 10 - 55 mm long, 3 - 22 mm wide, acute to acuminate at apex, truncate to rounded to acute at base, surfaces pubescent. Inflorescence of axillary or terminal, spicate axes to 15 cm long, these sometimes basally branched, the axes densely glandular. Bracts triangular-subulate to lance-subulate, 2 - 4 mm long, 1 - 1.5 mm wide, glandular. Bractlets lance-subulate, 2 - 3 mm long, 0.6 - 0.8 mm wide. Calyx 4-lobed, 3.5 - 5.5 mm long. Corolla pinkish purple, 23 - 35 mm long, sparsely glandular on outer surface, upper lip 6.5 - 11 mm long, lower lip 8 - 17 mm long with lobes 5 - 6 mm long. Stamens 8 - 9 mm long, the thecae parallel to subparallel, subequally inserted, 1.2 - 2.2 mm long, lacking prominent basal



**Figure 2.** Diagnostic features of genera of southwestern Acanthaceae: a, flower of *Anisacanthus thurberi*; b, capsule and seeds of *Carlowrightia serpyllifolia*; c, leaf of *Henrya insularis*; d, inflorescence node of *H. insularis* showing bracts, fused bractlets and flower bud; e, corolla of *Justicia candidans*; f, habit of *Tetramerium nervosum* showing dense, four-sided spikes.



**Figure 3.** Diagnostic features of genera of southwestern Acanthaceae: a, cyme of *Dicliptera resupinata* with three cymules; b, upper portion of androecium of *Dyschoriste decumbens*; c, habit of *Elytraria imbricata* showing scaley peduncles and densely bracted spike; d, bract of *E. imbricata*; e, flower of *Ruellia nudiflora*; f, capsule and seeds of *R. nudiflora*; g, corolla of *Siphonoglossa longiflora*; h, habit of *Stenandrium barbatum*; i, two stamens of *S. barbatum* showing monothealous anthers.

spurs. Capsule 10-12 mm long, densely glandular. Seeds 2-2.5 mm in diameter, densely tuberculate. (May).

Restricted in distribution to the southwestern United States and adjacent Mexico (Sonora). Known in our region from a single locality in southern Arizona where the plant was collected in a deep arroyo at 1230 meters elevation (Fig. 1h). The above description has been augmented by information from specimens from nearby Sonora.

Representative specimen examined: Arizona: Cochise Co.: Kiper Springs, ca. Lat. 32°03'N. Long. 110°24'W, Turner 79-77 (ARIZ).

**4. *Justicia californica*** (Benth.) D. Gibson, *Fieldiana: Botany* 34: 67. 1972.

*Beloperone californica* Benth. *Bot. Voy. Sulph.* 38. 1844.

*Jacobinia californica* Nees in DC. *Prodr.* 11: 729. 1847.

*Sericographis californica* (Benth.) Gray in Torr. in Emory, *Rep. U.S. & Mex. Bound. Surv.* 2(1): 125. 1859.

Erect shrub to 2 m tall. Younger stems terete, very finely and evenly pubescent giving the stems a pallid aspect, the trichomes 0.05 (-0.1) mm long. Leaves (plants often leafless at anthesis) petiolate, the petioles to 20 mm long, the blades ovate to deltate to suborbicular, 8-65 mm long, 5-40 mm wide, truncate to truncate-cuneate at base, acute at apex, surfaces pubescent. Flowers in racemose axes at branch apices, these often sparsely or densely glandular. Bracts caducous, lance-elliptic, 4-6 mm long, 1.5-2 mm wide, pubescent like inflorescence axis. Bractlets subulate, 1.5-4.5 mm long, 0.5-0.8 mm wide. Calyx 5-lobed, 4.5-8 mm long. Corolla entirely red (rarely yellow), 21-40 mm long, pubescent on the outer surface (occasionally with glands as well as eglandular trichomes), upper lip 9-20 mm long, lower lip 9-20 mm long with lobes 1-4 mm long. Stamens 15-19 mm long, the thecae unequally inserted, 2-2.8 mm long, the lowermost with a short basal spur. Capsule 16-22 mm long, pubescent. Seeds subglobose, 2.5-3.5 mm in diameter, glabrous. (October-June).

A species restricted in distribution to the Sonoran Desert region of the southwestern United States and northwestern Mexico where it occurs on sandy or rocky soil, particularly along washes, in desert scrub at elevations from 100 to 1200 meters (Fig. 1h).

Representative specimens examined: California: Imperial Co.: Jacumba Mts., 3 mi. SW of Ocotillo, *Holmgren and Holmgren* 7552 (ASU); Riverside Co.: ca. 22 mi. E of Indio, *Haller* 1552 (ASU); San Diego Co.: Hwy. S-22 at W edge of Borrego Springs, *Parfitt et al.* 2758 (ASU). Arizona: Maricopa Co.: Scottsdale Rd., 2.5 mi. N of Bell Rd., *Lehto* 134 (ASU); Mohave Co.: 3 mi. S of Hope, *Norris* 25 (ASU); Pima Co.: Organ Pipe Natl. Mon., East Loop, *Pinkava et al.* 9959 (ASU); Pinal Co.: Sierra Estrella, Lower Reservoir, *Smith* S090 (ASU); Yuma Co.: Tinajas Altas in Tinajas Altas Mts., *Reeves et al.* 5388 (ASU).

**5. *Justicia candicans*** (Nees) L. Benson, *Tr. & Sh. Southw. Des.* 218. 1981.

*Adhatoda candicans* Nees in DC. *Prodr.* 11: 396. 1847.

*Jacobinia ovata* Gray, *Proc. Amer. Acad. Arts* 21: 405. 1886. (Not *Justicia ovata* (Walt.) Lindau 1900).

*Jacobinia candicans* (Nees) Benth. & Hook. ex Hook. & Jacks. *Ind. Kew.* 1: 1246. 1893.

Erect shrub to 1.5 m tall. Younger stems subquadrate, evenly pubescent with flexuose to flexuose-ascending trichomes 0.2-1

mm long, the new growth very densely pubescent. Leaves petiolate, the petioles to 8 mm long, the blades ovate, 13-39 (-70) mm long, 7-30 (-36) mm wide, truncate to rounded to acute at base, acute to acuminate at apex, surfaces pubescent. Flowers solitary or clustered in axils of reduced upper leaves (these sometimes reduced to lanceolate or ovate bracts). Bractlets linear-subulate to oblanceolate, 5-12 mm long, 0.7-3 mm wide. Calyx 5-lobed, 5-8 mm long. Corolla red with white markings on the lower lip, 25-37 mm long, pubescent on outer surface, upper lip 9-16 mm long, lower lip 9-17 mm long with lobes 5-10 mm long. Stamens 15-16 mm long, the thecae parallel, subequally to unequally inserted, 1.5-2.2 mm long, the lower apiculate (sometimes obscurely so). Capsule 10-14 mm long, glabrous. Seeds subcircular, flattened, 3-4 mm in diameter, tuberculate, glabrous. (December-May).

A widely distributed species ranging from the southwestern United States southward through western Mexico to Oaxaca. In our region it occurs along washes and on canyon slopes in Sonoran Desert scrub at elevations from 500 to 1250 meters (Figs. 1h, 2e).

Representative specimens examined: Arizona: Maricopa Co.: 1.1 mi. SW of Port of Phoenix near Canyon Lake, *Marshall* 82 (ASU); Pima Co.: main canyon N of Alamo Canyon, Ajo Mts., *Gould and Darrow* 4683 (ARIZ).

***Ruellia* L.**

Herbs, shrubs, or trees; calyx 5-lobed; corolla usually with a distinct tube and throat and a subactinomorphic limb of 5 lobes; stamens 4, didynamous, anthers bithecal, the thecae equally inserted, lacking basal appendages; seeds 4 to 20 per capsule.

Approximately 250 species distributed primarily in the subtropics and tropics of both Old and New Worlds.

1. Herb from woody caudex; leaves 20-170 mm long, 10-90 mm wide, attenuate at base; calyx (9-) 11-25 mm long, the anterior lobes not joined for half or more of their length; corolla lobes 10-12 mm long; capsule 12-22 mm long, glandular; seeds 3-4 mm long. . . . . 1. *R. nudiflora*
1. Subshrub; leaves 9-35 mm long, 3-15 mm wide, acute at base; calyx 6-11 mm long, the anterior lobes joined for half or more of their length; corolla lobes 5-10 mm long; capsule 10-13 mm long, not glandular; seeds 2.5-3 mm long . . . . . 2. *R. parryi*

**1. *Ruellia nudiflora*** (Engelm. & Gray) Urban, *Symb. Antill.* 7: 382. 1912.

*Dipteracanthus nudiflorus* Engelm. & Gray, *Bost. J. Nat. Hist.* 5: 229. 1845.

*R. tuberosa* L. var. *occidentalis* Gray, *Syn. Fl. N. Amer.* 2(1): 325. 1878.

*R. nudiflora* var. *glabrata* Leonard, *J. Wash. Acad. Sci.* 17: 518, 1927.

*R. glabrata* (Leonard) Tharp & Barkley, *Amer. Midl. Nat.* 42: 13. 1949.

Herb from woody caudex to 3 dm tall. Stems bisulcate-quadrate, sparsely pubescent with flexuose trichomes to 2.5 mm long, especially at the nodes, sometimes with a dense understorey of straight trichomes and glands 0.2-0.5 mm long. Leaves petiolate, the petioles to 50 mm long, the blades ovate to broadly ovate, (2-) 3-17 cm long, 1-9 cm wide, long attenuate to truncate-attenuate at base, rounded to subacute at apex, margin

undulate-cripsed, surfaces pubescent. Inflorescence a terminal, thryoid panicle with glandular axes. Bracts subtending inflorescence branches lance-subulate, 3.5 - 9 mm long. Bractlets lance-subulate to subulate, 2 - 6 mm long. Calyx (9-) 11 - 25 mm long, glandular, the lobes subequal, linear, the anterior lobes not joined for half or more of their length (as in *R. parryi*). Corolla blue, (25 -) 30 - 50 mm long, the lobes 10 - 12 mm long. Longer stamens 11 - 12 mm long, shorter stamens 7 - 8 mm long, the thecae 3 - 3.5 mm long. Capsule ellipsoid, 12 - 22 mm long, glandular. Seeds usually 10 or more per capsule, flat, cordate, 3 - 4 mm long, covered with a smooth melding of trichomes which usually form a hyaline margin, the trichomes becoming distinct on wetting. (April - September).

Gray (1878, 1880) considered these plants to belong to *R. tuberosa* L. and described them as variety *occidentalis* of that species in 1878, noting that the Arizona specimens were glabrate forms. Leonard (1927) accepted *R. nudiflora* as a morphologically variable species closely related to *R. tuberosa*. In order to emphasize its diversity, he recognized nine varieties in *R. nudiflora*. Plants in our region were treated as *R. nudiflora* var. *glabrata*, distinguished by its mostly large and glabrate leaves and glandular-pilosulous inflorescences, and *R. nudiflora* var. *nudiflora*, with smaller leaves and glandular-puberulent inflorescences. In their colorful treatment of *Ruellia* in Texas, Sharp and Barkley (1949) raised most of Leonard's varieties to specific rank. It is not clear at the present time whether the minor differences among the taxa recognized in this assemblage are properly reflective of species, infraspecific taxa, or variation within a widespread species. Until a thorough revision of this complex has been completed, a conservative approach will likely suffice for treating these plants. When the relationships of the paniculate species of *Ruellia* of North and Central America have been studied in detail, I believe that the plants from the southwestern United States will ultimately be considered a part of *R. tuberosa* (or *R. paniculata* L.) where Asa Gray placed them over a hundred years ago.

As here treated, *R. nudiflora* is a widely distributed and morphologically variable species ranging from Arizona to Louisiana (although not reported from New Mexico), southward throughout much of Mexico and Central America to Costa Rica. In our region it occurs in sandy washes and roadside ditches in desert scrub and desert grassland at elevations from 450 to 1350 meters (Figs. 1i, 3e, f).

Representative specimens examined: Arizona: Cochise Co.: San Bernadino Ranch, *Mearns* 737 (DS); Pima Co.: 6 mi. S of Tucson, *Gould* 2645 (CAS); Santa Cruz Co.: between Sopori School and Arivaca, *Tate* 270 (ASU). Texas: Brewster Co.: NE side of Bullis Range, vic. of Tank 11 on Bullis Gap Ranch, *Butterwick and Lott* 3655 (TEX); Pecos Co.: 15.5 mi. W of Bakersfield at Tunis Spring, *Correll and Wasshausen* 27961 (LL); Terrell Co.: Mile Long Canyon at Langtry, *Skiles* 4 (SRSC).

## 2. *Ruellia parryi* Gray, Syn. Fl. N. Amer. 2(1): 326. 1878.

*Dipteracanthus suffruticosus* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 122. 1859. Not *R. suffruticosus* Roxb. 1814.

Erect subshrub to 5 dm tall. Younger stems bisulcate-quadrate, glabrous or evenly pubescent with retrorse trichomes 0.1 - 0.2 mm long. Leaves petiolate, the petioles to 7 mm long, the blades (ovate) lance-elliptic to elliptic to oblanceolate to

obovate, 9 - 25 (- 35) mm long, 3 - 15 mm wide, acute at base, acute to rounded at apex, margin entire to undulate, usually conspicuously ciliate, surfaces glabrous or pubescent with flexuose (often dendritic or malpighiaceus) trichomes to 1 mm long. Flowers axillary, subtended by 2 bractlets. Bractlets leaf-like, lanceolate to elliptic to obovate, 7 - 16 mm long. Calyx 6 - 11 mm long, the lobes unequal in size, the anterior segment 2 lobed at apex, the lateral lobes often reduced in length, the posterior lobe entire. Corolla blue, 27 - 42 mm long, the lobes 5 - 10 mm long. Longer stamens 7 - 9 mm long, shorter stamens 5 - 6 mm long, the thecae 2 mm long. Capsule 10 - 13 mm long, glabrous or pubescent with eglandular trichomes. Seeds 6 (or more) per capsule, flat, 2.5 - 3 mm long, pubescent with appressed trichomes. (March - October).

Distributed in the Chihuahuan Desert region of the southwestern United States and adjacent Mexico where it occurs on limestone ledges and in arroyo beds in desert scrub and juniper chaparral communities at elevations from 500 to 1800 meters (Fig. 1i).

Representative specimens examined: New Mexico: Dona Ana Co.: Rattlesnake Ridge, Organ Mts., *Worthington* 6049 (ARIZ, NMC, UTEP); Eddy Co.: ½ mi. SSE of Elevator Tower, *Dole* 84 (UC). Texas: Brewster Co.: near abandoned Wax Factory on Rio Grande at mouth of Big Canyon, *McVaugh* 7797 (DS, TEX); Culberson Co.: 18 mi. N of Van Horn, Sierra Diablo Mts., *Van Devender s.n.* (ARIZ); Hudspeth Co.: 4 mi. NE of Indian Hot Springs, Quitman Mts., *Waterfall* 4850 (CAS); Pecos Co.: 25 mi. S of Ft. Stockton, Madera Mts., *Correll et al.* 29697 (LL, UC); Presidio Co.: Livingston Hills, 4 mi. S of Shafter, *Van Devender et al. s.n.* (ARIZ); Terrell Co.: 1 mi. E of Sanderson, *Warnock* 11891 (LL).

## *Siphonoglossa* Oersted

Suffrutescent herbs: calyx 4 or 5-lobed; corolla with an elongate, cylindrical tube and a bilabiate limb comprising an entire or emarginate upper lip and a 3-lobed lower lip; stamens 2, anthers bitheous, the thecae unequally inserted, one or both minutely appendaged at base; seeds 4 or fewer per capsule.

About 25 species distributed in the New World and southern Africa.

1. Cauline trichomes 0.1 - 0.2 mm long; corolla white, 33 - 55 mm long. . . . . 1. *S. longiflora*
1. Cauline trichomes 0.2 - 1.5 mm long; corolla pink, 17 - 32 mm long . . . . . 2. *S. pilosella*

### 1. *Siphonoglossa longiflora* (Torr.) Gray, Syn. Fl. N. Amer. 2(1): 328. 1878.

*Adhatoda longiflora* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 125. 1859.

Erect subshrub to 3.5 (- 5) dm tall. Younger stems subquadrate, striate, evenly pubescent with retrorse-appressed trichomes 0.1 - 0.2 mm long. Leaves sessile to petiolate, the petioles to 7 mm long, the blades linear-lanceolate to lanceolate to elliptic to ovate, 5 - 70 mm long, 2 - 8 (- 14) mm wide, acute to subattenuate at base, acute to acuminate to falcate at apex, pubescent like stems. Flowers solitary or clustered in axils of upper leaves. Bractlets linear to lance-elliptic, 4 - 9 (- 20) mm long, 0.5 - 1.5 (- 3) mm wide. Calyx 5-lobed, 4.5 - 6 (- 12) mm



long, the lobes linear to lance-elliptic. Corolla white, 33 - 55 mm long, tube 28 - 43 mm long, 1 - 1.5 mm in diameter, upper lip 5 - 7 mm long, lower lip 6 - 10 mm long with lobes 4 - 8 mm long. Stamens 4 - 7 mm long, the thecae 1 - 1.5 mm long, basally spurred. Capsule 8 - 10 mm long, glabrous. Seeds subcircular, 2 - 2.5 mm in diameter, tuberculate. (March - December).

Occurring in the southwestern United States and northwestern Mexico where it grows in rocky washes and arroyos in desert scrub at elevations from 1000 to 1350 meters (Figs. 1j, 3g). The species has been reported from the Chihuahuan Desert of trans-Pecos Texas (Lott and Butterwick, 1980) however the specimen (*Butterwick and Lott 3872*) has been misplaced at TEX.

Representative specimens examined: Arizona: Graham Co.: Dry Canyon of Gila River, ca. 2 - 3 mi. downstream from Bonita Creek, *McGill 2312* (ASU); Maricopa Co.: ca. 3 mi. NE of Apache Trail in Superstition Mts., *Daniel and Butterwick 3191* (ASU); Pima Co.: 6 mi. W jct. Speedway and Silverbell in Tucson Mts., *Daniel 159* (ASU); Pinal Co.: 0.5 mi. S of Superior on Hwy. 177, *Wood s.n.* (ASU); Santa Cruz Co.: Agua Caliente Canyon, Santa Rita Mts., *Kaiser 1061* (ARIZ); Yavapai Co.: Lion Peak, Weaver Mts., *Butterwick and Hillyard 6894* (ASU).

**2. *Siphonoglossa pilosella*** (Nees) Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1): 124. 1859.

*Monechma pilosella* Nees in DC. Prodr. 11: 412. 1847.

*Adhatoda dipteracantha* Nees in DC. Prodr. 11: 396. 1847.

*S. dipteracantha* (Nees) Heller, Contr. Herb. Franklin & Marshall Coll. 1: 95. 1895.

Erect to spreading herbs to 2 dm tall from a woody rhizome. Stems bisulcate-quadrate, pubescent with evenly disposed (or mostly restricted to 2 lines) flexuose or retrorse trichomes 0.2 - 1.5 mm long. Leaves sessile or subsessile, the petioles to 5 mm long, the blades ovate to elliptic to obovate, 8 - 35 mm long, 4 - 20 mm wide, cuneate to acute at base, rounded to acute at apex, upper surface pubescent or nearly glabrous, lower surface usually pubescent. Flowers axillary. Bractlets leaf-like, oblanceolate to elliptic to ovate, 8 - 12 mm long, 1.5 - 6 mm wide. Calyx 5- (rarely 4-) lobed, 5 - 8 mm long, the lobes lance-subulate. Corolla pink with white eye on lower lip, 17 - 32 mm long, upper lip 3 - 10 mm long, lower lip 5 - 12 mm long. Stamens 5 - 7 mm long, the thecae 1.3 - 1.6 mm long, the lowermost with a short spur. Capsule 7 - 9 mm long, glabrous. Seeds cordate, 2.5 - 3.5 mm long, tuberculate. (March - November).

A species occurring from southeastern New Mexico eastward through trans-Pecos Texas to eastern and southern Texas and southward into adjacent regions of Mexico. In our region it grows on rocky ledges and slopes among brush or boulders mostly in grassland communities at elevations from 350 to 2150 meters (Fig. 1j).

Representative specimens examined: New Mexico: Eddy Co.: Walnut Canyon, Guadalupe Mts., *McKechnie s.n.* (UNM). Texas: Brewster Co.: ca. 16 mi. E of Alpine, *Warnock 46571* (US); Culberson Co.: Apache Mts., 4 mi. N of Kent, *Warnock 19740* (SRSC); Jeff Davis Co.: ca. 17 mi. N of Ft. Davis, *Correll and Hanson 29844* (US); Pecos Co.: 4 mi. W of Longfellow, *Turner 555* (SRSC); Presidio Co.: Capote Canyon, ca. 25 mi. W of Marfa, *Hinckley 1501* (ARIZ); Terrell Co.: 4 mi. E of Sanderson, *Hitchcock and Stanford 6824* (DS).

***Stenandrium* Nees**

Caulicent or acaulescent perennial herbs; calyx 5-lobed; corolla with a cylindrical-ampliate tube and usually a subactinomorphic, 5-parted limb; stamens 4, monotheous; seeds 4 or fewer per capsule.

Approximately 20 species distributed in the tropics and subtropics of the New World.

**1. *Stenandrium barbatum*** Torr. & Gray, Pacific Rail. Rep. (Pope's Explor.) 2: 168. 1855.

*Gerardia barbata* [Torr. & Gray] Blake, Contr. Gray Herb. 52: 100. 1917.

Dwarf perennial herb to 10 cm tall from a stout woody rhizome. Leaves clustered at ground level, sessile or short petiole, the petioles to 5 (-25) mm long, the blades oblanceolate to spatulate, 8 - 45 mm long, 2 - 5 (-9) mm wide, acute at apex, tapering-attenuate at base, pubescent with a sparse to dense understory of erect or bent trichomes 0.1 - 0.2 mm long and an overstory (sometimes restricted to the margin) of flexuose trichomes 1 - 4 mm long. Flowers axillary in leafy-bracteate spikes. Bracts oblanceolate to obovate to elliptic, 7 - 21 mm long, 2 - 4 mm wide, pubescent like leaves. Bractlets subulate, 1.5 - 6 mm long, 0.3 - 0.6 mm wide. Calyx 4 - 8 mm long, the lobes subequal, lance-subulate. Corolla pinkish purple with white streaks on lower lip, 13 - 21 mm long, the lobes subequal, 4 - 9 mm long. Stamens 1.5 - 2 mm long, the thecae 1.5 mm long. Capsule 9 - 14 mm long, glabrous (rarely pubescent). Seeds 3 - 5.5 mm long, densely pubescent with long, stiff, golden trichomes with recoiled branches. (March - October).

A species restricted to the Chihuahuan Desert of southern New Mexico, western Texas, and adjacent portions of Chihuahua and Coahuila where it occurs on limestone slopes and arroyo gravel in desert associations up to pinyon-juniper communities at elevations from 750 to 1350 meters (Figs. 1k, 3h, i).

Representative specimens examined: New Mexico: Chaves Co.: ca. 2 mi. W of Roswell, *Hinckley and Smith 4374* (SRSC); Doña Ana Co.: 6 mi. W of El Paso, *Hanson s.n.* (TEX); Eddy Co.: 2 mi. W of Carlsbad, *Crutchfield 1337* (LL); Lea Co.: Monument, *Castetter 70907* (UNM); Lincoln Co.: 10 mi. NW of Riverside, *Goodman and Waterfall 4958* (GH); Otero Co.: San Andres Canyon, Sacramento Mts., *Van Devender and Betancourt s.n.* (ARIZ); Sierra Co.: Elephant Butte Dam, *Nelson 6122* (UNM). Texas: Brewster Co.: along Rio Grande at Hot Springs, *Warnock 13937* (TEX); Culberson Co.: San Antonio Peak, Sierra Tinaja Pinta, *Correll and Rollins 23873* (ENCB, LL); El Paso Co.: ca. 3 mi. W of El Paso in Franklin Mts., *Warnock 8368* (LL, SRSC); Hudspeth Co.: 12 mi. NW Indian Hot Springs, *Turner 374* (LL, SRSC); Jeff Davis Co.: W of Chispa summit, *Johnston et al. 10684* (LL); Pecos Co.: ca. 25 mi. S of Ft. Stockton, Sierra Madera, *McVaugh 7914* (ASU, SRSC, TEX); Presidio Co.: 2 mi. S of Shafter, *Warnock 46642* (SRSC); Reeves Co.: 16 mi. NW of Toyahvale, *Correll and Correll 38527* (ENCB, LL, TEX, UC); Terrell Co.: between Langtry and Sanderson, *McKelvey 1926* (A).

***Tetramerium* Nees**

Subshrubs or shrubs; inflorescence usually conspicuously 4-sided; calyx 4 or 5-lobed; corolla with a slender, apically

ampliate tube and a bilabiate limb comprising an entire to emarginate upper lip and a 3-lobed lower lip; stamens 2, anthers bithecous, the thecae equally or subequally inserted, lacking basal appendages; seeds 4 or fewer per capsule.

Approximately 15 species distributed in North, Central, and South America.

**1. *Tetramerium nervosum*** Nees in Benth. Bot. Voy. Sulph. 148. 1844.

*T. hispidum* Nees in DC. Prodr. 11: 468. 1847.

*T. nervosum* Nees in Benth. var. *hispidum* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2[1]: 125. 1859.

Erect to sprawling subshrub to 3 dm tall. Younger stems terete to subquadrate, usually pubescent with a mixture of flexuose to retrorse trichomes 0.2 - 0.5 mm long, concentrated in 2 lines, and straight to flexuose, more or less evenly disposed trichomes 0.5 - 1 mm long (sometimes absent), rarely with glands to 0.4 mm long as well. Leaves petiolate, the petioles to 10 (- 20) mm long, the blades narrowly lanceolate to ovate, 10 - 45 (- 70) mm long, 2 - 16 (- 32) mm wide, acute to rounded at base, acute at apex, surfaces pubescent. Flowers in densely bracteate, 4-sided apical spikes. Bracts lance-ovate, 7 - 15 mm long, 3.5 - 5 mm wide, falcate-mucronate at apex, the surfaces strongly nerved, the margin conspicuously hirsute with trichomes to 1.5 mm long. Bractlets subulate, 2.5 - 5 mm long. Calyx 4-lobed (in ours), 2.5 - 4.5 mm long, the lobes subulate. Corolla cream with a blue eye streaked with purple veins on upper lip, 12 - 17 mm long, upper lip 6 - 8 mm long, lobes of lower lip 7 - 9 mm long, the lower-central lobe keel-like. Stamens 5 - 5.5 mm long, the thecae 1 - 1.1 mm long. Capsule 4 - 5.5 mm long, pubescent. Seeds suboval, 1.5 - 2 mm long, tuberculate. (April - October).

A weedy and widely distributed species occurring from the southwestern United States southward throughout much of Mexico and Central America to northern South America and the Galapagos Islands. In our region it occurs on rocky slopes, in washes and along arroyos in Sonoran and Chihuahuan Desert scrub, in grassland associations, and in disturbed places at elevations from 350 to 1650 meters (Figs. 11, 2f).

Representative specimens examined: Arizona: Cochise Co.: San Bernadino Ranch, ca. 17 mi. E of Douglas, *Daniel and Marrs 1807* (ASU); Graham Co.: 10 mi. N of Klondyke, *Darrow s.n.* (ARIZ); Pima Co.: I-19 and Palo Prado Rd., N of Nogales, *Lehto 20283* (ASU); Santa Cruz Co.: N outskirts of Carmen, *Keil 11060* (ASU). New Mexico: Socorro Co.: Bravo del Norte near

Puercos River, *Schott s.n.* (F). Texas: Presidio Co.: Musgrave Canyon, Sierra Tierra Vieja, *Hinckley 1912* (ARIZ, TEX).

**Acknowledgements**

I am grateful for the courtesies extended by the curators of the following herbaria: A, ARIZ, ASU, CAS, DES, DS, DUKE, ENCB, F, GH, K, LA, LL, MICH, MO, NCU, NMC, NY, PH, RSA, SMU, SRSC, Southwestern Research Station (Portal), TEX, UC, UNM, US, UTEP, WTU. The following people were especially helpful in one way or another: D. Pinkava, B. Turner, F. Almeda, R. Worthington, M. Butterwick, E. Shaw, T. Van Devender, G. Marrs, and R. Hilsenbeck. The illustrations were prepared by Mark Mohlenbrock.

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