

JUSTICIA (ACANTHACEAE) IN TEXAS

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ABSTRACT

A taxonomic reassessment of *Justicia* in Texas reveals seven species (*J. americana*, *J. lanceolata*, *J. longii*, *J. pacifica*, *J. pilosella*, *J. warnockii*, and *J. wrightii*) native to diverse ecoregions and habitats in the state. *Justicia turneri* is treated as conspecific with *J. pilosella*, and *J. runyonii* is treated as conspecific with *J. pacifica*. Lectotypes are designated for *Dianthera ovata* var. *lanceolata* and *J. runyonii*. A key to species in Texas, descriptions, illustrations, synonymies, maps, habitats, and pertinent discussions are provided.

RESUMEN

Una nueva valoración taxonómica de *Justicia* en Texas revela siete especies (*J. americana*, *J. lanceolata*, *J. longii*, *J. pacifica*, *J. pilosella*, *J. warnockii*, y *J. wrightii*) como nativas de las ecorregiones y los hábitats diversos en el estado. Se reconoce a *J. turneri* como conespecífica con *J. pilosella*, y *J. runyonii* como conespecífica con *J. pacifica*. Se designan lectotipos para *Dianthera ovata* var. *lanceolata* y *J. runyonii*. Se proporciona una clave para las especies de Texas, así como sus descripciones, ilustraciones, sinonimias, mapas, hábitats, y discusiones pertinentes.

INTRODUCTION

Justicia L. encompasses some 700 species and is the largest genus of Acanthaceae. The genus is predominantly pantropical, but many species occur in subtropical and temperate regions. Fifteen species are recognized as native to or naturalized in the United States and Canada; five (*J. angusta* (Chapm.) Small, *J. crassifolia* (Chapm.) Small, *J. lanceolata* (Chapm.) Small, *J. ovata* (Walt.) Lindau, and *J. wrightii* A. Gray) of these are endemic to the United States. Because of the tropical nature of the family, most occurrences of Acanthaceae in the United States are in the mesic southeastern states (especially Florida) and in the arid and semiarid southwestern states. Texas, which has more species of Acanthaceae (47, 42 native) than any other state, occupies the boundary between these regions and as a result is enriched by species from each. Studies of the genus there should contribute toward better understanding of the taxonomy and biogeography of species in both northern North America and Mexico. Goals of this account include completing the coverage of all species of *Justicia* occurring in continental North America (north of Mexico), providing a revised treatment of taxa in Texas, and documenting and discussing distributions of species in the state. Field and herbarium studies of *Justicia* in Texas for the forthcoming *Flora of North America* have resulted in reassessments of several taxa there and recognition of seven native species in the state: *J. americana* (L.) Vahl, *J. lanceolata*, *J. longii* Hilsenb., *J. pacifica* (Oerst.) Hemsl., *J. pilosella* (Nees) Hilsenb., *J. warnockii* B.L. Turner, and *J. wrightii*.

Some species of *Justicia* native to Texas have been treated in *Adhatoda* Mill., *Dianthera* L., *Siphonoglossa* Oerst., *Rhytiglossa* Nees, *Ecolium* Kurz, and *Monechma* Hochst.; the former three are included within *Justicia* (Graham 1988); the latter three are not, and are restricted to the Old World. Meagher (1974) studied and treated eight species of *Justicia* as native to the eastern United States and Canada; Wasshausen (1998) recognized five native species in the southeastern United States; and Daniel (1984) treated five species as native to the southwestern United States. Most of Texas is either located on the periphery of regions covered in these treatments or is beyond their geographic scope. The most comprehensive account of *Justicia* in Texas is that of Wasshausen (1966), who recognized seven species (two of them treated in *Siphonoglossa*). In spite of these studies, several taxonomic problems have persisted among Texan species. *Justicia runyonii* Small had not been compared to similar Mexican taxa, and is here treated as conspecific with *J. pacifica*. *Justicia lanceolata* had been treated both as a distinct species (Wasshausen 1966) and as a variety of *J. ovata* (Wasshausen 1998); a

rationale is offered below for treating it at the rank of species. The putative distinctions between *J. pilosella* and *J. turneri* have never been adequately demonstrated, and they are here treated as conspecific.

Two general distribution patterns, or groups of species, are evident among *Justicia* (and most other genera of Acanthaceae) in the United States and Canada. Species in the southwestern United States (i.e., southern, central, and trans-Pecos Texas westward to southern California) are, for the most part, Mexican species at the northernmost extent of their distribution. They generally occur in biotic communities that are more extensive in Mexico, but also extend into the American Southwest (e.g., Sonoran and Chihuahuan deserts, and Tamaulipan thornscrub). These include: *J. californica* (Benth.) D.N. Gibson, *J. candidans* (Nees) L.D. Benson, *J. pacifica*, *J. pilosella*, *J. sonora* Wassh., *J. longii*, and *J. warnockii*—four of which occur in Texas. These seven species do not appear to be closely related to one another; six of them were included in or associated with four sections of the genus by Graham (1988) and Hilsenbeck (1990). In contrast, five of the six species in the eastern United States (and Canada) are nearly or entirely endemic there, occur in wetlands, and appear to be closely related to one another (but not closely related to any of the species occurring in the American Southwest). *Justicia americana*, *J. angusta*, *J. crassifolia*, *J. lanceolata*, and *J. ovata* were treated by Graham (1988) in sect. *Dianthera* subsect. *Dianthera* (L.) V.A.W. Graham. Both *J. americana* and *J. lanceolata* occur in Texas, primarily in eastern and central portions of the state. The other putatively native *Justicia* in the eastern United States, *J. cooleyi* Monach. & Leonard, is closely related to several tropical American species of sect. *Sarotheca* (Nees) Benth. (Graham 1988), and appears to represent one of them (Daniel unpublished).

The distributions of species of *Justicia* in Texas are shown by county in Figure 1. Native species of the genus occur in 13 of the 18 ecoregions (Anonymous 2010) of Texas. Known habitats of Texan species vary from wetlands (e.g., *J. americana*) to moist forested bottomlands (e.g., *J. lanceolata*) to thornscrub (e.g., *J. pacifica*) to Chihuahuan desertscrub (e.g., *J. warnockii*).

Native species of *Justicia* in Texas can be distinguished from all other genera of Acanthaceae occurring in the state by the following combination of characters: herbs with membranaceous leaves, calyx 4- or 5-lobed, corolla limb strongly zygomorphic and with the lobes ascending cochlear in bud, upper lip of corolla rugulate, stamens 2, anthers 2-thecous with one or both thecae appendaged at base, staminodes absent, capsule with hook-like retinacula, and placenta with retinacula not separating from inner wall of mature capsule. Other characteristics of species in Texas are discussed below.

Pollen.—Pollen of *Justicia* in Texas varies from 2- to 4-aperturate (Figs. 2–3). Pollen with two apertures is most common among species in Texas, as it is among most species of *Justicia* from Mexico (Daniel 1998), but 3-aperturate (e.g., *J. longii*) and 4-aperturate (e.g., *J. warnockii* and *J. wrightii*) types are present as well. Pollen with four apertures was not recorded from the genus by Graham (1988), but has been reported in several Mexican species (Daniel 1998). The number of apertures appears to be constant within species of *Justicia*. The number of rows of insulae (when present) is sometimes variable within species, but is generally consistent as well.

Chromosome numbers.—Chromosome counts have been reported for five of the seven species that occur in Texas. Counts of $n=14$ have been reported for *Justicia pacifica* (as *J. caudata* A. Gray), *J. lanceolata*, *J. longii*, and *J. pilosella* (Lewis et al. 1962; Hilsenbeck 1983; Daniel et al. 1990); $n=28$ has been reported for *J. pilosella* (Hilsenbeck 1983); and $n=13$ has been reported for *J. americana* (Smith 1966). Although meiotic complements from 7 to 34 have been reported in the genus, $n=14$ is the most widely reported number in *Justicia* (Daniel 2000). From the counts reported, it would appear that both euploidy and dysploidy have played a role in the evolution of taxa known from Texas. The count of $n=13$ in *J. americana* (an apparent close relative of *J. lanceolata*), if correct, likely represents a dysploid reduction from an ancestor with $n=14$. The occurrence of both $n=14$ and 28 in *J. pilosella* reveals the presence of euploidy within that species.

Floral biology.—Most, if not all, of the species in Texas have ephemeral flowers (Fig. 4) that open and fall from the plant in the course of a single day. Ephemeral flowers have been noted on herbarium specimen labels or personally observed in *J. americana*, *J. lanceolata*, *J. longii*, and *J. pilosella*. Flowers of Texan species are mostly white to pinkish, usually with a colored palate on the lower lip (except in *J. longii* and white-flowered

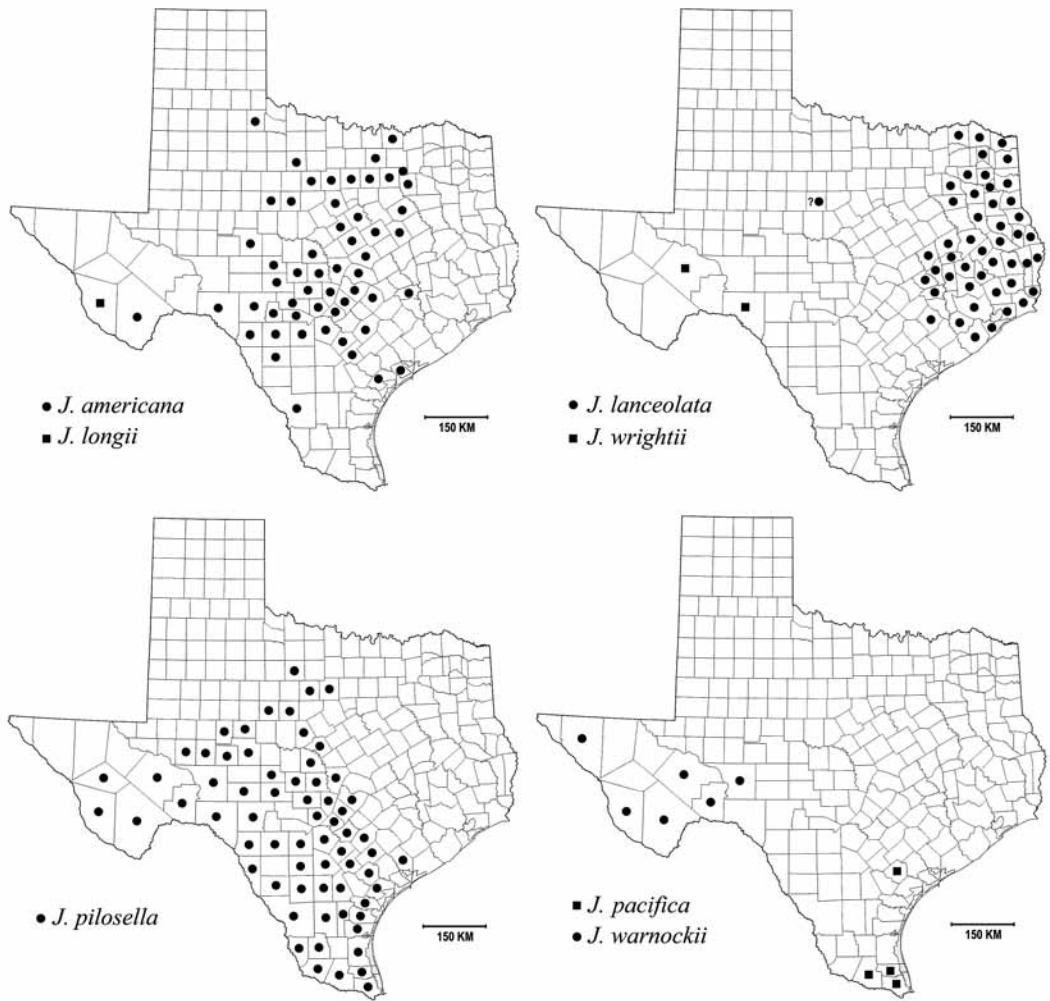


FIG. 1. Maps of Texas showing distributions of species of *Justicia* by county.

individuals of *J. pilosella*). Meagher (1974) observed bees, flies, butterflies, and ants visiting flowers of five species under cultivation in eastern North America, including *J. americana*, and *J. lanceolata*, and she suggested bee pollination for them. Robertson (1892) observed 26 floral visitors (Hymenoptera, Diptera, and Lepidoptera) to *J. americana* in July. Flowers of six of the seven species in Texas are diurnal. Hilsenbeck (1990) noted that the flowers of *J. longii* (corolla white with a long cylindrical tube) open in the early evening and are visited, and possibly pollinated, by hawkmoths (e.g., Sphingidae: *Celerio*). The flowers of *J. pilosella* are similar in form to those of *J. longii*, but they are diurnal, their cylindrical corolla tube is shorter, and the corolla color varies from pinkish (with a white palate) to white. These features suggest probable pollination by butterflies, bees, and/or flies in *J. pilosella*. Budlike cleistogamous flowers were observed on plants of *J. lanceolata* and *J. warnockii* early in the spring, prior to the appearance of chasmogamous flowers.

TAXONOMIC TREATMENT

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

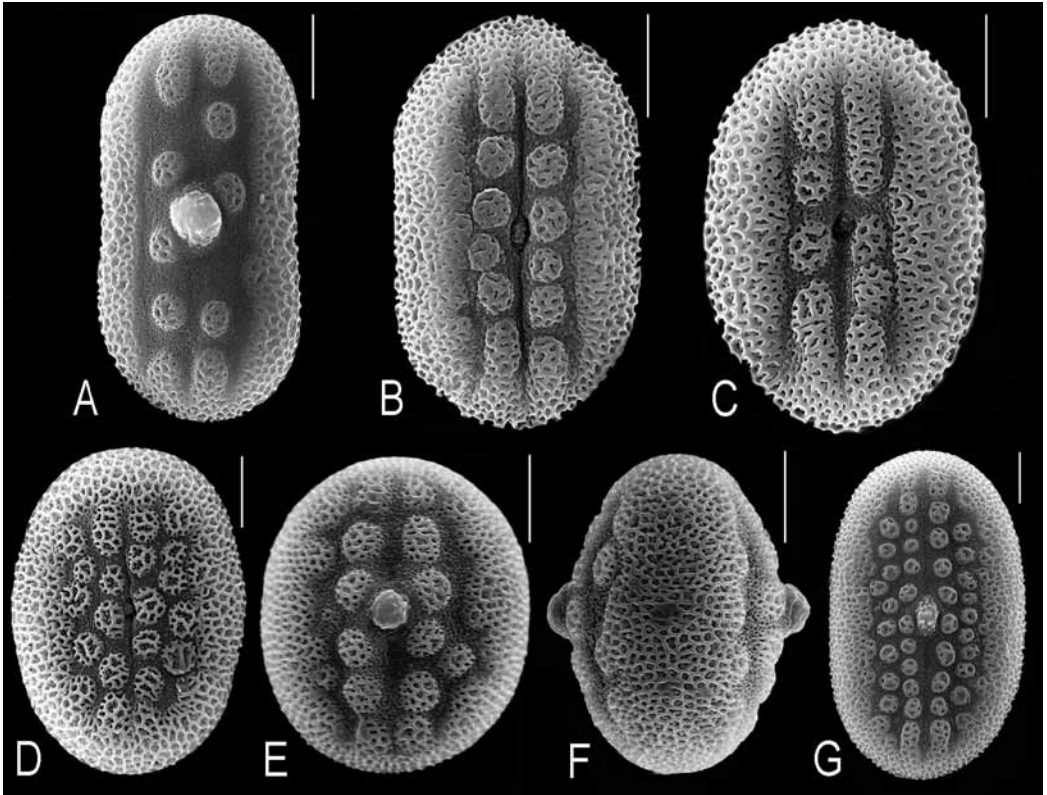


FIG. 2. Pollen of Texas species of *Justicia* with 2-aperturate grains. A. *J. americana* (Van Devender & Van Devender 93-649), apertural view. B. *J. lanceolata* (Worthington 7431), apertural view. C. *J. lanceolata* (Worthington 7431), apertural view. D. *J. pilosella* (Ertter 5230a), apertural view. E. *J. pilosella* (Breedlove 69493), apertural view. F. *J. pilosella* (Breedlove 69493), interapertural view. G. *J. pacifica* (Ertter & Larke 5232), apertural view. Scales=10 μ m.

Dianthera L. Sp. Pl. 1:27. 1753. Type: *Dianthera americana* L. (\equiv *Justicia americana* (L.) Vahl).

Adhatoda Mill., Gard. Dict. Abr., ed. 4, 1: without page numbers. 1754. LECTOTYPE (Heine, Fl. Gabon 13:173. 1966): *Adhatoda vasica* Nees (\equiv *Justicia adhatoda* L.).

Beloperone Nees in Wall., Pl. Asiat. Rar. 3:76. 1832. LECTOTYPE (Graham, Kew Bull. 43:609. 1988): *Beloperone amherstiae* Nees (\equiv *Justicia brasiliensis* Roth).

Jacobinia Moric., Pl. Nouv. Amer. 156. 1847. TYPE: *Jacobinia lepida* Nees (\equiv *Justicia lepida* (Moric.) Wassh.).

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

Decumbent to erect perennial herbs or shrubs (to small trees) with cystoliths. Leaves opposite, sessile to petiolate, margin entire to sinuate to crenate. Inflorescence of dichasia in leaf axils (rarely in axil of 2 partially fused bracts forming a cupulate involucre) or of axillary or terminal dichasiate spikes, racemes, thyrses, or panicles; dichasia alternate or opposite, 1(–3)-flowered, subtended by a leaf or a bract, sessile or pedunculate. Bracts alternate or opposite, green or brightly colored, prominent or inconspicuous, margin entire. 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, pinkish, red, or purplish, usually with white or colored markings (often restricted to lower lip), tube cylindrical to expanded distally, usually lacking a distinct throat, limb strongly zygomorphic, 2-labiate, upper lip internally rugulate (i.e., with a furrow in which the style is held within the upper lip), entire to 2-lobed, lower lip 3-lobed, corolla lobes imbricate (ascending cochlear) in bud. Stamens 2, inserted at vari-

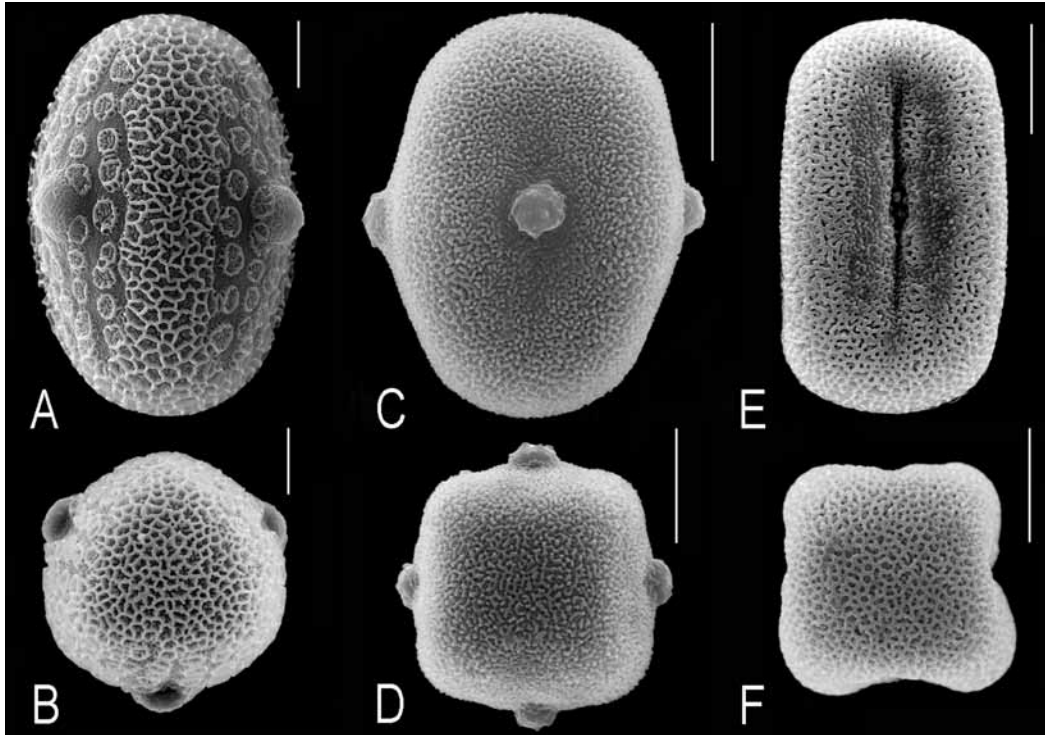


FIG. 3. Pollen of Texas species of *Justicia* with 3- or 4-aperturate grains. A. *J. longii* (Reina G. et al. 2004-379), interapertural view. B. *J. longii* (Butterwick 7384), polar view. C. *J. warnockii* (Rowell 5131), apertural view. D. *J. warnockii* (Rowell 5131), polar view. E. *J. wrightii* (Turner & Turner 96-95), apertural view. F. *J. wrightii* (Turner & Turner 96-95), polar view. Scales=10 μ m.

ous positions within corolla tube, exerted from mouth of corolla, anthers 2-theous (1 theca rarely sterile), thecae equal or unequal in length, equally inserted, unequally inserted (but overlapping for some portion of their length), or superposed (i.e., not overlapping), parallel to perpendicular, 1 or both with a basal appendage (or appendages absent), dehiscent toward lower lip (i.e., flower nototribic); pollen subprolate to perprolate, 2–4-aperturate (varying from porate to colpate with distinctness of colpi sometimes questionable), apertures flanked on each side by 1–several rows of \pm circular insulae and/or peninsulae or by both a solid band of exine and a pseudocolpus, exine usually reticulate; staminodes 0 (although pubescent thickenings near attachment of filaments rarely present). Style exerted 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, discoid to globose. ($x=7$).

About 700 species worldwide, primarily tropical. Morphological diversity in the genus is extensive and the above description and generic synonymy are derived from North American species only. Many non-native species of *Justicia* are cultivated in the United States, both out-of-doors and under glass, but few of these persist or become naturalized. Non-native species that have been documented from cultivation in Texas are noted in the Appendix 1.

KEY TO NATIVE SPECIES OF *JUSTICIA* IN TEXAS

1. Calyx 4-lobed; seeds sometimes pubescent, never subspheric.
2. Young stems \pm evenly pubescent; leaves pubescent (trichomes sometimes restricted to margin); calyx abaxially pubescent with eglandular trichomes; bracteoles 0.5–2 mm wide; lower theca 0.8–1.3 mm long _____ *J. wrightii*

2. Young stems mostly 2-fariously pubescent; leaves glabrous; calyx abaxially glabrous; bracteoles 0.2–0.4 mm wide; lower theca 0.7–0.8 mm long _____ **J. warnockii**
1. Calyx 5-lobed (1 lobe sometimes reduced in size); seeds lacking trichomes (or if with deciduous trichomes to 0.05 mm long as in *J. pacifica*, then seeds subspheric).
3. Bracteoles pubescent with eglandular and glandular trichomes (corolla tube neither elongate nor narrowly cylindrical); corolla externally pubescent with glandular (and sometimes eglandular as well) trichomes; margins of calyx lobes hyaline (to whitish or much lighter green than remainder of calyx); capsule pubescent with eglandular trichomes; seed subspheric, surface smooth and shiny, covered with deciduous trichomes to 0.05 mm long _____ **J. pacifica**
3. Bracteoles glabrous or pubescent with eglandular trichomes only (if with scattered glandular trichomes as rarely in *J. pilosella*, then corolla tube elongate and narrowly cylindrical); corolla externally pubescent with eglandular trichomes only; margin of calyx lobes not hyaline or whitish; capsule glabrous; seeds discoid, surface rugose, papillose, or tuberculate, not shiny, lacking trichomes.
4. Inflorescence of long-pedunculate dichasia spikes (or panicles of spikes) to 17.5 cm long from leaf axils, peduncles of spikes to 15.5 cm; bracteoles 0.5–2.5 mm long; leaves sessile to subsessile, petioles (if present) to 2 mm long; thecae superposed (separated by a gap to 0.7 mm); corollas 7–13 mm long, tube not elongate, slightly expanded distally, shorter than to equaling limb; plants of moist regions, aquatic to subaquatic.
5. Inflorescence spikes during anthesis subcapitate to capitate; dichasia dense (rachis not or only partially visible and internodes near midspike mostly 1–3 mm long during anthesis; internodes sometimes elongating after anthesis with rachis becoming visible), opposite at nodes; corolla white (to pale lavender) with purplish to maroon markings, lateral lobes of lower lip widely separated and diverging from central lobe at angles > 45°; plants of central, southern, and western Texas _____ **J. americana**
5. Inflorescence spikes during anthesis elongate; dichasia loose (rachis clearly visible and internodes near midspike 5 mm or more long during anthesis), those above basal node alternate (i.e., 1 per node); corolla usually pinkish with maroon markings, lateral lobes of lower lip barely diverging or diverging from central lobe at angles < 45°; plants of eastern Texas _____ **J. lanceolata**
4. Inflorescence of sessile to subsessile dichasia in leaf axils, peduncles of dichasia (if present) to 2 mm long; bracteoles 4–24 mm long; leaves subsessile to petiolate, petioles to 10 mm long; thecae subequally to unequally inserted (overlapping by 0.5–1 mm); corollas 12–55 mm long, tube elongate and cylindrical, more than 1.5 × longer than limb; plants of arid regions, not aquatic but sometimes growing along watercourses.
6. Corolla entirely white, 31–55 mm long; calyx lobes widest above and narrowed toward base; pollen 3-aperturate; plants known in Texas only from Presidio Co. (Chinati Mts.) _____ **J. longii**
6. Corolla pinkish to purplish with white markings (rarely entirely white), 12–30 mm long; calyx lobes usually widest at base; pollen 2-aperturate; plants wide-ranging in central, southern, and western Texas _____ **J. pilosella**

Justicia americana (L.) Vahl, Symb. Bot. 2:15. 1791. (Figs. 4A; 5A–C). *Dianthera americana* L., Sp. Pl. 1:27. 1753. *Dicliptera americana* (L.) Wood, Class-book (ed. 2) 395. 1847. *Echoliolum americanum* (L.) Kuntze, Revis. Gen. 2:980. 1891. TYPE: U.S.A. VIRGINIA: “habitat in Virginia” (fide protologue), Clayton 408 (LECTOTYPE, designated by Reveal in Jarvis et al. Regnum Veg. 127:42. 1993: BM-000051211).

Justicia linearifolia Lam., Tabl. Encycl. 1:41. 1791. *Dianthera linearifolia* (Lam.) Raf., Autikon Bot. 29. 1840. TYPE: U.S.A. “Ex Virginia, Florida ... Communic. ad Fraser” (fide protologue), “a carolina. fraser” (fide specimen) (presumed HOLOTYPE: P-Lamark; image!).

Justicia pedunculosa Michx., Fl. Bor. Amer. 1:7. 1803, nomen. superfl. (*Dianthera americana* L. cited in synonymy). *Rhytiglossa pedunculosa* (Michx.) Nees in de Candolle, Prodr. 11:339. 1847, nomen illegit.

Justicia ensiformis (Walt.) Elliott, Sketch 1:11. 1816. *Dianthera ensiformis* Walt., Fl. Carol. 63. 1788, non *Dianthera ensiformis* Wood (1870). TYPE: Not designated (no specimens, localities, or reference to other original materials were cited in the protologue). On making the combination in *Justicia*, Elliott noted that he had only seen specimens without flowers, and “grows in St. John’s, Dr. Macbride. Flowers May.”

Dianthera longifolia Raf., Autikon Bot. 30. 1840. TYPE: U.S.A.: “Found in R. Susquehannah” (fide protologue); no specimens seen; presumably pertains to this species.

Dianthera repanda Raf., Autikon Bot. 30. 1840. TYPE: U.S.A. “From Arkansas” (fide protologue); specimens not seen; name presumably pertains to this species.

Justicia americana var. *subcoriacea* Fernald, Rhodora 43:641. 1941. *Dianthera americana* var. *subcoriacea* (Fernald) Shinnars, Field & Lab. 25:79. 1957. TYPE: U.S.A. TEXAS: Tom Green Co.: S. Concho R. at Christoval, 5 Jun 1934, V. Cory 8860 (HOLOTYPE: GH!).

Justicia mortuifluminis Fernald, Rhodora 44:92. 1942. *Justicia umbratilis* Fernald, Rhodora 43:639. 1941, non *Justicia umbratilis* S. Moore (1913). TYPE: U.S.A. VIRGINIA: Southampton Co.: bottomland woods along Nottoway River, Monroe Bridge, 22 Jun 1941, M. Fernald & B. Long 13162 (HOLOTYPE: GH!; ISOTYPES: NY! PH). See discussion below.

Aquatic or subaquatic rhizomatous or stoloniferous perennial herbs with emergent shoots to 1 m tall, sometimes forming colonies. Young stems quadrate-sulcate to ± flattened, glabrous, nodes of submerged stems sometimes with masses of fibrous roots. Leaves sessile to subsessile, petioles (if present) to 2 mm long, blades mostly ascending, linear to lance-elliptic (to elliptic) to oblanceolate to obovate, 30–125 mm long, 2.5–27 mm wide, (2–)3.3–19.5 × longer than wide, subrounded to acute at apex, acute to rounded to truncate at base,

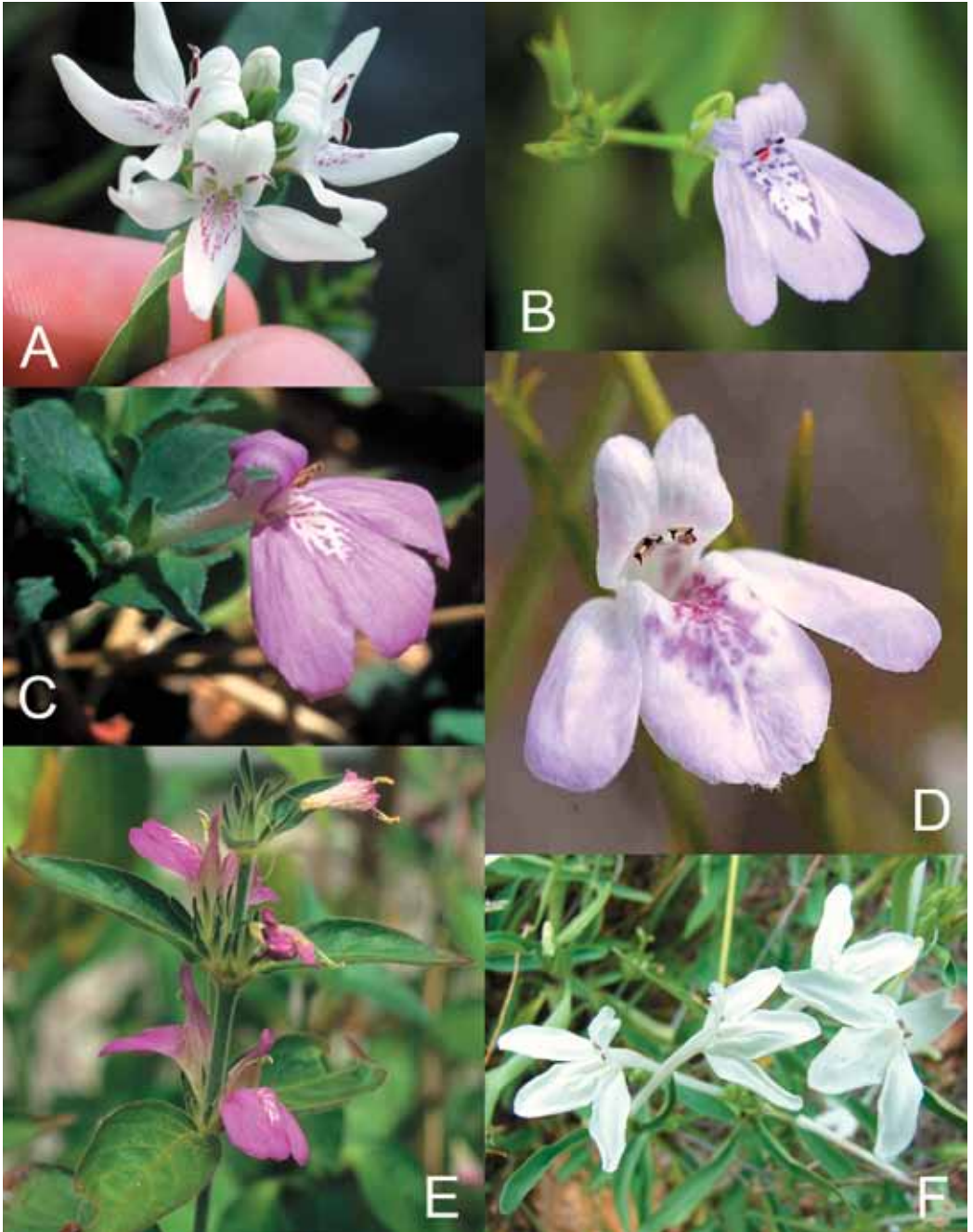


FIG. 4. Photographs of flowers of Texas species of *Justicia*. A. *J. americana*. B. *J. lanceolata*. C. *J. pilosella*. D. *J. warnockii*. E. *J. pacifica*. F. *J. longii*. Photos by author except D (R. Morey) and F (J. Verrier, taken in Arizona), which are used with permission.

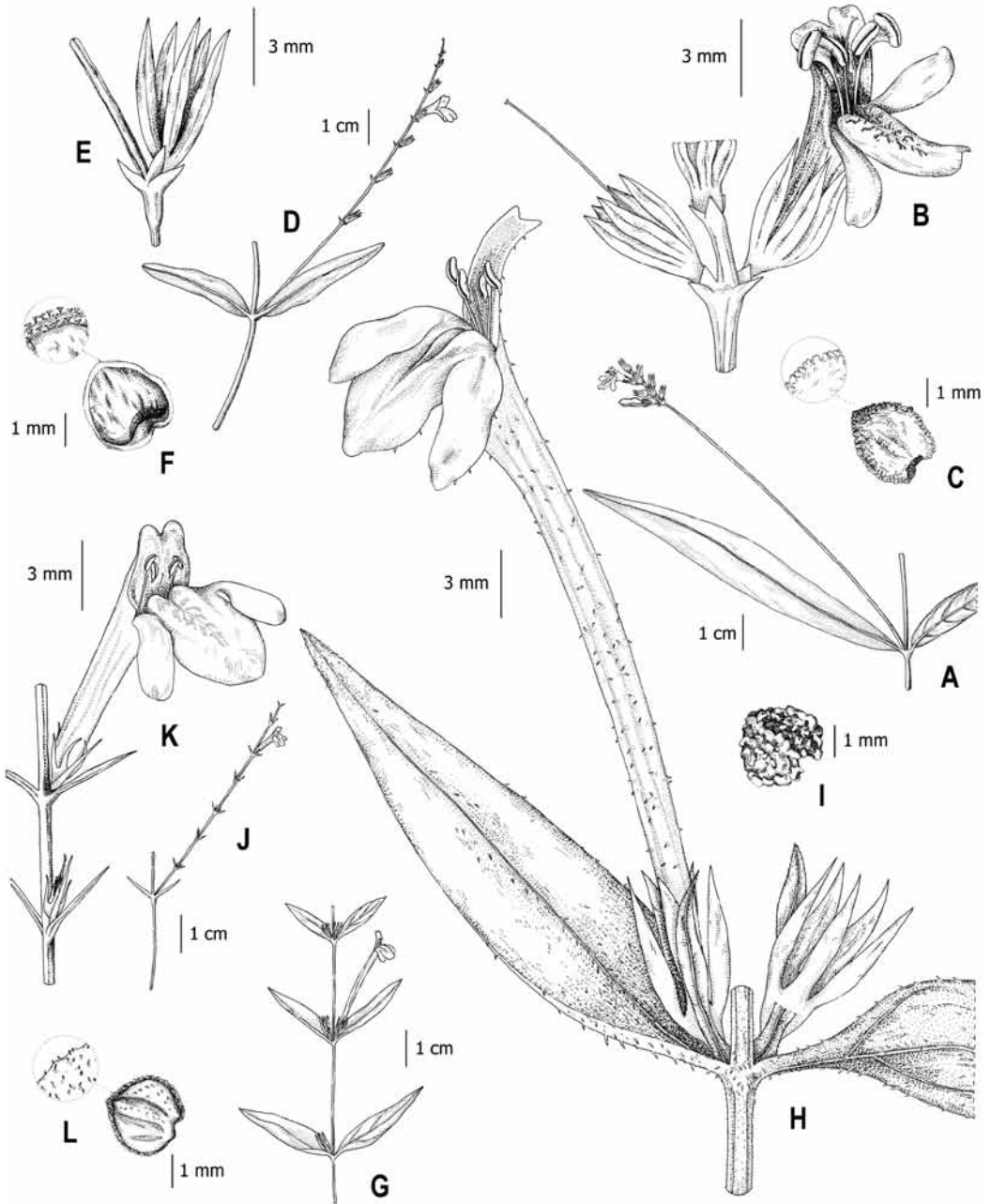


FIG. 5. Texas species of *Justicia*-I. A-C. *J. americana*. A. Habit (Daniel & Lott 10530). B. Inflorescence node (Van Devender 2003-820). C. Seed with detail of margin (Van Devender 2003-820). D-F. *J. lanceolata*. D. Habit (Palmer 7939). E. Inflorescence node (Palmer 7939). F. Seed with detail of margin (Van Devender 93-692). G-I. *J. longii*. G. Habit (Butterwick & Hillyard 7384). H. Inflorescence node (Butterwick & Hillyard 7384) with one bracteole on right partially removed. I. Seed (Reina G. et al. 2004-379). J-L. *J. warnockii*. J. Habit (Van Devender & Cohen s.n.). K. Inflorescence nodes (Van Devender & Cohen s.n.). L. Seed with detail of margin (Correll & Correll 30661). Drawn by J. Weller.

surfaces glabrous, margin entire to crenate, eciliate. Inflorescence of axillary pedunculate densely-flowered spikes to 17.5 cm long (including peduncles and excluding corollas), peduncles to 15.5 cm long, glabrous, spikes subcapitate to capitate (internodes near midspike mostly 1–3 mm long during anthesis; sometimes elongating after anthesis), rachis usually not (or barely) visible during anthesis, glabrous; dichasia opposite at nodes, sessile, 1-flowered. Bracts triangular, 0.8–2.5 mm long, 0.8–1.2 mm wide, abaxially glabrous or very sparsely pubescent with eglandular trichomes. Bracteoles triangular, 0.5–1 mm long, 0.3–0.5 mm wide, glabrous or pubescent like bracts. Flowers sessile to subsessile (i.e., pedicels to 1 mm long). Calyx 5-lobed, 3.8–6 mm long, lobes lanceolate to lance-subulate to linear-elliptic, subequal, 3.5–5.5 mm long, 0.6–1.2 mm wide, widest near base or near midpoint, abaxially glabrous (or sparsely pubescent near apex with eglandular trichomes 0.05 mm long). Corolla white (to light purple) with purplish to maroon markings on lower lip, 8–13 mm long, externally pubescent with erect to antrorse eglandular trichomes 0.05–0.1 mm long, tube 2–4.4 mm long, slightly expanded distally, upper lip reflexed, 4–6.5 mm long, lobes 0.5–0.8 mm long, lower lip 4–10 mm long, lobes \pm revolute, 3–8 mm long, lateral lobes widely separated and diverging from central lobe at angles $> 45^\circ$. Stamens 6–7 mm long, thecae maroon, subparallel to perpendicular, 1.2–1.9 mm long, unequally inserted (overlapping by up to 1.2 mm) or superposed (gap to 0.3 mm long), glabrous, lacking basal appendages or the lower theca with an inconspicuous appendage 0.1 mm long; pollen 2-aperturate, apertures flanked on each side by 1 row of insulae, exine reticulate. Style 7–9 mm long, proximally pubescent with eglandular trichomes 0.05 mm long, stigma unequally 2-lobed, 1 lobe 0.2 mm long, other lobe 0.05–0.1 mm long. Capsule 9–13 mm long, glabrous. Seeds 4 per capsule, discoid, 2.8–3.5 mm long, 2.5–3.5 mm wide, surfaces covered with low, rounded (moundlike) tubercles or becoming \pm rugose. ($n=13$).

Phenology.—Flowering: March–October; fruiting: April–November.

Distribution and habitats.—Canada (Ontario, Québec), United States (Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia), and Mexico (Coahuila); Texas plants occur in and along rivers, streams, lakes, ditches, sloughs, often on limestone substrates, at elevations from 7 to 550(–730) m. Although its distribution includes at least nine ecoregions of Texas, it is found primarily in east-central Texas (Fig. 1) in the following regions: Cross Timbers and Prairie, Blackland Prairies, Edwards Plateau, and Stockton Plateau.

Justicia americana is the most geographically widespread species of the genus in the United States. Its distribution also extends farther northward (ca. lat. 47°N) than any other species in the family. The species is nearly endemic to the United States, but is known from nearby regions of southeastern Canada and north-central Mexico. It is the most hydrophilous among Texas *Justicia*, with the roots and proximal portion of the shoots generally submerged. It is best developed in shallows of flowing streams, but survives in wet soil above the water table and in water more than a meter deep (Penfound 1940). The species sometimes forms dense stands or colonies that spread by horizontal stolons, fragmentation of shoots, and seeds. Absence of *J. americana* from eastern Texas is somewhat surprising; however, it is uncommon in Louisiana and the other states of the northern Gulf of Mexico region. Similar habitats in eastern Texas and the northern Gulf are mostly occupied by *J. lanceolata*, the range of which only sporadically overlaps that of *J. americana*.

Unusual plants with affinities to *J. americana* were collected in Madison County (Senator Ranch, Carr Lake, 23 May 1998, A. Neill 1888 at TAMU), somewhat to the east of the range of that species in Texas. Vegetatively, the plants resemble *J. americana* (e.g., sessile, linear leaves). However, the inflorescences consist of spikes (sometimes branched and sometimes curved) with mostly opposite dichasia 6 to 9 mm distant at the median internodes, making the rachis clearly visible. Whether such plants represent a rare or abnormal form of *J. americana*, hybrids between that species and *J. lanceolata* (which is also known from Madison County), or hybrids between *J. americana* and *J. ovata* (the nearest current occurrences of which are in southern Alabama and western Florida) remains to be determined.

At or near the type locality of *J. mortuiflumini* in southeastern Virginia, both *J. americana* and *J. ovata*, as

well as plants intermediate between them, have been collected. The density of flowering spikes of the type of *J. mortuifluminis* suggest that this name likely pertains to the synonymy of *J. americana*, but it might apply to intergrades between *J. americana* and *J. ovata*.

Representative Texas specimens examined: **Bandera Co.:** 2.5 mi E of Bandera, *D. Correll & J. Crutchfield 31078* (LL); Sabinal River Canyon, 2 mi N of Vanderpool, *D. Correll & I. Johnston 18148* (LL); 4 mi NW of Medina, *V. Cory 23530* (GH); Vanderpool, *H. Parks RX1783* (MO), *RX1784* (TEX), *RX1786* (MO). **Bastrop Co.:** Shipp Lake, between SR 71 and RR, *W. Carr 8733* (TEX); Cedar Creek at Penturf bridge, *H. Duval 156* (TEX). **Bell Co.:** W of Salado Creek Bridge on Hwy. 81, Salado Creek, Salado, *J. Massey 276* (LL, NCU, SMU); 9.3 mi W of Belton, Nolan Creek, *C. York & G. York 54226* (TEX); Salado Creek, Salado, *C. York & G. York 54586* (TEX); near Temple, *S. Wolff 2972* (US). **Bexar Co.:** San Antonio, *J. Clemens 1047* (DS, MICH, MO), *1048* (MICH, MO); Cibolo Creek, E of Bulverde, *V. Cory 6079* (GH); Selma, Cibolo River, *B. Groth 204* (CAS, F, GH, US); Comanche Spring, New Braunfels, *F. Lindheimer 64* (MO), *1061* (F, GH, TEX, UC, US); Leon Creek-Water Sommerset Rd., 9 mi SW of San Antonio, *M. Metz 2234* (UC); Helotes Creek, *E. Schulz 114* (US); San Antonio River, San Antonio, *G. Thurber s.n.* [April 1853] (F, GH), San Antonio, *E. Wilkinson 142* (MO). **Blanco Co.:** Blanco State Park, picnic area along Park Road 32, 0.1 mi W of park headquarters, banks of Blanco River, *L. Sanchez 874* (BRIT); Cypress Creek near Cypress Mill, *G. Webster 110* (DAV, TEX); Comanche Creek, on 310 11 mi W of jct. with 962, 30°55'N, 98°36'W, *G. Webster et al. 33391* (DAV). **Bosque Co.:** ca. 2 mi NW of Mosheim W from dam site along Hog Creek, *B. Lipscomb 2246* (NCU, SMU). **Brewster Co.:** near Big Bend National Park entrance, *D. Demaree 48572* (SMU). **Burnet Co.:** 1 mi E of Briggs, *J. Brenckle 48127* (SMU); Oatmeal School Creek, ca. 3 mi S of Bertram, *M. Johnston 6357* (LL, US). **Calhoun Co.:** 5 mi E of Tivoli, *C. Rogers 6619* (TEX). **Callahan Co.:** Baird, *Letterman 62* (MO). **Comal Co.:** New Braunfels, Comal River, *F. Lewton 709* (LL); Comala Creek, *F. Lindheimer 475* (MO). **Coryell Co.:** 6.2 mi E of Evant, *L. Shimmers 27322* (SMU). **Cottle Co.:** Chalk Bluff, *H. Parks & V. Cory 29196* (TAES). **Dallas Co.:** "ponds n. Eagle ford," *H. Eggert s.n.* (MO); Dallas, *M. Hynes s.n.* (TEX); Tanner Rd. in NW Dallas, *B. Lipscomb 1422* (NCU, SMU, UC); Bachman Dam, *C. Lundell & A. Lundell 7034* (LL, MICH, US); Dallas, *J. Reverchon 729* (MO), *s.n.* [June 1874] (GH); White Rock Lake, Dallas, *L. Shimmers 20110* (SMU, TEX); vicinity of Dallas, *M. Stephenson 90* (US). **Denton Co.:** Pilot Knob Ranch near Argyle, *D. Correll & H. Correll 23383* (F, LL); 7 mi S of Denton, *W. McCart 1098* (SMU). **Edwards Co.:** along Nueces River near Barksdale, *D. Correll & D. Wasshausen 27999* (LL, MO, SMU, US); Hackberry Creek, ca. 0.5 mi NW of Kalentine Hole, *J. Smith & M. Butterwick 266* (LL). **Erath Co.:** without locale, *L. Gough s.n.* (TEX); Stephenville, *E. Palmer 14182* (MO). **Gillespie Co.:** LBJ National Historic Park, along Pedernales River at ranch house (Texas White House), below dam, 30°15'N, 98°37'W, *R. Sanders 5111* (BRIT); Harper, *E. Whitehouse s.n.* (TEX). **Gonzales Co.:** Ottine, *E. Bogusch 3224* (TEX). **Grayson Co.:** Munson Park around Lake Denison, *H. Gentry 310* (BRIT, TEX). **Hamilton Co.:** 4 mi S of Hamilton, *R. Innes & B. Moon 1322* (F, GH, TEX); Leon River near Edson, *S. Wolff 2083* (US). **Hays Co.:** Wimberley, *G. Fisher 43045* (F); Onion Creek at I-35 overpass, *J. Mears 619* (TEX); 0.75 mi NNW of Wimberley near jct. Cypress Creek and Blanco River, *J. Walker 3* (TEX); Cypress Creek, 2 mi above Wimberley, *G. Webster 2083* (GH, TEX). **Karnes Co.:** Cibolo Creek, 1 mi SW of Pawelekville, *J. Johnson 1295* (SMU, TEX, US). **Kaufman Co.:** Seagoville Ranch, ca. 32°37'N, 96°30'W, *S. McDaniel et al. 31556* (VSC). **Kendall Co.:** 1 km E of Boerne, Cibolo Creek at Hert Rd. bridge, *C. Lieb & V. Roessling 645* (CAS). **Kerr Co.:** Verde Creek, *D. Correll & H. Correll 12804* (SMU); Kerrville, *A. Heller 1748* (MO, SMU, UC, US). **Kimble Co.:** Llano River at Junction, *D. Correll 31521* (LL); Llano River at Hwy. 385, 8 mi S of Junction, *D. Correll et al. 28243* (LL, US); Paint Creek, 3 mi S of Telegraph, *V. Cory 49663* (GH, SMU); South Llano River State Park, ca. 5 mi SW of London on US Hwy. 377, *T. Van Devender & R. Van Devender 93-649* (CAS). **Kinney Co.:** ca. 3 mi NW of jct. hwy. 277 and 693, *D. Correll & D. Wasshausen 27764* (LL, US); Las Moras Creek at Las Moras, *V. Cory 29023* (GH). **Limestone Co.:** Fort Parker State Park, Hwy. 14 and Pk. Rd. 28, *J. Singhurst et al. 1251* (BRIT). **Llano Co.:** Inks Lake State Park, *D. Correll & I. Johnston 17342* (LL, MO); City Park on Llano River, *J. Crutchfield 2313* (LL); Llano River in Llano, 30°45'N, 98°40.5'W, *A. Reina & T. Van Devender 2003-729* (CAS). **Mason Co.:** north of Llano River, ca. 13 mi S of Mason, *Henderson 62-305* (FSU). **McLennan Co.:** 2.1 mi NNW of McGregor, *L. Shimmers 14950* (SMU); North Shore Crossing at Rapids, *L. Smith 293* (TEX); Tonkawa Park, SE of Crawford, *L. Smith 557* (TEX); gravel pit, South 3rd St., *L. Smith 811* (NY, TEX). **Medina Co.:** Medina River just S of Medina Lake, *D. Correll & E. Ogden 25359* (LL, SMU); Hondo Creek, 8 mi E of Hondo, *D. Correll et al. 28189* (LL). **Menard Co.:** Menard, *V. Cory s.n.* (TAES). **Navarro Co.:** Chambers Creek off Hwy. 31, *C. Lundell 15095* (LL, US). **Palo Pinto Co.:** 4 mi W of Palo Pinto, *D. Correll & E. Ogden 28477* (LL); without locale, *Palo Pinto School s.n.* (TEX); Brazos, *I. Parks s.n.* (TEX). **Parker Co.:** Mineral Wells State Park, *B. Lipscomb 2426* (SMU, TEX); 9.5 mi E of Weatherford, *L. Shimmers 10167* (SMU). **Real Co.:** 10.8 km N of Ranch Road 1120 on US 83, *D. Boufford 10556* (A, MO); Bull Head Creek at its jct. with Nueces River, ca. 0.25 mi SW of Vance, *J. Taylor & W. Mahler 31660* (BRIT). **Refugio Co.:** Tivoli, *G. Fisher 41099* (US); Tivoli - Green Lake, *E. Whitehouse s.n.* (TEX). **Rockwall Co.:** 1.25 mi W of Rockwall, *V. Cory 53306* (GH, MICH, SMU, US). **San Saba Co.:** 6 mi SW of San Saba, *E. Howell 7* (LL); San Saba River, 20 mi S of Richland Springs, *W. McCart & R. McMillan 44* (SMU). **Stephens Co.:** Caddo Creek, ca. 2.3 mi NNE of jct. US 180 and Park Road 33 at Caddo, 32°44'35.9"N, 98°38'57"W, *W. Carr 26873* (TEX); without locale, *Tharp s.n.* (MO). **Tarrant Co.:** 6.75 mi S and 0.75 mi W of Court House, Ft. Worth, *V. Cory 54416* (LL, SMU); Boaz Park, Benbrook, *V. Cory 54479* (LL, SMU); without locale, *O. Killian 6780* (TEX); Ft. Worth, *A. Ruth 267* (F, GH, LL, MO, SMU, UC); Lake Como Park, Fort Worth, *W. Wilson & W. McCart 2190* (TEX). **Taylor Co.:** ca. 2 mi SW of Elmdale, SE of Abilene, *W. Mahler 3364* (MO, SMU); Lake Lytle near Abilene, *W. Tolstead 7281* (GH, TEX, SMU, UC); Abilene, *S. Tracy 8297* (F, GH, MO, US); Elmdale, E of Abilene, *B. Warnock 46357* (TEX, US). **Throckmorton Co.:** ca. 13 km N and 4 km W of Throckmorton, Texas A&M Experimental Ranch, *J. Cornelius 1906* (BRIT), ca. 9 mi W of Throckmorton, *D. Correll & E. Ogden 28462* (LL). **Tom Green Co.:** San Angelo, *E. Palmer 10359* (DS, MO, US); Knickerbocker Ranch, Dove Creek, *F. Tweedy 186* (US). **Travis Co.:** Slaughter Creek, Joe Carrington Farm, *C. Albers s.n.* (TEX); near Colorado River, 5 mi below Austin, *F. Barkley 13110* (MO, TEX, US); Barton Springs Creek, *F. Barkley 13642* (UC); Bull Creek, *F. Barkley & L. Ripperton 14529* (TEX); Onion Creek, *W. Brown s.n.* (TEX); Onion Creek, 8.5 mi S of Colorado River (in Austin), *D. Correll & H. Correll 29948* (LL, MO, SMU); Austin, *E. Hall 423* (F); Shoal Creek, Austin, *Heald & Wolf 653* (TEX); above Barton Springs, Austin, *W. Krodell 28* (F, MO, TEX, US); Oak Hill,

C. *Lundell* 15108 (LL, US); 9 mi W of Oak Hill, C. *Lundell* & A. *Lundell* 8896 (LL, MICH, US); Bull Creek City Park on SE side of Loop 360, SW of Spicewood Springs Road, W side of Austin, J. *Saunders* & B. *Ertter* 1323 (GH, LL); Onion Creek, Austin, B. *Tharp* s.n. (MO, UC); Shoal Creek, Austin, B. *Tharp* s.n. (UC); Austin, B. *Tharp* s.n. (TEX); near jct. Barton Creek and Little Barton Creek, ca. 1 mi SE of Bee Cave, G. *Webster* 13768 (DAV, MICH, TEX); Onion Creek, E. *Whitehouse* s.n. (TEX); Walnut Creek at Water's Park, C. *York* 46060 (LL, MICH, MO, UC); Austin, H. *York* 80 (DS); Austin, H. *York* s.n. (TEX); Shoal Creek, Austin, H. *York* s.n. (TEX). **Uvalde Co.:** Rio Frio, Garner State Park, D. *Correll et al.* 15941A (LL); Chalk Bluff on Nueces River, V. *Cory* 29197 (GH); Garner State Park, V. *Cory* 49404 (GH, SMU); 2 mi NW of Utopia, Sabinal River, W. *McCart* 5751 (SMU); Nueces River, Chalk Bluff, E. *Palmer* 13331 (MO, US). **Val Verde Co.:** San Felipe Springs, Del Rio, D. *Correll & E. Ogden* 25084 (LL, US); near mouth of Devil's River, D. *Correll & D. Wasshausen* 27776 (LL, US); Sycamore Creek, V. *Cory* 721 (GH); San Felipe Country Club, Del Rio, C. *Cory* 41740 (GH); Devil's River at Baker's Crossing, H. *Cutler* 1829 (CAS, GH, MO, WIS); fork of Devil River, Ozona-Comstock Rd., R. *Ferris & C. Duncan* 3027 (MO); Del Rio, G. *Fisher* s.n. (UC); Sycamore Creek, along US 277 between Del Rio and Eagle Pass, J. *Miller et al.* 5087 (MO); Devil's River, Neally 504 (F, US); ca. 25 mi N of Comstock on SR 163, C. *Rowell* s.n. (SMU, TEX); 20.8 mi N of Comstock where Hwy. 183 crosses Devils River, B. *Turner* 98.180 (TEX); Baker's Crossing of Devil's River, 33.9 km N of Comstock on TEX 163, 29°58'N, 101°09'W, T. *Van Devender & A. Reina* 2003-820 (CAS). **Washington Co.:** without locale, R. *Reeves* (coll. by *Taber*) 1896 (TAES). **Webb Co.:** 35 mi W of Laredo, H. *Hamby* 1705 (LL). **Williamson Co.:** San Gabriel River at Georgetown, J. *Crutchfield* 334 (LL); South Fork of San Gabriel River where it crosses Hwy. 183, N of Leander, M. *Johnston & W. McCart* 5278 (NCU, TEX); Brushy Creek, just off Great Valley Dr., N of Hwy. 620, T. *Patterson* 7236 (TEX); Smith Branch, Georgetown, G. *Wolcott* 101 (TEX); Brushy Creek W of Round Rock, C. *York* 46179 (TEX). **Wilson Co.:** Cibolo Creek, R. *Johns* s.n. (MICH); Southerland Springs, Cebelo Creek, E. *Palmer* 9305 (DS, MO, US). **Zavala Co.:** Nueces River, 11.5 mi S of Uvalde, V. *Cory* 11959 (GH); 10 mi N of La Pryor, Nueces River on US Hwy. 83, E. *Dickey* 67 (SMU). **County undetermined:** Comings Creek, F. *Lindheimer* 291 (MO); Del Rio-Eagle Pass, E. *Whitehouse* (TEX); Gonzales Marsh, J. *Normand* s.n. (TEX).

Justicia lanceolata (Chapm.) Small, Man. S.E. Fl. 1231. 1933. (**Figs. 4B; 5D–E**). *Dianthera ovata* var. *lanceolata* Chapm., Fl. South. U.S. 304. 1860. *Dianthera lanceolata* (Chapm.) Small in N.L. Britton, Man. Fl. N. States 855. 1901. *Justicia humilis* var. *lanceolata* (Chapm.) Gleason, Phytologia 4:24. 1952. *Justicia ovata* var. *lanceolata* (Chapm.) R.W. Long, J. Arnold Arbor. 51:303. 1970. TYPE: U.S.A. FLORIDA: "River-banks," Jul (fide protologue), *Chapman* s.n. (LECTOTYPE, designated here: NY (ex Columbia College Herbarium; NYBG bar code 00311890!); possible ISOLECTOTYPE: NY ex Herbarium Columbia University, NYBG bar code 00311889!).

Mostly erect, subaquatic, perennial herbs to 3 dm tall, sometimes forming colonies. Young stems quadrate-sulcate to ± flattened, glabrous or sparsely pubescent (± evenly so or trichomes ± disposed in multiple lines) with retrorse eglandular trichomes 0.05–0.1 mm long. Leaves sessile (to subsessile), naked petioles absent or to 2 mm long, blades ascending to horizontal, elliptic to linear-elliptic to lance-elliptic (to oblanceolate), 21–59(–90) mm long, 2.5–12(–28) mm wide, (2–)3.6–13.6 × longer than wide, subrounded to acute at apex, acute at base, surfaces glabrous, margin entire to subcrenate, ciliolate. Inflorescence of axillary pedunculate loosely-flowered spikes (or branched and becoming panicles of spikes) to 120(–150) mm long (including peduncles and excluding corollas), peduncles to 60 mm long, glabrous, spike elongate (to 115 mm long), often curved, rachis clearly visible, glabrous; dichasia alternate (i.e., 1 per node) above proximalmost node, sessile, 1-flowered. Bracts triangular to subulate, 1–2 mm long, 0.5–1 mm wide, abaxial surface glabrous or pubescent with antrorse eglandular trichomes 0.05 mm long. Bracteoles subulate to lanceolate to ovate to elliptic, 1–2 mm long, 0.3–0.7 mm wide, abaxial surface glabrous or pubescent like bracts. Flowers sessile to subsessile (i.e., with pedicels to 0.5 mm long). Calyx 5-lobed, 4.5–7 mm long (up to 8 mm long in fruit), lobes linear, 4–6.2 mm long, 0.3–1 mm wide, abaxially glabrous. Corolla pale to dark pink to pinkish purple with maroon markings on lower lip, (7–)8–11(–13) mm long, externally pubescent (at least the limb) with erect to flexuose to antrorse eglandular trichomes 0.05–0.2 mm long (the tube sometimes mostly or entirely glabrous), tube slightly expanded distally, 3.5–5(–6) mm long, 1–1.8 mm in diameter, upper lip (3–)4–6 mm long, lobes 0.2–0.6 mm long, lower lip (3.5–)5–7(–9) mm long, lobes (1–)2–4.5 mm long, (0.6–)1–4 mm wide, lateral lobes barely diverging or diverging from central lobe at angles <45°. Stamens 3.5–5 mm long, filaments glabrous, thecae maroon, subperpendicular to perpendicular, superposed (gap 0.3–0.7 mm long), 0.7–1.6 mm long, unequal in size (lower theca longer), upper theca glabrous and lacking appendage, lower theca glabrous and with a basal appendage 0.05–0.2 mm long; pollen 2-aperturate, apertures flanked on each side by 1 row of insulae (insulae sometimes ± coalescing into a band), exine reticulate. Style 5–8 mm long, distally glabrous, proximally pubescent (sometimes sparsely so) with glandular and eglandular trichomes, stigma unequally 2-lobed, 1 lobe ± obsolete, up to 0.1 mm long, other lobe 0.2 mm long. Capsule 9–13 mm long, glabrous, stipe 3–5.5 mm long, head ellipsoid with slight medial constriction, 6–7.5 mm long. Seeds 4, discoid, 2–3 mm long, 1.9–2.7 mm

wide, surfaces and margin \pm rugose and covered with minute trichomelike subconical papillae up to 0.05 mm long, margin not differentiated from remainder of surface (i.e., seed lacking a distinct peripheral band) or sometimes slightly thickened, entire to \pm crenate.

Phenology.—Flowering: March (cleistogamous flowers only), April–October; fruiting: May–October.

Distribution and habitats.—United States (Alabama, Arkansas, Florida, Georgia, Illinois, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, Texas); Texas plants occur in and along streams, roadside ditches, ponds, swamps, bayous, marshy meadows, and low/wet bottomlands at elevations from 1 to 56(–140) m. In Texas, the distribution (Fig. 1) is generally limited to the easternmost six ecoregions: Coastal Plains and Flatwoods (Western Gulf), Mid Coastal Plains (Western), Oak Woods and Prairies, Louisiana Coastal Prairies and Marshes, Eastern Gulf Prairies and Marshes, and Central Gulf Prairies and Marshes.

This species is endemic to the southeastern United States (primarily Gulf coastal plain) and the southern half of the Mississippi River valley. *Letterman 381* at F, which was collected in 1882 from Baird (Callahan County) at about 450 m elevation, pertains to *J. lanceolata*. This locality is well to the west of the range of other plants in Texas, and considerably higher in elevation. Whether presence of the species there is attributable to a labeling error for the collection or an outlying occurrence in the Rolling Plains of central Texas remains to be confirmed.

Justicia lanceolata is sometimes treated (e.g., Wasshausen 1998; Diggs et al. 1999; Wunderlin and Hansen 2003) as a variety of *J. ovata*, a species of Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia, that occurs primarily in the Atlantic coastal plain. Morphological distinctions and tendencies between *J. lanceolata* and *J. ovata* from throughout their ranges are summarized in the couplet below. The differences appear to be as significant as those between other species of the genus in the eastern United States, and fewer plants with characters intermediate between these two taxa have been encountered than between other pairs (e.g., *J. ovata* and *J. americana*; cf. Beal and Brown 1976) with overlapping distributions.

1. Spike not secund, dichasia opposite (i.e., paired at inflorescence nodes); leaves subsessile to petiolate, petioles to 6 mm long _____ **J. ovata**
 1. Spike secund, dichasia above basal node alternate (i.e., solitary at inflorescence nodes); leaves sessile to subsessile, petioles to 2 mm long _____ **J. lanceolata**

Although there is overlap in leaf shape and size, in general leaves of *J. lanceolata* tend to be narrower than those of *J. ovata*. The inflorescence character provides a much better means of distinguishing between these taxa. Another character that might help to distinguish these species is the relative positions of the two thecae of an anther. Among limited specimens examined from throughout their ranges, thecae of *J. lanceolata* are superposed (either contiguous or with a gap between them to 0.7 mm), whereas those of *J. ovata* are unequally inserted (overlapping by up to 0.3 mm). There is little question that these two species are similar and likely closely related. Their distributions overlap in southern Georgia, north-central to northwestern Florida, and southern Alabama.

Chapman (1860) did not cite a type or specimens from which to choose one in his protologue. The types of names in Chapman's 1860 *Flora of the Southern United States* went to Columbia College/University (Stafleu and Cowan 1976), and are now at NY. There are two specimens at NY (ex Columbia) that likely represent syntypes of this species. One was collected by Chapman in Florida; the other bears a label of the Chapman Herbarium and was also collected in Florida. Both bear Chapman's name in what appears to be his handwriting, correspond to the protologue, and represent *J. lanceolata*. The specimen with the printed "Herb. Chapman" label is a more complete specimen and is designated as the lectotype above. The other specimen is likely a duplicate of this collection.

Additional Texas specimens examined: **Angelina Co.**: 0.25 mi S of Angelina River on US Hwy. 59, *V. Cory 56747* (SMU); Bodan Creek, 6 mi SE of Wells, *L. Shimmers 24446* (SMU). **Bowie Co.**: 7 mi W of Texarkana on Hwy. 82, *E. Whitehouse 21417* (SMU). **Brazoria Co.**: San Bernard Refuge, *R. Fleetwood 9759* (TEX); Eaglenest Lake, 10 mi N of West Columbia, *R. Fleetwood 10354* (MO). **Brazos Co.**: banks of Navasota River near mouth of Carters Creek, *P. Fryxell 1852* (BRIT, NY); Bryan, *E. Palmer 11761* (GH, MO, NY, US); E of Bryan, *R. Reeves 356* (US); Navasota River, *R. Reeves 357* (US). **Burleson Co.**: 6 mi W of Snook on Hwy. 60, *P. Fryxell 3118* (MICH, NY, SMU, TEX). **Callahan Co.**: Baird, *G. Letterman 381* (F). **Cass Co.**: Cypress Creek on Hwy. 11 E of Hughes Springs, *E. Whitehouse 20277* (SMU). **Chambers Co.**: Trinity River bot-

toms, ca. 2 mi N of Cove on Texas Hwy. 73, A. *Traverse* 794 (LL, SMU); 7.8 mi N of High Island, V. *Cory* 20212 (GH); between RR tracks and Hwy. 124, 4.6 mi S of Winnie (ca. 25 mi SW of Beaumont), M. *LeLong* s.n. (NCU); along I-10 at Trinity River Bridge and town of Wallisville, R. *Worthington* 7431 (CAS). **Cherokee Co.:** ca. 14.5 mi SE of Troup, ca. 5.7 mi N of Hwy. 79, G. *Ajilvsgi* 6724 (BRIT). **Colorado Co.:** Columbia, *Bush* 1496 (MO); Altair, B. *Tharp* 2669 (TEX, US). **Fort Bend Co.:** Hale Ranch, 16 mi SE of Rosenberg, L. *Lodwick* & B. *Snyder* 564 (BRIT); rest area on I-10 at Brookshire (ca. 20 mi W of edge of Houston), T. *Van Devender* & R. *Van Devender* 93-692 (ARIZ, CAS). **Galveston Co.:** 0.25 mi N of Link Road behind old Bradshaw Nursery, League City, F. *Waller* 3807 (GH, TEX). **Gregg Co.:** without locality, *York* s.n. (TEX). **Grimes Co.:** FM 244, 0.9 mi S of Hwy. 30, S. *Jasper* E04-2 (TAMU). **Hardin Co.:** near Sour Lake, Sour Lake–Beaumont road, above Pine Island Bayou, C. *Lundell* & A. *Lundell* 14107 (LL, SMU, US); 7 mi N of Kountze, E. *Whitehouse* 23289 (SMU). **Harris Co.:** Houston, B. *Bush* 256 (MO); vicinity of Houston, R. *Dixon* 620 (F); Houston, G. *Fisher* 1739 (US), s.n. (UC); Houston, E. *Hall* 424 (F, GH, MO, NY, US); Houston, E. *Johnston* s.n. (DAV); 5 mi W of Houston, White Oak Bayou, F. *Lindheimer* 159 (F, GH, MO, UC); near Houston, F. *Lindheimer* s.n. (SMU). **Harrison Co.:** 2.75 mi E of Karnack, V. *Cory* 22889 (GH); Caddo Lake State Park, near boat ramp, R. *Fleetwood* 12243 (BRIT). **Henderson Co.:** just S of Chandler on rte. 315, Kickapoo Creek, D. *Correll* & H. *Correll* 28537 (US); off Hwy. 31, Cedar Creek, E of Trinidad, C. *Lundell* 15097 (LL, US); 9.5 mi S of Athens, L. *Shinners* 19125 (SMU). **Houston Co.:** Grapeland, *LeSueur* & *Smith* s.n. (PH, TEX). **Jasper Co.:** 2.33 mi S of Jasper, V. *Cory* 56580 (SMU, US). **Jefferson Co.:** 5 mi S of Grayburg, D. *Correll* 16471 (LL, SMU). **Lamar Co.:** Hinckley, F. *Thurow* s.n. (US). **Leon Co.:** Fort Boggy State Park, 4 mi S of Centerville on Hwy. 75, E. *Nixon* 17715 (BRIT); 4.8 mi S of Centerville, L. *Shinners* 24282 (SMU). **Liberty Co.:** jct. Trinity River and Hwy. 105, E. *Nixon* 4201 (NCU); 1 mi W of Hardin Co. on Texas Hwy. 105, R. *Thomas* et al. 39733 (BRIT). **Madison Co.:** CR 431, ca. 5.3 mi W of North Zulch, A. *Neil* 59 (TAMU); Navasota River at Hwy. 21 bridge, A. *Neill* 284 (TAMU). **Montgomery Co.:** without locality, R. *Dixon* 496 (F); 13 mi S of Conroe, Hwy. 75, B. *Turner* 2910 (SMU). **Nacogdoches Co.:** 10.5 mi SW of Nacogdoches, V. *Cory* 10677 (GH), 10678 (GH). **Newton Co.:** without locality, *Tharp* s.n. (TEX). **Orange Co.:** N of Neches River, near Beaumont, R. *Crockett* 7020 (LL, US); I-10, ca. 12 mi W of Orange, J. *Crutchfield* 2540 (LL NY). **Panola Co.:** 18.4 mi NW on FR 31 from its jct. with Hwy. 84 in Logansport, La., S. *Jones* & G. *Jones* 3677 (ARIZ); 0.7 mi NE of Sabine River and Hwy. 59, W. *Lewis* & R. *Oliver* 5311 (SMU); 8 mi NE of Carthage, Sabine River bottoms, L. *Shinners* 15654 (SMU). **Polk Co.:** 4.33 mi E of Corrigan, V. *Cory* 22146 (GH); 5.5 mi W of Corrigan, D. *Correll* & H. *Correll* 38962 (GH, LL, UC); jct. hwy. 1926 and 938, Big Sandy Section, Big Thicket National Preserve, L. *Dorr* et al. 2184 (MO, NCU). **Red River Co.:** Lennox Woods Nature Preserve, 10 mi N of Clarksville on SH 37, 1.5 mi W along FM 2118 (to Mt. Pleasant community), and 1 mi S along county road, Pecan Bayou, 33.45 N, 95.05 W, R. *Sanders* 1966 (BRIT, TEX); 16.5 mi N of Clarksville on Hwy. 37, E. *Whitehouse* 20570 (SMU). **Robertson Co.:** Walnut Creek at SH 6, 30°22.21'N, 96°20.56'W, D. *Arrington* & K. *Winemiller* BRA-07-26 (TAMU); see page above Navasota River at Camp Cooley Ranch, T. *Starbuck* 2233 (TAMU); US Hwy. 79 and Navasota River, T. *Starbuck* 2404a (TAMU). **Rusk Co.:** 0.5 mi W of jct. hwy. 322 and 149, S of Longview, R. *Mitchell* 3173 (LL). **Sabine Co.:** 4 mi N of Hemphill, V. *Cory* 22749 (GH). **San Augustin Co.:** ca. 6 mi NW of Denning, D. *Correll* 27428 (LL). **San Jacinto Co.:** Rt. 150, ca. 4 mi W of Sheperd, D. *Correll* & J. *Crutchfield* 30979 (GH, LL, UC); ca. 7 mi NNW of Cleveland on Tex. Hwy. 2025 in Sam Houston Natl. Forest, J. *Strother* 201 (DS, SMU, TEX). **Shelby Co.:** 4.9 mi E on FM 139 at Chambers Creek Bayou from its jct. with FM 2427, S. *Jones* et al. 1368 (TAES). **Smith Co.:** swamps, Big Sandy, *Reverchon* 2031 (MO). **Titus Co.:** N of FM 127 NE of Monticello community, Blundell Creek area, P. *Amerson* 906 (SMU); ca. 1.5 mi E of Monticello on Hwy. 127, 33°06'N, 95°05'W, W. *Mahler* 6464 (SMU). **Trinity Co.:** Trinity, *Tharp* 731 (US). **Tyler Co.:** E edge of Spurger, D. *Correll* 27376 (LL, MO, NCU, SMU, UC); Town Bluff Lake, Neches River, E of Woodville, D. *Correll* & E. *Ogden* 25146 (LL, MO, SMU). **Upshur Co.:** 8.5 mi N of Ore City, at Morris Co. line, L. *Shinners* 18938 (SMU). **Van Zandt Co.:** Purts Creek State Park, W. *Carr* 9757 (TEX); 9 mi E of Edom (1.3 mi W of Neches River) on SR 64, R. *Van Vleet* 532 (SMU); near Ocean Lake N of Edgewood, E. *Whitehouse* 16456 (MICH, SMU). **Walker Co.:** Huntsville, *Tharp* s.n. (TEX). **Washington Co.:** Yegua Creek, E. *Brackett* s.n. (GH, TEX); without locale, E. *Brackett* s.n. (GH). **Wood Co.:** Little Sandy Club, Hawkins, W. *Mahler* 9957 (BRIT); Quitman, E. *McMullen* s.n. (TEX); Lake Fork Creek and adjacent pond at Hwy. 182, 4 mi E of Quitman, R. *Mitchell* 3906 (LL); Mineola, J. *Reverchon* s.n. (MO). **County undetermined:** Harrisburg, J. *Joor* s.n. (US).

Justicia longii Hilsenb., Pl. Syst. Evol. 169:231. 1990. (Figs. 4F; 5G–I). *Siphonoglossa longiflora* (Torr.) A. Gray, Syn. Fl. N. Amer. 2(1):328. 1878. *Adhatoda longiflora* Torr. in Emory, Rep. U.S. & Mex. Bound. Surv. 2(1):125. 1859, non J. *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!; ISOTYPE: F!; probable ISOTYPE: US).

Perennial herb to 3.5(–5) dm tall. Young stems subquadrate, multi-striate, evenly pubescent with 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 × longer than wide, (rounded to) acute to acuminate to subfalcate at apex, acute to subattenuate at base, surfaces puberulent with 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-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, similar to bracteoles except smaller. 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, widest above and narrowed toward 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, 28–43 mm long, 1–1.5 mm in diameter near midpoint, upper lip 5–12 mm long, 2-lobed at apex, lobes rounded, 1 mm long, 1.2 mm wide, lower lip 6–13 mm long, lobes 4–12 mm long, 3–5.6 mm wide, apically rounded. Stamens 4–7 mm long, filaments glabrous; thecae 1.4–2 mm long (including spur), equal in size, parallel, unequally inserted (overlapping by 1 mm), both spurred at base, spurs to 0.3 mm long; pollen 3-aperturate, apertures flanked on each side by 2(–3) rows of insulae, exine reticulate. 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, 6–6.5 mm long. Seeds 4, discoid, 2–2.5 mm long, 2–2.5 mm wide, surface and margin bubbly-tuberculate (covered with low, rounded, moundlike tubercles that do not or but barely overlap one another).

Phenology.—Flowering: unknown; fruiting: June.

Distribution and habitat.—Southwestern United States (Arizona, Texas) and northwestern Mexico (Sonora); Texas plants occur in a region of Chihuahuan desertscrub at elevations near 1515 m. In Texas the species is known only from the Chinati Mountains in Presidio County (Fig. 1), in the Basin and Range ecoregion of the Trans-Pecos. Both known collections were made in 1977.

The description above has been augmented with data from specimens collected outside of Texas. The Texan plants greatly resemble those from Arizona and Sonora (Daniel 2004), which are found in Sonoran desertscrub and thornscrub at elevations from 380 to 1360 meters. Other Acanthaceae that are disjunct between western Texas and Arizona/Sonora consist of *Carlowrightia arizonica* A. Gray and *Ruellia nudiflora* (Engelm. & A. Gray) Urb.

Morphologically similar species, and likely close relatives of *J. longii*, include *J. pilosella* and *J. masiaca* T.F. Daniel. The former species differs by the characters noted in the key above, and the latter differs by its corolla with a purplish limb and pollen that is 4-aperturate (Daniel 2004).

Daniel (2004) briefly discussed the typification of *Adhatoda longiflora*, but neglected to provide relevant details. Collection data on the type specimen from Torrey's herbarium at NY is complete and matches that in the protologue. The specimen is annotated in Torrey's hand with the name as published, "*Adhatoda ? longiflora*," and it includes attached drawings with floral details (that are included in Torrey's description) based on dissected flowers. This specimen was treated as the holotype by Hilsenbeck (1990) and Daniel (2004); however, Hilsenbeck annotated it as the lectotype in 1982. A duplicate of Schott's collection is extant at F, and a likely duplicate (bearing only the Boundary Survey number, "726") is at US; both collections were annotated by Hilsenbeck as isolectotypes. The specimen at F is mounted on a sheet with several other collections of this species made by Schott that lack correlation with accompanying labels. The label includes Schott's number, locality, and the year of collection, but does not bear Torrey's name or handwriting. It is not known to which of the various plants on the sheet this label pertains, however. The specimen at US lacks Torrey's name or handwriting; "*Adhatoda Torr*" is written on the Mexican Boundary Survey Label in a hand similar to, but not identical with that of Torrey. It appears that instead of two, or possibly three syntypes, the specimen at NY is the only one known to have been used by Torrey in preparing his protologue. It is thus treated as the holotype.

Texas specimens examined: **Presidio Co.**: lower San Antonio Canyon, S side of Chinati Mts., *M. Butterwick* & *E. Lott 3864b* (TEX); Chinati Mts., *M. Butterwick* & *E. Lott 3872* (TEX).

Justicia pacifica (Oerst.) Hemsl., *Biol. Cent.-Amer., Bot.* 2:515. 1882. (Figs. 4E; 6A–C). *Adhatoda pacifica* Oerst., *Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn* 1854. 164. 1855. TYPE: MEXICO. OAXACA: Pacific Coast, Puerto de Santa Cruz, Oct 1842, *F. Liebmann 10687* (HOLOTYPE: C!).

Justicia furcata Jacq., *Pl. Rar. Hort. Schoenbr.* 1:2, t. 3. 1797, nom. illegit. (non Lam. 1785, which appears to pertain to *Ruellia paniculata* L.).

Adhatoda furcata (Jacq.) Nees in *Alph. de Candolle, Prodr.* 11:398. 1847. *Ecbolium furcatum* (Jacq.) Kuntze, *Revis. Gen. Pl.* 2:980. 1891.

Adhatoda furcata var. *terminalis* Nees in *Alph. de Candolle, Prodr.* 11:398. 1847. *Justicia furcata* Jacq. var. *terminalis* (Nees) Greenm., *Publ. Field Columbian Mus., Bot. Ser.* 2:262. 1907. TYPE: MEXICO: syntypes of Andrieux and Galeotti from Oaxaca, and Berlandier from the Valley of Mexico were cited.

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).

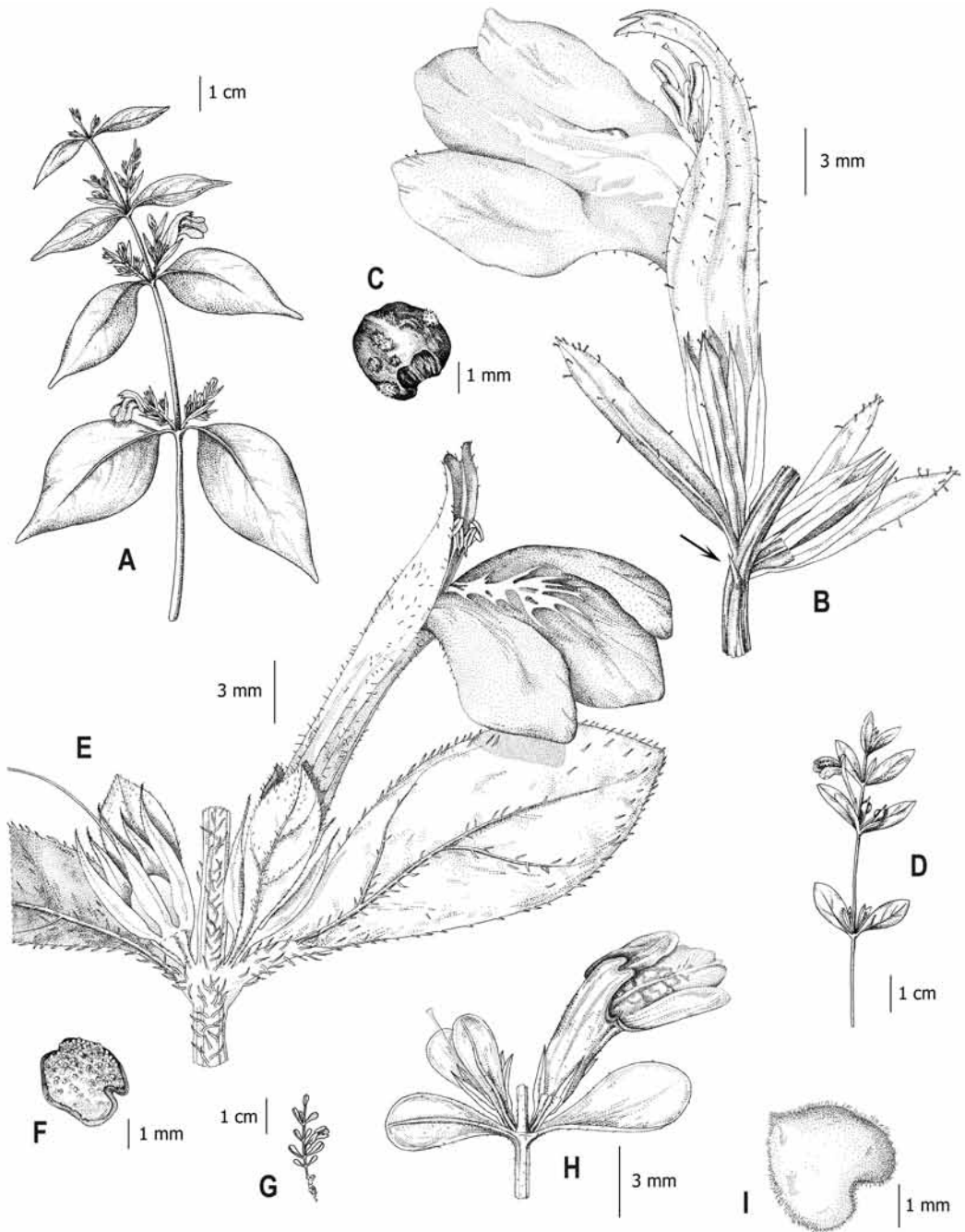


FIG. 6. Texas species of *Justicia*-II. A–C. *J. pacifica*. A. Habit (Daniel 419 and Hernández M. et al. 6371). B. Inflorescence node (Daniel 419 and Hernández M. et al. 6371) with one fertile bract partially removed on right, arrow indicates a sterile bract. C. Seed (Daniel 9771). D–F. *J. pilosella*. D. Habit (Daniel 186). E. Fertile node (Daniel 186) with one bracteole partially removed on left. F. Seed (Reina G. & Van Devender 2003-864). G–I. *J. wrightii* (Turner & Turner 96-95). G. Habit. H. Fertile node with one bracteole partially removed on right). I. Seed. Drawn by J. Weller.

Justicia runyonii Small, *Addisonia* 15:29. 1930. TYPE: U.S.A. TEXAS: Cameron Co.: near Brownsville, R. Runyon s.n.; collection from plants "grown in prop. house. #56095" (LECTOTYPE, designated here: NY!).

Reclining to erect perennial herbs to 1 m tall. Young stems subterete to subquadrate, multistriate, internodes mostly glabrous, nodes usually pubescent with antrorse to retrorse to antrorsely or retrorsely appressed eglandular trichomes 0.1–0.3 mm long, the trichomes sometimes extending several mm down the internode in 2 lines. Leaves petiolate, petioles to 4(–8) mm long, blades ovate to ovate-elliptic to narrowly elliptic to linear, 27–150 mm long, 2.6–43 mm wide, 2.5–19 × longer than wide, acuminate at apex, acute to attenuate at base, surfaces sparsely pubescent with antrorse to antrorsely appressed eglandular trichomes, margin entire to crenate, ciliate with trichomes like those on surfaces. Inflorescence of axillary and terminal dichasiate spikes (rarely of 1-flowered dichasia in leaf axils); axillary spikes sessile or borne on peduncles to 2 mm long, spikes (or 1-flowered dichasia) mostly opposite, 1–2 per axil, to 18 mm long (excluding corollas), rachis glabrous or sparsely pubescent with flexuose to antrorse eglandular trichomes 0.1 mm long, dichasia alternate, sessile, 1-flowered, bracts heteromorphic, subopposite to alternate, fertile bracts linear to lance-linear, 6–10 mm long, 0.9–1.5 mm wide, abaxial surface pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.2 mm long and distally with erect to flexuose glandular trichomes 0.1–0.2 mm long as well, sterile bracts smaller than fertile bracts, linear, 1–10 mm long, 0.1–0.7 mm wide, nearly glabrous or pubescent like fertile bracts; terminal spikes to 20 mm long, rachis pubescent like young stems, dichasia opposite, sessile, 1-flowered, bracts homomorphic, linear, 8–17 mm long, 0.7–1.5 mm wide, abaxial surface pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.2 mm long and distally often with flexuose glandular trichomes 0.05–0.2 mm long as well. Bracteoles linear, 4–9 mm long, 0.3–0.7 mm wide, pubescent like bracts. Flowers sessile. Calyx 5-lobed, 4–9 mm long, lobes lanceolate, 3.3–8 mm long, 1–1.6 mm wide, margin hyaline or lighter colored than central portion, abaxially glabrous or sparsely pubescent with antrorse eglandular trichomes 0.05 mm long. Corolla pinkish to violet with white markings on lower lip, 12–23 mm long, externally pubescent with erect to flexuose glandular (and sometimes eglandular as well) trichomes 0.1–0.2 mm long, tube 5–10 mm long, ampliate distally, upper lip 7.5–14 mm long, 2-lobed, lower lip 7–15 mm long, lobes 4–8 mm long, 3–6 mm wide. Stamens 6.5–12 mm long, filaments glabrous, thecae parallel, unequally inserted (overlapping by 0.5 mm), unequal in size (lower theca larger), 1.4–2.3 mm long (including basal appendage), glabrous or the upper theca dorsally pubescent with eglandular trichomes, lower theca with a basal appendage 0.05–0.3 mm long; pollen 2-aperturate, apertures flanked on each side by 2 rows of insulae, exine reticulate. Style 11–16 mm long, distally glabrous, proximally pubescent with eglandular trichomes, stigma 0.1 mm long, lobes not evident. Capsule 10–15 mm long, pubescent with erect to flexuose to retrorse eglandular trichomes 0.05–0.1 mm long, head ovoid to ellipsoid with a medial constriction, 7–9 mm long. Seeds 4, subspherical, 2.5–3 mm long, 2.3–2.9 mm wide, surfaces smooth, covered with deciduous trichomes to 0.05 mm long.

Phenology.—Flowering: July–December; fruiting: September–December.

Distribution and habitats.—United States (southern Texas), Mexico, Guatemala; Texas plants occur in thornscrub and evergreen woodlands, mostly on sandy soils at elevations from 4 to 21 m. In Texas, the species is limited to the Rio Grande Plains in the southernmost region of the state (Fig. 1). The occurrence of this species in Goliad County, well to the north of its other known occurrences (Wasshausen 1966; Turner et al. 2003; Poole et al. 2007), is based on a series of collections from an unspecified locale by E. F. Owens in 1940. These specimens indeed conform to the species, which has not been recollected in Goliad County since then.

In Texas this species has been known as *J. runyonii*. Small (1930) noted that it had evidently eluded botanists of the Mexican Boundary Survey and that the species had not been collected until 1922 when Robert Runyon found it on the banks of the Resaca Viejo, about five miles east of Brownsville. Small also noted its decorative potential, horticultural value, and drought tolerance. He indicated that it flowers sporadically, but following the autumn rains it blooms profusely.

On the label of one of his collections of this species, Runyon perceptively noted that this was "probably a Mexican specie[s] entering this region." I am convinced that he was correct in his speculation. Indeed, *J. runyonii* is indistinguishable from Mexican plants that have been associated with the following names: *J. furcata*

Jacq. (nom. illegit.; e.g., Sánchez S. 1979), *J. caudata* (Daniel 1995, 2004), and *J. pacifica*. All of these names pertain to plants as described above for Texan collections. While I suspect an older name that will apply to the North American plants lurks among West Indian or South American species in the little-studied *J. periplocifolia/sphaerosperma* complex, I herewith use the oldest legitimate name that has been applied to Mexican plants that correspond to *J. runyonii*, until such time as the taxonomy and nomenclature of the West Indian and South American species have been resolved.

In the protologue of *J. runyonii* Small discussed both wild plants from Texas and cultivated plants grown at the New York Botanical Garden, but he did not cite specific specimens. At NY, there is a specimen collected by Robert Runyon near Brownsville in Cameron County, and grown in a propagation house at the New York Botanical Garden. The specimen bears a date of 1925 (whether this refers to the collection in the field or collection of the cultivated plants remains uncertain) and was annotated as a probable holotype in 1982. A specimen from the Runyon Herbarium at LL was collected by Runyon (no. 569) on 20 October 1923 “in El Jardin tract about 5 miles from Brownsville, Texas.” The specimen was identified by Small as *J. runyonii* at an unknown date. Both specimens are likely syntypes of *J. runyonii*, and the cultivated specimen at NY is designated as the lectotype above.

Additional Texas specimens examined: **Cameron Co.:** USFWS tract on E side of South Thompson Rd., 1.3 mi S of jct. F.M. 107 (1.9 air mi SE of jct. F.M. 107 and F.M. 506 at Santa Rosa, 26°14'N, 97°48'W, W. Carr et al. 11572 (TEX); 4 mi E of La Paloma, D. Correll & I. Johnston 17977 (LL); 2.5 mi NE of Olmito, V. Cory 36473 (GH); Resaca del Rancho Viejo (“Old Cannon Resaca”), I. Davis 53-593 (TEX); Lower Adams Tract, L. Davis & M. Johnston s.n. (TEX); Resaca at Olmito, R. Fleetwood 11557 (SMU); Beaumont levee, 2.4 mi N of Lozano, M. Johnston 2757 (SMU, TEX); Olmito, J. Rose & P. Russell 24188 (US); El Jardin tract, ca. 5 mi from Brownsville, R. Runyon 569 (LL, US); near Barreda, 13 mi N of Brownsville, R. Runyon 3259 (TEX); near Barreda, R. Runyon 3555 (TEX). **Goliad Co.:** without locale, E. Owens 3149 (TAES), 3150 (TAES), 3151 (TAES). **Hidalgo Co.:** Methodist Camp Thicket S of Weslaco on Rt. 1015, just N of Llano Grande Lake, B. Ertter & J. Larke 5232 (CAS, NY); Santa Ana Natl. Wildlife Refuge, S of Alamo, R. Fleetwood 3166 (TEX). **Willacy Co.:** Yturria Ranch, ca. 0.8 mi NNE of Atwood windmill, ca. 2.3–2.4 mi SSE of Villareal Artesian Well, 26°35'13.8"N, 97°38'39"W, W. Carr & S. Najera 26526 (TEX).

Justicia pilosella (Nees) Hilsenb., Pl. Syst. Evol. 169:225. 1990. (Figs. 4C; 6D–F). *Monechma pilosella* Nees in A. de Candolle, Prodr. 11:412. 1847. *Siphonoglossa pilosella* (Nees) Torr. in Emory, Rep. U.S. Mex. Bound. Surv. 2(1):124. 1859. TYPE: U.S.A. TEXAS: between Brazoria and San Felipe, 1835, T. Drummond coll. 3, 255 (HOLOTYPE: K ex hb. Bentham; ISOTYPE: K ex hb. Hooker).

Adhatoda dipteracantha Nees in A. de Candolle, Prodr. 11:396. 1847. *Siphonoglossa dipteracantha* (Nees) A. Heller, Contr. Herb. Franklin & Marshall College 1:95. 1895. TYPE: MEXICO. TAMAULIPAS: ad Tampico de Tamaulipas, without date, J. Berlandier 192 (LECTOTYPE, designated by Hilsenbeck, 1990: G-DC; presumed ISOLECTOTYPE: G-Moricandl!).

Dipteracanthus procumbens Nees in A. de Candolle, Prodr. 11:133. 1847, invalid name (not accepted in original publication, see discussion below).

Siphonoglossa greggii Greenm. & C.H. Thomps., Ann. Missouri Bot. Gard. 1:409. 1914. TYPE: MEXICO. TAMAULIPAS: Matamoros, 7 Jun 1847, J. Gregg 915 (HOLOTYPE: MO!).

Justicia turneri Hilsenb., Pl. Syst. Evol. 169:227. 1990. TYPE: U.S.A. TEXAS: Cameron Co.: vicinity of Brownsville, 10 m, 11 Jun 1941, R. Runyon 2773 [cited as “2273” in protologue](HOLOTYPE: TEX!; ISOTYPE: US!).

Perennial herbs to 3.5 dm tall, sometimes trailing. Young stems subquadrate to quadrate with 4 longitudinal grooves, internodes 2-fariously pubescent with retrorse to retrorsely appressed eglandular trichomes 0.3–1 mm long and ± evenly pubescent with flexuose to flexuose-retrorse eglandular trichomes 0.5–1.3 mm long (latter trichomes sometimes sparse or absent) or internodes evenly pubescent with erect to flexuose to flexuose-retrorse eglandular trichomes 0.7–2 mm long. Leaves petiolate, petioles to 5 mm long, blades concolorous or discolorous, lance-ovate to ovate to narrowly or broadly elliptic, 9–53 mm long, 3.5–23 mm wide, 1.4–5.3 × longer than wide, rounded to acute at apex, (rounded to) acute at base, surfaces and margin pubescent (sometimes very sparsely so and/or with trichomes of surfaces restricted to midvein) with erect to flexuose to antrorse to antrorsely appressed eglandular (rarely also with scattered glandular) trichomes to 1.4 mm long, abaxial surface sometimes inconspicuously glandular punctate, margin entire to subsinuate. Inflorescence of sessile to subsessile dichasia in leaf axils, peduncles (if present) to 2 mm long; dichasia opposite or alternate, 1(–2) per axil, 1-flowered. Bracteoles subsessile to petiolate, oblanceolate to obovate to elliptic or subfoliose, 4–16 mm long, 1–5.5 mm wide, abaxial surface pubescent like leaves. Flowers sessile to subsessile (i.e., pedicels to 0.5 mm long). Calyx 5-lobed, 3.5–9 mm long, lobes subulate to lance-subulate, 2–7.6 mm long, 0.3–0.9

mm wide, usually widest at base, abaxially nearly glabrous or pubescent like bracteoles, margin ciliate. Corolla pinkish to light purplish with white markings on lower lip or entirely white, 12–30 mm long, externally pubescent with flexuose eglandular trichomes 0.05–0.4 mm long, tube cylindric, 8.5–19 mm long, 0.9–2 mm in diameter near midpoint, upper lip 3–9 mm long, 2-lobed at apex, lobes 0.5–1.2 mm long, lower lip 3–12 mm long, lobes 1.5–9 mm long, 1.5–5 mm wide. Stamens 3–7 mm long, filaments glabrous, thecae subparallel to subperpendicular, 0.7–1.6 mm long, subequal in length, glabrous, subequally to unequally inserted (overlapping by 0.5–1 mm), lower theca with an inconspicuous basal appendage 0.05–0.2 mm long; pollen 2-aperturate, apertures flanked on each side by 1–2 rows of insulae (sometimes incompletely formed or peninsulae), interapertural exine reticulate. Style 12–20 mm long, glabrous or sometimes pubescent near base with antrorse eglandular trichomes, stigma 0.1–0.2 mm long, equally to unequally 2-lobed or lobes not evident. Capsule 5–10 mm long, glabrous, head ovoid to ellipsoid, 4–6 mm long. Seeds 4, discoid, reddish or orangish turning dark brown when mature, 2.2–3.2 mm long, 2–3.3 mm wide, surface covered with low and rounded (\pm mound-like) non-overlapping tubercles.

Phenology.—Flowering: all year; fruiting: all year.

Distribution and habitats.—Southwestern United States (Texas and New Mexico) and Mexico (Chihuahua, Coahuila, Durango, Guanajuato, Hidalgo, Nuevo León, Puebla, Querétaro, San Luis Potosí, Tamaulipas, Zacatecas); in Texas plants occur mostly in association with limestone in arid and semi-arid regions of west-central, southern, and western regions of the state (Fig. 1) on rocky slopes, and along watercourses, roadsides, and fencerows in several biotic communities (e.g., Chihuahuan desertscrub, desert grassland, mesquite scrub, oak scrub, juniper woodland, oak-juniper woodland, oak woodland, pecan-cypress riparian forest) at elevations from 6 to 1660 m. The widespread species occurs in at least eight ecoregions of Texas, but is most abundant in the Rio Grande Plains, Stockton Plateau, Edwards Plateau, Basin and Range, and Rolling Plains.

Justicia turneri was previously known in Texan botanical literature as *Siphonoglossa greggii*, and distinguished from *J. pilosella* by its cauline pubescence consisting of retrorse trichomes disposed in decussating lines (vs. spreading and evenly disposed trichomes; e.g., Correll and Johnston 1970). Hilsenbeck (1990) indicated that the type of *S. greggii* pertained to *J. pilosella*, but that the species, as represented by paratypes, was distinctive. Thus, he described a new species, *J. turneri*, based on the paratypes and additional collections. Hilsenbeck (1990; key on p. 225) distinguished *Justicia turneri* from *J. pilosella* on the basis of the following attributes: stem hairs mostly 0.1–0.3 mm long (vs. “mostly 0.5–1.5 mm long”) and disposed in two lines, leaves lanceolate to elliptic (vs. “rarely ovate, more often obovate to oblong”) and strongly discolorate (vs. “not conspicuously discolorate”), corolla usually white (vs. purple or pink), anthers 0.9–1.3 mm long (vs. 1.5–2.2 mm long), and seeds 2.3×2.3 mm (vs. 3.3×3 mm). In spite of Hilsenbeck’s efforts, these taxa have remained difficult to distinguish. Study of plants conforming to these taxa from northeastern Mexico also tend to “blur” the putative distinctions between them. Cauline pubescence (length, disposition, and shape) is particularly variable among both “typical” *J. pilosella* and among plants treated by Hilsenbeck (1990) as *J. turneri*. Indeed, most of the specimens annotated as *J. turneri* by Hilsenbeck have trichomes to 0.8 mm long; and sometimes these are either \pm evenly disposed to concentrated in two lines. Leaf shape varies from lanceolate to elliptic among specimens treated as *J. turneri* and ovate to elliptic to obovate among those of *J. pilosella*. Surface discoloration of the leaves (dark adaxially and light abaxially) is prevalent among most, but not all, plants identified as *J. turneri*, but can also occur in plants of *J. pilosella*. Stanford *et al.* 2139 (annotated by Hilsenbeck as *J. turneri*) from Tamaulipas does not show strong discoloration, but a plant from Querétaro (Carranza G. 734) that otherwise conforms to *J. pilosella* shows conspicuous foliar discoloration. Corolla color in plants identified as *J. turneri* by Hilsenbeck varies from white (some Texan plants) to pinkish to purplish (other Texan plants, but apparently more common in Nuevo León and Tamaulipas). In the protologue of *J. turneri* Hilsenbeck (1990) noted that flowers of the species were rarely lavender or pink. He discussed a form of the species from near Monterrey with both purple flowers and a “very densely hispid pubescence throughout.” Richardson collected plants (1406, 1407) at Olmito Lake in Cameron County with pink corollas (with white stripes) and others with white corollas. Label data on Runyon 3257 from the same locality noted the occurrence of plants with either white or

purple corollas there. Runyon also noted that seeds from white-flowered plants produced progeny with white corollas. In Hidalgo County, Ertter collected plants with leaves discolorate and lanceolate to elliptic, and with stems 2-fariously pubescent with retrorse trichomes to 0.6 mm long. Both white-flowered plants (5230a) and violet-flowered plants (5230) were encountered in this population. Anther thecae among specimens treated as *J. turneri* vary from 0.7–1.4 mm long, whereas those among specimens of *J. pilosella* vary from 1–1.6 mm long. Seed size among specimens treated as *J. turneri* varies from 2.2–2.8 × 2–2.9, whereas it varies from 2.5–3.2 × 2.5–3.3 among specimens of *J. pilosella*.

The considerable variation and overlap among the character states used by Hilsenbeck (1990) to distinguish these two taxa preclude recognition of *J. turneri* as a distinct species based on them. Other superficially similar, and likely closely related, species from northern Mexico appear to differ from *J. pilosella* in several characters. For example, *J. decurvata* Hilsenb., from Durango, differs by its linear to lance-linear leaves 2–4 mm wide and evenly puberulent young stems with trichomes to 0.3 mm long; and *J. hintoniorum* Nesom, from Nuevo León, differs by its corollas 31–35 mm long and capsules 10–11 mm long that are pubescent with eglandular trichomes.

Some plants of *J. pilosella* from southern Texas (e.g., *Daniel 191* at CAS and *Cory 51455* at CAS, both from Cameron County) and adjacent regions of Tamaulipas (e.g., *Daniel & Baker 3691* at CAS) and Nuevo León (*Daniel & Baker 3630* at CAS), have flexuose glandular trichomes on the bracteoles (and sometimes on adjacent leaves). These glands appear to be present on some (but not all) plants that have discolorate and lanceolate to ovate to elliptic leaves.

Hilsenbeck's (1990) lectotypification of the sole specimen ("Drummond ! coll. 3, n. 255, in h. Bentham") cited in the protologue of *Monechma pilosella* would appear to be unnecessary.

The name "*Dipteracanthus procumbens*" is treated as invalid for the following reason. Nees (1847) described "*Dipteracanthus procumbens*" as a new species on page 133 of de Candolle's *Prodromus*. There, he cited a single specimen: *Berlandier 192* from Tampico de Tamaulipas, Mexico, in Moricand's herbarium. On page 396 of the same work, Nees described *Adhatoda dipteracantha* as a new species based on 1) *Berlandier 192* from Tamaulipas as seen in the herbaria of de Candolle and Moricand, and 2) Drummond's "coll. 3 n. 250 in h. Hooker" from "Belio Bragosa et S. Felipe in prov. Texas." Under *A. dipteracantha*, he also cited as a synonym: "*Dipteracanthus procumbens* N. ab E.! in h. Moricand." Both pages were published simultaneously in 1847. Because "*Dipteracanthus procumbens*" was not accepted by the author in the original publication (i.e., he treated it both as the name of a new species and as a synonym for another name), according to Article 34.1 of the International Code of Botanical Nomenclature (McNeill et al. 2006) it is not validly published; however, *A. dipteracantha* is. Hilsenbeck (1990) designated *Berlandier 192* at G-DC as the lectotype of the latter name based on the microfiche of that specimen. Data on *Berlandier 192* at G-Moricand, a presumed isolectotype of *Adhatoda dipteracantha*, reveal that it was collected in 1827.

Representative Texas specimens examined: **Atascosa Co.:** 5.75 mi E of Pleasanton, *V. Cory 55364* (SMU, US). **Bexar Co.:** S of San Antonio, *E. Bogusch & M. Bogusch 4705* (F); 11 mi N of San Antonio, *M. Clare 86* (CAS, MICH); San Antonio, *J. Clemens & Clemens 1061* (CAS, DS, MO); near Bracken, *B. Groth 79* (F); Comanche Springs, New Braunfels, *F. Lindheimer 1065* (F, P, UC, US). **Blanco Co.:** Edwards Plateau, Pedernales River near Pedernales Falls, ca. 30°20'N, 98°15'W, *T. Daniel & M. Butterwick 8962* (CAS); Pedernales Falls State Park, *B. Ertter et al. 4879* (CAS). **Brewster Co.:** Hwy. 385, 12.1 mi S of jct. Hwy. 385 and Hwy. 90, *T. Daniel 115* (CAS); 10 mi E of Alpine, *C. Rowell 11542* (SMU, UC); Hwy. 223, ca. 1 mi N of Alpine, *O. Sperry T1055* (UC); ca. 11 mi S of Marathon, *O. Sperry 1560* (UC); ca. 16 mi E of Alpine, *B. Warnock 46571* (TEX, UC). **Brown Co.:** Brownwood, *E. Palmer 26803* (MO); Brownwood, *H. Purvis 3* (LL, SMU). **Burnet Co.:** Mormon Hole near Mormon Mills, Hamilton Creek, *D. Correll & H. Correll 12719* (SMU); along Colorado River, *S. Wolff 3214* (US). **Callahan Co.:** Baird, *G. Letterman 29* (MO), 389 (F); ca. 3 mi W of Putnam on US Hwy. 80, *N. Henderson 62-779* (SMU); Baird, *J. Reverchon 728* (F). **Cameron Co.:** Rio Hondo, *H. Chandler 7081* (MO); Arroyo Colorado, Harlingen, *D. Correll 28966* (LL, MO, US); Arroyo Colorado, just E of Harlingen, *D. Correll & I. Johnston 17901* (LL, MO, SMU); 4 mi E of La Paloma, *D. Correll & I. Johnston 17974* (LL); Resaca del Rancho Viejo, 0.5 mi SW of Olmito, *V. Cory 51455* (DS, GH, SMU, TEX, US); Camp Perry (Boy Scout Camp) near Hwy. 1420, 2.9 mi S of Willacy Co. line, *T. Daniel 191* (CAS, MICH); near Resaca del Rancho Viejo, NE of Brownsville, *N. Hotchkiss 6145* (US); near Port Isabel, *C. Lundell & A. Lundell 8659* (LL, MICH, SMU, US); Olmito Lake, Olmito, *A. Richardson 1406* (TEX), 1407 (TEX); Olmito, *J. Rose & P. Russell 24187b* (US), 24189 (US); La Feria, *R. Runyon 63* (TEX, US); Brownsville, *R. Runyon 370* (TEX), 422 (TEX); Loma near coast, *R. Runyon 1445* (TEX, US); Olmito Lake, *R. Runyon 3257* (TEX); Barrera Station, *R. Runyon 5188* (TEX); Arroyo Colorado, Harlingen, *R. Runyon 5191* (TEX); Green Island, *B. Tharp 1211* (TEX, US). **Coke Co.:** Rancho Escondido, 0.2 mi NW of main entrance, near Wildcat Creek, UTM 3512 35227, *L. Sanchez 4341* (TEX). **Comal Co.:**

New Braunfels, *F. Lindheimer* 396 (MO, SMU), 505 (MO), *H. Ripley* & *R. Barneby* 4155 (CAS); near the Guadalupe River, *R. Wagoner* & *F. Barkley* 13802 (MO, TEX, UC). **Crockett Co.:** Hwy. 163, 18.2 mi N jct. Hwy. 163 and Hwy. 189 (east branch), *T. Daniel* 121 (CAS); rocky shades, *J. Reverchon* 728 (DS, F, MICH, MO, SMU, US). **Dewitt Co.:** Cuero, *B. Tharp* 2664 (TEX). **Dimmit Co.:** Chaparral Wildlife Management Area, near research buildings, *D. Goldman* 1853 (MO). **Duval Co.:** San Diego, *M. Croft* s.n. in 1885 (MICH); 6.7 mi SE of Freer, *L. Shimmers* 19617 (SMU); 3 mi E of Bruni on SH 359, *M. Solis* 34 (SMU). **Edwards Co.:** Hwy. 55, 18.4 mi S jct. Hwy. 55 and Hwy. 377 South in Rocksprings, *T. Daniel* 197 (ASU, CAS). **Frio Co.:** 5 mi N of Pearsall, rest area, *J. Taylor* & *B. Lipscomb* 31779 (BRIT). **Gillespie Co.:** Threadgill, *G. Jermy* 448 (US); LBJ National Historic Park, Pedernales River near Ranch House, 30°15'N, 98°37'W, *R. Sanders* 5308 (BRIT). **Goliad Co.:** McNamara Ranch, 0.2 mi NE FM 1351, SE side Hwy. 59, *S. Hill* 6146 (NY). **Gonzales Co.:** near Gonzales, *J. Drushel* 8344 (MO, US). **Guadalupe Co.:** 4.2 mi NE of New Berlin on Farm Road 775, *M. Johnston* & *W. McCart* 5099 (SMU). **Hays Co.:** San Marcos, *F. Pennell* 10435 (NY); San Marcos, *Trelease* s.n. (MO). **Hidalgo Co.:** Mission, *I. Chateau* s.n. (F); Santa Ana Wildlife Refuge, *D. Correll* & *C. Schweinfurth* 15619 (LL); West Lake, Santa Ana Wildlife Refuge, *D. Correll* & *D. Wasshausen* 27690 (LL, US); Methodist Camp Thicket S of Weslaco on Rt. 1015, just N of Llano Grande Lake, *B. Ertter et al.* 5230 (CAS, TEX), 5230a (CAS, NY); Santa Ana Wildlife Refuge, Alamo, *R. Fleetwood* 30 (US); La Joya, *R. Runyon* 2850 (TEX, US); North Edinburg, *I. Schillerr* 868 (US); McAllen, *E. Schulz* 2862 (F). **Irion Co.:** 3.1 mi SSW of Mertzon, *L. Shimmers* 31487 (SMU). **Jackson Co.:** 3 mi SE of Vanderbilt, Red Fish Bayou, *B. Turner et al.* 3308 (TEX). **Jeff Davis Co.:** Mt. Livermore, *L. Hinckley* 634 (F); Limpia Canyon, 11 mi NE of Fort Davis on Hwy. 17, *C. Lundell* & *A. Lundell* 13131 (SMU); Davis Mt. State Park, Davis Mts., 7.4 km W of Fort Davis on TEX 118, 30°36'N, 103°56'W, *A. Reina* & *T. Van Devender* 2003-864 (CAS); Davis Mts., *S. Tracy* & *F. Earle* 351 (US). **Jim Hogg Co.:** Farm Rd. 649, Vela Pena Ranch, 20 mi S of Miranda City, *R. Sanchez et al.* 8314 (TEX). **Jim Wells Co.:** N of Alice, *C. Albers* 46370 (TEX, UC); 4 mi W of Alice, *L. Shimmers* 19578 (SMU). **Karnes Co.:** 1.5 mi SE of Falls City on US Hwy. 181, *J. Johnson* 1029 (US). **Kendall Co.:** 14 km (air) NNE of Boerne, Camp Alzafar, vic. Guadalupe River, *C. Lieb* 560 (NY). **Kenedy Co.:** King Ranch (Norias Division), Portales #3 B.M., Laguna Madre coast in Saltillo Pasture, *M. Johnston* 53266.2 (TEX); King Ranch, Norias Division, *C. Lundell* & *D. Correll* 15129 (LL, MO, SMU, UC, US). **Kimble Co.:** South Llano River at Schreimer Park in Junction, ca. 30°30'N, 99°46'W, *T. Daniel* & *M. Butterwick* 9999 (CAS). **Kinney Co.:** Fort Clark, *E. Mearns* 1454 (DS, US); Anacacho Mts., ca. 30 mi SE of Brackettville, *J. Strother* 249 (DS, SMU). **Kleberg Co.:** Kingsville, *E. Bogusch* 11911 (UC); San Fernando Creek NE of Kingsville, *D. Correll* & *C. Schweinfurth* 15602 (LL, SMU, UC); S end of Canelo Pasture, Santa Gertrudis Division of King Ranch, *M. Johnston* 5423 (SMU, TEX); Kingsville, *J. Sinclair* s.n. (TEX). **La Salle Co.:** 8 mi W of Artesia Wells, Chaparral Wildlife Management Area, *D. Seigler et al.* 15107 (TEX). **Live Oak Co.:** Rte. 281 S of George West, 11.1 mi N of FM 3162, *S. Hill* 18258 (MO). **Llano Co.:** Llano, *W. Bray* 309 (TEX, US). **Mason Co.:** Loyal Valley, *E. Dapprich* 7423 (SMU). **Maverick Co.:** 18 mi E of Eagle Pass, *D. Correll* & *D. Wasshausen* 27722 (LL, UC, US); 7.7 mi SE of jct. hws. 277 and 693, *T. Daniel* 183 (CAS); 5 mi N of Normandy, SCORA 2292 (US). **Medina Co.:** 19 mi N of Hondo along Hondo Creek, *D. Correll et al.* 28218 (LL, US). **Menard Co.:** John Royal Ranch, 19 mi SE of Menard, *F. Gould* 5718 (SMU). **McMullen Co.:** 2 mi N of Fowlerton on SH 72, *F. Gongora et al.* 8524 (SMU). **Mills Co.:** 8.5 mi SW of Goldthwaite on Hwy. 16, *V. Cory* 58205 (SMU); rest stop on state hwy. 16, ca. 1.1 mi N of Colorado River, *J. Taylor* & *C. Taylor* 33703 (BRIT). **Nueces Co.:** 9 mi NW of Corpus Christi, *V. Cory* 20586 (GH); Corpus Christi, *A. Heller* 1425 (US); Corpus Christi, *E. Virden* s.n. (Sept 1860) (MO). **Palapinto Co.:** Strawn, *E. Palmer* 14252 (MO). **Pecos Co.:** Pecos River bottoms near Sheffield, *R. Ferris* & *C. Duncan* 2885 (CAS, DS, MO); Mesquite Valley and Floureusia Valley, *B. Tharp* 43-856 (TEX, UC), 43-857 (MO, TEX); 2 mi SE of Longfellow Ranch (40 mi E of Marathon), 30°09'N, 102°37'W, *G. Webster* & *B. Westlund* 32516 (DAV). **Presidio Co.:** Big Bend Ranch State Park, W side of The Solitario, ca. 29°27'N, 103°51'W, *T. Daniel* & *M. Butterwick* 8433 (CAS); Chinati Mts. State Natural Area, Pekillos Arroyo on SW side of Chinati Mts., 29°51.5'N, 104°29'W, *E. Lott* & *S. Rankin* 4958 (CAS, TEX). **Reagan Co.:** along Hwy. 67 just before it enters Upton Co., 31°18'N, 101°46'30"W, *B. Turner* 20-157 (LL). **Refugio Co.:** Austwell, *B. Tharp* s.n. (TEX). **San Patricio Co.:** 7 mi S of Taft, *F. Jones* 398 (SMU). **San Saba Co.:** Chappel, *B. Barnette* 248 (SMU); San Saba, *E. Palmer* 11833 (MO, TEX). **Starr Co.:** W of Sullivan City on US Hwy. 83, *C. Lundell* & *A. Lundell* 9898 (MICH, SMU); Rio Grande City, *Nealley* 4359 (F); 3 mi N of Roma, *L. Shimmers* 17713 (SMU). **Stephens Co.:** Caddo, *A. Ruth* 1303 (US); 13.5 mi NNW of Breckenridge, *L. Shimmers* 30336 (SMU). **Sterling Co.:** edge of Concho River, 4 mi SW of Sterling City, *J. Crutchfield* 1842 (LL, NY). **Sutton Co.:** Hwy. 277, 11.8 mi S jct. Hwy. 277 and Hwy. 290 in Sonora, *T. Daniel* 200 (CAS). **Taylor Co.:** near Cedar Creek, N of Hwy. 20 on N side of Abilene, *W. Mahler* 3740 (MO, SMU); near Camp Barkeley, *W. Tolstead* 7121 (TEX, UC); at Camp Barkeley, *W. Tolstead* 7137 (MICH, MO). **Terrell Co.:** 4 mi E of Sanderson, *C. Hitchcock* & *L. Stanford* 6824 (DS, UC); Sanderson, *C. Orcutt* 724 (DS); Sanderson Canyon, 14 mi E of Sanderson on Hwy. 90, *E. Whitehouse* 18615 (SMU). **Throckmorton Co.:** Clear Fork of the Brazos River, ca. 11 km W and 16 km S of Throckmorton, John Matthews Ranch, *J. Cornelius* 1072 (BRIT). **Tom Green Co.:** San Angelo, *J. Reverchon* s.n. (5-20-1907) (MO); Knickerbocker Ranch, Dove Creek, *F. Tweedy* 280 (US). **Travis Co.:** Barton Springs Creek, *F. Barkley* s.n. (TEX, UC); Mount Bonnell, vicinity of Austin, *L. Taylor* 3188 (UC); Austin, *B. Tharp* s.n. (UC). **Upton Co.:** along Hwy. 67 just before it enters Reagan Co., 31°18'N, 101°47'W, *B. Turner* 20-141 (LL). **Uvalde Co.:** Nueces River on Hwy. 55 just SE of Laguna, NW of Uvalde, *B. Ertter* 5374 (CAS, TEX); W of Uvalde, *M. Ferguson* & *A. Otley* 4367 (UC); Sabinal, *E. Palmer* 10113 (DS, MO, US); Neal's Camp on Frio River, ca. 60 km N of Uvalde on TX 127 near Cancon, 29°30'N, 99°43'W, *A. Reina* & *T. Van Devender* 2003-816 (CAS); ca. 5 mi E of Uvalde, *S. Solymosy* S090569116 (SMU); Hondo, *B. Tharp* s.n. (CAS). **Val Verde Co.:** Hwy. 163, 5.9 mi N jct. Hwy. 163 and Hwy. 189 (east branch), *T. Daniel* 123 (CAS); Del Rio, *M. Jones* 26213 (DS, MO [“26218”], US); along Devil's River at Fawcett Lodge, 20–30 mi upriver, *B. Warnock* 11291 (LL, SMU); Tres Niños Ramcj. ca. 9 mi NW of Pandale, 30°15.5'N, 101°41'W, *G. Webster et al.* 33037 (DAV). **Webb Co.:** Pan American Courts Motel lawn, W of I-35, N of Laredo, *T. Daniel* 258 (CAS); Bruni, *R. Lopez* 100 (SMU); near Laredo, *K. Mackenzie* 31 (MO); Laredo, *C. Orcutt* 5703 (MO). **Willacy Co.:** between Raymondville and Red Fish Bay, *E. Clover* 1266 (MICH, NY); Sauz Ranch, ca. 2 mi SW of headquarters, *L. Davis* & *M. Johnston* 53266.4 (TEX). **Wilson Co.:** Southerland Springs, *E. Palmer* 9198 (DS, MO, US), 9299 (DS, MO, US). **Zapata Co.:** Arroyo Veleno on Hwy. 16, 8.2 mi NE of jct. Hwy. 16 and Hwy. 83 in Zapata, *T. Daniel* 186 (CAS). **County undetermined:** Reficillos, *V. Harvard* s.n. (US);

Justicia warnockii B.L. Turner, Field & Lab. 19:100. 1951. (Figs. 4D; 5J–L). TYPE: U.S.A. TEXAS: Brewster Co.: slope one-third way up Old Blue, Glass Mountains, 5000 ft, 2 Jun 1941, B. Warnock W325 (HOLOTYPE: TEX!; ISOTYPES: DS!, F!, GH!, LA!, MO!, NCU!, NY!, PH!, POM!, SI, SRSC!, UCI).

Erect, basally branched, broomlike to globose suffrutescent perennial herbs to 4 dm tall. Younger stems green, striate, pubescent in 2 vertical decussate lines (or with pubescence \pm diffuse or very inconspicuous) with recurved eglandular trichomes 0.05–0.2 mm long (strigillose). Leaves sessile, strongly ascendant, (acicular to) linear to narrowly oblanceolate (to obspatulate near base of plant), 2.5–25 mm long, 0.4–1.3(–2) mm wide, 6–18 \times longer than wide, acute at apex, narrowed to base, surfaces glabrous, margin flat to somewhat revolute, glabrous. Inflorescence of dichasia in leaf axils or in axils of reduced leaves or bracts along distal portion of stem forming a spicate axis to 8 cm long; dichasia alternate, sessile, 1-flowered. Bracteoles linear-subulate to filiform, 1.5–4.5 mm long, 0.2–0.4 mm wide, glabrous. Flowers sessile to subsessile (i.e., with pedicels to 0.3 mm long). Calyx deeply 4-lobed, 1.5–4 mm long, lobes subulate, 1–3.5 mm long, 0.1–0.2 mm wide, abaxially glabrous. Corolla whitish or lavender with maroon to purplish markings in throat, 7–13.5 mm long, externally pubescent with erect to retrorse eglandular trichomes 0.05–0.2 mm long, tube 4.5–6 mm long, distally gradually expanded to mouth, upper lip \pm erect, 4–6.5 mm long, emarginate to 2-lobed, lower lip 5–7 mm long, lobes not strongly revolute, 2–4 mm long, 1.2–3 mm wide, central lobe larger than lateral lobes. Stamens 3.5 mm long, filaments glabrous, thecae maroon, 0.5–0.8 mm long, parallel to subparallel, subequal in size (lower slightly longer), unequally inserted (overlapping by 0.5 mm), glabrous, lower theca with a basal spur 0.1–0.2 mm long; pollen 4-aperturate (4-porate, lacking insulae and pseudocolpi), exine reticulate. Style 5–7 mm long, glabrous; stigma \pm capitate, 0.2 mm long. Capsules stipitate, 5.5–8 mm long, glabrous (rarely minutely and inconspicuously pubescent at apex with eglandular trichomes to 0.05 mm long), stipe 2–3.2 mm long, head ellipsoid, lacking a medial constriction, 3.5–5 mm long, 2.5–3 mm wide. Seeds 4 per capsule, discoid, 2–2.5 mm long, 1.8–2.5 mm wide, surfaces minutely granulate, glabrous (or glandular), margin differentiated from remainder of seed surface (i.e., distinct peripheral band present), fringed with glandular trichomes up to 0.1 mm long.

Phenology.—Flowering: April (cleistogamous only), June–September; fruiting: May–December.

Distribution and habitats.—Southwestern United States (Texas) and north-central Mexico (Chihuahua, Coahuila); Texas plants occur on limestone slopes and arroyos in Chihuahuan desertscrub and mesquite-juniper brush at elevations from 545 to 1400 meters. In Texas the species is limited to the Stockton Plateau and the Basin and Range ecoregions in the arid western portion of the state (Fig. 1).

Justicia warnockii is endemic to the northern Chihuahuan Desert region, and it appears to be related to several other species endemic to this region (see under *J. wrightii* below). Plants typically have numerous, dense, thin, and wispy stems that give them a broom- or brushlike appearance. *Daniel & Butterwick 8431*, collected in April, contains old stems with persisting fruits from the previous season and new growth bearing a few cleistogamous flowers 1.5–2.5 mm long; chasmogamous flowers appear later in the season.

Additional Texas specimens examined: **Brewster Co.**: summit of Bullis Range S of Bullis Gap on Bullis Gap Ranch, *M. Butterwick & E. Lott 3583* (TEX); Black Gap Wildlife Refuge, lower Maravillas Canyon, *D. Correll & H. Correll 30661* (CAS, LL); near mouth of Heath Canyon, *D. Correll 31564* (LL); Reagan Canyon, 3 mi from Rio Grande, *L. Hinckley & B. Warnock 461097* (MO, RSA, S, TEX, UC, US); Packsaddle Mountain, 65 mi S of Alpine, *G. McKenzie 307* (SMU); Black Gap Wildlife Management Area, Frog Canyon, ca. 35 mi SSE of Marathon, *C. Rowell 5131* (DAV, SMU), *11612* (UNM); head of Brushy Canyon just below E side of Sue Peak, 29°25'N, 102°56'W, *B. Turner 22-149* (TEX); W of Rio Grande Village, Big Bend Natl. Park, *T. Van Devender & V. Cohen s.n.* (CAS); Black Gap Wildlife Refuge, Maravillas Canyon, 8.6 mi from headquarters, *T. Van Devender & L. Toolin s.n.* (CAS); Shackelford Ranch, head of Brushy Canyon, E side of Sue Peaks, 29°25'N, 102°56'W, *B. Turner & B. Dodson 23-278* (CAS); slopes of Old Blue, Glass Mountains, *B. Warnock 325* (GH-collected on different date from type); Old Blue, Glass Mts., *B. Warnock 9039* (LL, SMU); near McKinney Springs, Dead Horse Mts., Big Bend Natl. Park, *B. Warnock 10786* (LL, SMU); S of Ward Spring, W side of Chisos Mts., Big Bend Natl. Park, *B. Warnock 13007* (LL); Black Gap Refuge, upper Big Brushy Canyon of Dead Horse Mts., 95 mi S of Alpine, *B. Warnock & L. Hinckley BG-137* (LL, SMU); Reagan Canyon, *B. Warnock & L. Hinckley 3742* (NY, US). **Crockett Co.**: bluff of Pecos River, above its jct. with Independence Creek, *G. Webster 492* (MICH, TEX). **Hudspeth Co.**: below and E of Deer Peak, southern Quitman Mts., *A. Powell et al. 2901* (LL); Mayfield Canyon, S of Quitman Mts., near Rio Grande, *A. Powell et al. 2928* (LL); Quitman Mts., S of Sierra Blanca, *B. Warnock et al. 18061* (SRSC). **Pecos Co.**: main canyon on NE side of Sierra Madre, ca. 25 mi S of Fort Stockton, *R. McVaugh 10654* (DS, DUKE, ENCB, LL, MICH, MO, NY, PH, SRSC, UC, US); mesa margins, *B. Tharp 43-854* (MO, NY, PH, TEX, UC, US).

Presidio Co.: Big Bend Ranch State Park, W side of The Solitario, ca. 1.5 km NW of Solitario Peak, ca. 29°28'N, 103°51'W, T. Daniel & M. Butterwick 8431 (CAS); 0.25 mi N of Solitario Peak, 29°28'N, 103°50'W, M. Johnston 3430 (NY, US). **Terrell Co.:** along Rio Grande between Reagan Canyon and Sanderson Canyon, B. Warnock 15855 (MO, SRSC).

Justicia wrightii A. Gray, Syn. Fl. N. Amer. 2:329. 1878. (**Fig. 6G–I**). *Ecbolium wrightii* (A. Gray) Kuntze, Revis. Gen. Pl. 2:981. 1891. TYPE: U.S.A. TEXAS: western Texas to El Paso, New Mexico, May–Oct 1849 (fide label); Val Verde Co.: calcareous hills of San Felipe, 7 Jul 1849 (fide field notes), C. Wright 445 (HOLOTYPE: GH!; possible ISOTYPES: GH!, US!).

Erect perennial herbs to 2 dm tall from a stout woody caudex. Younger stems subquadrate to ridge-angled, sometimes multistriate with ridges brownish and grooves green, ± evenly and sparsely to very sparsely pubescent with retrorse to retrorsely appressed (to antrorse) eglandular trichomes 0.05–0.2 mm long. Leaves sessile to subsessile, petioles (if present to 1 mm long), blades linear to elliptic to obovate to oblanceolate, 4–15 mm long, 1–4 mm wide, 2.2–8.6 × longer than wide, usually reduced in size acropetally, acute to rounded at apex, tapered to base, surfaces pubescent with cauline type trichomes or with trichomes mostly restricted to margin, margin flat. Inflorescence of dichasia in axils of leaves; dichasia alternate, 1-flowered, 1 per axil, sessile. Bracteoles linear-subulate to linear to oblanceolate, 2.5–11 mm long, 0.5–2 mm wide, pubescent with mostly retrorse to retrorsely appressed eglandular trichomes 0.05–0.2 mm long. Flowers sessile. Calyx 4-lobed, 2.3–5 mm long, lobes subulate, equal, 2–4.5 mm long, 0.4–0.6 mm wide, pubescent like bracteoles or with the trichomes becoming antrorse to antrorsely appressed. Corolla “purplish” (in dried state: light colored and tinged with maroon and with maroon markings on lower lip), 8–12 mm long, externally pubescent with erect to flexuose eglandular trichomes 0.1–0.2 mm long, tube ± gradually expanded distally, 3–3.5 mm long, 1.6 mm in diameter near midpoint, upper lip 4–6.5 mm long, apically 2-lobed, lobes 0.3–0.7 mm long, lower lip 4–6 mm long, lobes 3–4 mm long, 1.5–3.5 mm wide, central lobes larger than lateral lobes. Stamens inserted in distal half of corolla tube, 2.5–5 mm long, filaments glabrous, thecae 0.5–1.3 mm long (including basal appendage), unequal (upper theca 0.5–0.9 mm long and lower theca 0.8–1.3 mm long), subparallel to subperpendicular, unequally inserted (overlapping by 0.3 mm), upper theca dorsally pubescent with eglandular trichomes, lower theca glabrous, with a basal spurlike appendage 0.1–0.3 mm long; pollen 4-aperturate (4-colporate, lacking insulae and pseudocolpi), exine reticulate. Style 4.5–6 mm long, glabrous or pubescent with eglandular trichomes proximally, stigma 0.2–0.3 mm long, minutely 2-lobed. Capsule 7–8.5 mm long, glabrous or sparsely pubescent at apex with eglandular trichomes 0.1 mm long, stipe 1.5–2 mm long, head ellipsoid, 5.5–6.5 mm long. Seeds 4, discoid, 2.5–3.5 mm long, 2.5–3.6 mm wide, surfaces smooth to reticulate, pubescent with apically barbed trichomes (sometimes ± restricted to margin) 0.05–0.2 mm long, marginal region undifferentiated to ± differentiated (becoming less so at maturity) from remainder of seed.

Phenology.—Flowering: April–August; fruiting: April–July.

Distribution and habitats.—Endemic to the southwestern United States (New Mexico and Texas); Texas plants occur on rocky calcareous soils in Chihuahuan desertscrub and semi-arid scrubland at elevations from 300 to 1455 meters in the Basin and Range and Stockton Plateau ecoregions (i.e., in and adjacent to the eastern edges of the Chihuahuan Desert; Fig. 1).

Although this species likely occurs in adjacent regions of Mexico, it remains documented only from north of the Rio Grande where it is a rare species based on both low numbers of individuals and a limited distribution. Based on the fewer than twenty known global occurrences of *Justicia wrightii*, it has a global rank of G2 and a state rank (for Texas) of S2 (based on the Nature Conservancy ranking system; cf. Poole et al. 2007). These rankings denote that the species is imperiled both globally and in Texas because of rarity and is very vulnerable to extinction throughout its range or extirpation from Texas. Poole et al. (2007) reported possible occurrences in Brewster and Terrell counties, but no specimens of the species from those counties have been located. A specimen from Castolon in Brewster County (*Parks & Cory s.n.* at TAES) that was identified as *J. wrightii* and recorded as such by the Texas Natural Heritage Program appears to pertain instead to *Carlownrightia linearifolia* (Torr.) A. Gray. The most recent collection of *J. wrightii* from Texas was made in 1996 in Pecos County.

Based on morphological similarities the closest relatives of *Justicia wrightii* are the Chihuahuan Desert

endemics *J. henricksonii* T.F. Daniel and *J. warnockii* (Daniel 1980). Although pollen of *J. henricksonii* has not been studied, pollen of both *J. wrightii* and *J. warnockii* differs from other species of *Justicia* in the Chihuahuan Desert and the United States by having four (vs. two or three; cf. figs. 2 and 3) apertures. Four-aperturate pollen is known among other species of *Justicia* elsewhere in Mexico (Daniel 1998). The description above includes data from plants collected in New Mexico.

Additional Texas specimens examined: **Pecos Co.:** ca. 19 mi E of Ft. Stockton along IH-10, just W of roadside park, B. Turner & G. Turner 96-95 (TEX); 40–45 mi SE of Ft. Stockton toward Sanderson, B. Warnock 13438 (LL); hwy. to McCamey, 20 mi N of Ft. Stockton, B. Warnock 46181 (TEX); 22 mi S of Ft. Stockton, B. Warnock & R. McVaugh 8707 (LL, SMU, SRSC). **Val Verde Co.:** Del Rio, M. Jones 26216 (POM); between Del Rio and Loma Alto, B. Warnock 11204 (LL, SMU); ca. 3 mi W of Del Rio, B. Warnock 11319 (LL, SMU).

APPENDIX 1

Species of *Justicia* cultivated out-of-doors in Texas

Collections from plants cultivated out-of-doors in Texas have been documented for the six species of *Justicia* listed below. These species may sometimes persist following cultivation, and have potential to become naturalized. A brief description, with diagnostic characters of each, is provided to permit their identification. Other species that have been observed in greenhouses of botanical gardens in the state include: *J. aurea* Schldl., *J. betonica* L., *J. californica* (Benth.) D.N. Gibson, *J. candicans* (Nees) L.D. Benson, *J. extensa* T. Anders., *J. gendarusa* Burm.f., and *J. scheidweileri* V.A.W. Graham.

1. *Justicia adhatoda* L. (Malabar nut, basaka, adulsa)

Shrubs to 3 (or more) m tall; inflorescence of axillary, pedunculate, and elongate spikes; bracts green, ovate elliptic to elliptic, 14–25 mm long; corolla white with maroon markings on lower lip, 25–30 mm long; anthers green. Native to Asia.

Cameron Co.: R. Runyon 5440 (TEX).

2. *Justicia brandegeana* Wash. & L.B. Sm. (shrimp plant). Perennial herbs to shrubs to 1 m (or more) tall, branches weak or drooping; inflorescence drooping or nodding; bracts maroon-tinged (sometimes merely yellowish green), broadly ovate to ovate, apex not spreading, rounded to cordate at base; bracteoles ovate to elliptic, 3–6.5 mm wide; corolla white (to yellowish) with maroon or reddish markings within. Native to Mexico. Selections and/or hybrids (e.g., “fruit cocktail”) involving this species have resulted in numerous forms with variously colored bracts and corollas, and with erect inflorescences.

Hidalgo Co.: C. Lundell & A. Lundell 12776 (GH, LL, MICH, US). **Galveston Co.:** F. Waller & J. Bauml 3526 (TEX). **Harris Co.:** A. Traverse 1395 (LL). **Travis Co.:** J. Wiedenhoff 21 (TEX).

3. *Justicia carnea* Lindl. (Brazilian plume)

Perennial herbs or shrubs to 3 m tall; inflorescence of terminal, dense, headlike clusters; bracts conspicuous, green to very dark maroon; corolla pink (or white), 50–65 mm long; anthers pink to maroon. Native to southern South America. All of the corollas tend to open at the same time, resulting in a dramatic display. A form with white flowers is sometimes cultivated, but the pink-flowered form is more common.

Bexar Co.: H. Parks s.n. (GH). **Harris Co.:** A. Traverse 2408 (BRIT).

4. *Justicia fulvicoma* Schldl. & Cham. (Mexican plume, orange shrimp plant)

Perennial herbs or shrubs to 1 m (or more) tall, branches stout and erect; inflorescence erect; bracts maroon-tinged, lanceolate to ovate to elliptic, apex recurved-spreading, rounded to acute at base; bracteoles lanceolate to linear, 0.9–2 mm wide; corolla orange and usually with reddish markings within. Native to Mexico.

Bexar Co.: T. Daniel 6295 (CAS). **Sutton Co.:** V. Cory s.n. (GH). **Kleberg Co.:** E. McClane s.n. (GH).

5. *Justicia leonardii* Wash. (orange justicia, summer sun justicia)

Shrubs to 1 m tall; stems and leaves not yielding a bluish dye in boiling water; leaf surfaces (especially abaxial surface) ± evenly pubescent throughout; corolla orange, subfusiform in bud, 26–43 mm long, externally glabrous or sparsely pubescent near base of tube with inconspicuous glandular and eglandular trichomes to 0.1 mm long or pubescent throughout (or only on distal portion of lips) with eglandular (and sometimes glandular trichomes), lower lip usually recoiled. Native to Mexico. The species is very similar to, and is often confused with, *J. spicigera*.

Bexar Co.: H. Parks s.n. (GH). **Maverick Co.:** M. Nee 25402 (F). **Nueces Co.:** A. Traverse 1779 (BRIT). **San Patricio Co.:** F. Jones 581 (SMU). **Webb Co.:** L. Shinnars 32366 (SMU).

6. *Justicia spicigera* Schldl. (muicle, Mexican honneysuckle)

Shrubs to 1 m (or more) tall; stems and leaves yielding a bluish dye in boiling water; leaf surfaces glabrous or pubescent with trichomes mostly restricted to major veins; corolla orange, fusiform in bud, 30–55 mm long, externally sparsely and inconspicuously pubescent near base of tube with glandular trichomes to 0.1 mm long, otherwise glabrous, lower lip recoiled. Native to Mexico. Cultivated throughout Mexico for ornamental and medicinal purposes, and for use as a dye.

Cameron Co.: R. Runyon 1065 (TEX). **Harris Co.:** A. Traverse 1997 (BRIT). **Hidalgo Co.:** R. Fleetwood 8005 (TEX).

ACKNOWLEDGMENTS

I thank the following individuals for their contributions to this study: C. Anderson, W. Anderson, T. Atkinson, R. Felger, K. Gandhi, J. Henrickson, C. Kiel, E. Lott, R. Morey, G. Ocampo, J. Poole, D. Riskind, S. Serata, B. Turner, T. Van Devender, J. Verrier, T. Wendt, and A. Whittemore. Julia Weller composed the illustrations during an internship at the California Academy of Sciences. I am most grateful for loans and other courtesies extended by the following herbaria: ARIZ, ASU, BRIT, CAS, DAV, DS, DUKE, ENCB, F, GH, LA, LL, MICH, MO, NCU, NY, P, PH, POM, S, SMU, SRSC, TAES, TAMU, TEX, UC, US, VSC, and WIS.

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