

STUDIES IN THE GENUS *Dyschoriste* (ACANTHACEAE): I. PLANTS OF NORTHERN MEXICO, TEXAS TO ARIZONA

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Abstract: A systematic treatment of *Dyschoriste* (Acanthaceae) of northern Mexico, Arizona, and Texas is provided. The taxa show few unique characteristics; taxonomy is largely based on differences in vestiture and growth habit; intergradation is widespread. Five species are recognized: (1) *D. schiedeana* with four intergrading varieties, var. *schiedeana*, var. *cinerascens*, var. *decumbens*, and var. *prostrata*, of central-northern Mexico north to trans-Pecos Texas and Arizona; (2) *D. linearis* var. *linearis* and var. *sanpatriciensis* of Texas; (3) *D. crenulata*, of the Big Bend area and southmost Texas and adjacent Mexico; (4) *D. poliodes* var. *poliodes*, var. *obispoensis*, and var. *glabra*; and (5) *D. greenmanii* of Nuevo León and Tamaulipas. Keys and descriptions are provided.

Resumen: Se presenta un tratado sistemático de *Dyschoriste* (Acanthaceae) para Texas, Arizona, y el norte de México. Los taxones muestran pocas características únicas; la taxonomía del grupo se base en gran parte en diferencias en el indumento y el hábito de crecimiento, y existe amplia intergradación. Se reconocen cinco especies en total: (1) *D. schiedeana* del centro-norte de México hasta Arizona y el "Trans-Pecos" de Texas, con cuatro variedades que muestran amplia intergradación entre sí, var. *schiedeana*, var. *cinerascens*, var. *decumbens*, y var. *prostrata*; (2) *D. linearis* var. *linearis* y var. *sanpatriciensis* de Texas; (3) *D. crenulata* de la región del "Big Bend" del oeste de Texas, la parte más septentrional del mismo estado, y partes colindantes de México; (4) *D. poliodes* var. *poliodes*, var. *obispoensis*, y var. *glabra* de Nuevo León; y (5) *D. greenmanii* de Coahuila, Nuevo León y Tamaulipas. Se incluyen claves y descripciones.

Keywords: Acanthaceae, *Dyschoriste*.

Preparation of a treatment of *Dyschoriste* for the Flora of the Chihuahuan Desert Region has necessitated this revision of *Dyschoriste* for north central and north-eastern Mexico, adjacent Texas, New Mexico and Arizona. A second paper (in prep.) will treat the remainder of the North American species exclusive of the three species in Florida.

The American species of *Dyschoriste* were last treated by Kobuski (1928) who recognized 22 species in Mexico and the United States. Noting the relative uniformity of the structure of floral and vegetative characters within the genus, Kobuski divided the species only into informal groups. One such group, centered in

northern Mexico, consisted of ten species, eight from northern Mexico and adjacent United States, and two from the southeastern United States; he considered the wide-ranging north central Mexican-Arizonian *D. decumbens* as the base species of this group from which the others were derived. The taxa were distinguished on the basis of leaf shape, size, vestiture and corolla length. His treatment, in my opinion, was hindered by the limited specimens available at that time. His succinct key and brief and vague descriptions also have created problems in making critical comparisons of the taxa.

This study is based on herbarium specimens borrowed from A, ARIZ, CAS,

DS, ENCB, F, GH, MEXU, MO, NY, TEX-LL, and US. Examination of the collections over an extended period coupled with field studies reveals an often diverse and confusing pattern of variation. While there are some large areas where the plants are relatively uniform and recognizable as a taxon, there are other areas where adjacent taxa obviously intergrade, and still other areas where the available collections are highly diverse, indicating either the presence of multiple taxa or a single highly diverse taxon with morphs reflecting exposed vs. protected habitats. Disturbed habitats appear to allow establishment of diversity that perhaps would not be expressed in undisturbed habitats. It is apparent that plant habit is affected by environment. An assemblage of collections from northern Mexico characterized by a lax, often spreading growth habit, large leaves and few flowers were found to be "seep" plants representing several different taxa. These similar, fast-growing plants were collected from seeps and drainages during the dry season when little else was in flower and thus are disproportionately represented in collections. There are lax plants from shaded habitats in the mountains near Saltillo, Coahuila that are vegetatively very similar to plants from similar shaded habitats in the Davis Mts. of Texas, but the respective populations appear to belong to different taxa. In addition, occasional plants of most taxa exhibit sterility in which the anthers are small and without pollen and the fruits fail to develop; the plants may have normal sized flowers or the flowers may be smaller than normal for the taxon (Hilsenbeck, pers. comm.).

Judging from the variation patterns found it appears that the taxa in this study are not genetically isolated, that variation encountered may reflect both past introgression and environmental effects on development. In this treatment taxa that are geographically and morphologically isolated are treated as species. Taxa that strongly introgress with other taxa, as evi-

denced by mixing of characters, are treated as varieties of an encompassing species.

Since Kobuski's (1928) treatment of *Dyschoriste*, few papers have been published dealing with the systematics of the genus for Mexico and United States. New taxa have been added by Leonard and Gentry (Gentry, 1948) and Daniel (1990, 1996). Species have been transferred into the genus (Ramamoorthy and Wasshausen, 1985), and variously combined (Daniel 1993, 1995). Floristic treatments have been provided for the taxa in Chiapas (Daniel, 1995), southeastern United States (Wasshausen, 1998), and a key to the taxa in Nueva Galicia of western Mexico is provided in Daniel (1996).

PLANT MORPHOLOGY

As noted by Kobuski, all species in this northern group are very similar in morphology. They are perennial herbs with clusters of erect, ascending or rhizomatous stems from shallow fibrous rootstocks. The stems, whether erect, decumbent or procumbent, are decurrently angled, quadrate, with two convex surfaces and two depressed (sulcate) surfaces and variously vestitured with short, curved to straight, multicellular, uniseriate, sometimes setose hairs. The opposite leaves are mostly linear to oblanceolate (the lowermost, early deciduous leaves are usually more obovate), acute to rounded, often apiculate at the tips, cuneate to a slender, short-petiolate base, entire, repand to crenulate at the margins, variously conduplicate, thin or thick in texture, puberulent to pubescent or strigulose throughout or only on the basal margins and veins on the lower surface.

The flowers are borne in condensed, axillary, leafy-bracted, true dichasia in groups of 1-3(-7); pedicels and peduncles are usually short, vestitured as the stems. The bracts are leaf-like in texture, shape, and vestiture but slightly smaller than the leaves. The nodal clusters of leaves and

flowers may be shorter than the adjacent internodes giving the plant a verticillate appearance, or they may be longer than the adjacent internodes. The calyces are five parted, green; the calyx tubes are about one-half to one-third the total calyx length and are membranous between the veins. The calyx lobes are lacinate and the sepal margins and keel-like midvein are usually pubescent and may be coarsely ciliate. The corollas are ascending, purplish-lavender, sometimes marked with red, variously rugose-puckered in the lower throat between the main veins, and slightly zygomorphic. The narrow cylindrical tube is abruptly ampliate around the ovary at the base and expands to a campanulate throat that bears five oblong-obovate to orbicular lobes. The upper two lobes are ascending and shorter than the lower three spreading lobes. The stamens are didynamous, epipetalous; the filament pairs separate from the corolla at the posterior (upper) basal throat just above the tube and the individual filaments separate at that point and place the anthers in a two plus two arrangement at the posterior, distal throat. The anthers are glabrous, purplish or yellowish, drying yellowish, and are bithecal, with short, white mucronate appendages at the base of each theca that extend downward into the corolla throat. The ovary is cylindrical; the style is elongate, sparsely pubescent, and extends along a groove in the upper corolla throat beyond the anther where it recurves. The style lobes are unequal with a short to nearly non-existent lower lobe and a much elongate, upper stigmatic lobe.

The fruits are compressed oblanceolate, not stipitate, shiny light brown, moderately thick-walled, glabrous, tardily

dehiscent into two valves; the four seeds are flattened, obovate, notched and oblique at the base, and covered with whitish hairs that quickly become mucilaginous and protrude outward when wetted.

The features distinguishing the taxa within this complex involve growth habit, (i. e., the plants may be erect, decumbent or procumbent, or with both erect and decumbent stems); the presence or absence of rhizomes; stem, leaf, bract and sepal vestiture; leaf shape; and corolla size.

TAXONOMY

Dyschoriste of this northern Mexico, adjacent United States region are considered to form a complex of eight taxa. The oldest name at the species rank in this complex is *Calophanes linearis* Torr. & Gray (1845) [= *Dyschoriste linearis* (Torr. & Gray) Kuntze], a species centered in Texas, that is here considered to consist of two varieties. The oldest name within the taxa centered in the Chihuahuan Desert is *Calophanes schiedeana* Nees (1847), [= *Dyschoriste schiedeana* (Nees) Kuntze] a species described from the arid valley west of Jalapa, Veracruz and here considered to consist of four intergrading varieties (var. *schiedeana*, var. *cinerascens*, var. *decumbens*, and var. *prostrata*) that range from Puebla, to trans-Pecos Texas and Arizona. The other taxa (*D. linearis*, *D. crenulata*, *D. poliodes*, *D. greenmanii*) are all treated as species as they show less or minor introgression with the other taxa. The taxa can be identified using the following key, but distribution serves well for identification of most taxa.

1. Leaves and foliaceous flower bracts with trichomes moderately to strongly present throughout both surfaces, not confined to the veins on the lower surface (use strong lens).
2. Plants procumbent throughout or with the central stems more erect-ascending and the lateral stems procumbent; leaf surfaces, stem and sepal margins rather uniformly pubescent with curved hairs, these sparse or dense but similar throughout the plant, the sepal margins without longer marginal setae.
3. Leaf margins entire or nearly so, the leaves densely to sparsely vestitured; the plants usually consistently procumbent, central Durango, Chihuahua, southeast Arizona, adjacent Sonora, southern Baja California del Sur (rare), also mountains of trans-Pecos Texas. 1c. *D. schiedeana* var. *decumbens*

3. Leaf margins distinctly crenulate, the leaves always densely and uniformly vestitured; the central plant with more erect-ascending stems, the lateral stems more procumbent; southern Texas, adjacent northern Mexico, also Chisos Mts. in trans-Pecos Texas. 3. *D. crenulata*
2. Plants erect-ascending, sometimes with lateral procumbent-decumbent stems; the plants not uniformly pubescent, mostly with some long setose hairs present on the leaf margins and/or sepal margins.
 4. Leaves and bracts yellow-green or olive green, sparsely and closely pubescent with curved hairs to 0.2(-0.3) mm long; leaves mostly 8-15 mm long; plants mostly small, bushy; southeastern Coahuila through Nuevo León, adjacent Tamaulipas and eastern San Luis Potosí. 1a. *D. schiedeana* var. *schiedeana*
 4. Leaves and bracts slightly cinereous gray; leaves, bracts, sepal margins with some longer setae 0.5-1.5 mm long; leaves mostly longer than 15 mm.
 5. Plants without rhizomes, the stems developing from buried rootstalks that may give rise to clusters of stems; stems mostly erect-ascending, though lateral stems may be short decumbent; leaves and bracts somewhat grayish in color, crowded at the nodes, the internodes often longer than the leaves and bracts giving the plant a verticillate appearance; sepals usually with short marginal setae to 0.8 mm long; San Luis Potosí, southern Coahuila north through trans-Pecos Texas. 1b. *D. schiedeana* var. *cinerascens*
 5. Plants with rhizomes or tending to be procumbent, the stems either erect or with erect central stems and lateral procumbent stems; leaves and bracts not grayish in coloration; sepals with setae 1.0-1.2 mm long.
 6. Plants erect, colonial with rhizomes; leaves greenish, not densely vestitured, the dense setae developed mainly on the upper leaves, bracts and sepals; southern Texas. 2b. *D. linearis* var. *sanpatriciensis*
 6. Plants with erect-ascending central stems and spreading-procumbent lateral stems; leaves and stems densely pilose-hirsute with long whitish hairs; southern Nuevo León.
 7. Leaves oblong-ovate; flowers 1(-2) per leaf axil; clusters of old dried calyces not present on plant. 4a. *D. poliodes* var. *poliodes*
 7. Leaves oblong-lanceolate; flowers (1-)2-5 per leaf axil; the old gray dried calyces persisting on the stems. 4b. *D. poliodes* var. *obispoensis*
1. Leaves and foliaceous flower bracts with trichomes scattered or occurring only along the midrib of the upper surface and only along the basal margins and/or the main veins of the lower surface, the intercostal areas are glabrous on the lower leaf surface, or the leaves mostly glabrous.
 8. Plants procumbent, the stems growing along the ground; rhizomes not present.
 9. Plants glabrous throughout except for hairs along the basal leaf margins and at the nodes.
 10. Corollas 12.5-16 mm long, Tamaulipas and adjacent Nuevo León. 5. *D. greenmanii*
 10. Corollas 16-28 mm long.
 11. Plants of Sonora. 1c. *D. schiedeana* var. *decumbens*
 11. Plants of Nuevo León. 4c. *D. poliodes* var. *glabra*
 9. Plants pubescent along the stem and on the veins of the lower leaf surface; Durango to Hidalgo. 1d. *D. schiedeana* var. *prostrata*
 8. Plants erect-ascending, sometimes with procumbent-decumbent marginal stems; plants often rhizomatous.
 12. Flowering calyces (12-)15-23 mm long; sepal margins with coarse setae 0.5-1.5 mm long; leaves mostly glabrous except along margins and veins; central and south Texas. 2a. *D. linearis* var. *linearis*
 12. Flowering calyces 9.5-12 mm long; sepal margins with hairs 0.1-0.5 mm long, the hairs not coarsely setose; leaves usually pubescent on the upper surface and along veins and margins on the lower surface except when the leaves are highly reduced; Nuevo León, southeast Coahuila, adjacent Zacatecas, San Luis Potosí, to Hidalgo. 1a. *D. schiedeana* var. *schiedeana*

1. *DYSCHORISTE SCHIEDEANA* (Nees) Kuntze.

Erect to marginally decumbent or procumbent, sometimes colonial HERBS 0.5-2(-4) dm tall from a fibrous root system that bears erect, ascending, sometimes

horizontal (rhizomatous) subsurface shoots that bear or terminate in stems. Stem internodes longer or shorter than the subtending leaves, usually puberulent-strigulose with bent to decurved, thickish trichomes or with more spreading, rather crisped trichomes. LEAVES linear, linear-

oblanceolate to oblong-oblanceolate, 7–40 mm long, 1–7 mm wide, acute to rounded at the apex, cuneate with margins forming narrow wings along the short petiole at the base, the margins entire to erose, the leaf-blades thin and flat or thickened and more conduplicate, olive green to grayish, sparsely strigulose with short antrorsely curved or bent hairs or longer spreading hairs throughout or the hairs lacking in the intercostal areas on the lower surface. FLOWERS 1–3(–7) per leaf axil in compressed dichasial cymes; peduncles 0.2–1(–2) mm long; paired bracts leafy, usually linear-oblanceolate, acute, 0.5–2.5 cm long, vestitured as leaves; calyces 8.5–17 mm long, glabrous or vestitured, lobes 5, puberulent, hispid to setose along the margins and midrib with hairs 0.1–0.3(–0.5) mm long. Corollas lavender to purplish, sometimes with whitish veins and some-

times marked with red in the lower throat, 9–24 mm long (dry), the tube cylindrical, 3.2–10 mm long, throat campanulate, 3.5–7 mm long, lower 3 lobes slightly decurved, oblong-obovate, rounded to emarginate at the tips, the upper 2 lobes ascending, rounded; anthers 4, glabrous, purplish, drying yellowish, 1.2–1.7 mm long, with or without a terminal apiculation, basal spurs 0.15 mm long; longer free filaments 2.8–4 mm long, the shorter free filaments 1.5–3.2 mm long, the style 7–14 mm long, exerted beyond the anthers and usually extending from the throat. FRUITS 8–10 mm long; seeds 2–4, about 2.5 mm long.

As recognized here, *Dyschoriste schiedeana* is a highly variable taxon consisting of four widespread varieties. The four taxa can be separated by the following key.

1. Plants with erect-ascending stems, sometimes also with lateral decumbent, procumbent stems.
 2. Stems all erect-ascending or the marginal stems decumbent or procumbent; leaves and bracts yellowish to olive-green, usually thin, folded only in the lower half with the upper portion less folded and appearing broader, or folded all along the midrib or strongly conduplicate and the leaves nearly cylindrical; leaves usually hairy above, but hairy only on the veins beneath, occasionally uniformly hairy on both surfaces, the hairs mostly less than 0.2 mm long, occasionally to 0.5 mm long but falling away on older stems and leaves; internodes usually shorter than the subtending leaves; central Veracruz, Hidalgo, Nuevo León to southern Coahuila.
 - 1a. *D. schiedeana* var. *schiedeana*
 2. Stems all erect-ascending from an underground rootstalk, the lateral stems sometimes shortly decumbent; leaves and bracts typically grayish, erect, usually thickish, pubescent-strigulose on both surfaces; internodes mostly longer than the clustered leaves and bracts giving the plant a somewhat verticillate appearance; San Luis Potosí, southern Coahuila, north to trans-Pecos Texas.
 - 1b. *D. schiedeana* var. *cinerascens*
1. Plants procumbent, the stems all sprawling from a central rootstalk, these sometimes producing erect lateral stems near the plant center.
 3. Leaves usually uniformly pubescent to strigulose throughout, equally hairy on both surfaces, with similar short vestiture throughout the sepals and stems (occasional plants in Sonora nearly glabrous throughout); leaves mostly 15–40 mm long; corollas 16–25.5 mm long; Arizona, eastern Sonora, western Chihuahua, south to Durango, also trans-Pecos Texas.
 - 1c. *D. schiedeana* var. *decumbens*
 3. Leaves sparsely pubescent-strigulose on margins and veins or throughout and the vestiture diminishing in the intercostal areas of the lower surface, the hairs on the keel and margins of the sepals in part or mostly longer than those of the leaves; leaves mostly 10–15 mm long; corollas 10–18 mm long, rarely longer; Durango, Zacatecas, San Luis Potosí, south to Aguascalientes, Guanajuato.
 - 1d. *D. schiedeana* var. *prostrata*

1a. *DYSCHORISTE SCHIEDEANA* (Nees)
Kuntze var. *SCHIEDEANA* (Fig. 1A-G.)

Dyschoriste schiedeana (Nees) Kuntze Rev. Gen. Pl. 2: 486. 1891; *Calophanes schiedeanus* Nees in DC. Prodr. 11: 111. 1847. TYPE. MEXICO. Veracruz:

prope Jalapam (Xalapa), *Schiede* 122 (HOLOTYPE: HAL!)

Dyschoriste lloydii Kobuski, Ann. Missouri Bot. Gard 15:46. 1928. TYPE. MEXICO. Zacatecas: Hacienda de Cedros, 1908, F. E. Lloyd 199 (HOLOTYPE: US!)

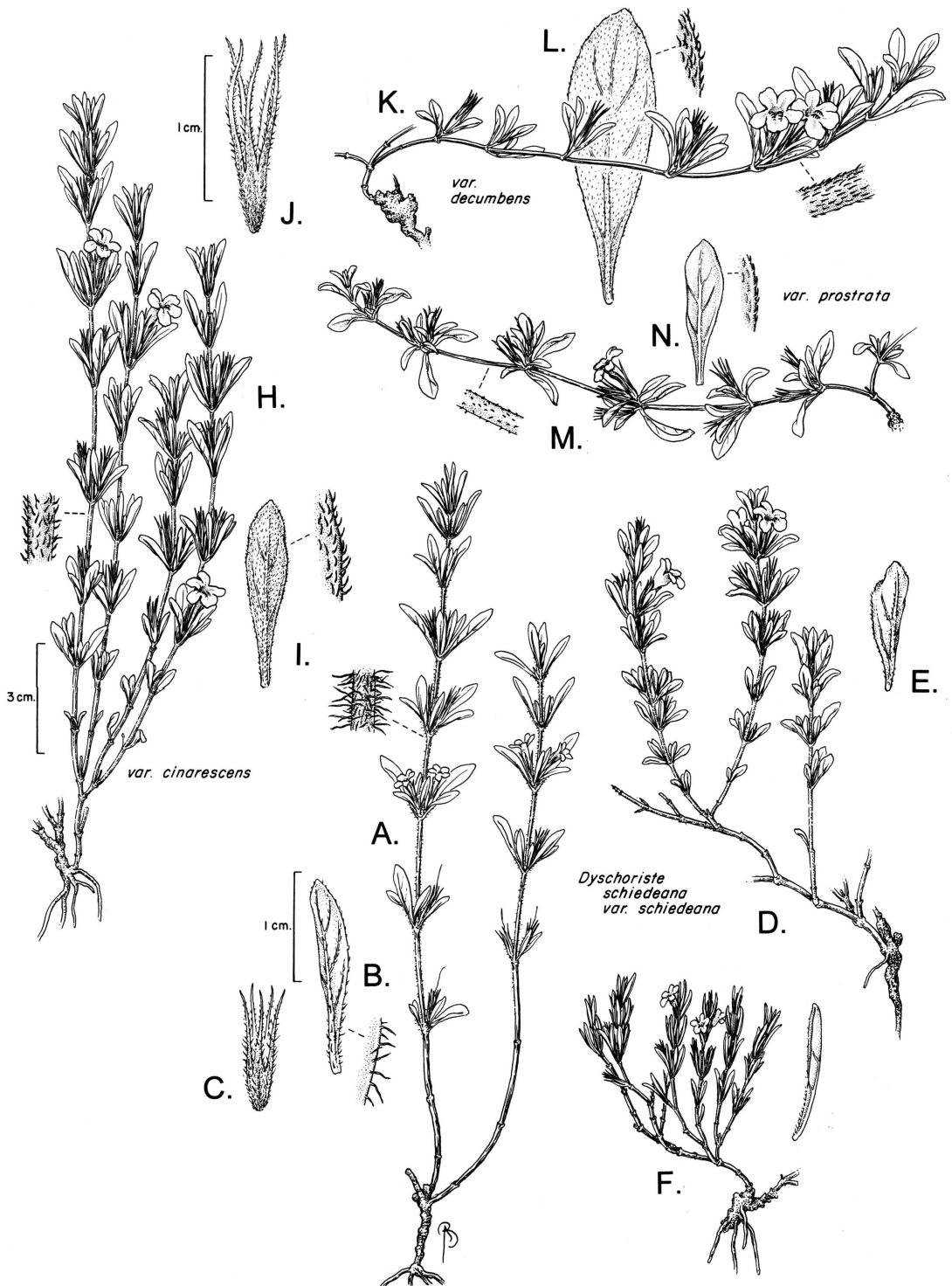
Erect to erect-ascending HERBS 0.5–2(–4) dm tall, sometimes with the marginal stems decumbent-procumbent, or the stems produced solitary or in multi-stemmed clusters along rhizomes, or the plants essentially non-rhizomatous, bushy, with a cluster of fibrous roots; internodes (3.5–)10–25(–50) mm long, longer or shorter than the subtending leaves, usually puberulent-strigulose with bent to curved, short thickish hairs 0.06–0.2 mm long, or with spreading, rather crisped hairs to 0.3(–5) mm long. LEAVES linear-oblanco- late to oblong-oblanco- late, (7–)12–25 (–40) mm long, (1–)2–5(–7) mm wide, acute, obtuse, apiculate to rounded at apex, cuneate at base, the margins entire, occa- sionally erose, the leaf-blades thin, flat or thickened and variously folded along the lower midrib, sometimes nearly cylindrical, straight and erect or arching outward, sparsely strigulose with antrorsely curved or bent hairs 0.06–0.15 along the upper surface, basal margins and main veins of the lower surface or the hairs more uni- formly scattered on both surfaces, or with more conspicuous, tapering, rather crin- kled hairs to 0.3(–0.5) mm long through- out; petioles 0.5–2.5 mm long, channeled, winged; the leaves and bracts yellowish to olive-green; paired bracts foliaceous, usu- ally linear-oblanco- late, acute, 0.5–2.5 cm long. FLOWERS with calyces 8.5–12 mm long, glabrous or variously vestitured, the lobes puberulent, strigulose along the mar- gins and midrib with hairs 0.1–0.3(–0.5) mm long, the longer hairs sometimes slightly setose; corollas (9.2–)12–16(–18)

mm long (dry), the tube cylindrical 3.2–7 mm long, throat ampliate, 3.5–5.5 mm long, the 2 upper lobes upcurved, 2.2–4 mm long. 1.7–3.5 mm wide, the lower 3 lobes slightly decurved, the medial lobe oblong-obovate, 3.6–4.5 mm long, 3–4.2 mm wide, rounded to emarginate at the tip. FRUITS 8–10 mm long.

DISTRIBUTION (FIG. 2) AND HABITAT. *Dyschoriste schiedeana* var. *schiedeana* occurs in caliche, rocky, gravelly, clay, flats, slopes, rocky ledges, limestone and gypseous areas, in grasslands, arid scrub, oak-pine, *Yucca* or juniper woodlands; central Veracruz to eastern San Luis Potosí, western Tamaulipas, Hidalgo, Querétaro, through the Sierra Madre Oriental in Nue- vo León to southeast Coahuila from 1000 to 2400 m elevation; flowering from May through November.

Dyschoriste schiedeana var. *schiedeana*, as recognized here, is a very variable taxon characterized by its erect, ascending stems, sometimes also with marginal decumbent stems that develop from a fasciculate root system that may produce broad-based, rather bushy individual plants or occasion- ally colonial groups of bushy or erect, sin- gle-stemmed plants scattered along a rhi- zome. Leaves are mostly linear-oblanco- late, yellowish green or olive green, sparsely or closely vestitured, thin or thick in tex- ture, flat or variously conduplicate, sparsely pubescent throughout or more com- monly only along the veins of the lower surface with the intercostal areas glabrous.

Fig. 1. (Next Page) *Dyschoriste schiedeana*. A–G. *D. schiedeana* var. *schiedeana*. A. Plant from area where type collected in Veracruz, Mexico showing tall, erect, growth habit, note long vestiture on stems, leaves. B. Leaf showing vestiture confined to lower margins and veins on abaxial surface. C. Calyx. (*Ventura 8517*, LL). D–E. Typical growth habit of variety through its central range with thin leaves on new shoots of season. E. Leaf. (Coahuila, *Roe et al. 60*, LL). F–G. Xeric phase of var. *schiedeana* with small condensed growth habit and folded, narrow oblanco- late, rather stiff leaves. (Coahuila, *Ginzburg 194*, TEX).—I–H. *D. schiedeana* var. *cinerascens*. I. Characteristic erect growth habit with leaves shorter than internodes; plants have close, dense cinereous vestiture on stem, leaves (I), and calyx (J). (Coahuila, *Stewart 444*, LL). K–L. *D. schiedeana* var. *decumbens*. K. Growth habit is decumbent, vestiture is of uniformly short, usually dense hairs on stems, leaves (E) and



calyces. (Arizona, Correll & Correll 39299, LL). M–N. *D. schiedeana* var. *prostrata*. M. Growth habit is decumbent, vestiture is more sparse, usually confined to leaf margins and veins beneath. (Nelson 4597, LL). All leaves, stems, and calyces drawn to the same scale.

Leaf vestiture many be short or long and coarse and tending to fall from older leaves when longer. Corollas are generally small (9.2–)12–16(–18) mm in total length. This variety has several different morphotypes that are discussed below.

Type 1: Rhizomatous plants producing a series of separate, erect, long stems with large leaves usually separated by longer internodes (Fig. 1A). They have thin, flat, yellow-green, spatulate leaves 8–25 mm long, 1.5–5 mm wide, with rather coarse hairs to 0.5(–0.7) mm long scattered on the upper leaf surface, but usually restricted to the veins and margins on the lower surface though scattered hairs may occur on both surfaces (Fig. 1B). Corollas are 11–15 mm long, calyces 6.5–8 mm long with tubes 2–2.2 mm long and the sepal margins have scattered slender hairs and some setae to 0.5 mm long (Fig. 1C). These plants occur from the type region of the species near Jalapa, Veracruz, to eastern San Luis Potosí and through Nuevo León into Coahuila and in Hidalgo. It is not possible to separate these tall, slender plants from the more common low, bushy type plants discussed below, as the two types intergrade completely.

REPRESENTATIVE SPECIMENS EXAMINED:

MEXICO. Coahuila: Lirios, E of Saltillo, 10–13 Jul 1880, *Palmer 1010* (GH, MO, US). Nuevo León: Chipinque Park, SW of Monterrey, 11 Jun 1978, *Poole & Watson 1389* (TEX); Mpio. Aramberri, Cerro Grande, 6 Jul 1986, *Hinton 18992* (TEX); Santa Gertrudis near Dr. Arroyo, 20 Jul 1993, *Hinton 23048* (TEX); 15 mi E of San Rafael off Hwy 57, 25°03'N, 100°26'W, 22–23 Jul 1977, *Wells & Nesom 119* (TEX). San Luis Potosí: San Dieguito near Cd. Valles, 13–16 Jun 1904, *Palmer 99* (GH, US). Veracruz: Mpio. Dos Ríos, Cerro Gordo, 3 Jul 1973, *Ventura 8517* (ARIZ, LL); Mpio. Xalapa, Cerro Colorado, 27 Mar 1974, *Ventura 9775* (LL). Hidalgo: Mpio. Jacala, Pine woods, 1 Jul 1939, *Chase 7259* (F); Cupresus forest, along hwy 85, 7.4 mi SW of Jacala, 15 Aug 1984, *Daniel & Baker 3731* (CAS).

Type 2: Bushy low plants to 1 dm tall with many erect-ascending central stems from an underground rootstock, with thin, rather broad, uniformly vestitured leaves

and short internodes. They may have procumbent marginal stems (Fig. 1D). Some collections show rhizomes connecting separate plants. This is the most commonly encountered form of *Dyschoriste schiedeana* var. *schiedeana* and would include the type of the species. The leaves are crowded, moderately thin, closely pubescent-puberulent throughout or the hairs may be absent or diminish in the intercostal areas of the lower surface. Leaves are mostly narrowly oblanceolate or somewhat obovate, but they may appear narrower as they are variously conduplicate, and sometimes they are folded only above the petiole, not near the apex (Fig. 1E). Corollas range from 9–18 mm in length.

The type of *Dyschoriste lloydii* Kobuski from Hacienda de Cedros in northern Zacatecas also fits into this group. The type plant is short, multistemmed with erect-ascending stems and glabrous intercostal areas on the lower leaf surface. Other specimens from that general area (*Shreve 9399*, *Stanford et al. 492*) are similar, but all have decumbent marginal stems. The presence of marginal procumbent stems may originate from introgression with *Dyschoriste schiedeana* var. *prostrata*.

REPRESENTATIVE SPECIMENS EXAMINED:

[Those with leaves hairy throughout are preceded with an (H) those with decumbent-procumbent stems with a (D)]. MEXICO. Coahuila: (H-D) Fraile, 59 km S of Saltillo, 10 Jul 1941, *Stanford, Retherford & Northcraft 272* (ARIZ, GH, MO, NY); (D) 2–16 mi E of Carneros Pass to Hedionda Grande, 2 May 1955, *Correll and Johnston 21343* (LL); (H-D) 11 km NE of Jimulco, 28 Jun 1941, *Stanford, Retherford & Northcraft 24* (ARIZ, GH, MO, NY). San Luis Potosí: (D) Mpio. Cd. del Maíz, 15.6 mi SW of Jct. with hwy 80 at San Tiburcio, 14 Sep 1988, *Nesom & Wells 6671* (TEX); (H-D) Charcas, Jul–Aug 1934, *Lundell 5049* (LL); (H-D) Valley Río Verde, 14–15 Sep 1954, *Sohns 1255* (US–2). Zacatecas: (D) Base of Pico Teyra, 12 Sep 1939, *Shreve 9399* (ARIZ, GH); (D) 15 km W of Concepción del Oro, Coah.–Zac. border, 19 Jul 1941, *Stanford, Retherford & Northcraft 492* (ARIZ, GH, MO, NY). Nuevo León: (H) Mpio. Aramberri, La Escondida to Aramberri, 23 Oct 1993, *Hinton 32728* (TEX); (D) 29 mi W of Galeana, 20 Nov 1958, *Rollins & Tryon 58177* (LL); (with rhi-

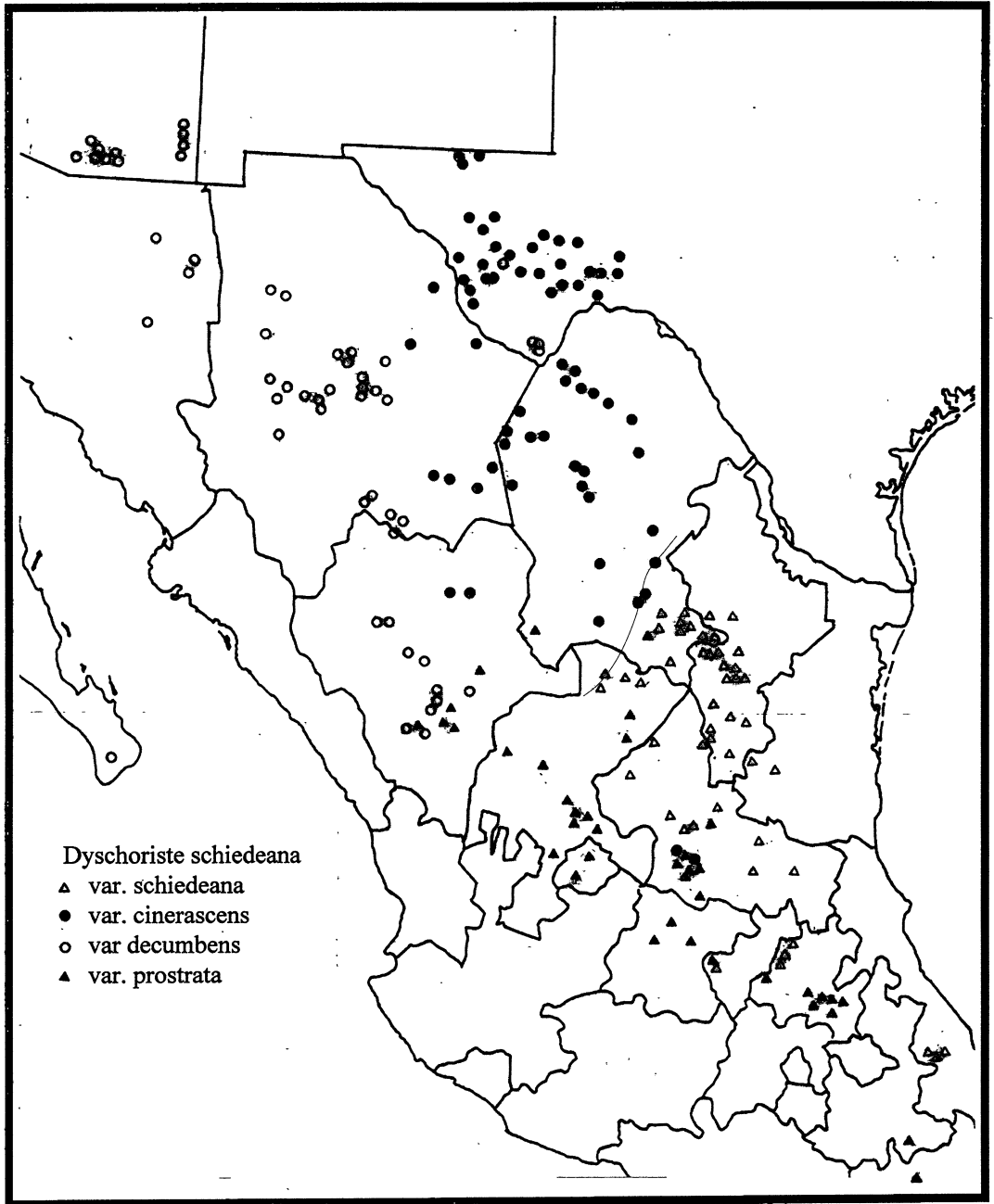


Fig. 2. Distribution of *Dyschoriste schiedeana* var. *schiedeana* (open triangles); var. *cinerascens* (closed circles); var. *decumbens* (open circles); and var. *prostrata* (closed triangles) in Mexico and adjacent United States.

zomes) 3 mi above Iturbide, rd to Galeana, 18 May 1949, *McVaugh 10565* (LL, NY, US). Querétaro: near Querétaro, 20–23 Aug 1906, *Rose 11148* (NY). Hidalgo: (D) NE of Jalaca, 16 Jul 1947, Moore 3412 (GH); (D) Mpio. Jacala, Rocky mt side, 26 Jun 1939, *Chase 7171* (F, GH).

Type 3: Small, bushy, multistemmed plants 0.5–1 dm tall, with thick, crowded, narrowly folded leaves (Fig. 1F, G). The leaves are linear-oblancoelate, 8–12 mm long, 1–2 mm wide, conduplicate and in some collections are nearly cylindrical due to folding (Fig. 1G). They may or may not have marginal decumbent-procumbent stems. These plants occur scattered throughout the range of the taxon and appear to represent a more xeric morph of exposed habitats.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Tamaulipas: Near Miquihuana 23°42' N, 99°45' W, 8 Aug 1941, *Stanford, Retherford & Northcraft 759* (ARIZ, GH, MO, NY); 5 mi NE of Jaumave, 23°29' N, 99°21' W, 1 Aug 1976, *Webster & Armbruster 20550* (TEX). Nuevo León: 3 km N of Galeana, in gypsum, 26 Jul 1993, *Turner 93-159* (TEX); near Ojo de Agua, foot of Cerro Potosí, 15 Jul 1945, *Sharp 45725* (GH, NY, US). Coahuila: 17 mi S of Saltillo, 1.1 mi N of turnoff to San Antonio de las Alazanas, 24 Jul 1985, *Ginsbarg et al. 194* (TEX).

In addition to the above, there are plants with erect-ascending central stems and well developed lateral procumbent stems with crowded, thin leaves and colonial plants consisting of bushy plants interconnected by subterranean rhizomes.

It is not actually known how much of the variation present in *Dyschoriste schiedeana* var. *schiedeana* comes through introgression with other taxa within the species. The uniform leaf vestiture may well be derived from var. *cinerascens*; it is strongly suspected that the tendency to produce lateral decumbent stems is derived from vars. *prostrata* and *decumbens*. Plants similar to var. *schiedeana*, but with larger leaves, occur scattered throughout the range of var. *cinerascens*, as far north as trans-Pecos Texas. Whether these are truly var. *schiedeana* or a more mesic

phase of var. *cinerascens* is not known. Likewise, plants with the characteristic growth habit of var. *cinerascens* occur scattered well within the range of var. *schiedeana* in San Luis Potosí and Nuevo León. This great overlap of characters make recognition of the two taxa at the species level impossible and adds to the difficulty of understanding this group.

The most difficult group of specimens encountered in this complex consists of overgrown erect to broadly spreading plants with long internodes and large, green to gray green, thin leaves to 25–43 mm long, 3–9 mm wide, with entire or erose margins and long, rather slender petioles. None of the specimens (see listing below) has many flowers and some have no flowers or fruit. The vestiture on the stem is moderately dense, that of the leaves is variable, but generally sparse on both surfaces. These plants occur widely scattered throughout the range of all the varieties of *Dyschoriste schiedeana*. It is my contention that these collections do not represent a taxon but are either shade forms or water-rich "seep" specimens from arroyo margins, seeps, or stock ponds with uncharacteristic strong vegetative growth. They appear to be preferentially collected when little else is in flower.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Chihuahua: Mesa N of La Junta, 10–19 Oct 1935, *LeSueur 422* (F, MO, TEX) = var. *decumbens*. Coahuila: Sierra la Paila, 10 km NNE Est. Martí, 25 Jul 1993, *Turner 93-126* (TEX); same, *Turner 93-138* (TEX); Sierra de la Paila, Ejido El Cedral, 25°57' N, 101°33' W, 4 Oct 1989, *Villarreal 5252* (TEX); Rancho Santa Teresa, S of Castaños, 19 Jun 1963 *Wynd & Mueller 190* (A-with wide leaves; ARIZ, MO, US, with narrow leaves and referable to var. *cinerascens*); Cañón de Ybarra in Sierra del Pino, 22–23 Sep 1941, *Stewart 1895* (LL); Sierra de la Cruces, Santa Elena Mines, 15 Oct 1940, *Stewart 289* (LL). San Luis Potosí: San Luis Potosí, 1879, *Schaffner 354* (US–1 of 3 specimens on sheet). Nuevo León: Sierra Madre Mts., Monterrey, 17 Jul 1933, *Muller & Muller 117* (F, GH, TEX); Zacatecas: Rd between Colotlán and Platrado, 31 Aug 1897, *Rose 3615* (US).

1b. *Dyschoriste schiedeana* var. *cinerascens* Henrickson & Hilsenbeck, var. nov.
(Fig. 1 H-J)

TYPE. UNITED STATES. Texas: Presidio Co., rocky hills about 12 miles S of Marfa, 18 Jun 1963, *D. S. Correll & D. C. Wasshausen 27900* (HOLOTYPE: LL!; ISOTYPES: GH! MO! US!).

A *Dyschoriste schiedeana* var. *schiedeana* differt foliis crassioribus acutioribusque et foliis ac floribus verticillatis; a *D. schiedeana* var. *decumbenti* ac var. *prostratae* differt habitu erecto et marginibus sepalorum ac carinae setis longioribus; a *D. lineari* differt absentia rhizomatum, foliis et bracteis vestimento uniformi intercostali (non limitato ad margines ac venas), et corollis brevioribus [(12.5–)14–18(–20) mm longis vs. 18–26 mm longis].

Bushy, verticillate, erect-ascending, sometimes briefly decumbent HERBS 0.8–3(–4)[–10] dm tall from an underground rootstock bearing fibrous roots; stems several, few-branched near the base with internodes 0.5–3(–6.2) cm long, closely pubescent, strigulose, strigose, or hirsutulous with antrorse curved, bent or spreading hairs 0.1–0.3 mm long to more strongly villous-hirsute to setose with dense, spreading, crisped hairs to 0.5–1.2 mm long mainly on the angles or with longer hairs on the angles and shorter hairs throughout. LEAVES erect-ascending, oblanceolate, linear-spatulate to linear, moderately thick, (10–)12–25(–38) mm long, (2–)3–7(–14) mm wide, acute to sometimes rounded at apex, cuneate at base, the larger with petioles to 1–5(–8) mm long at the base, entire to commonly sinuate, sometimes closely undulate at the margins and thus sometimes appearing crenulate, uniformly pubescent to strigulose with antrorsely curled hairs 0.1–0.2(–0.3) mm long on both surfaces (these not confined to the veins and margins on the lower surface), the margins frequently, and the midrib less frequently, with longer curved or spreading hairs or setae 0.2–0.8 mm long, the blades flat or

often conduplicate, often bluish-gray in color; bracts linear-spatulate to linear, (5–)10–20 mm long, (0.7–)1.5–3 mm wide, leaf like in texture and vestiture. FLOWERS with calyces 7–17 mm long, the tubes 2.2–5 mm long, the lobes 0.8–1 mm wide at the bases, 5–12 mm long, uniformly pubescent-strigulose to hirtellous throughout with hairs 0.1–0.2(–0.3) mm long, the hairs on the lower lobe and keel margins more setose-hirsute, 0.2–0.6(–1.2) mm long; corollas (12.5–)14–18(–20) mm long, the tubes cylindrical 4–7 mm long, the throat campanulate, to 5–6(–7.5) mm wide, the lobes oblong-obovate, 3.5–5.5 mm long and wide. FRUITS 8–11 mm long.

DISTRIBUTION (FIG. 2) AND HABITAT. *Dyschoriste schiedeana* var. *cinerascens* occurs in shallow calcareous-derived clay loams over limestone and sandy areas in grasslands, pine-juniper-oak woodlands, yucca-cactus scrublands, roadsides from trans-Pecos Texas south into eastern Chihuahua, northern Durango and across Coahuila, also San Luis Potosí from 1500–2200 m elevation; flowering from April through October dependent on the occurrence of the spring-summer rains.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. Texas: Jeff Davis Co.: 20 mi W of Alpine, 2 Sep 1977, *Sanders 1090* (TEX); Pecos Co.: 11 mi E of Ft. Stockton, 27 Apr 1947, *Warnock 5171* (LL); Presidio Co.: Alpine, Sul Ross campus, 7 Jun 1940, *Warnock 21442* (TEX); Culberson Co.: Guadalupe Mts. Nat'l. Park, lower McKittrick Canyon, 9 Aug 1974, *Northington 795* (TEX); 10 mi W of Kent, 30 Jul 1958, *Correll & Wasshausen 27941* (LL); Reeves Co.: Jct. of US hwy 80 & 290, 13 Jul 1950, *Gentry 690* (TEX). MEXICO. Chihuahua: 3 km ENE of Santo Tomás, E margin of Las Pampas Ranch, 27°21'N, 104°34'W, 28 Aug 1972, *Chiang et al. 8965* (LL); 15 mi N of jct. hwy 45 & 49, 27 Jul 1975, *Engard & Gentry 626* (LL). Coahuila: 7.5 mi N of Rancho El Jarín, 29°09'N, 102°12'W, 28 Jul 1973, *Johnston et al. 11843b* (LL); Sierra del Pino, vic. La Noria, 20–26 Aug 1940, *Johnston & Muller 693* (LL); 3 km N of Australia, Sierra de los Alamitos, 26°29'N, 102°19'W, 13 Jun 1972, *Chiang 7746* (LL). Durango: 11 mi E of La Zarca, rt. 30, 26 Jul 1958, *Correll & Johnston 20227* (LL). San Luis Potosí: 9 mi E of San Luis Potosí, hwy. 86, 5 Jul 1973, *Luckow 2688* (TEX).

This taxon can be distinguished by its bushy, rather compact, erect-ascending growth habit with leaves and flowers crowded at nodes, often separated by longer internodes, giving the plant a distinctive tiered or verticillate arrangement (Fig. 1H), and by its somewhat bluish-gray vegetative coloration. Plants vary considerably in flower size, habit size and particularly in vestiture.

In lightly vestiture plants, leaves and bracts have a sparse to moderately dense covering of antrorsely curved, tapering hairs 0.06–0.2 mm long on both surfaces without longer hairs on margins and veins. Stems have a similar uniform and close vestiture of antrorsely or sometimes retrorsely curved, tapering hairs 0.1–0.2 mm long with some longer uncurved spreading hairs at the nodes. Sepals will have some upcurved hairs 0.2–0.5(0.8) mm long along the margins and midvein. This very close vestiture pattern matches that found in many plants of *Dyschoriste schiedeana* var. *schiedeana* and var. *decumbens*. These plants may also have a yellow-green or olive-green coloration as in var. *schiedeana* or *D. linearis* rendering some of these plants difficult to classify.

A more commonly occurring pattern is with leaves and bracts having more dense intercostal spreading or curved-bent hairs 0.1–0.3 mm long, with some or many upcurved hairs 0.2–0.5(–0.8) mm in length along the lower margins and less frequently along the main veins beneath (Fig. 1I). Young stems may have only short hairs or a mixture of short and long spreading to upwardly curved hairs 0.2–0.8 mm long. These hairs may be uniformly arranged or the longer hairs may occur mostly on stem angles; basal internodes characteristically have a closer vestiture. Sepal lobes are vestitured as the leaves, but have longer hairs 0.2–0.5(–0.8) mm long along the margins and midvein (Fig. 1J).

Densely vestitured plants have leaves and bracts with dense antrorsely curved hairs to 0.3–0.5 mm long with longer hairs

on the lower margins and main veins to 1 mm long. Stems are densely canescent and hirsute with both short and longer spreading, upcurved or crinkled hairs to 1.5 mm long and again the longer hairs may be dispersed or confined to the stem margins. Sepals are densely vestitured with longer setae along the margins and keels.

There is no geographical basis to the differences in vestiture encountered, nor are there three discrete morpho types, rather the above noted types are trends encountered over the range of the species. Plants with the sparse and close vestiture, as noted above, are similar in that character to *Dyschoriste schiedeana* var. *decumbens*, but var. *cinerascens* can be distinguished from var. *decumbens* by its erect-ascending habit. Plants of var. *cinerascens* with well developed decumbent lateral stems, however, may approach var. *decumbens*.

Dyschoriste schiedeana var. *cinerascens* shows strong mixing with var. *schiedeana* in its southernmost range where the distributions of the two taxa overlap. Separation of the two taxa is difficult as vestiture and structural patterns combine and often occur mixed in available collections. To separate the taxa I have relied on the habit differences with var. *cinerascens* having a distinctive verticillate, erect-ascending, non-rhizomatous growth habit, thicker stems, and thicker, bluish-gray leaves and bracts with curved hairs on the intercostal areas.

Dyschoriste schiedeana var. *schiedeana*, in contrast, tends to be rhizomatous and may form colonies of slender, erect-stemmed plants with thinner, more yellow- to olive-green leaves and bracts with hairs restricted to the upper surface and the margins and veins beneath. Plants considered to be influenced by var. *cinerascens*, tend to be more branched, have thicker, narrower leaves or leaves with curved hairs on both surfaces, and tend to have central erect-ascending stems and marginal decumbent stems; many plants included

in var. *schiedeana* exhibit these characteristics.

As *Dyschoriste schiedeana* var. *cinerascens* approaches the southern portion of its range the plants tend to be of reduced stature, to have more decumbent spreading lateral stems, and a sparser leaf vestiture. Two collections from near San Luis Potosí [12 mi N of San Luis Potosí, *McGregor et al.* 547 (LL-2); 9 mi E of San Luis Potosí, *Luckow* 2688 (TEX)] have the configuration, coloration, and leaf thickness of var. *cinerascens*, but have sparse understory leaf vestiture and tend to produce decumbent lateral stems as in var. *prostrata*, which also occurs in the region.

Ironically some specimens from montane habitats in the far northern range of *Dyschoriste schiedeana* var. *cinerascens* appear much like var. *schiedeana*. These specimens have erect stems, thin, rather long, olive-green leaves with sparse understory vestiture, and except for the generally larger corollas, they appear much like specimens from mountains south of Saltillo, Coahuila. These include the following: Texas: Culberson Co.: Guadalupe Mts., below McKittrick Canyon, *Webster* 4536 (GH). Jeff Davis Co.: Ft. Davis, *Palmer* 32082 (MO, TEX); Davis Mts., *Palmer* 30819 (MO); Davis Mts., *Young s.n.* (GH). Brewster Co.: Greene Valley, Glass Mts., *Warnock* W590 (MO); Chisos Mts., *Mueller* 8167 (MO). The presence of these plants in the northern extreme of the range of var. *cinerascens* generally in higher woodlands and forests, indicates that environmental factors account for these differences.

Dyschoriste schiedeana var. *cinerascens* can be distinguished from *Dyschoriste linearis* by: (1) its lack of rhizomes-var. *cinerascens* develops directly from a underground fibrous-root bearing rootstock; (2) by its leaf and bract understory vestiture that is uniformly pubescent-strigose with antrorse curved or bent hairs on both surfaces not just confined to the veins and margins on the lower surface; (3) by its

bluish gray, not yellowish- or olive-green coloration; and (4) by its generally smaller corollas (12.5–)14–18(–20) mm long (not 18–27 mm long). Intermediates between these two taxa are discussed under *D. linearis*.

1c. *Dyschoriste schiedeana* var. *decumbens* (A. Gray) Henrickson, comb. et stat. nov. (Fig. 1 K–L)

Calophanes decumbens A. Gray, Syn. Fl. N. Am. ed. 1, 2⁰: 325. 1875. *Dyschoriste decumbens* (A. Gray) Kuntze, Rev. Gen. Pl. 2: 486. 1891. TYPE. UNITED STATES. Arizona: Near Santa Cruz, stony soil in mountain valley, *C. Wright* 1462, [LECTOTYPE: (here designated) GH!; ISOLECTOTYPES: GH! NY!] The number 1462 was assigned by Dr. Gray to all of Wright's collections of this taxon, thus Wright 1462 from "valley of the Rio Grande" at MO is not considered type material. Kobuski (1928) did not designate a type.

Procumbent, occasionally somewhat decumbent HERBS 0.3–0.5 dm tall, 2–8 dm wide from a fibrous-root bearing underground rootstock; stems several from the base, radiating; internodes 0.5–4.5(–5.5) cm long, closely, uniformly puberulent, hirtellous to canescent with erect to antrorse, retrorse, curved, bent or crinkled white hairs 0.05–0.1(–0.2) mm long. LEAVES erect-ascending, oblanceolate, spatulate to linear-oblanceolate or linear (those of the lowermost stems sometimes obovate), (4–)10–30(–45) mm long, (2–)4–7(–15) mm wide, rounded, obtuse to acute, apiculate at apex, cuneate, the larger leaves with petioles 3–10 mm long at base, the margins entire to somewhat repand, green to grayish-green, usually uniformly puberulent to strigulose with mostly antrorsely curved or bent, often thickish hairs 0.05–0.1(–0.2), long on both surfaces, those of the margins and veins on the lower surface often more dense. FLOWERS sometimes forming very dense aggregations with the bracts at the nodes; peduncles-pedicels 0.5–2(–9) mm long, generally more densely and closely vested than the stems; bracts leafy, spatulate

to linear-spatulate, linear, (3–)9–18 mm long, (1–)1.5–4 mm wide; calyces (8–)10–16.5 mm long, the tubes (3–)3.5–5.5 mm long, the lobes subulate, (6.5–)9–11 mm long, 0.7–1 mm broad at the base, closely and rather evenly pubescent throughout with hairs similar to those of the leaves, sometimes the hairs on the sepal margins somewhat longer but never over 0.3 mm long and never setose; corollas lavender, sometimes pinkish-lavender, with whitish or pale veins, sometimes with red-purple markings in the throat, 16–25.5 mm long, the tube 6–11 mm long, the throat 4–7 mm long, campanulate-funnelform, to 5–8 mm broad below the lobes; lobes oblong-obovate, (4–)5.5–8 mm long, 4–6.5 mm wide. FRUITS 8.5–12(–13) mm long.

DISTRIBUTION (FIG. 2) AND HABITAT. In open shallow limestone- and volcanic-derived soils in grasslands, flats, open oak and pine woodlands, foothill grasslands from Arizona, (Santa Cruz and adjacent Cochise, Pima counties) possibly New Mexico (Rio Grande Valley by Wright), south into eastern Sonora and the woodlands and grasslands of eastern slope of the Sierra Madre Occidental of Chihuahua and into Durango, disjunct in trans-Pecos Texas and in Baja California del Sur, mostly from 1300–2450 m, flowering from July through September.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. Texas: Brewster Co.: Blue Creek Trail, Chisos Mts., 9 Oct 1933, *Cory 7344* (GH); Big Bend National Park, Chisos Mts., Pine Canyon, 17 Jun 1963, *Correll & Wasshausen 27861* (LL). Jeff Davis Co.: E slope of Mount Lock, Davis Mts., 1 Sep 1935, *Sperry T132* (US) (with closely crenulate leaf margins). Arizona: Pima Co., Greaterville, 16 Sep 1916, *Shreve 4970* (ARIZ). Santa Cruz Co.: Patagonia Mts., 18 Aug 1928, *Peebles, Harrison & Kearney 5608* (ARIZ). Cochise Co.: Ft. Huachuca Military Reservation, 20 Aug 1960, *Goodding 232-60* (ARIZ), Picket Canyon, Chiricahua National Monument, 16 Aug 1934, *Clark 8619* (ARIZ).

MEXICO. Baja California del Sur: Cape Region, Potrero de Almenta, head of S fork of Canon San Pedro, 23°19'N, 109°56'W, 10 May 1955, *Moran 7392* (DS). Sonora: Region of Río Bavispe, El Tajo,

Río Fronteras, 20 Aug 1941, *White 4060* (ARIZ, GH); Quipur, 23 Jul 1970, *Pennington 72* (TEX). Chihuahua: Vicinity Majalca Village, 11 May 1959, *Correll & Johnston 21776* (LL); Rocky hills near Chihuahua, May 1885, *Pringle 66* (GH, F, NY–2, US); 34 mi S of Parral, 9 Aug 1956, *Waterfall 12522* (GH). Durango: Tepehuanes, 28 Jul 1944, *Fisher 44297* (GH, MO, NY); 21 mi SE of Santiago Papasquiaro, 3 Aug 1970, *Flyr 1525* (TEX); Llano Grande, 42 WSW of Cd. Durango, 10 Aug 1955, *Maysilles 8493* (NY, TEX); 16 km SW of Durango along Hwy 20, 24 Jun 1964, *Mick & Roe s.n.* (US).

Dyschoriste schiedeana var. *decumbens* is characterized by its strictly decumbent growth habit and its close, very short, uniform vestiture on stems, leaves and calyces—the hairs along the calyx margins are typically the same length as those of the leaves, rarely to twice as long but never conspicuously long setose. Throughout its range it is quite variable in leaf size, vestiture and flower size. In Texas, Arizona, Chihuahua and northern Durango the plants flower during the late summer wet season; the specimens are usually quite large, have large leaves and a uniform vestiture of short, blunt curved hairs mostly 0.1 mm long on both leaf surfaces and stems. The short hairs continue onto the sepals; sepal margin and keel hairs are rarely to 0.2 mm long, never long setose. When leaves are large, vestiture may be rather sparse and sometimes conspicuously stronger on the leaf margins. In northern Sonora the local populations tend to have large, nearly glabrous leaves except for small scattered hairs on the veins of the lower leaf surface and leaf margins as exemplified by *White 3763*, *White 3705*, *Laferriere 1535*. These are not nomenclaturely recognized as vestiture is often reduced in other fast-growing plants with large leaves and other specimens from the region have solitary flower, but are more strongly vestitured.

A single collection from Baja California del Sur (*R. Moran 7392*) reported by Daniel (1997) initially appeared to be distinct in having a very short stem and leaf vestiture only 0.03–0.05 mm long, with some specimens showing much longer

hairs 0.3–0.7 mm long clustered on the margins and veins of younger leaves. While the longer tufted hairs were distinctive, they have been observed in occasional specimens elsewhere in the genus and are considered anomalous. The are not consistent in the specimens seen. The specimen in other ways appears to fit within *Dyschoriste schiedeana* var. *decumbens*.

In drier habitats from in eastern Chihuahua and Durango the plants have smaller leaves, often with a denser vestiture, and are overall more condensed. The presence of a disjunct population of *Dyschoriste schiedeana* var. *decumbens* in the Chisos Mountains of trans-Pecos Texas is surprising. While most of these collections have entire leaf margins, a few collections there have undulate-crenate margins as in *Dyschoriste crenulata*.

As the stems of *Dyschoriste schiedeana* var. *decumbens* are horizontal, the flowers are ascending to upright and relatively large. Total corolla lengths, based on 1 measurement per sheet, when available, from dried specimens, were 21–25.4 mm in Arizona, 16.5–19 mm for Texas, 15.5–24 mm for Chihuahua, and 14–24 mm for Durango.

Populations of *Dyschoriste schiedeana* var. *decumbens* are well separated geographically from those of var. *schiedeana*. But they blend into var. *schiedeana* through the highly variable var. *prostrata* that ranges from central Durango to San Luis Potosí south into Guanajuato, Aguascalientes, Hidalgo, Puebla and Oaxaca. *Dyschoriste schiedeana* var. *prostrata* is also procumbent, but differs from var. *decumbens* in usually having shorter leaves (8–)13–18(–25) mm long, a much coarser and less uniform vestiture with hairs often confined to the margins and veins on the lower leaf surface. The sepal margins are often more coarsely vestitured sometimes having some rather setose-like hairs to 0.4–0.6 mm long. *Dyschoriste schiedeana* var. *prostrata* also tends to have smaller corollas, particularly in its eastern range.

Dyschoriste schiedeana var. *decumbens* can be distinguished from var. *cinerascens* and *D. linearis* by its procumbent habit and its uniform, close, short, leaf and bract vestiture and the lack of longer ciliae on the sepal margins and keel. It is distinguished from the procumbent *D. crenulata*, as the latter has crenulate leaf margins, from *D. greenmanii*, as the latter is glabrous, from the procumbent *D. poliodes* by its conspicuously long hairs.

1d. *Dyschoriste schiedeana* var. *prostrata*
Henrickson, var. nov. (Fig. 1 M–N)

TYPE. MEXICO. San Luis Potosí: Region of San Luis Potosí, 1878, C. C. Parry & Ed. Palmer 699 (HOLOTYPE: NY!, ISOTYPES: F–2 sheets! GH! US!).

A *Dyschoriste schiedeana* var. *decumbenti* differt foliis minoribus vestimento minus uniformi et floribus generaliter minoribus.

Prostrate HERBS with stems 1–2(–3) dm long; internodes 14–36 mm long, 0.7–1 mm in diameter, uniformly pubescent-hirtellous with erect to decurved, rather thickish hairs 0.05–1.5(–2) mm long, the hairs rarely to 0.5 mm long and tapering. LEAVES linear-oblongate to obovate, small and thickened or in some plants larger and thin, 6–20(–24) mm long, 1.8–4(–9) mm wide, acute to emarginate at the apices, long tapering and cuneate above a petiole 1–4 mm long at the base, sparsely to moderately pubescent throughout with thickish curved hairs 0.05–0.15 mm long, the hairs in the intercostal areas often falling leaving hairs mostly along the midvein on the upper surface and along the main veins beneath, occasional plants with tapering hairs to 0.4 mm long. FLOWERS sometimes forming dense nodal aggregations; peduncles-pedicels 0.5–2(–5) mm long, closely vestitured; bracts spatulate to linear-oblongate, linear, leafy; calyces 8–11 mm long, tubes 2.5–4.5 mm long, lobes 6–7 mm long, pubescent throughout, the marginal

hairs 1–2 mm long; corollas lavender, sometimes with lighter veins, sometimes purplish on lower lip, or pinkish throughout, 10–19 mm long, the tubes 4–9 mm long. FRUITS 8–10 mm long.

DISTRIBUTION (FIG. 2) AND HABITAT. In open shallow limestone- and volcanic-derived rocky soils in grasslands, cactus scrub, oak and pine woodlands, from central Durango, west to Zacatecas and southern San Luis Potosí to Aguascalientes, Guanajuato, Hidalgo, Puebla, and Oaxaca from 1700–2400 m elevation; flowering from May through September.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Durango: Cd. Durango & vicinity, Apr–Nov 1896, *Palmer 276* (GH, US); same data, *Palmer 309* (F, MO, NY); same data, *Palmer 930* (GH, MO, NY, US); 13 mi NE of Durango, rt. 31, 25 Jul 1958, *Correll & Johnston 20160* (LL); Hwy 40, 8 km W of Durango, 31 Aug 1967, *Oliver 654* (MO); Near La Purisima, 26 Aug 1939, *Shreve 9178* (ARIZ, GH); Sierra Gamon above Peñón Blanco, 19–20 Sep 1948, *Gentry 8359* (GH, US). Zacatecas: 20 mi NW of Fresnillo, Hwy 45, 22 Aug 1975, *Davidse 9998* (TEX); S slope of La Bufa, Cd. Zacatecas, 10 Aug 1948, *Dressler 97* (MO, US); 6 mi S of Sierra Hermosa, 5 Sep 1938, *Shreve 8603* (ARIZ, US). San Luis Potosí: Sierra de Alvarez, 22–25 rd mi ESE of San Luis Potosí, 20 May 1951, *McVaugh 12251* (US); Sa. de San Miguelito, S of San Luis Potosí, 28 Jul 1934, *Pennell 17723* (GH, US); 3 km N of Moctezuma, rd. to Venados, 2 Jul 1972, *Chiang, Wendt & Johnston 8214h* (LL). Aguascalientes: Mpio. San Jose de Garcia, 28.6 km N de Cd. Aguascalientes, 5 Jul 1983, *Cowan 4026* (TEX). Guanajuato: Near San Miguel de Allende, Aug 1947, *Kenoyer 2460* (GH); Mpio. San Felipe, 25 km NNE de León, 8 Aug 1987, *Galvan 2798* (TEX). Hidalgo: Mpio. Zempoala, Sierra de Pitos, 16 Sep 1973, *Rzedowski 31220* (ENCB); Cerro Gordo, 7 km al W de Pachuca, 11 Jul 1967, *Rzedowski 23920* (ENCB); 5 km al E de Tulancingo, 4 Jul 1979, *Hernández 3302* (ENCB); 1 km N de Tolcayuca, 4 Sep 1971, *Jiménez 136* (ENCB). Puebla: Vicinity San Luis Tultitlanapa, Jul 1908, *Purpus 3347* (F, MEXU); 4 km SSE of Cañada Morelos, 23°50'N 24°24'W, 16 Jul 1991, *Mayfield et al. 902* (TEX). Oaxaca: Dist. Coixtlahuaca, 2.5 km SSE de Concepción Buenavista, 23 Aug 1968, *R. Cruz C. 2058* (ENCB).

With its generally smaller leaves, unevenly distributed leaf-bract vestiture *Dyschoriste schiedeana* var. *prostrata*

appears to be a transitional taxon between the larger, more uniformly vestitured var. *decumbens* to the north and the equally small, often equally vestitured var. *schiedeana* to the east. *Dyschoriste schiedeana* var. *schiedeana* differs from var. *prostrata* only in habit, with var. *prostrata* having only procumbent stems while var. *schiedeana* has more erect or ascending central stems, but may have decumbent to procumbent marginal stems. *Dyschoriste schiedeana* var. *schiedeana* also has smaller flowers, but the corollas range from (9–)13–19 mm and this overlaps with the corolla sizes characteristic of var. *prostrata*, which vary throughout its range. Corolla lengths of var. *prostrata*, as measured from dried specimens, are 14–19 mm for Zacatecas, 13.5–19 mm for San Luis Potosí, 16–18 mm for Guanajuato and Aguascalientes, and 12–17.5 mm for Hidalgo specimens.

Dyschoriste schiedeana var. *prostrata* represents a taxon intermediate between var. *decumbens* and var. *schiedeana* and it may have originated from introgression between the two taxa. *Dyschoriste schiedeana* var. *prostrata* is recognized as it nomenclaturally separates the broad zone of decumbent, unevenly vestitured plants from the uniform vestitured, often larger-leaved, larger-flowered plants of var. *decumbens*, throughout Chihuahua, Arizona, and trans-Pecos Texas and the more erect-ascending plants that characterize var. *schiedeana* from southeastern Coahuila to Hidalgo. But along each zone, many intermediate specimens exist. At one time I considered combining all the decumbent plants into var. *decumbens*, but it was apparent that the taxon was polyphyletic with some plants representing true *decumbens* and others plants being either intermediate with or derived from var. *schiedeana*.

2. *DYSCHORISTE LINEARIS* (Torr. & A. Gray) Kuntze. (Fig. 3 A–H)

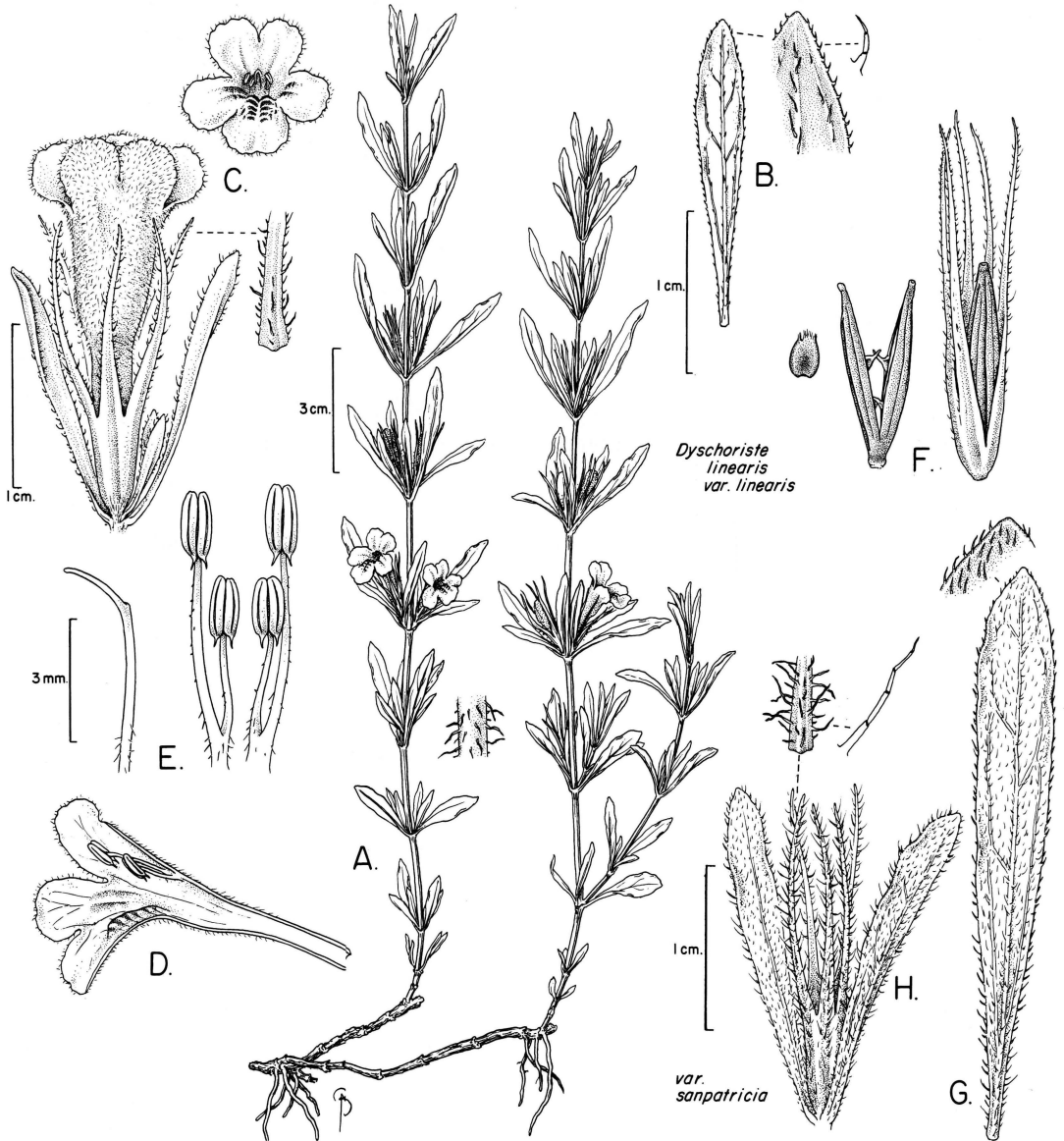


Fig. 3. *Dyschoriste linearis*. A–F. *D. linearis* var. *linearis*. A. Growth habit showing basal rhizomes, erect stems with well spaced nodes (School & Williams s.n.). B. Leaf showing hairs confined to margins and veins of lower leaf surface. C. Flower showing subtending bracts, calyx, corolla and face view of corolla. Note bullate surface at lower tip of throat. D. Longitudinal section of flower showing placement of stamens. E. Stamens showing short vs. long filaments and dithecal anthers each with a basal slender spur. (B–E from Correll & Johnston 17192, LL)—F. Mature capsule within a calyx, open capsule showing retinacula that subtend seeds, and seed (Correll & Wasshausen 28026, LL). G–H. *D. linearis* var. *sanpatriciensis*. G. Leaf showing vestiture throughout surface. H. Node showing more strongly vestitured bracts and calyx (Lundell & Lundell 14933, LL). All leaves, stems, and flower parts drawn to the same scale.

Rhizomatous HERBS 1.5–4 dm tall forming colonies 2–8 dm in diameter; rhizomes 1–1.5 mm thick, dark brown, similar in size and color to the fibrous roots; stems briefly decumbent or erect-ascending with internodes 1–3.5(–6) cm long, simple or few (–several) branched in the lower half, glabrous or sparsely to densely pubescent, strigose to villous-setose with retrorse to decurved, spreading, wavy or straight, tapering, mostly coarse, white, uniseriate hairs 0.1–1.2(–1.5) mm long, these or only the longer hairs restricted to the four angles of the stem. LEAVES ascending-erect; lower leaves spatulate-obovate, large or commonly strongly reduced and soon deciduous; upper-mid leaves spatulate, linear-spatulate, oblong, to linear, 2–4.5(–6.5) cm long, (0.8–)2–10 (–13) mm wide, acute to rounded at the apices, narrowly cuneate, the larger leaves with winged petioles 1–5(–7) mm long at the base, entire to irregular sinuate-repand, yellow-green, the midveins, sometimes the lateral veins yellow and raised beneath, the midvein yellow and raised above, glabrous to mostly antrorsely pubescent or strigulose or more curved to spreading pilose-setose with white tapering hairs 0.1–0.8 (–1.2) mm long along the margins and on the veins of the lower surface, sometimes also on the midrib above, the inter-

vein areas typically glabrous (except in var. *sanpatriciensis*), conspicuously lineolate (when dry). FLOWERS crowded in 1–3-flowered axillary dichasia; peduncles and pedicels 0.5–2 mm long; paired bracts leafy, linear-spatulate to linear 1–2(–3) cm long, 1–3.5 mm wide; calyces (11–)15–20 (–23) mm long at anthesis, the tubes 4–6.5(–8) mm long, the lobes attenuate, subulate, to 0.7–1.7 mm wide at the base, glabrous to mostly pubescent and pilose-setose at least along the lower margins and on the raised midrib with antrorsely curved short hairs 0.1–0.3 mm long and longer spreading hairs (setae) 0.3–1(–1.5) mm long; corollas lavender-blue, lavender-pink, often with purple and white markings on the lower lip and throat, ascending, 18–26 mm long, the tube cylindrical 5–8.5 mm long, the throat broadly campanulate, the lobes repand, oblong-obovate, 5–8 mm long, 4–6 mm wide, rounded; anthers 1.6–2 mm long, produced in the upper throat, basal spurs 0.2–0.4 mm long; lower filaments 3–5 mm long, the upper filaments 2–3.5 mm long; styles 17–20 mm long, extending beyond the anthers. CAPSULES 10–12.5 mm long, 2.2–2.5 mm broad; seeds 4, 2.8–3.2 mm long, 1.5–1.7 mm wide.

The two varieties recognized are separated by the following key:

1. Leaves sparsely vestitured, the hairs confined to the leaf margins and main veins; stems glabrous or with scattered setae on the margins; the inflorescence and sepals glabrous except for the setae along the sepal-lobe margins and keel.
2a. *D. linearis* var. *linearis*
1. Leaves densely vestitured, the hairs present throughout the intercostal areas of both surfaces; stems densely vestitured with hairs to 1.2 mm long; hairs of inflorescence and sepals dense, to 1.5 mm long
2b. *D. linearis* var. *sanpatriciensis*

2a. *DYSCHORISTE LINEARIS* (Torr. & A. Gray) Kuntze var. *LINEARIS* (Fig. 3 A–F)

Dyschoriste linearis (Torr. & A. Gray) Kuntze, Rev. Gen. Pl. 2: 486. 1891; *Dipteracanthus linearis* Torr. & A. Gray, Bost. Jour. Nat. Hist. 5: 50 1845 (Pl. Lindh. 1:50); *Calophanes linearis* (Torr. & A. Gray) A. Gray, Syn. Fl. N. Am 2(1): 324. 1879. TYPE. UNITED STATES. Texas: *Drummond 178* [LECTOTYPE: GH! (designated by Kobuski, 1928); ISOLECTOTYPE: TEX!]

Calophanes oblongifolius var. *texensis* Nees in DC. Prodr. 11: 108. 1847. TYPE. UNITED STATES. Texas: *Drummond 178* [LECTOTYPE: (here designated) GH!; ISOLECTOTYPE: TEX!]

LEAVES sparsely vestitured, the hairs confined to the leaf margins and midvein above and the main veins beneath, the intercostal areas glabrous or the leaves sometimes glabrous throughout; stems

glabrous or with scattered setae along the angles; the sepals glabrous except for setae along the margins and keels of the lobes.

DISTRIBUTION (FIG. 4) AND HABITAT. Mostly shallow calcareous clay-loams or gravelly loams mixed with or overlying limestone, in plains, prairies, hillsides, Tamaulipan scrub, roadsides, from south-central Oklahoma, through central, western to southern Texas, south into Mexico (Múzquiz, Coahuila) where rare, 10–700 m; with flowers from April to June.

REPRESENTATIVE SPECIMENS EXAMINED:
UNITED STATES. Oklahoma: Cotton Co., 6 mi S of Randlette, 15 Jul 1949, *Waterfall 9167* (NY). Texas: Dickens Co.: Dickens, 4 Jun 1961, *Graham 11* (TEX). Garza Co.: E of Post, 19 May 1932, *Reed 3591* (US). Borden Co.: 10 mi W of Gail, 10 May 1966, *Correll 32809* (GH, LL). Nolan Co.: Sweetwater, 27 May 1918, *Palmer 13758* (MO–2, US). Tom Green Co.: San Angelo, 18 May 1920, *Pennell 10495* (NY). Baylor Co.: S of Semor, 26 May 1932, *Clark 4689* (MO). Taylor Co.: Abilene, 22 May 1902, *Tracy 8079* (F, GH, MO, NY, TEX, US). Crockett Co.: 25 mi S of Ozona, 21 Jun 1963, *Correll & Wasshausen 27983* (LL). Val Verde Co.: 2 mi NW of Comstock, 15 Jun 1963, *Correll & Johnston 27789* (GH, LL). Young Co.: Graham, 14 Jun 1941, *Tharp s.n.* (GH, TEX). Callahan Co.: 8 mi W of Clyde, 20 Jun 1946, *Warnock 46339* (F, TEX). Eastland Co.: Ranger, 1935 *Parks s.n.* (GH). Brown Co.: 10 mi N of Brownwood, 5 Jun 1966, *Ewing 7* (LL, TEX), Menard Co.: Menard, 11 May 1917, *Palmer 11871* (MO, TEX). Blanco Co.: 8 mi E of Johnson City, 26 Jun 1946, *Warnock 46485* (TEX). Kerr Co.: 4 mi SW of Kerrville, 28 Apr 1946, *Cory 51766* (GH, NY, US). Kendall Co.: 2.5 mi SE of Comfort, 23 Jun 1963, *Correll & Wasshausen 28058* (LL). Uvalde Co.: 3 mi N of Sabinal, 23 Jun 1963, *Correll & Wasshausen 28026* (LL). Goliad Co.: Goliad, 1 Jun 1926, *Williams 48* (F). Nueces Co.: Corpus Christi Bay, 9–12 Apr 1894, *Heller 1529* (ARIZ, GH, F, MO, NY–2, US). Wise Co.: 5 mi E of Decatur, 1 Jun 1957, *Correll 16508* (LL). Tarrant Co.: Ft. Worth, 9 May 1948, *Cory 54414* (LL). Comal Co.: Comanche Springs, New Braunfels, May 1851, *Lindheimer 1063* (ARIZ, F, GH, MO, NY, TEX, US). Hamilton Co.: 8 mi N of Hamilton, 10 Jun 1955, *Gould 6843* (TEX). Travis Co.: 11 mi W of Austin, 26 Jun 1946, *Warnock 46462* (F). Burnet Co.: 2.7 mi E of Lampasas, 15 May 1955, *Johnston & McCart 5370* (TEX–2). Milam Co.: 2 mi S of Rockdale, 16 May 1964, *Bounds 259* (TEX). Jackson Co.: Ganado, 20 Mar 1916, *Palmer 9218* (MO). San Patricio Co.: Welder Wildlife Refuge, 4 May 1958, *Williges 67*

(TEX). Matagorda Co.: Bay city, 6 May 1916, *Palmer 9667* (MO, US).

MEXICO. Coahuila, Múzquiz, Spring 1935, *Marsh 174* (F, TEX–2).

Dyschoriste linearis var. *linearis* is characterized by: (1) erect-ascending growth habit (Fig. 3A); (2) the presence of slender underground rhizomes with the plants tending to form small colonies (Fig. 3A); (3) the larger ascending, broad-throated corollas (Fig. 3C–D); (4) the vestiture of leaves and bracts largely confined to the margins and veins of the lower surfaces and sometimes along the midvein above with the intercostal areas remaining glabrous (Fig. 3B).

This species shows variation in plant size (from 1 to 4 dm in overall height); in leaf size (ranging from linear-not exceeding 2 mm in width, to typically those with broader more spatulate leaf blades); and particularly in vestiture with the plants ranging from nearly glabrous to having well developed setae along the sepal and leaf margins and veins.

On one extreme are plants with glabrous stems, with leaves and bracts glabrous except for curved appressed marginal hairs 0.1–0.2 mm long along the margins and sometimes the major veins of the lower surface, and the sepal margins and keels have a mixture of similar small upwardly curved, tapering hairs and setae to 0.3–0.8 mm long. Other plants are more densely vestitured and have short decurved hairs (0.1–0.3 mm long) or short setae (0.3–1 mm long) on the stems (often in four decurrent rows), more setae on the leaf and bract margins and either setae or shorter decurved hairs on the veins of the lower surface and the basal midvein of the upper surface and the sepal margins and keels are typically setose with antrorsely curved hairs 0.3–1.2 mm long.

The variety can be distinguished from *Dyschoriste schiedeana* var. *cinerascens* as the latter lacks rhizomes and is not colonial, has smaller flowers 14–17(–22) mm long, and mostly narrower, thicker leaves

with hairs continuing onto the intercostal areas on the lower surface, and generally more strongly vestiture in the inflorescence and a distribution west of the Pecos River and south into Mexico. However collections from Texas, [Terrell Co., 30 miles N of Sanderson, *Warnock 14824* (LL, NY, TEX); 10 mi NW of Sanderson, *Lundell & Lundell 14195* (LL); 18 mi S of Sheffield, *Webster 221* (TEX); Pecos Co., 45 mi S of Fort Stockton, *Correll 29883* (LL); Val Verde Co. 2 mi NW of Comstock, *Correll & Wasshausen 27789* (LL)] all have the close, curved leaf-bract vestiture of var. *cinerascens* (or var. *decumbens*), and most of the specimens have rhizomes as in *D. linearis* implying that introgression between the taxa does occur in the region of overlap.

Other plants appearing much like *Dyschoriste linearis* var. *linearis*, but having a similar close vestiture of curved hairs and lacking setae except along the sepal margins also occur in south Texas; [Webb Co., 6 mi E of Laredo, *Ibarra 61* (LL, TEX); Jim Wells Co., 17.4 mi S of Alice, *Johnston 541212* (TEX); Jim Hogg Co., 30 mi S of Hebronville, *Tharp s.n.* (TEX)]. These specimens are anomalous within *D. linearis*, but all have rhizomes and large flowers that otherwise conform to the characteristics of the species.

Dyschoriste linearis is considered a distinct species as it does not show strong introgression with the *D. schiedeana*, except as noted above with var. *cinerascens*. Its zone of introgression with var. *cinerascens* is relatively minor.

2b. *Dyschoriste linearis* var. *sanpatriciensis* Henrickson, var. nov. (Fig. 3G–H)

TYPE. UNITED STATES. Texas: San Patricio Co., along Nueces Bay, ca. 3.4 mi W of projected end of Hwy. 893, 7 May 1959, *Traverse 1278* (HOLOTYPE: TEX!; ISO-TYPES: F! LL! MO! US!)

A *Dyschoriste lineari* var. *lineari* differt vestimento denso, caulibus trichomata ac setas 0.5–1.2

mm long parientibus, foliis in area intercostali paginae infera trichomata parientibus, et marginibus sepalorum ac carinae setis usque ad 1.5 mm longis.

Plants similar to those of var. *linearis* but more densely vestitured throughout. The leaves with hairs present throughout the intercostal areas of both surfaces; the stems densely vestitured with hairs to 1.2 mm long; the hairs throughout the inflorescence dense, to 1.5 mm long.

DISTRIBUTION (FIG. 4) AND HABITAT. Sandy, silty prairies, Tamaulipan scrub, coastal and southern border of Texas (Terrell and San Patricio counties), also northern Coahuila near Piedras Negras, 40–600 ft. Flowering in spring.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. Texas: Kleberg Co.: NE of Kingsville, 23 Apr 1949, *Lundell 14933* (LL–3 sheets). Val Verde Co.: foot of Devils Lake, 20 mi NNW of Del Rio, 22 May 1949, *McVaugh 10588* (US); Val Verde Co., without locality, May 1913, *Orcutt 6029* (MO);

MEXICO. Coahuila: Piedras Negras, *Howard s.n.* (F, US).

Dyschoriste linearis var. *sanpatriciensis* is a minor variant comprised of strongly vestitured collections of *D. linearis* from southern Texas and adjacent Tamaulipas whose stems have dense hairs and setae 0.5–1.2 mm long, whose leaves and bracts have densely setose margins and veins with smaller decurved hairs on the intervein areas of the lower surface, and whose sepal margins and keels are densely setose with hairs to 1.5 mm long (Fig. 3G–H). These plants have a vestiture similar to that of *D. poliodes* var. *poliodes* of Nuevo León. In their rhizomes, erect-ascending stems, large leaves and large flowers they are otherwise typical of *Dyschoriste linearis*.

The type collection is distinguished by having the setae confined to the stem angles, rather than being universally distributed. This variety is known only from five scattered collections along the southern range of the species.

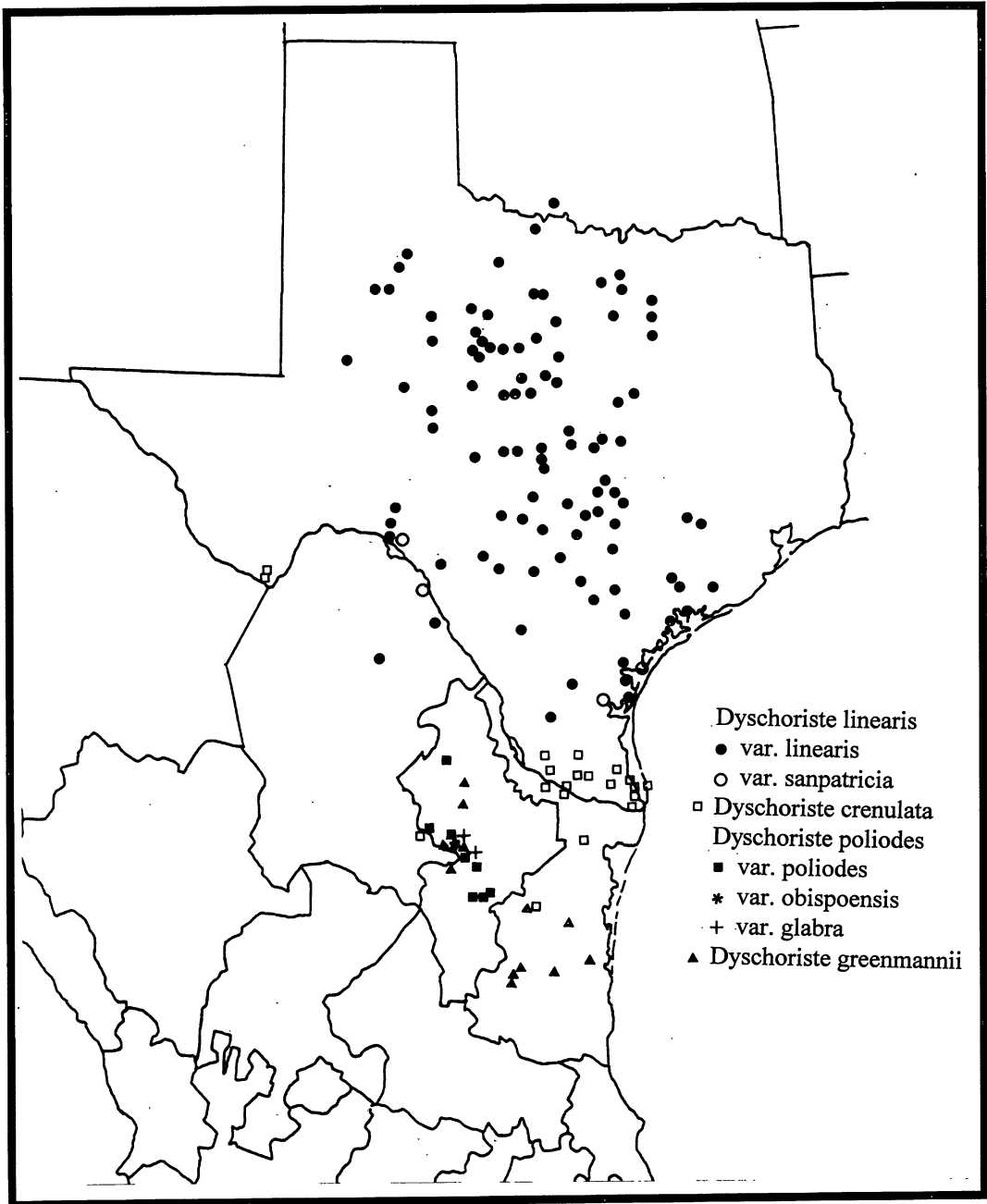


Fig. 4. Distribution of *Dyschoriste linearis* var. *linearis* (closed circles) and var. *sanpatriciensis* (open circles); *Dyschoriste crenulata* (open squares); *D. poliodes* var. *poliodes* (closed squares); var. *obispoensis* (asterisk); var. *glabra* (plus sign); and *D. greenmannii* (closed triangles) in Mexico and adjacent Texas, and Oklahoma.

3. *DYSCHORISTE* *CRENULATA* Kobuski (Fig. 5A–B).

Dyschoriste crenulata Kobuski, Ann. Missouri Bot. Gard. 15:41. 1928. TYPE. MEXICO. Tamaulipas: San Fernando to Jiminey, 26–27 Feb 1902, E. W. Nelson 6604 (HOLOTYPE: GH!; ISOTYPE: US!)

Perennial HERBS with erect-ascending central stems and decumbent lateral stems, 0.5–3 dm tall, 2–8 dm wide from a woody rootstock with dark brown fibrous roots 1–1.5 mm in diameter; stems with internodes 1–3(–5) dm long, closely and uniformly canescent with mostly spreading to somewhat antrorse, slightly crinkled hairs 0.1–0.2(–0.3) mm long. LEAVES erect-ascending, oblanceolate, spatulate or the lowermost more obovate, ovate, 1–3.5 (–4.5) cm long, 3–10(–15) mm wide, rounded to acute, sometimes apiculate at the apices, cuneate, the larger leaves with winged petioles 1–5(–9) mm long at the base, the margins repand-crenate to denticulate in the distal half, entire below, grayish-green to grayish, uniformly canescent on both sides with straight to slightly decurved, slender, tapering, white hairs 0.1(–0.2) mm long. FLOWERS crowded in axillary 1–3(–5)-flowered dichasia; peduncles and pedicels 0.5–2(–4) mm long, vestitured as the stem; bracts leafy, spatulate to linear-oblanceolate, 8–20 mm long, 2–5 mm wide, with texture and vestiture of the leaves; calyx (11–)14–16 mm long, the tube 4–6.5 mm long, the lobes subulate, 0.7–1.5 mm wide at the base, 6–10 mm long, uniformly pubescent-canescens throughout with spreading hairs 0.1–0.2 mm long (larger marginal and keel setae not present); corollas lavender with white-purple markings on the throat, (14.5–)17–24 mm long, erect, the tube cylinder, (5.5–)7–11.5 mm long, the throat narrowly campanulate, the lobes oblong-obovate, 4–6 mm long, 3.5–5 mm wide, the longer filaments 4.5–5 mm long, the shorter filaments 2–3 mm long, anthers 1.2–1.4(–1.5) mm long with basal spurs 0.1–0.2 mm long. FRUITS 10–11.5 mm long.

DISTRIBUTION (FIG. 4) AND HABITAT. In sand, sandy-clay loams, clays, caliche areas in open Tamaulipan scrub and grasslands in southernmost Texas and adjacent Tamaulipas, Mexico; mostly 10–50 m elevation. Flowering from April to June.

REPRESENTATIVE SPECIMENS EXAMINED: UNITED STATES. Texas: Starr Co.: 12.8 mi W of La Gloria, along rd 1017, 31 May 1974, *Fleetwood 11006* (TEX); 17 mi NE of Rio Grande City, 3 Apr 1941, *Lundell 9915* (LL). Hidalgo Co.: Samfordyce, 1 Sep 1925, *Runyon 897* (TEX, US); 12 mi N of Mission, 4 Apr 1941, *Lundell 9957* (ARIZ, LL). Willacy Co.: 3 mi N of headquarters of Sauz Ranch, 29 Jul 1953, *Johnston 53266.17*. Cameron Co.: 1 mi S of Sebastian, 21 Apr 1959, *Correll & Rollins 20995* (GH, LL, MO, NY, US); Brownsville, 1942, *Schiller 688* (US–3).

MEXICO. Tamaulipas: 20 mi W of Reynosa 28 Feb 1944, *Barkley & Painter 14393* (GH, NY, MO, TEX); 48 mi from Reynosa on San Fernando Road, 27 mi from Matamoros-San Fernando Hwy, 19 Oct 1959, *Johnston & Graham 4382* (TEX); Sierra de San Carlos, vicinity San Miguel, 27 Jul 1930, *Bartlett 10646* (F). Coahuila: 30 mi SW of Monterrey, 1 Dec 1945, *Warnock & Barkley 14806M* (F, TEX).

This species is characterized by its spreading habit with erect-ascending central stems and decumbent-procumbent lateral stems, by closely crenulate leaf margins, by having a uniform and relatively dense vestiture of short hairs mostly to 0.15–0.2 mm long on stems, leaves, bracts, and sepals, of a type similar to that found in *Dyschoriste schiedeana* var. *decumbens*. The larger setae characteristic of *D. linearis* and *D. schiedeana* var. *cinerascens* are not present in this taxon. The taxon can be distinguished from *D. schiedeana* var. *decumbens* by its more erect habit, its distinctly crenulate leaf margins, and its distribution in south Texas and adjacent Tamaulipas. *Dyschoriste crenulata* is recognized as a species as it appears not to intergrade with other taxa of the complex.

4. *DYSCHORISTE* *POLIODES* Leonard & Gentry

Grayish, strongly vestitured, perennial, rhizomatous HERBS producing decum-

bent-procumbent spreading stems 1.5–5 dm long, occasionally with erect-ascending stems to 2 dm high from the plants center or along extended rhizomes; stems internodes 1.5–4(–6.2) cm long, 0.5–1.1 m in diameter, strongly hirsute-pilose with spreading, straight or variously wavy, white hairs (0.2–)0.5–1.2 mm long or nearly glabrous with decurved pubescence to 0.1 mm long. LEAVES oblong-ovate to oblong-elliptical to elliptical-lanceolate, to linear lanceolate, more ovate when smaller, (11–)15–25(–40) mm long, (3–)4–14 mm wide, rounded, obtuse to acute at the apices, broadly cuneate at the base and tapering to a channeled petiole 1–4 mm long at the base, entire or commonly irregularly erose, moderately thickened, the blades slightly bicolored, moderately to densely pilose-hirsute on both surfaces with long, slender, spreading or terminally wavy hairs 0.3–0.7(–1.2) mm long or glabrous except where pubescent along the lower margins. FLOWERS 1–5(–9) per leaf axil in leafy-bracted dichasia; peduncles to 2 mm long, bracts leafy, narrowly lanceolate, 5–15 mm long, (1.2–)2–4 mm wide, vestitured as the leaves; calyces 9.5–18 mm

long, the tubes 3–5 mm long, the lobes lanceolate, 6–10 mm long, strongly pilose-setose to puberulent on the tube and lobes, the hairs (0.1–)0.5–1 mm long, typically curved upward along the sepal margins; corollas purple-lavender, violet, 14–28 mm long, tube 6–10 mm long, throat ampliate, 4.2–9.5 mm long, lobes oblong-obovate, 5–9 mm long, 3.5–6.5 mm wide; anthers 9.5–2.1 mm long, spurs 0.15 mm long; short free filament 2–4 mm long, long free filament 3–5 mm long; style 11–14 mm long, slightly puberulent. FRUITS 9–11 mm long.

Dyschoriste poliodes is distinguished by its mostly decumbent growth habit, its usual dense, long pilose-hirsute vestiture on stems and leaves, by its narrowly ovate to linear-lanceolate leaves, and its few flowers per node. The taxon, however, exhibits considerable variation, with some plants being subglabrous and having long corollas and others having narrower leaves and more flowers per node. To accommodate this variation, three varieties are recognized, separable by the following key.

1. Plants long pilose-hirsute with hairs 0.2–1.2 mm long on young stems, leaves, sepals; corollas 14–22 mm long.
 2. Leaves oblong-ovate; flowers 1(–2) per leaf axil; clusters of old dried calyces not present.
 - 4a. *D. poliodes* var. *poliodes*
 - 4b. *D. poliodes* var. *obispoensis*
 2. Leaves oblong-lanceolate; flowers (1–)2–5(–9) per leaf axil; the old gray dried calyces typically persisting on the stems.
 - 4c. *D. poliodes* var. *glabra*
1. Plants subglabrous, stems, lower leaf margins and sepal margins pubescent with slender curved hairs to 0.1 mm long; corollas 22–28 mm long.

4a. *DYSCHORISTE POLIODES* LEONARD & GENTRY var. *POLIODES* (Fig. 5 F–G)

Dyschoriste poliodes Leonard & Gentry, *Brittonia* 6: 326. 1948. TYPE. MEXICO. Nuevo León: 3 mi W of Montemorelos, 14 Aug 1942, H. S. Gentry 6721 (HOLOTYPE: US!; ISOTYPE: Gentry Herbarium now at DES).

Decumbent, grayish, densely pilose-hirsute perennial HERBS, occasionally rhizomatous; stems spreading, sometimes

forming erect stems 1–2 dm tall near the root or along the rhizomes; young stems hirsute-pilose with straight or wavy, white hairs 0.2–1.2 mm long. LEAVES ovate, oblong-ovate to lanceolate, (11–)14–25(–40) mm long, 3–7(–12) mm wide, moderately to densely pilose-hirsute throughout with hairs 0.3–0.7 mm long. FLOWERS 1(–2) per leaf axil; bracts narrowly lanceolate, 7–15 mm long, 2–4 mm wide, leaf-like in vestiture; calyces (9.5–)13–14(–18) mm

long, the tubes 4–5(–6.3) mm long, the lobes 6–11 mm long with marginal hairs 0.3–0.5 mm long; corollas 14–22 mm long, the basal tube 6–9.2 mm long, the ampliate throat 4–6 mm long, the lobes oblong-obovate, 4.5–5.5 mm long, 3.5–4.2 mm wide.

DISTRIBUTION (FIG. 4) AND HABITAT. Known from in arid oak scrub to forested hills, roadsides in limestone areas, from northern to central Nuevo León from 330 to 1000 m elevation.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO: Nuevo León: Mts. E of State hwy 34, 1.4 km N of Bustamente, then 16.3 km E of hwy, 15 Mar 1983, *Cowan & Nixon 3820* (TEX); Mt. Chipinque Road, Monterrey, 12 May 1960, *Smith M210* (TEX); Sierra Madre Mts., Monterrey, 7 Jul 1933, *Mueller 115* (GH); same area, 12 Jul 1933, *Mueller 113* (F, GH); same area, 14 Jul 1933, *Mueller 119* (GH); Hacienda Vista Hermosa, 35 mi S of Monterrey, 27 Jun 1939, *White 1579* (GH); above Horsetail Falls, near Hacienda de Vista Hermosa, 20 Jun 1940, *Leavenworth 131* (F, GH, MO); 5 mi N of Villa Santiago, 14 Jul 1946, *Rowell & Barkley 16m367c* (TEX); below Ebanito, Dist. Linares, 12 May 1980, *Hinton 17786* (TEX); Río Ramos, 20 km NW of Montemorelos, 5 Jun 1942, *Weaver 564* (GH, TEX); 16 mi W of Linares, road to Galeana, 19 Jul 1958, *Correll & Johnston 19778A* (LL); Horsetail Falls, ca. 20 mi SSE of Monterrey, 22 May 1974, *McPherson 880* (ENCB).

Dyschoriste poliodes var. *poliodes* is characterized by its decumbent growth habit, although the horizontal stems or rhizomes may produce series of erect stems forming rather bushy colonies, its distinctive long pilose-hirsute vestiture on stems, leaves and calyces, its oblong-ovate leaf blades, the basal blades more ovate the upper ones more lanceolate, its mostly solitary flowers in the leaf axils, and its moderately long corollas 14–22 mm long. Most of the specimens show strong growth, and some specimens have very large leaves.

4b. *Dyschoriste poliodes* var. *obispoensis*
Henrickson, var. nov.

TYPE. MEXICO. Nuevo León: Sembradas en medio de la piedras del monte en la vecinidad del Cerro del Obispado, cerca de Monterrey, 29 Jun 1944, *C. Fernandez C. & F. A. Barkley 14512B* (HOLOTYPE: MO!; ISOTYPES: F! MEXU! NY! TEX!)

A Dyschoriste poliode var. *poliode* differt foliis oblongis-oblancoelatis (non ovatus) floribus (1–)2–5 [non 1(–2)] per axil, calycibus viejos persistente in callibusque.

Mostly decumbent to erect-ascending perennial HERBS, the plants often bearing erect stems near the roots; stems long pilose-hirsute with hairs (0.2–)0.4–1.2 mm long. LEAVES oblong-oblancoelate, oblong-lanceolate to oblong, 1.3–2.5(–3) cm long, 1.5–5 mm wide, acute at apex, abruptly cuneate above a channeled petiole 1–5 mm long at base, entire, coarsely pilose-hirsute with white, tapered wavy-tipped hairs 0.5–0.7 mm long throughout or in some specimens the hairs more sparse and confined to the leaf margins and lower surface veins, the blades commonly conduplicate and sometimes arching abaxially. FLOWERS in axillary dichasia of 1–5(–9); bracts oblancoelate, linear-oblancoelate, 5–10(–20) mm long, (0.5–)1–2.5 mm wide, leaf like in texture, color and vestiture; calyces 10–13(–17) mm long, the tubes 3–4.5(–5) mm long, lobes subulate, 5.5–7.5(–9) mm long, strongly keeled, with tapered, wavy hairs 0.2–0.7 mm long at the margins and keel, the older calyces turning gray and tending to persist at the nodes; corollas 13–16.5 mm long, basal tube 4–6 mm long, the ampliate throat 4–5.5 mm long, the lobes 3.5–5(–7) mm long, 2–5.5 mm wide.

DISTRIBUTION (FIG. 2) AND HABITAT. *Dyschoriste poliodes* var. *obispoensis* accommodates the distinctive specimens from the Obispado, a limestone hill within the city of Monterrey topped by a ancient cathedral.

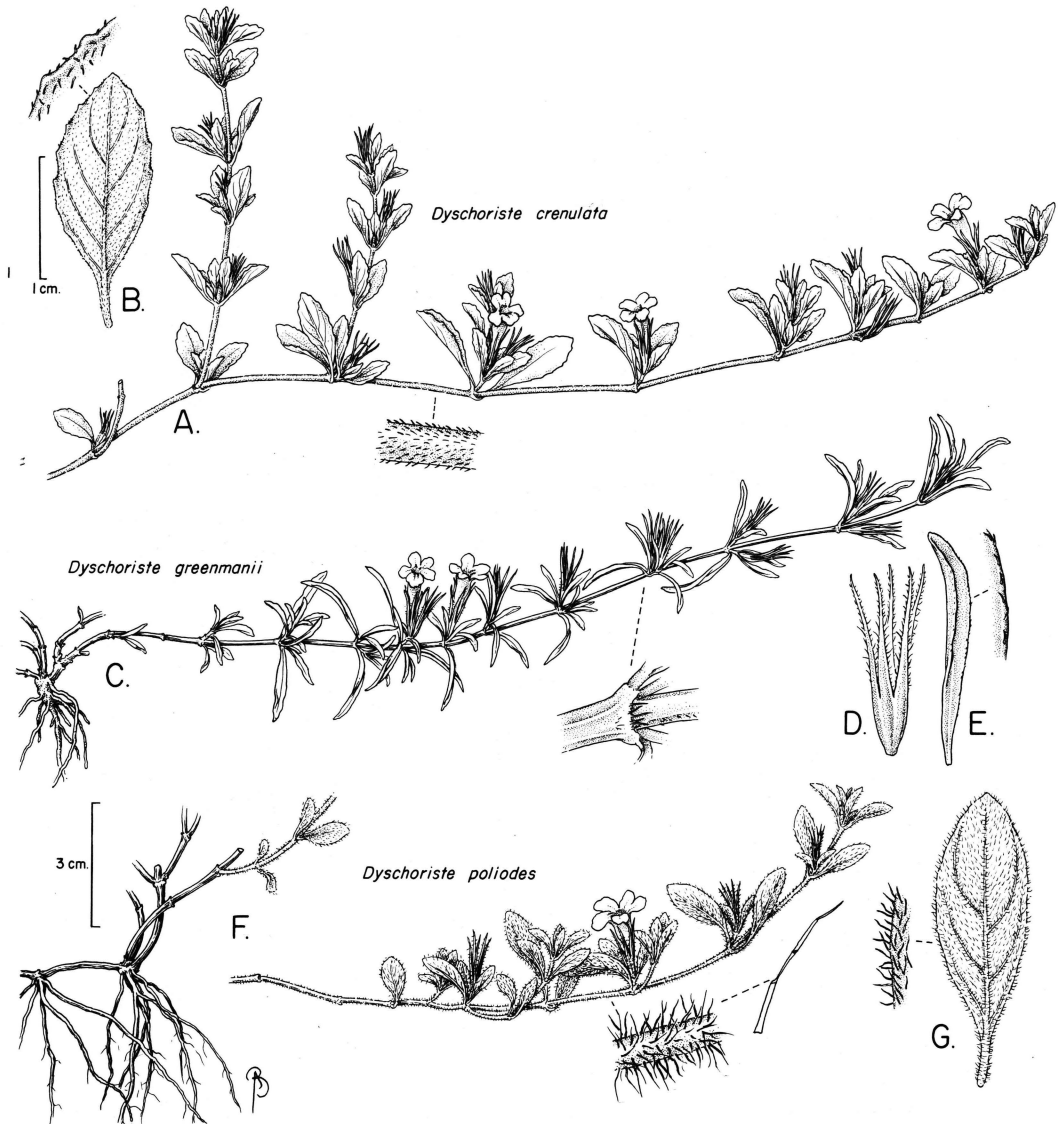


Fig. 5. *Dyschoriste crenulata*, *D. greenmanii*, and *D. poliodes*. A–B. *D. crenulata*. A. Decumbent branch with basal erect stems, vestiture is dense, short throughout. B. Leaf with crenate margin and dense, short vestiture. (Johnston 266-2, TEX). C–E. *D. greenmanii*. C. Decumbent growth habit—stems are often glabrous but have longer hairs at nodes. D. The calyx is glabrous except for longer marginal hairs. E. Leaf with marginal short hairs. (Nesom 5367, TEX). F–G. *D. poliodes* var. *poliodes* showing decumbent growth habit developed from fibrous rootstalk, note long hairs on stems and leaf margins. (Hinton 17741, LL). All leaves and stems drawn to the same scale.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Nuevo León: Limestone hills cerca Monterrey, below the Obispado, 25 Feb 1946, *Johnson & Barkley 15045M* (F, TEX); Loma del Obispado, Monterrey, 31 Jun 1907, *Safford 1214b* (US); Obispado, *Arsene 187* (MO); Obispado, *Arsene 6411* (US).

Specimens of *Dyschoriste poliodes* var. *obispoensis* have a long pilose-hirsute vestiture as found in var. *poliodes*, but differ from var. *poliodes* in having narrower, more oblong-ob lanceolate leaves as in var. *greenmanii* (leaves of *D. greenmanii*, however, are nearly glabrous). Flowers in var. *obispoensis* number (1-)2-5 flowers per leaf axil, not 1(-2) per leaf axil in var. *poliodes* and var. *greenmanii*, and the older, dried, gray calyces tend to persist at the nodes giving the plants a distinctive appearance. As in var. *poliodes*, the plants tend to form erect lateral stems along the horizontal stems or rhizomes. Overall, specimens of *Dyschoriste* from the Monterrey region show considerable diversity, perhaps reflecting long history of disturbance as well as geographically diversity.

4c. *Dyschoriste poliodes* var. *glabra* Henrickson, var. nov.

TYPE. MEXICO. Nuevo León: Mesas N of Monterrey, 13 Jun 1935, Ora M. Clark 6778 (HOLOTYPE: MO!)

A *Dyschoriste poliode* var. *poliode* differt foliis calycibus caulibusque glabris vel sparsim puberulis trichomatibus tenuibus usque ad 0.1 mm longis (non grosse pilosi-hirsutis trichomatibus 0.4-1.2 mm longis) et corollis 22-28 mm longis (non 15-22 mm longis).

Decumbent perennial HERBS; stems sparsely puberulent with descending curved hairs to 0.1 mm long in the sulci or glabrous. LEAVES obovate, elliptical to broadly elliptical, 11-22 mm long, 3.7-10.2 mm wide, glabrous throughout or very sparsely puberulent with ascending curved hairs to 0.1 mm long along the lower margins. FLOWERS 1(-2) per node; bracts elliptical to oblanceolate, 6-12 mm long,

1.5-3.5 mm wide; calyces 11.5-16.2 mm long, the tube 3.5-6 mm long, the lobes broad, to 1 mm wide at the base and tapering to the apex, 7.5-10.5 mm long, with a prominently thickened midvein, appearing glabrous but with sparse, slender, antrorsely curved hairs 0.1 mm long along the margins and on the inner lobe surfaces; corollas 22-28 mm long, the tubes 9-10 mm long, the ampliate throats 7.5-9.5 mm long, the lobes 6-9 mm long, 5-6.5 mm wide.

DISTRIBUTION (FIG. 4) AND HABITAT. *Dyschoriste poliodes* var. *glabra* is known from three collections near Monterrey, in openings and roadsides in thorn scrub at 500-1000 m elevation.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Nuevo León: 5 mi SE of Monterrey on Mex 85 and 2 mi W of Valle Alto, 14 Jun 1971, *Parker 418* (LL); Monterrey, 5 Jul 1938, *Cottam 10585* (ARIZ).

Dyschoriste poliodes var. *glabra* is named to accommodate a small series of specimens with more or less glabrous, elliptical-obovate leaves, slender, decumbent stems, mostly solitary flowers at the nodes with distinctive, nearly glabrous, calyces with broad lobes, and large corollas 22-28 mm long. In the decumbent habit, ovate leaves, solitary flowers this variety resembles *D. poliodes* var. *poliodes*, but differs conspicuously in its dense pilose-hirsute vestiture and smaller corollas. In its lack of strong vestiture, it approaches *D. greenmanii*, but the latter has linear to linear-oblong leaves that are hairy along the margins and veins beneath, and corollas 12.5-16 mm long. The three known collections, all from the vicinity of Monterrey, are very similar in several characteristics giving credence that this represents a variety and not a sporadic recombinant forma.

5. *DYSCHORISTE GREENMANII* Kobuski (Fig. 5 C-E)

Dyschoriste greenmanii Kobuski, Ann. Missouri Bot. Gard. 15: 33. 1928. TYPE. MEXICO. Tamaulipas; vicinity of Victoria, ca. 320 m, 1 May–13 Jun 1907, E. J. Palmer 492 (HOLOTYPE: US!, ISOTYPES: F! GH!)

Procumbent, sprawling perennial HERBS; stems 2–6 dm long; internodes (8–)15–35(–45) mm long, 0.5–1.1 mm in diameter, quadrangular, convex-sulcate, sparsely puberulent with decurved hairs to 0.1 mm long in the sulci, sometimes glabrous, except were pilose at the nodes, green, often becoming purplish with age. LEAVES linear, linear-oblongate, oblong when larger, 15–25(–45) mm long, 1.1–4(–6) mm wide, acute to obtuse at the apices, cuneate above a short petiole at base, at margins entire to erose, thickish, flat to conduplicate, usually closely strigose with antrorse hairs 0.1–0.3 mm long along the margins and main veins beneath, otherwise glabrous, the blades yellow-green to olive green in specimens. FLOWERS solitary in leaf axils; peduncles 1–1.5(–4) mm long; pedicels 0–1 mm long; bracts linear-oblongate 8–15 mm long, 0.7–1.5 mm wide; calyces 10–18 mm long, tube 3.5–6 mm long, glabrous, the lobes subulate, green, 6–10(–13.5) mm long, the midrib prominent, the margins setose with hairs 0.2–0.3(–0.4) mm long; corollas lavender-purple, 12.5–16 mm long, the tube 4.5–7 mm long, the throat moderately ampliate, 4–6 mm long, the lobes oblong-obovate, emarginate, the upper lobes 3.3–4 mm long, 2.4–3.5 mm wide, the medial lower lobe 3.5–6 mm long, 2.3–5.2 mm long; anthers glabrous 1.1–1.6 mm long, basal spur 0.12 mm long; longer free filament 2.7–4 mm long; shorter free filament 2–3 mm long; style 10–14 mm long, exerted beyond the anthers. FRUITS 8.5–10 mm long.

DISTRIBUTION (FIG. 4) AND HABITAT. Limestone, caliche slopes and flats in Tamaulipan scrub, oak scrub, rocky grasslands, in Nuevo León and Tamaulipas, 150–1100 m elevation, with flowers from May to December.

REPRESENTATIVE SPECIMENS EXAMINED: MEXICO. Coahuila: 23 mi SW of Monterrey, 1 Dec 1945, Warnock & Barkley 14856M (F–2, TEX). Nuevo León: above Mamulique Pass, 36 km. S of Sabinas Hidalgo, 26°11'N, 100°06'W, 7 Apr 1990, Bridges & Woodruff (TEX); 57 km N of Monterrey towards Nuevo Laredo, 23 Apr 1939, Frye & Frye 2460 (GH, MO–2, NY, US); Microwave tower at pass where Hwy 53 passes over Sierra el Rincon del Arco between Monterrey and Monclova, 26°15'N, 100°40'W, 18 Oct 1993, Patterson et al. 6422 (TEX). Tamaulipas: 6 mi N of Santander Jiménez, 9 Dec 1959, Johnston 4899 (TEX); 8.1 mi E of Soto de Marina to La Pesca, 23°51'N, 98°00'W, 6 Oct 1993, Patterson & Mayfield 7274 (TEX); 3–5 km S of Huisachal, 27 Jun 1949, Stanford et al. 2141 (NY, US).

Dyschoriste greenmanii is characterized by its procumbent growth habit, its slender, subglabrous, greenish, often long stems, its narrow, nearly glabrous leaves with usually antrorsely appressed hairs along the lower margins and solitary flowers at the nodes. In these characteristics it remains a relatively easily recognized taxon. However, variation occurs in vestiture with most specimens being glabrous or with very small hairs while other specimens are more coarsely hairy along the leaf and calyx-lobe margins and stem sulci. In one gathering of four specimens [TAMAULIPAS: 8 mi E of Dulces Nombres, 25 Jun 1948, Meyers & Rogers 2673 (GH, MO, NY, US)] three specimens have nearly glabrous leaves, solitary flowers, and fit well into *D. greenmanii*, while the fourth (MO) has leaves pubescent throughout and multiple flowers at the nodes, the latter possibly having introgressed with *D. schiedeana* var. *schiedeana*.

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LITERATURE CITED

- Daniel, T. F. 1990. New and reconsidered Mexican Acanthaceae. IV. Proc. Calif. Acad. Sci. 46: 279–287.
- . 1993. New and reconsidered Mexican Acanthaceae. V. Contr. Univ. Michigan Herb. 19: 271–291.
- . 1995. Acanthaceae. in D. E. Breedlove (ed.) Flora of Chiapas 4: 1–158.
- . 1996. New and reconsidered Mexican Acanthaceae VII. Polibotanica 2: 1–9.
- . 1997. The Acanthaceae of California and the Peninsula of Baja California. Proc. Calif. Acad. Sci. 49: 309–403.
- Gentry, H. S. 1948. Additions to the flora of Sinaloa and Nuevo León. Brittonia 6: 309–331.
- Kobuski, C. E. 1928. A monograph of the American species of the genus *Dyschoriste*. Ann. Missouri Bot. Gard. 15: 9–90. 1928.
- Ramamoorthy, T. P. and D. C. Wasshausen. 1985. A new name in *Dyschoriste* (Acanthaceae). Brittonia 37: 358–359.
- Wasshausen, D. C. 1998. Acanthaceae of the South-eastern United States. Castanea 63: 99–116.