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A NEW SPECIES OF *POLYGALA* (POLYGALACEAE) FROM TAMAULIPAS, MEXICO, WITH NOTES ON THE *POLYGALA NUDATA* COMPLEX

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Abstract: *Polygala madrensis* is described as a new species from the Sierra Madre Oriental of southwestern Tamaulipas, Mexico. The new species is most closely related to *P. nudata*. All five species of the *P. nudata* complex, including *P. madrensis*, are shown to be diploid with $n = 9$. A key to the five species is presented and their geographical ranges summarized.

Resumen: Se describe a *Polygala madrensis* como una especie nueva de la Sierra Madre Oriental del suroeste del estado de Tamaulipas, México. La especie nueva está emparentada más estrechamente con *P. nudata*. Se presentan datos para mostrar que las cinco especies del complejo de *P. nudata*, incluyendo a *P. madrensis*, son diploides con $n = 9$. Se incluyen una clave para la identificación de las cinco especies y datos sobre sus rangos de distribución geográfica.

Keywords: Chromosome numbers, flora of Mexico, flora of Tamaulipas, Polygalaceae, *Polygala*.

Novelties in *Polygala* section *Rhinotropis* S.F. Blake discovered during work on the author's doctoral dissertation (Wendt, 1978) have mostly been published elsewhere (Wendt, 1979; Wendt & Todsén, 1982). However, one narrowly endemic new species from the Mexican state of Tamaulipas has remained until now officially nameless. That lapse is here rectified, and relevant information on the *Polygala nudata* Brandegees species complex, to which the new species belongs, is presented.

Polygala madrensis T. Wendt, sp. nov. (Figure 1).

TYPE: MEXICO. TAMAULIPAS: Mpio. Bustamante, 18 km by winding road SE of Bustamante toward La Presita and Tula, 23°20'N, 99°40'W, ca. 1700 m elev., gypsaceous limestone slope with *Pinus nelsonii*, *Arctostaphylos*, *Coldenia*, *Ilex*, *Lindleya*, *Philadelphus*, 20 May 1973, M. C. Johnston, T. L. Wendt & F. Chiang 11153 (HOLOTYPE: MEXU; ISOTYPES: ANSM, ENCB, GH, LL, MICH, NY, UC, WIS.)

A *Polygala nudata* Brandegees habitu robustiore (4–10 dm alto), caulibus glabris glaucis et sepalis externis glabris magis rotundatis firmioribus, a *P. maravillasensi* Correll habitu, alis cremoricoloribus, pilis seminis brevioribus et base capsulae rotundata recedit.

Robust suffrutescent fastigiata PERENNIALS 4–10 dm tall, entirely glabrous except for scale-leaves and flowers; green stems numerous, usually erect, the thickest (1.7–)2.0–4.2 mm diam. (dry) in green portion, more or less glaucous, few- to several-branched. LEAVES scattered or seemingly lacking, mostly on young stems or near branch bases, mostly minute and scalelike, grading into a few larger leaves, these lanceolate or linear or rarely narrowly obovate, to 4.5(–6.0) mm long, acute at tip, sessile or very short-petiolate, lightly puberulent with incurved hairs. RACEMES terminal on major branches and often also on reduced branches arising just below racemes of main branches, to 20 cm long, laxly 10–45-flowered, rachis straight; bracts lanceolate to ovate, 0.9–2.1(–2.5) mm long, persistent, grading into stem leaves; bracteoles 0.3–1.0 mm long, persistent; mature pedicels ascending or recurved, (1.4–)1.8–3.5 mm

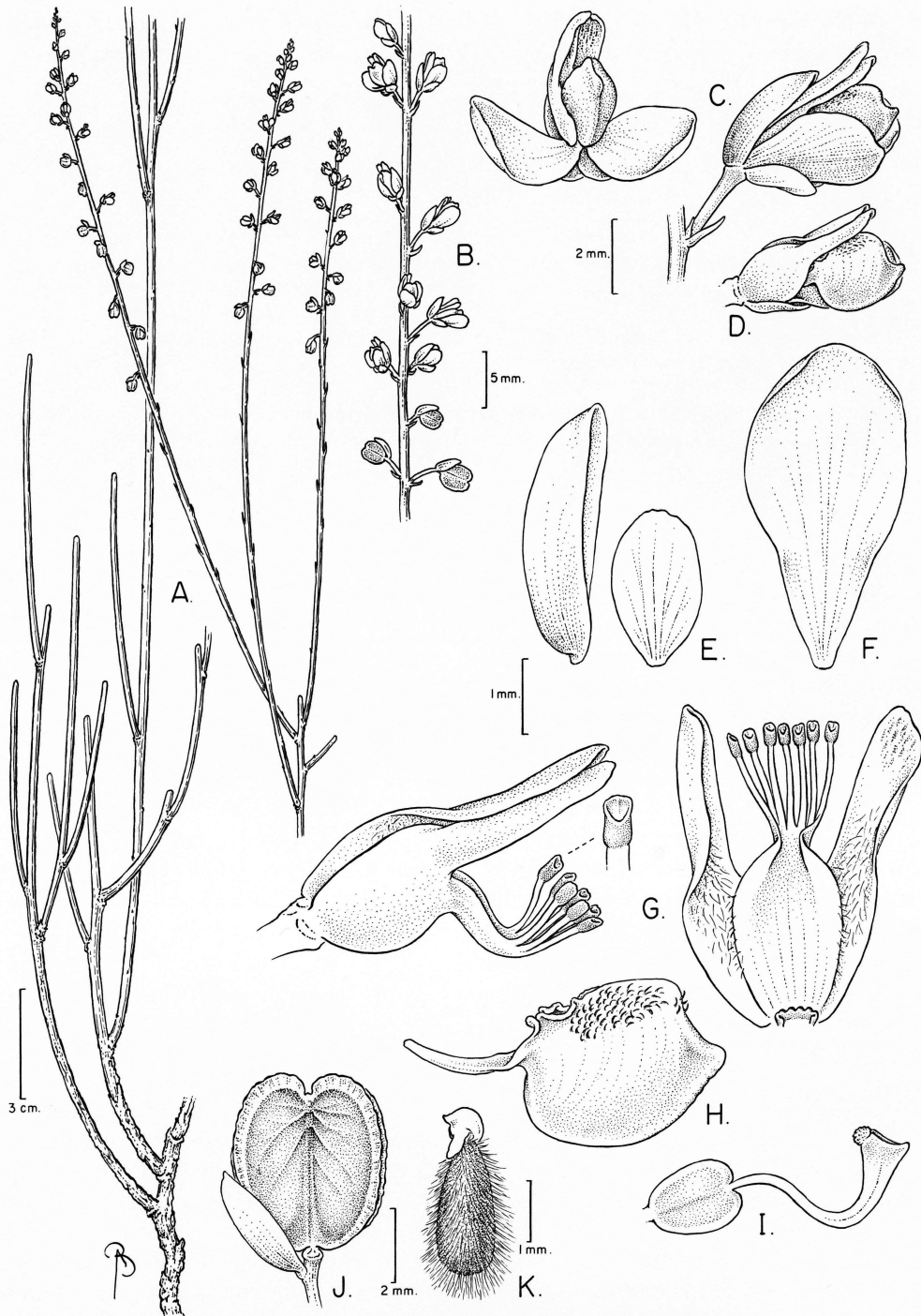


FIG. 1. *Polygala madrensis*. A. Lower (left) and upper parts of plant. B. Portion of inflorescence, with flowers (above) and fruits. C. Flower in two views. D. Flower, lateral view, with some sepals removed. E. Upper (right) and lower sepals. F. Wing sepal. G. Upper petals and stamens in lateral (left, with enlarged anther) and adaxial views. H. Keel petal, with base (to left, fused to staminal column when in natural position), sac, and small apical broadly conical beak (to right). I. Gynoecium. J. Fruit, with persistent upper sepal. K. Arillate seed. All based on the holotype; drawing by Bobbi Angell.

long. FLOWERS (3.4–)3.8–5.2 mm long. SEPALS deciduous in fruit except for persistent upper (adaxial) sepal; upper sepal ovate to elliptic, cymbiform, 2.3–3.4 mm long, rose-green to purplish with cream margin and usually some green at base; lower sepals ovate to elliptic, usually obliquely so, (1.2–)1.4–2.4 mm long, color as in upper sepal; wings obovate, usually obliquely so, (3.1–)3.4–4.4 mm long, (2.1–)2.4–3.0 mm wide, center rose-green to purplish, this often expanded distally, margin cream to greenish, base cuneate, tip rounded. UPPER PETALS (3.5–)3.7–5.2 mm long; free margin of basal (fused) portion heavily pubescent with spreading hairs adaxially, abaxially glabrous or with scattered hairs; distal free portion narrowly oblong to broadly oblanceolate, 2.0–3.3 mm long, usually heavily pubescent with spreading hairs adaxially near base, otherwise glabrous, cream-colored basally, distally pale green, the broad rounded irregularly non-squarrose tip 0.8–1.1 mm wide, pale green with rose to purplish markings. KEEL PETAL usually short-beaked, 3.0–4.6 mm long; adnate base oblanceolate, 1.1–1.6 mm long, cream-colored; saccate portion 1.7–2.4 mm long (excluding beak), 1.6–2.3 deep, densely puberulent with minute incurved hairs in upper third, distally minutely papillose, green or with the basal half cream-colored, the lips small but interlocking; beak narrow and usually descending or represented by a broad-based but short and obscure protuberance, 0.1–0.5(–0.6) mm long, cream- or yellow-green to rose, or essentially absent. LATERAL PETALS rudimentary, 0.3–0.4 mm long, distal free portion 0.05–0.1 mm, deltate, or essentially absent. STAMENS 7, the column basally heavily ciliate and pubescent near margin, otherwise glabrous, filaments free for 0.5–1.0 mm; anthers 0.3 mm long, bilocular. Intrastaminal DISC poorly developed. STYLE deeply sigmoid, 2.3–3.2 mm long. CAPSULE obovate to oval or nearly round in outline, 4.0–5.0 mm long, 3.4–4.3 mm wide, strongly veined, margin narrowly winged, this expanded dis-

tally to 0.4–0.8 mm, base rounded to subtruncate, apex rounded, deeply (0.6–1.1 mm) notched. SEEDS (including aril and pubescence) 2.6–3.2 mm long; body 1.7–2.2 mm long, moderately densely pubescent, the hairs projecting 0.2–0.6 mm beyond non-arillate end of seed body; aril 0.6–1.0 mm long, the umbo rounded, ventrally apiculate, 0.4–0.5 mm high, 0.8–0.9 mm long dorsiventrally, the ventrolateral lobes 0.2–0.4(–0.5) mm long, linear to narrowly triangular, up to 0.3 mm wide in the distal half, sometimes nearly obsolete. Chromosome number $n = 9$.

ADDITIONAL SPECIMENS EXAMINED: MEXICO. TAMAULIPAS: Mpio. Bustamante, ca. 33 km E of Jaumave, ca. 5 km N of Hwy 70 on road to Bustamante, near 23°19'N, 99°40'W, 1900 m, 6 Oct 1982, *J. Henrickson & W. Hess 19107* (TEX); Mpio. Bustamante, 4.8 mi N of Rte 101 on road to Bustamante (this road leaves Rte 101 26.1 mi SW of Jaumave), 23°19'N, 99°41'W, 2100 m, 26 May 1974, *T. Wendt & F. Chiang 178* (ANSM, LL); Mpio. Bustamante, 5.8 mi N of Rte 101 on road to Bustamante [= type locality], 23°20'N, 99°41'W, 2100 m, 26 May 1974, *T. Wendt & F. Chiang 184* (LL); Mpio. Bustamante, 9.5 mi W of Bustamante, coming down out of a pass after a llano, on road to Mier y Noriega, 23°23'N, 99°51'W, 1900 m, 26 May 1974, *T. Wendt & F. Chiang 193* (LL, MEXU); 13 km al S de Palmillas, en arroyo con chaparral, 20 Jul 1985, *A. McDonald 1678* (UAT); Mpio. Tula, 2 km al N de la Verdolaga, cerca de la Antonina, 1300 [sic: 1800] m, 12 Aug 1972, *F. González Medrano et al. 4589* (MEXU); Mpio. Tula, 2 km al N de la Verdolaga, 1800 m, 13 Dec 1976, *F. González Medrano 10265* (MEXU).

The new species is known only from the Sierra Madre Oriental (hence the epithet) of southwestern Tamaulipas (Figure 2.) It is locally common in crevices or on open rocky slopes in areas of slightly gypsaceous limestone, at elevations of 1700–2100 m. It occurs in diverse piedmont/montane scrub (often with scattered *Pinus nelsonii*) with species of *Quercus*, *Arctostaphylos*, *Dasyllirion*, *Brahea*, *Juniperus*, *Agave*, *Cercocarpus*, *Mimosa*, *Rhus*, *Ephedra*, *Orthosphenia*, *Bauhinia*, *Hechtia*, *Acacia*, *Lindleya*, and other genera. Some collections are from

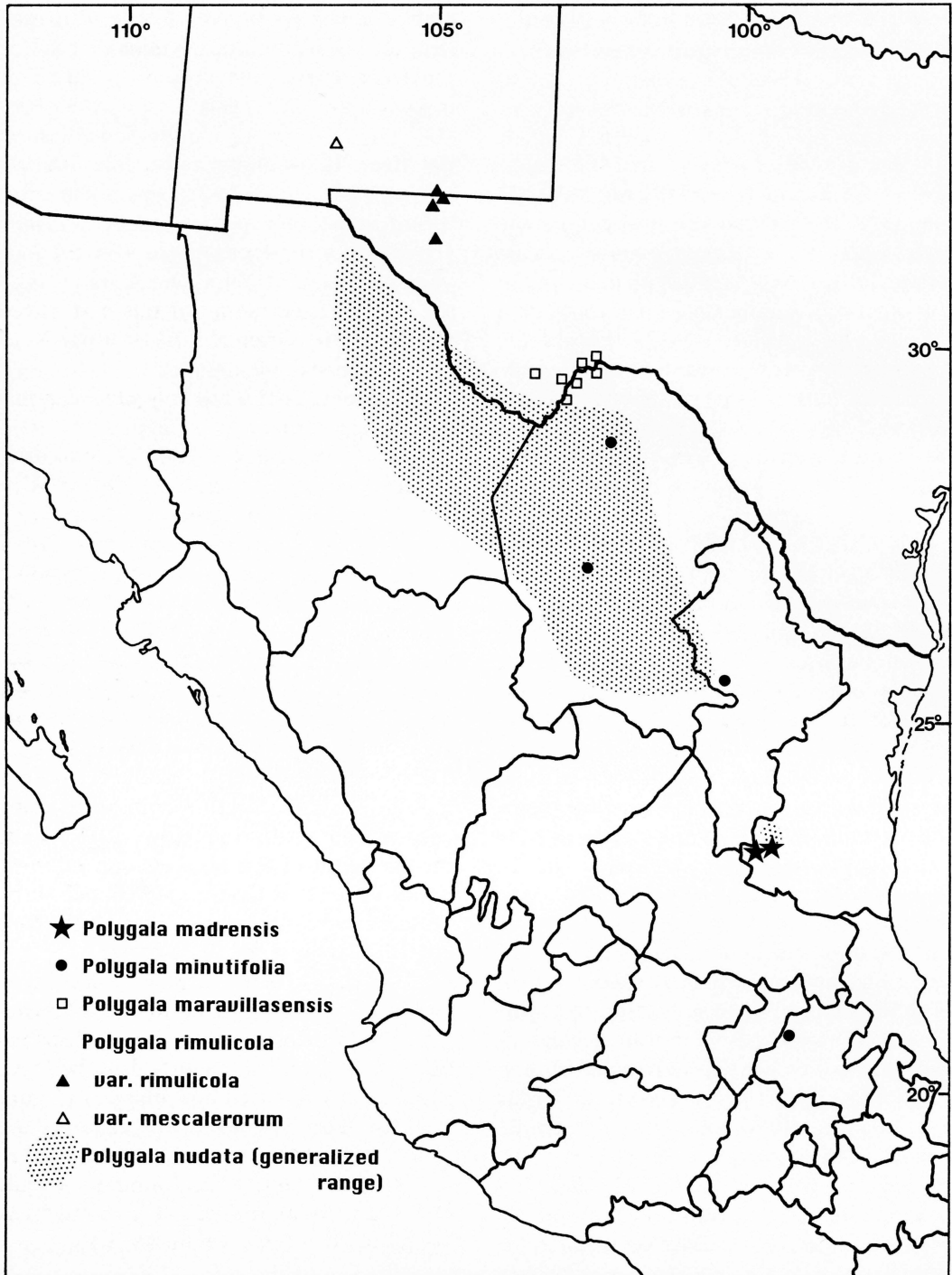


FIG. 2. Known geographical distribution of the taxa of the *Polygala nudata* complex (Texas, New Mexico, and Mexico.)

very near the Nuevo León line and thus the species is to be expected in that state.

The *Polygala nudata* complex (as defined by Wendt, 1978) comprises five related species, including *P. madrensis*, which are mostly restricted to the northern and central Chihuahuan Desert and northern Sierra Madre Oriental. This group of perennials may be distinguished morphologically from all other New World polygalas by the combination of: 1) adaxial sepal alone persistent in fruit (Figure 1-J); 2) racemes terminal on branches, never appearing leaf-opposed (Figure 1-A); 3) stamens seven (Figure 1-G). The keel-petal in these species (as in most species of section *Rhinotropis*) bears a distal beak that varies by species from a short-conical knob (Figure 1-H) to a well developed cylindrical appendage (see Figure 1-A in Wendt & Todsén, 1982); this beak is sometimes reduced but only rarely essentially lacking. All species are strongly lithophilic on limestone, generally growing directly out of cracks of limestone exposures or cliff faces. In four of the five species, including *P. madrensis*, leaves are nearly absent or squamiform, and the plant appears as a group of naked greenish stems with terminal racemose inflorescences.

Polygala madrensis is unique in the *P. nudata* complex in its robust habit, with typical unbrowsed plants being close to a meter tall; plants of the largest of the other species in the complex rarely exceed 40 cm. It appears morphologically closest to *P. nudata* itself, from which it can be distinguished by the characters given in the key. *Polygala nudata* is not known to occur south of the Saltillo area, 150 miles to the northwest of *P. madrensis*, except for a single collection (Johnston *et al.* 11164 (LL)) from the immediate area of the type locality of *P. madrensis*. This collection is unique in several ways. In its glabrous, deeply and evenly notched fruits it resembles *P. madrensis*, but it is quite distinct from that species in its puberulent and non-glaucous stems, pubescent flowers, seed characters, thin-textured and acute sepals, chromato-

graphic pattern (Wendt, 1978) and overall size, clearly resembling *P. nudata* in all of these characters. The decumbent habit of this specimen is uncommon for either species. The significance of this population is not clear. It could represent, for instance, the remnant of a disjunct population of *P. nudata* that subsequently gave rise to *P. madrensis*, or secondary sympatry of the two species with limited introgression. The scantily-collected nature of this part of the Sierra Madre Oriental makes analysis of such problems difficult.

The robust nature of *Polygala madrensis* might suggest that it is a polyploid, but this is not the case. All species in the complex, including the new species, are diploids with $n = 9$, as shown in Table 1 (although one individual of *P. maravillasensis* there listed yielded a count of $n = 18$ with occasional multivalent formation at meiosis.) All counts were made from floral bud material field-collected into modified Carnoy's solution (4 parts chloroform: 3 parts 95% ethanol: 1 part glacial acetic acid, by volume.) Meiotic chromosomes were studied using pollen mother cells of anthers squashed in acetocarmine stain, using standard techniques (Löve & Löve, 1975.) With the exception of *P. rimulicola* var. *mescaleorum* (Wendt & Todsén, 1982), all chromosome numbers given represent the first published reports for these species.

The taxa of the *Polygala nudata* complex may be distinguished by the following key, after which the geographical distribution of each of the previously described taxa is briefly summarized and mapped (Figure 2.) More complete information on typification and distribution for *P. nudata* and *P. minutifolia* Rose can be found in Wendt (1979) and for all species in the above-mentioned dissertation (Wendt, 1978.)

KEY TO TAXA OF THE *POLYGALA NUDATA* COMPLEX

1. Plants usually upright and fastigiate, often in crevices or rocky soil but rarely on vertical cliffs and

TABLE 1. Chromosome numbers in the *Polygala nudata* complex. Vouchers for all counts are deposited at LL.

Species	n	No. of individuals/ comments	Collection or bibliographic reference
<i>P. madrensis</i>	9	3	Mexico: Tamaulipas: <i>Wendt & Chiang</i> 184.
	9	1	Mexico: Tamaulipas: <i>Wendt & Chiang</i> 193.
<i>P. maravillasensis</i>	18	1; occasional multivalentes present	Mexico: Coahuila: Río Grande, Sierra del Carmen, <i>Johnston, Chiang, Wendt, et al.</i> 12374.
	9	1	U.S.A.: Texas: Brewster Co., Bullis Gap Range, <i>Butterwick & Lott</i> 3567.
	9	1	U.S.A., Texas: Brewster Co., San Francisco Canyon, <i>Butterwick & Lott</i> 3739.
<i>P. minutifolia</i>	9	1	Mexico: Coahuila: Sierra de la Madera, <i>Wendt & Lott</i> 1221.
<i>P. nudata</i>	9	1	Mexico: Chihuahua: Sierra Morrión, <i>Johnston, Chiang & Wendt</i> 8411.
	9	1	Mexico: Coahuila: Sierra de los Alamitos, <i>Johnston, Chiang & Wendt</i> 7778.
	9	1	Mexico: Coahuila: Sierra de las Margaritas, <i>Johnston, Chiang & Wendt</i> 9514.
	9	1	Mexico: Coahuila: Sierra de la Paila, <i>Johnston, Chiang & Wendt</i> 10521D.
	9	1	Mexico: Coahuila: Sierra del Carmen, <i>Johnston, Chiang, Wendt & Riskind</i> 11763B.
	ca. 9	1	Mexico: Coahuila: Sierra del Carmen, <i>Johnston, Chiang, Wendt & Riskind</i> 11853.
	9	2	Mexico: Coahuila: 8 mi W of Saltillo, <i>Wendt & Valdés</i> 2008.
	9	1	Mexico: Tamaulipas: 18 km SE of Bustamante, <i>Johnston, Chiang & Wendt</i> 11164. (<i>Wendt & Todsén</i> , 1982).
<i>P. rimulicola</i> var. <i>mescalerorum</i>	9	1	
<i>P. rimulicola</i> var. <i>rimulicola</i>	9	1	U.S.A.: Texas: Culberson Co., Sierra Diablo, <i>Wendt & Lott</i> 2100.

then not mat-forming; thickest stems (0.7–)0.9–4.2 mm in diameter in thickest green portions; plants appearing leafless, or occasionally with a few scattered narrow leaves to 15 mm long; stems glabrous or, when minutely puberulous with incurved or appressed hairs, then seed hairs projecting only 0.1–0.2(–0.4) mm beyond non-arillate end of seed.

2. Wings pink; capsule cuneate basally; seed hairs extending 0.4–1.0 mm beyond non-arillate end of seed, the seed body usually subglabrous above; plant glabrous, glaucous, 15–40 cm tall *P. maravillasensis* Correll

2. Wings white or greenish, often with a purplish center strip but rarely pink overall; capsule rounded or subtruncate basally; seed hairs extending 0.1–0.6 mm beyond non-arillate end of

seed, the seed body usually evenly pubescent; plant with stems minutely puberulent with incurved or appressed hairs or, when glabrous and glaucous, then the plant robust, 40–100 cm tall.

3. Plant sparsely minutely puberulent with incurved or appressed hairs or rarely nearly glabrous, never glaucous, 15–40(–50) cm tall; outer sepals ciliate and usually puberulent with incurved hairs; ventrolateral aril lobes 0.4–1.1 mm long, 0.3–0.7 mm wide in distal half, usually irregularly oblong to subflabellate *P. nudata* Brandege

3. Plant glabrous and glaucous, robust, 40–100 cm tall; outer sepals glabrous; ventrolateral aril lobes 0.2–0.5 mm long, to 0.3 mm wide

- in distal half, irregularly linear to narrowly triangular *P. madrensis* T. Wendt
1. Plants typically loosely to densely mat-forming, confined to crevices of vertical limestone cliffs; thickest stems 0.5–0.9 mm in diameter in thickest green portions; plants obviously leafy with many elliptic leaves 2–7.5 mm long, or, if essentially leafless, then young stems minutely puberulous with incurved or appressed hairs and seed hairs projecting 0.4–0.9 mm beyond non-arillate end of seed.
 4. Plant leafless or with scattered mostly lanceolate or narrowly truncate leaves; aril lobes 0.2–0.9 mm long; racemes 4–10(–16)-flowered *P. minutifolia* Rose
 4. Plant leafy, the leaves elliptic to obovate; aril lobes minute (to 0.3 mm) or absent; racemes 1–3(–5)-flowered.
 5. Beak of keel deltate or rounded in outline, often obscure, 0.1–0.3(–0.5) mm long, its length equal to or less than its diameter in the vertical plane at its junction with the keel-sac; seed body (1.0–)1.1–1.5(–1.7) mm long
 *P. rimulicola* Steyermark var. *rimulicola*
 5. Beak of keel linear or oblong in outline, 0.3–0.7 mm long, its length usually more than 1.5 times as great as its diameter in the vertical plane at its junction with the keel-sac; seed body (1.4–)1.7–1.9 mm long
P. rimulicola var. *mescalerorum* T. Wendt & Todsén

Polygala nudata is by far the most widespread and common species in the complex, ranging from southern Trans-Pecos Texas (southern Brewster and Presidio counties) and eastern Chihuahua (and to be expected in northeastern Durango) through Coahuila to extreme western Nuevo León, with an apparently disjunct population in the Sierra Madre Oriental of Tamaulipas as discussed above; it is fairly common in Coahuila and infrequent elsewhere. All of the other species are rather to quite rare.

Polygala minutifolia is known only from four widely scattered localities in Coahuila (Sierra de la Madera and Rincón de María), Nuevo León (Sierra Madre near Monterrey), and Hidalgo (Barranca de Tolimán.) *Polygala maravillasensis* is restricted to an area in the Lower Canyons and lower Bocuillas Canyon of the Río Grande in Texas (Brewster and Terrell counties) and Coahuila, and westward in low desertic ranges to central Brewster Co., Texas. *Polygala rimulicola* var. *rimulicola* is known only from Culberson Co., Texas (Guadalupe Mts. and Sierra Diablo) and Eddy Co., New Mexico (Guadalupe Mts.) *Polygala rimulicola* var. *mescalerorum* is a very rare taxon known only from the type locality in the San Andrea Mountains on the White Sands Missile Range in Doña Ana Co., New Mexico.

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