**Phaseolus texensis** (Leguminosae: Phaseolinae): A New Species from the Edwards Plateau of Central Texas

Alfonso Delgado-Salinas and William R. Carr

1Departamento de Botánica, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-233, 04510 México, D. F. MEXICO
2The Nature Conservancy of Texas, P.O. Box 1440, San Antonio, Texas 78295-1440

**Abstract:** *Phaseolus texensis* is a new species known only from rocky canyons of the eastern and southern Edwards Plateau of central Texas. Morphological examination and field observations, in conjunction with current molecular phylogenetic analyses based on nuclear ribosomal and chloroplast DNA sequences and a discrete and limited geographical range, support the taxonomic recognition of this species, which is accordingly described and illustrated here.

**Resumen:** La especie *Phaseolus texensis* es dada a conocer como restringida a cañones pedregosos de las partes orientales y meridionales de la región conocida como Edwards Plateau, de la porción central del estado de Texas, Estados Unidos de América. Un examen morfológico y observaciones en campo, aunados a estudios filogenéticos moleculares basados en secuencias de ADN nuclear ribosomal y de cloroplastos y a una restringida distribución garantizan el reconocimiento de esta especie y por lo tanto, aquí se describe e ilustra.

**Keywords:** Leguminosae, Phaseolinae, *Phaseolus*, Edwards Plateau, Texas.

During the course of a taxonomic revision of *Phaseolus* for the *Flora of North America* (Delgado-Salinas, in prep.), it became evident that plants from the botanically relatively well-known central part of Texas represent taxonomically problematic populations meriting further study. One herbarium specimen from this area (V. L. Cory 52444 CAS-DH) was annotated in the first half of the last century by Oliver W. Norvell as *Phaseolus pedicellatus* var. *scabrellus* ined. (Section Pedicellati Freytag). Subsequently, Delgado-Salinas (1985) hypothesized these plants to be atypical forms of *P. polystachios* (L.) Britton, Sterns & Poggenb., a species of the eastern U.S.A. Recently, Freytag and Debouck (2002) identified two herbarium specimens from this area as *P. polystachios* subsp. *smilacifolius* (Pollard) Freytag (Section Paniculati Freytag), pointing out, however, that the plants concerned were anomalous in this taxonomic placement. Apparently, Debouck (in Freytag & Debouck, 2002) was of the opinion that these plants would be better referred to another species. This has lead to consternation, particularly for workers not conversant with this group.

Examination of more herbarium material and of populations in the field reveals that these plants are morphologically closer to those of section Pedicellati Freytag, and that they appear to represent a morphologically distinct taxon allopatric to all other species of *Phaseolus*. In addition, in a phylogenetic analysis of *Phaseolus* (Delgado-Salinas et al., 2006) based on combined sequence data of nrDNA (ITS) and cpDNA (trnK/matK), two accessions of *P. texensis* were established in a clade with 100% bootstrap support as sisters to a larger group of species (Fig. 1). This clade, named the Pedicellatus group, comprises all species of sections Pedicellati and Digitati Freytag, along with a species of section Paniculati (Delgado-Salinas et al., 2006; Mercado-Ruaro et al., in press). Conversely, there was no support for the placement of *P. texensis* within the clade that comprises species of section Paniculati (i.e., *Phaseolus polystachios*), included in this analysis in the Lunatus and Polystachios phylogenetic
Thus, the combination of morphological, distributional, and molecular evidence strongly supports the recognition of these central Texas populations as a separate, narrowly endemic species, placed in a rather enlarged but well supported section **Pedicellati** (Delgado-Salinas et al., 2006). Within the Pedicellatus group, this
new species is sister to accessions of north
and central Mexico, and to the geographi-
cally closer *P. grayanus* Wooton & Standl.,
inhabiting the Chihuahuan Desert region of
northern Mexico, Trans-Pecos Texas, southern
New Mexico, and southeastern Arizona.

**Phaseolus texensis** A. Delgado & W. R.
Carr, sp. nov. (Figs. 2, 3).

**TYPE:** UNITED STATES. TEXAS. Kerr
Co.: E side of St. Rt. 16 at foot of switch-
backs on ridge separating Guadalupe and
Medina watersheds, 3.2 road miles S of
Turtle Creek bridge S of Kerrville, Fall Creek
Quadrangle, at N 29° 55′ 24.5″, W 099° 14′
15.2″, elev. 1180–1900 ft, 29 Oct 2005, W. R.
Carr et al. 24232 (TEX) (HOLOTYPE: TEX;-
ISOTYPE: MEXU!).

**Phaseolus grayanus** Wooton & Standley affinis,
se differt petioliis, inflorescentiis axe, pedicellis pilis
uncinatis (vs. plerumque numerosis pilis recti vel curvi
antorsis), bracteolis 0.5 mm (vs. 1.0 mm), fructibus
5–6(7) (vs. 4–5(6)) seminibus.

Herbaceous perennial **VINES**, trailing or
climbing up to 7 m long, from tuberous
taproots. **STEMS** terete, striate, ligneosum at
maturity, sparsely beset with hooked and
retrose hairs. **LEAVES** with axillary buds
sometimes developed at the base of the
inflorescence; stipules lanceolate, 1.5–3.0
mm long, 0.8–1.2 mm wide, acute at tip,
3-veined, ascending to reflexed; petioles and
rachises canaliculate, sparsely covered with
hooked hairs; petioles 1.0–5.0 cm long;
rachises 0.7–1.7 cm long; stipels subulate-
obovate, 1.0–2.5 mm long, ascending on
terminal pulvinus and spreading on lateral
pulvini; leaflets membranous to slightly
chartaceous, terminal leaflets ovate to broad-
ly so, occasionally round to quadrate lobed
at base, 2.0–8.5 cm long, 2.0–7.0 cm wide;
leaflets ovate, sometimes basally
lobed, acute at tip, apiculate, 1.5–7.0 cm
long, 2.2–4.8 cm wide, rounded to subtrunc-
cate at base; upper and lower surfaces of
leaflets sparsely covered with hooked hairs
intermixed with antrorse-curved hairs. **INF-
LORESCENCES** of pseudoracemes, often min-
ute secondary axes or stalks developed on
floral nodes, main axis usually covered with
hooked hairs; peduncles 5.0–10.0 cm long;
rachises up to 12.0 cm long, with 5–13 floral
nodes, each 2–3 flowered, often the middle
one on a short stalk; primary nodal bracts
triangular, 1.0–2.0 mm long, ca. 0.8 mm
wide, 3-veined, persistent; secondary nodal
bracts oblong, ca. 1 mm long, usually
caducous; pedicels 4–9 mm long, sparsely
covered with hooked hairs, arcuate in fruit;
bracteoles ovate, ca. 0.5 mm long, 1-veined,
persistent. **CALYCES** campanulate, 2.5–3.5
mm long, ca. 2.5 mm broad; inner surface
covered with appressed hairs in the tube,
outer surface with minute hooked and
straight hairs on the lobe margins; upper
lobe emarginate, laterals and lower lobes
triangular, ca. 1.0 mm long. **COROLLAS**
fading to dark pink, 1.2–1.5 cm long, ca.
7.0 mm high; standards oblong to orbicular,
ca. 1.2 cm long, ca. 1.0 cm wide, emarginate
at apex, glabrous, lamina thickened at point
of flexure, toward the base on both sides of
claw bearing two flap-like appendages,
tongue-guide surface concave and papilllose,
basal claws ca. 1.0 mm long; wings obovate,
1.2–1.5 cm long, ca. 8.0 mm wide, con-
stricted toward base, upper basal margin
folded and thickened, round-auriculate,
claw ca. 4.0 mm long; keels 6.5–9.0 mm
long, ca. 6.0 mm high, 1½ closely-coiled
diameter ca. 2.0 mm across, twisted and
facing forward, transverse pouch ca. 1 mm
long, claws of keel ca. 4.0 mm long. **ANDROECIUM**
with vexillary stamen ca. 1.0 cm long with a globose appendage
toward the base; staminal tube ca. 1.5 cm
long, biauriculate toward the base, with 4
dorsifixed and 5 basifixed anthers, these
oblone, ca. 0.6 mm long. **POLLEN** tricolpo-
rate, often with pseudocolpi, subtectate,
finely reticulate. **GYNOECIUM** with nectary
disc ca. 1.0 mm long; ovary linear, ca.
6.0 mm long, sericeous; ovules 5–7; style
bearded introrse; stigmas usually introrse;
stigmatic pads oblanceolate, ca. 0.6 mm
long. **FRUITS** oblong, slightly falcate, 3.5–
5.2 cm long, ca. 8.0 mm wide, short-beaked
Fig. 2. *Phaseolus texensis* (H. B. Parks 35738, GH, V. L. Cory 24567, GH, W. R. Carr et al. 24232, TEX). a. Plant habit, showing inflorescences with flower buds, flowers at anthesis, and immature and elastically dehiscent fruits with twisting valves. b. Flower, side view. c. Flower, front view. d. Calyx. e. Standard. f. Wing petal. g. Keel, distally 1 1/2 coiled. h. Keel, with stigma protruding. i. Androecium, staminal tube and free vexillary stamen with globose base. j. Gynoecium. k. Distal portion of style with pollen brush and introrse stigma. l. Seed, front and side views. Figure by Albino Luna (IBUNAM).
(2.0–3.0 mm), pendent, elastically dehiscent, compressed; valves chartaceous, strigose, expanding slightly over the 5–6(7) seeds. Seeds oblong, ca. 5.0 mm long, ca. 4.5 mm wide; hilum oblong, ca. 1.0 mm long, with epihilum; lens not prominent; halo black; surfaces smooth, brown mottled with black. Seedlings with hypogeal germination (or phanerogean); epicotyl pilose, often red-pigmented; stipules entire to bifid; petioles with basal and apical pulvini; stipels minute; eophylls simple, ovate, obtuse to acute at tip, truncate or slightly lobed at base; next leaves trifoliolate. Chromosome number unknown.

Flowering and Fruiting: September through November.


Additional Specimens Examined: UNITED STATES. Texas. Bandera Co.: W-facing but rather mesic slope on E side of Williams Creek, ca. 500–1000 ft. N of Williams Creek Rd. crossing ca. 4.5–4.6 road miles N of jct. R. M. 470 at Tarpley, on Creveling Ranch, Tarpley Quadrangle, at N 29° 42’ 19.3”, W 099° 19’ 10.2”, elev. 1480–1500 ft, 16 Apr 2002 (sterile), W. R. Carr 20635 (TEX). Kerr Co.: 8.2 mi NE of Kerrville, 19 Sep 1937, V. L. Cory 24567 (GH); 13 miles southwest of Kerrville, frequent on steep limestone bank of Lamb Creek, 2 Oct 1946, V. L. Cory 52444 (CAS-DH); 9 mi SW of Kerrville, 13 Oct 1940, H. B. Parks 35738 (GH-2). Travis Co.: Tributary of Bull Creek emanating from Stillhouse Hollow, ca. 100–200 ft. upstream from (E of ) its confluence with Mayfield Creek, downstream from a trail crossing near...

Phaseolus texensis can be distinguished from P. polystachios (section Paniculati), with which it has been considered recently conspecific (Freytag and Debouck, 2002), by a basic difference in inflorescence structure. The inflorescences of P. texensis are pseudoracemes, while those of P. polystachios are contracted panicles with lateral branches developing along the axis of the inflorescence.

Phaseolus texensis is positioned in the section Pedicellati, because of the support from molecular data (Fig. 1), and to its morphological similarity with other species of this section. It is in many ways most similar to P. grayanus, but it differs in leaf form, density of vestiture, length of the bracts and bracteoles, and ovule number. The terminal or uppermost leaflets in Phaseolus grayanus tend to be mostly deeply tri-lobed, while those of P. texensis range from broadly ovate to slightly tri-lobed, not as dissected as in the former. Indument in P. grayanus tends to be more profuse than in P. texensis, especially distinctive by the presence of more ascending hairs on petioles, peduncles, and pedicels. Bracts and especially bracteoles are slightly smaller in P. texensis (bracteoles ca. 0.5 mm long) than in P. grayanus (bracteoles ca.1.0 mm long). Ovaries in P. texensis bear 5 to 7 ovules, whereas those of P. grayanus have 4 to 5 (rarely 6) ovules.

In addition, the habitat preferences of these two species are distinct.Phaseolus texensis grows on limestone soils in mixed woodlands at low to mid-elevations (200 to 600 m), whereas plants of P. grayanus occur on drier slopes or canyons in rich volcanic soils, among oak and pine-oak forests between 1600 to 2500 m.

Based on our field observations and herbarium specimens, Phaseolus texensis is a rather rare species that deserves protection, and therefore, considering human activities around the few localities where it has been collected, we recommend treating it as vulnerable.

KEY TO THE SPECIES OF PHASEOLUS SECTION PEDICELLATI IN TEXAS

1. Leaflets mostly tri-lobed, lobes commonly quadrate; inflorescence with 5–7 floral nodes; bracteoles ovate-lanceolate, ca. 1.0 mm long; fruits 2.5–3.0 cm long, 4–5(6)-seeded; Chihuahuan Desert region of northern Mexico, Trans-Pecos Texas, southern New Mexico, and southeastern Arizona; elevations from 1600 to 2500 m ................................................. P. grayanus

1. Leaflets mostly ovate to broadly ovate, occasionally lobed, lobes commonly round; inflorescence with 5–13 floral nodes; bracteoles ovate, ca. 0.5 mm long; fruits 3.5–5.2 cm long, 5–6(7)-seeded; eastern and southern parts of the Edwards Plateau of Texas; elevations from 200 to 600 m ................................................. P. texensis

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**LITERATURE CITED**


Index to scientific names:

1. *P. grayanus* Wooton & Standl.
2. *P. pedicellatus* Benth.
4. *P. polystachios* subsp. *smilacifolius* (Pollard) Freytag
5. *P. texensis* A. Delgado & W. R. Carr

Index to numbered collections examined:

Carr, W. R. 14909 (5); 14861 (5); 15065 (5); 20635 (5); 24232 (5); Cory, V. L. 24567 (5); 52444 (5); Normand, E. s.n. (5); Parks, H. B. 35738 (5); Wendt, T. L. & Carr, W. R. 7379 (5).