

ASTRAGALUS PILOSIOR (FABACEAE), A NEW SPECIES FROM THE
SIERRA MADRE OCCIDENTAL IN CHIHUAHUA, MEXICO

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ABSTRACT

Astragalus pilosior Spellenb. & E.W. Anderson is described and illustrated as a new species. It is known to occur in the pine forests of southwestern Chihuahua, Mexico, on the western slopes of the Sierra Madre Occidental between approximately 1900 m and 2500 m elevation. The new species is placed in the section *Strigulosi*. It is compared with the recently described *A. spellenbergii* from southwestern Durango, Mexico.

RESUMEN

Astragalus pilosior Spellenb. & E.W. Anderson se describe e ilustra como una nueva especie. Que se localiza en bosques de pino al suroeste de Chihuahua, México. La especie ocupa las laderas montañosas del oeste de la Sierra Madre Occidental a elevaciones aproximadas de 1900 m y 2500 m. La nueva especie pertenece a la sección *Strigulosi*. Aquí se compara *A. pilosior* con *A. spellenbergii* que fue recientemente descrita del suroeste de Durango, México.

TAXONOMIC TREATMENT

In late March and early April, 2013, we were traveling the backroads of the upper reaches of the large canyons called Barranca de Batopilas and Barranca de Urique. The primary purpose of this trip was to enjoy the area and photograph the plants that were flowering in this portion of the Sierra Madre Occidental in Chihuahua. For those species that we did not know in the field, and which we believed we could not identify from photographs alone, we prepared vouchers to be deposited at herbaria in Mexico and the United States. We encountered several species of *Astragalus*, one of which we found at two different sites and which was unknown to us at the time. We made vouchers from each of these two populations. After our return to the United States, we could not identify our collections of one of these *Astragalus* species in Barneby (1964) or by comparison of astragali from the region at New Mexico State University (NMC, acronyms of herbaria from Thiers, 2018) or the New York Botanical Garden (NY). We also searched the University of Arizona herbarium (ARIZ) and found no specimens that matched ours except for a single, unidentified collection made in 1997 by Mark Fishbein in Chihuahua well to the south of our new records. We herein describe the plants represented by these specimens as belonging to a new species presently known only from western Chihuahua (Fig. 1). The specific epithet refers to the dense, soft pubescence of the stems, foliage, calyces, and fruits.

Astragalus pilosior R.W. Spellenb. & E.W. Anderson, **sp. nov.** (Fig. 2). TYPE: MEXICO. CHIHUAHUA. Mpio. de Batopilas: on old Batopilas – Urique road, near top of ridge between Río Batopilas and Río Urique, 16.8 km SSE of junction with road down to Urique, 25 km road km NW of crossing of Río Batopilas at La Junta, 1.75 km N of junction to Manzano (18 air km SE of Urique, 9.4 km NNW of Batopilas), 27.1017°N 107.7870°W, elev. 2090 m., dry pine/oak forest on N-facing slope of blocky rhyolitic tuff, plants on road bank, spreading and hanging over edge; petals pale bluish purple, the keels and wing more intensely colored; banner with a pale center finely lined with blue-purple, 30 Mar 2013, R. Spellenberg, W. Anderson 14532 (HOLOTYPE: NMC; ISOTYPES: CIIDIR, NY).

Caulescent perennial (Figs. 3, 4), with a taproot or shortly forking caudex at or just below soil-level, the herbage cinereous-pilose. **Stems** simple or branched, completely aerial or shallowly subterranean for 2–8 cm, widely decumbent-ascending or decumbent-sprawling, to 55 cm long, slender at base and becoming somewhat thicker distally, often heavily grazed and then appearing sub-pulvinate, densely soft-hairy with ascending-spreading hairs to 1 mm long. **Stipules** variable on stem, the distal stipules foliaceous, broadly lanceolate, acute to acuminate, 4–5 mm long, sometimes reflexed, amplexicaul, mostly free, shaggy pilose on dorsal

surface, less densely so on ventral surface, stipules toward base of stem fully amplexicaul and forming a low collar around the stem, paler, much smaller, translucent, pale green, or those at the base or below soil surface stramineous. **Leaves** 2–6 cm long, basal with a petiole to ca. 1 cm long, distal subsessile, with 9–19 elliptic to obovate, flat or slightly folded leaflets 3–12 mm long, the apex rounded or shallowly emarginate, abaxial surface pilose with loosely appressed and ascending hairs, the adaxial surface less densely so, the hairs mostly ascending. **Peduncles** incurved-ascending. **Racemes** densely 15–35-flowered, the flowers early ascending, soon declined, tightly emarginate, the raceme axis 10–25 mm long in flower, lengthening to 20–35 mm in fruit. **Bracts** thin, greenish, becoming membranous and pallid, lanceolate to narrowly elliptic, 2–3.5 mm long, soon reflexed, shaggy pilose with loosely appressed white or fuscous hairs on the abaxial surface, glabrous or glabrate on the adaxial surface. **Pedicels** arched outward and downward, at anthesis 0.2–0.3 mm long, thickening and lengthening in fruit to 1.1–1.5 mm long, persistence on fruiting peduncle unknown. **Bracteoles** 0 or 2, 0.5–0.9 mm long. **Flowers** (Fig. 5) 5.5–6.7 mm long. **Calyx** herbaceous, pale greenish or greenish-stramineous, usually slightly anthocyanic, 3.9–5.3 mm long (including teeth), softly hairy with white and fuscous hairs, the disk slightly oblique, 0.5–0.6 mm deep, the campanulate tube 2.2–3 mm long, 1.6–2.0 mm diam., the narrowly linear-lanceolate teeth 1.7–2.5 mm long, 0.2–0.3 mm wide at midlength, the whole becoming papery, rupturing on the ventral side of the pod and persisting at the base of the pod on the dorsal side. **Petals** pale purple or bluish-purple in distal part of petals, the bases near white, banner longitudinally striate with fine darker lines. **Banner** recurved 45–80°, claw broad, 2.5–3.2 mm long, 1.5–1.7 mm wide, blade broadly oblong, 2.5–3.5 mm long, 2.2–2.5 mm wide, rounded truncate across the apex, the margins gently recurved. **Wing** claw very slender, 2.5–3.0 mm long, blade obliquely obovoid, 3.5–4.1 mm long, 1.3–1.4 mm wide, incurved through 30–45°, margin entire, tip rounded, held just above keel tip. **Keel** (ca. equal to wing, slightly shorter as positioned in the flower) 5.3–5.8 mm long, claws 1.8–2.1 mm long, blade 3.5–3.7 mm long, 1.7–1.8 mm wide, the half ovate blades curved through 30–45° to the broadly acute tip. **Anthers** 0.5–0.6 mm long. **Ovules** 7–13. **Pod** (Fig. 6) shortly stipitate, the stipe 0.4–0.8 mm long, hidden by the marcescent calyx; pods semi-persistent, densely clustered, spreading or nodding in racemes ca. 2.5 cm wide, much of the peduncle not visible between pods; pod as viewed from the ventral surface lance-ovoid in outline, as viewed from the side more or less ½ lanceolate and incurved through about 1/8 of a circle, 9–12 mm long, 2.6–3.2 mm wide, bluntly triquetrous, about as deep as wide, distally tapering to a sharply acuminate beak ca. 2 mm long, the ventral side bluntly angled, the suture prominent, the dorsal side deeply and narrowly sulcate, the suture infolded as a complete septum ca. 3 mm deep, the lateral faces deeply convex, the valves at first pale green, becoming coriaceous and stramineous or brownish, softly hairy with more or less contorted white hairs up to ca. 0.7 mm long, the valves smooth beneath the shaggy tomentum; dehiscence unknown; **seeds** unknown.

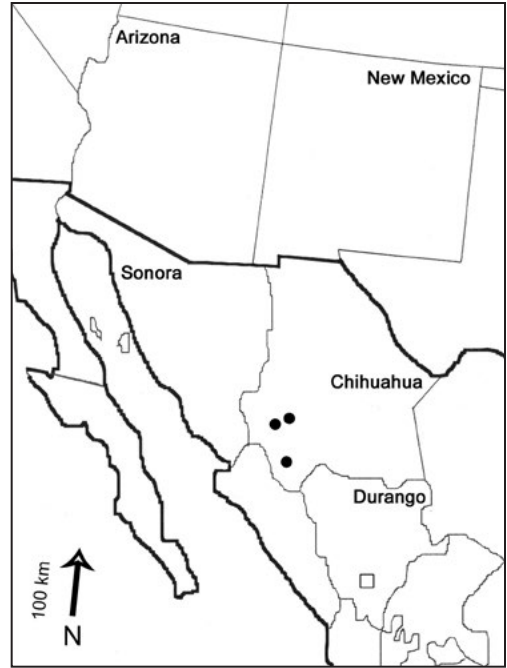


FIG. 1. Map of northwestern Mexico and adjacent United States showing known distribution for *A. pilosior* in southwestern Chihuahua, Mexico (black dots) and the known area for *A. spellenbergii* (open square). The area of the holotype of *A. pilosior* is indicated by the dot at the upper left of the array of the three black dots. The arrow indicating north also represents a scale representing approximately 100 km.



Fig. 2. Photograph of the holotype of *Astragalus pilosior* (R. Spellenberg, W. Anderson 14532, NMC).



FIG. 3. *Astragalus pilosior* at the type locality in Mpio. de Batopilas (collection site 14532), the stems spreading down the road bank from the root crown located at upper left corner of photo (photo by RS).



FIG. 4. Habit of *A. pilosior* on open, flat ground at paratype site 15348 above Urique (photo by B. Weber).

Paratypes: **MEXICO. Chihuahua:** Barranca Sinforosa, Rancho Coyeachic, 4 km E of Pino Gordo, 26°33'N 106°58'W, elev. approx. 2450 m, SE-trending ridge in pine-oak forest with *Pinus douglasiana*, *P. arizonicus*, *P. leiophylla*, *Quercus mcvaughii*, *Q. coccolobifolia*, *Arbutus xalapensis*; prostrate, rhizomatous perennial herb; petals pale purple; fruit declined; uncommon, 8 Mar 1997, Mark Fishbein 2910 (ARIZ 336765). **Mexico. Mpio. de Guachochi:** on Samachique – Batopilas road (Chih. Hwy. 185) 7.2 km S of junction with Creel – Guachochi highway (Chih. Hwy. 25); 27.2561°N 107.5190°W, elev. 2200 m, heavily grazed sandy-gravelly creek bottom, with *Pinus ayacahuite*, *P. engelmannii*, *Juniperus deppeana*, *Quercus rugosa*; plants grazed to almost pulvinate form; petals pale purple, the keel more intensely colored, the banner paler and purple-lined in center, 1 Apr 2013, R. Spellenberg & W. Anderson 14540 (MEXU, NMC). **Mpio de Urique:** on the Batopilas to Las Cieneguita road 1.5 km S of the junction to Urique, 7.8 air km E of Guapalayna, 14.0 air km NE of Batopilas, 27°09.689'N, 107°48.751'W, elev. 1890 m, white degraded tuff on N-facing slope, along edge of road, with *Quercus tarahumara*, *Q. jonesii*, *Q. viminea*, *Q. sideroxylla*, pines, 8 Mar 2017, R. Spellenberg, T. Lowrey, W. Anderson 15348 (MEXU, NMC, UC, UNM); on the Batopilas to Las Cieneguita road 1.1 km N of junction with road to Manzano, 26.5 km N of junction with bridge over Río Batopilas at main highway, 27°06.082'N, 107°47.706'W, elev. 2075 m, igneous-derived soil in open pine forest, with *Quercus sideroxylla*, *Q. jonesii*, *Ceanothus*, *Arbutus arizonica*, *A. xalapense*, 8 Mar 2017, R. Spellenberg, T. Lowrey, W. Anderson 15349 (ASU, NMC, RSA, UNM).



Fig. 5. Flowers of *A. pilosior* in side view, from type locality, collection 14532 (photo by WA).

Astragalus pilosior is known only from open pine forests (Fig. 7) on the west slope of the Sierra Madre Occidental in western Chihuahua at about 1900–2500 m elev. It occurs on the floor of open pine forests, and responds positively to disturbance, becoming frequent along road shoulders. Where not grazed, it forms loose spreading mats 30–80 cm wide. Occasionally it occurs in heavily grazed ground of short-clipped grasses (Fig. 8) where it also is grazed, and where it appears more or less pulvinate. *Astragalus pilosior* is the only species known from the pine forests of western Chihuahua that has small purplish flowers, declined, incurved small triquetrous, bilocular pods, and dense pubescence of soft, shaggy, loosely ascending-appressed hairs on foliage and pods.

Astragalus pilosior, with its basifixed pubescence, connate basal stipules, small flowers, and deflexed, subtriquetrous, shortly stipitate, bilocular pods, is considered to reside in the section *Strigulosi* M.E. Jones, as keyed in Barneby (1964). This section is primarily Mexican, extending northward into the southwestern U.S. in Arizona and New Mexico, and southward in Central America to Honduras. The section is defined by Barneby primarily by the connation of basal stipules opposite the petiole. It also has pods persistent or nearly persistent on the receptacle. Our original inclination was to include this new species in the smaller section *Miselli*, which has persistent, shortly stipitate, triquetrous, bilocular pods, but stipules not connate, or even a smaller section *Micranthi*, which has similar, but deciduous pods, and stipules not connate. Study of our collections reveals the basal stipules to be shortly connate opposite the petioles. The section *Strigulosi*, as defined by Barneby, had 25 species at the time of publication of his Atlas of North American *Astragalus* (1964). He said of the section, “The gamut of variation in the section is so great that we are led to seek more exactly definable subsidiary categories within it, equivalent if possible to the subsections recognized elsewhere in the Atlas.” He goes on to say that species for natural groups that cannot be unequivocally delimited from others and that better knowledge of persistence of the pods is needed. The “Atlas” is a remarkable work and even after 55 years remains a central reference for the taxonomy of *Astragalus*. It is likely, however, that the comparatively sparse material available 55 years ago, representing a wide range of diversity, was insufficient to allow Barneby to adequately organize infrageneric categories. With the addition of many new collections from Mexico since then, and with the possibility of molecular approaches to reveal related groups, meaningful realignment of *Astragalus* species at the level of section may be feasible.

About midway in the period of time between our initial discovery of *A. pilosior* and its description herein, Estrada-Castillón et al. (2016) described as new *Astragalus spellenbergii* (honoring the first author of the



FIG. 6. Fruits of *A. pilosior* from paratype site 14540 (photo by RS).

present paper). It is known only from the Mpio. de Pueblo Nuevo in southwestern Durango (Figs. 2, 9). They included their new species in section *Strigulosi*. Dra. Socorro González-Elizondo, a co-author of that paper, unaware of our discovery to the north, alerted us to the new species. From their excellent description and illustration, it seemed likely that the two species were closely related and we thought perhaps conspecific. We sent an isotype of the yet unnamed *A. pilosior* to Dra. González at CIIDIR and she assured us that the two taxa were distinct, differing conspicuously in the nature of the pubescence (*A. pilosior* – indumentum shaggy, soft, the hairs steeply ascending or more or less loosely appressed, mostly white [Fig. 7], with some fuscous hairs on the calyx, vs. *A. spellenbergii* – indumentum coarse, spreading-pilose, with numerous dark hairs on the calyx



FIG. 7. Habitat of *Astragalus pilosior* at paratype site 15439 on ridge between the Barranca de Urique and Barranca de Batolipas, Chihuahua. The *Astragalus* was sporadic on the forest floor, and common along the immediate roadside (photo by RS).



FIG. 8. Habitat of *Astragalus pilosior* at paratype site 14540, near Samachique, Mpio. de Guachochi, Chihuahua. The *Astragalus* was locally frequent in open gravelly soil in grassy area, the plants grazed and appearing pulvinate (photo by WA).



FIG. 9. Inflorescence from a pressed and dried specimen of *A. spellenbergii* at CIIDIR (photo by J. Tena-Flores).

[Fig. 9] and on the pod). *Astragalus spellenbergii* also occurs about 1000 m higher in the Sierra Madre and 300 km further south. As far as is known, *A. spellenbergii* flowers in October and November, whereas *A. pilosior* is known to flower in March and April. The species may also differ in flower color, flower size, and ovule number. The color of the petals in *A. spellenbergii* is only known from dried material, sample sizes are small, and differences now seen in ovule number (fewer in *A. pilosior*) may not be significant,

ACKNOWLEDGMENTS

Bruce Weber, who participated on a trip with us in 2017 to the region around the type locality of *Astragalus pilosior*, contributed to the photographs. Socorro Elizondo-Gonzales read the manuscript and made comments regarding the distinctive nature of *A. spellenbergii*. Jorge A. Tena-Flores provided photographs of flower and fruit parts of *A. spellenbergii* from specimens held at CIIDIR. Phil Tonne and Tim Lowrey (the latter also accompanying us on the 2017 trip to Batopilas and vicinity) provided a photograph of the NMC holotype. Naida Zucker assisted with the intricacies of PhotoShop in preparing photographs from multiple digital cameras. Sara Fuentes-Soriano (NMC) provided the Spanish translation of the English abstract. All these contributions are gratefully acknowledged. We thank two reviewers of the manuscript, Eduardo Estrada-Castillón and Martin F. Wojciechowski, for their helpful comments.

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