

NEW SPECIES OF *MENTZELIA* (LOASACEAE)
AND *PHACELIA* (HYDROPHYLLACEAE) FROM NEW MEXICO

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ABSTRACT.—New species of *Mentzelia* and *Phacelia* are described from northwestern New Mexico, USA, as *Mentzelia todiltoensis*, N. Duane Atwood & Stanley L. Welsh, and *Phacelia sivinskii* N. D. Atwood, sp. nov. The new *Mentzelia* is compared to *M. humilis* based on similarities in seed, fruit, leaf, and flower morphology and to *M. memorabilis* in stem, leaf, and fruit morphology. *Phacelia sivinskii* is compared to *P. constancei* N. D. Atwood on the basis of seed, leaf, and flower morphology.

Key words: *Mentzelia*, *Phacelia*, *New Mexico*, *nomenclature*, *North America*, *Loasaceae*, *Hydrophyllaceae*.

The new *Mentzelia* and *Phacelia* are part of voucher collections made during the 2004 field season in conjunction with fieldwork on the genus *Phacelia* for the North American Flora project.

MENTZELIA

Initial attempts at identification of the *Mentzelia* were made using the early treatment of *Mentzelia* by Darlington (1934), Martin and Hutchins (1980), descriptions of related species, and the large collection of plants at Brigham Young University (BRY). Specimens examined do not match any herbarium collections studied or fit descriptions of existing taxa in the literature. Besides the type of the new *Mentzelia*, 2 additional collections, one by N.H. Holmgren et al. (15051) and an earlier one by Bill Hevron (1736) were available for study. Some of the lower leaves on the Hevron collection have a few short lobes, whereas all other collections have entire leaves. *Mentzelia todiltoensis* (Todilto stickseed) belongs to section *Bartonia*, a group of ca. 40 species with lenticular, mostly winged seeds that are horizontally aligned in the capsule. It is related to the suffrutescent, long-lived perennials of the section, many of which are restricted to specific geological strata. The new *Mentzelia* is known from the Todilto Formation with some overlap on the upper part of the Morrison Formation. These formations are members of the San Rafael Group of Middle Jurassic age (Scholle 2003).

Mentzelia todiltoensis N. D. Atwood & S. L. Welsh, sp. nov. (Fig. 1)

TYPE here designated: USA. New Mexico: **Cibola Co.**, vicinity of I-40/junction of Hwy 6, 4 August 2004, N. D. Atwood & A. Clifford 30538 (holotype, BRY; isotypes, BRY, ASU, MO, NMC, NY, RM, SJNM); vicinity of I-40/junction of Hwy 6, 28 September 2004, N. D. Atwood 30814. Paratypes: USA, New Mexico: **Bernalillo Co.**, T10N, R3W, S10NE1/2, Canoncito Navajo Reservation, Gypsum Dome in Canada de los Apaches W of Day School, 1 July 1992, Bill Hevron 1736 (BRY); **Santa Fe Co.**, desert 32 km (20 miles) air distance NE of Interstate 25 at Exit 242 (for Bernalillo); 35°27'06"N, 106°13'25"W, T41N, R7E, S7, 2 August 2003, Noel H. Holmgren et al. 15051 (BRY).

A *M. humilis* (Gray) Darlington in caulibus elatioribus foliis caulinarum linearis anguste revolutis ad planis, rare paucilobatis; petalis plus numerosis, brevioribus et angustioribus; calyce loborum longioribus; capsulis longioribus; trichomatis caulinarum et foliorum reflexus; et a *M. memorabilis* N. H. & P. K. Holmgren in caulibus elatioribus et robustioribus, foliis caulinarum longioribus; capsulis longioribus et latoribus, subcylindricis non crateriformibus, differt.

Similar to *M. humilis* (Gray) Darlington but differing in having taller stems 2.2–8 dm tall vs. 2–4 dm tall; narrowly linear revolute to flat cauline leaves (rarely with a few lobes) vs. pinnately lobed leaves; 10 petals vs. 5 petals; longer

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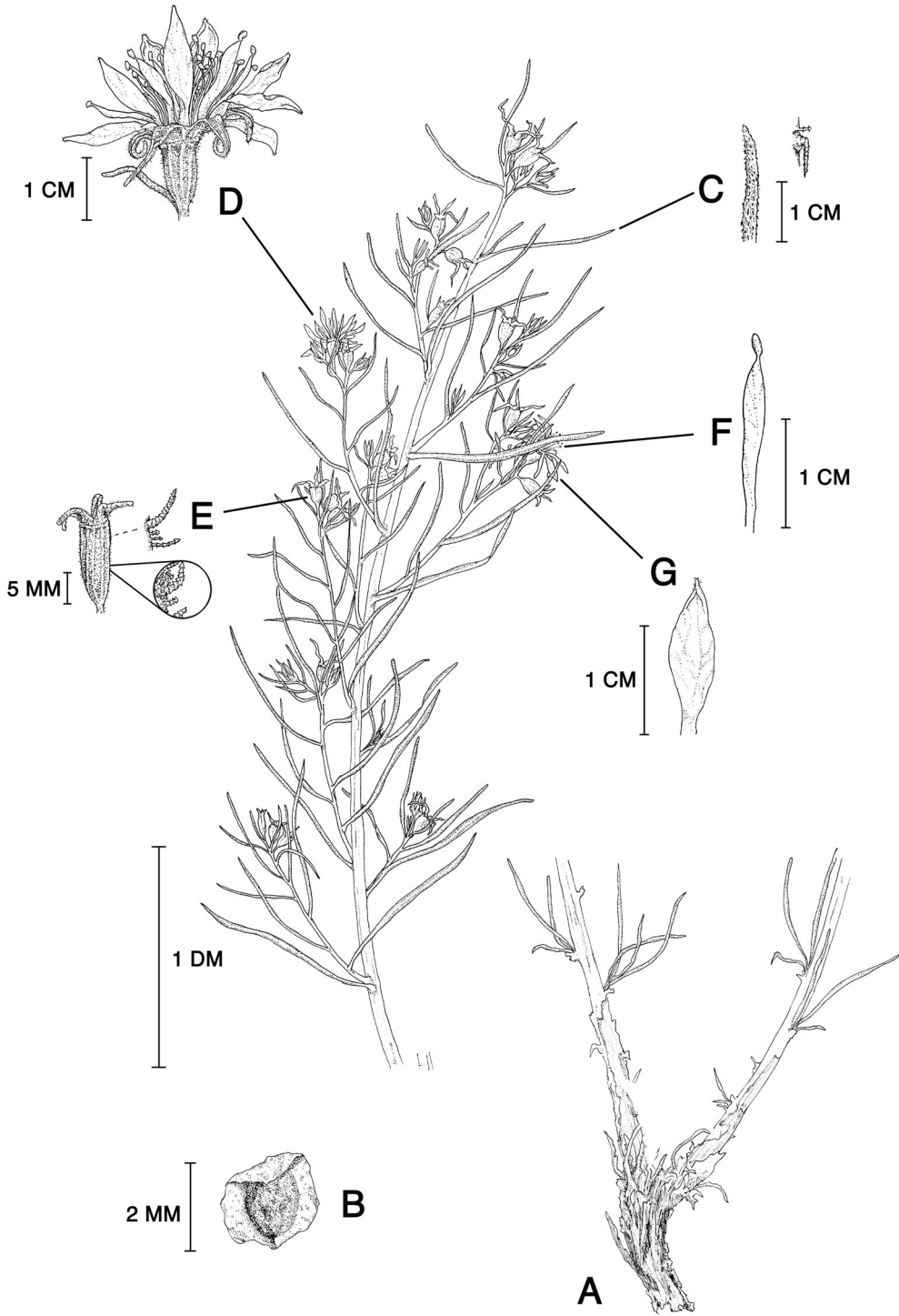


Fig. 1. *Mentzelia todiltoensis* N. D. Atwood & S. L. Welsh, sp. nov.: A, habit; B, seed; C, leaf; D, flower; E, fruit; F, stamens; G, petal. Drawn from holotype collection (N. D. Atwood & A. Clifford 30538 [BRY]).

calyx segments 6.3–8.2 mm vs. 5 mm; shorter; narrower apically acute petals 11–12 mm long × 0.6–1.6 mm wide vs. longer; wider apically obtuse petals 12–15 mm long × 2–3 mm wide; longer capsules 8–12 mm long vs. 7 mm long; reflexed to spreading leaf and stem trichomes vs. ascending leaf and stem trichomes; and differing from *M. memorabilis* N. H. & P. K. Holmgren in having more robust and taller stems to 1 cm thick or more and 2.2–8 dm tall vs. 4 mm or less thick and 1.5–4.5 dm tall; similar but longer cauline leaves 5–11.5 cm long vs. 2–6 cm long; larger and different fruit 8–12 mm long × 5–6 mm thick and subcylindrical vs. 4–6.5 mm long × 3.5–4.5 mm wide and bowl-shaped; reflexed to spreading leaf and stem trichomes vs. ascending leaf and stem trichomes.

Mentzelia todiltoensis also has some relationship with *M. multiflora* which occurs in New Mexico. Both species are tall, robust taxa; however, Todilto stickseed is easily distinguished from it by the generally much larger, longer 2.2–18 dm, and more numerous ridged stems; almost always simple, entire, narrow cauline leaves; more pointed oblanceolate 11–12 mm long petals; smaller 8–12 mm long × 5–6 mm wide subcylindrical capsules vs. mostly shorter 4–8 dm long, smooth stems; broader usually sinuate to pinnate leaves; oblong-oval obtuse tipped 15–20 mm long petals; and larger 15–20 mm long × 6–8 mm wide urceolate capsules. Both *M. humilis* and *M. memorabilis* are more disjunct from populations of *M. todiltoensis*.

Robust, usually multi-stemmed perennial, 2.2–8 dm high; **stems** 1–18, erect, stout, ridged, to 1 cm thick or more, white, leafy, covered with minutely reflexed to spreading glochidiate pubescence, with both tapering, spinelike, barbed and capitate heads, eventually exfoliating at least below; cauline **leaves** entire, green, narrowly linear to narrowly oblanceolate, tightly revolute to flat or subterete, sessile, 5–11.5 cm long, 0.5–3.8 mm wide, covered with white, dense, stout, recurved glochidiate hairs with bulbiform and disklike or pustulate base; **basal leaves** weathering, not persistent; **flowers** on the upper part of stems and branches in corymbosely branched clusters of (1) 2–3, sessile to subsessile, subtended by 1 or 2 small linear-filiform bracts, opening just before sunset and remaining open through the night;

calyx segments 5, 6.3–8.2 mm long, glochidiate, spreading to reflexed in fruit; **petals** 10, yellow, oblanceolate, 11–12 mm long, 0.6–1.6 mm wide at the middle, base tapering, apex acute and barbed; **stamens** numerous, the outer sinus filaments dilated, the inner shorter; **anthers** 0.5–0.7 mm long, short-glochidiate, twisted at anthesis; **capsule** subcylindrical, obtuse at the base, 8–12 mm long, 5–6 mm wide, glochidiate; **seeds** semi-orbicular, horizontal in the capsule ca. 28, flattened-lenticular, 2–2.3 mm long, 1.4–1.6 mm wide, winged, minutely tuberculate or papillate on the body and wing, the wing 0.3–0.4 mm wide.

Key to Related Species

1. Stems tall, 2.2–8 dm long; fruiting capsules 8–12 mm long, 5–6 mm thick, subcylindrical, obtuse at the base; cauline leaves narrowly linear, entire; trichomes of stem and leaf reflexed *M. todiltoensis*
- Stems shorter, 1.5–4 dm long; fruiting capsules 4–7 mm long, obpyramidal or bowl-shaped; cauline leaves pinnately lobed; trichomes of stem and leaf ascending 2
- 2(1). Capsules narrowly obpyramidal, 7 mm long or more, 4–6 mm wide *M. humilis*
- Capsules turbinate, bowl-shaped, 4–6.5 mm long, 3.5–4.5 mm thick *M. memorabilis*

HABITAT AND DISTRIBUTION.—Apparently restricted to the Todilto and upper part of the Morrison Formations in Bernalillo, Cibola, Santa Fe, and Socorro Counties, New Mexico. Associated species include *Ephedra torreyana*, *Tetradymia filifolia*, *Cryptantha pustulosa*, *Dalea frutescens*, *Selenocarpus lanceolatus*, *Calylophus hartwegii* var. *filifolius*, *Tiquilia hispidissima*, *Sporolobus neeleyi*, *Mentzelia pumila*, and *Phacelia sivinskii*, from 5600 to 5840 feet elevation. Flowering from late June through September.

PHACELIA

In 2002 Atwood made an extensive study of herbarium specimens annotated as *Phacelia integrifolia* from collections on loan from herbaria in the Midwest and Southwest. Based on this review, it was apparent that several new species were present in the 1500 collections on loan. One of these is *P. sivinskii*. Early collections of *Phacelia sivinskii* (Sivinski's phacelia) were few in number and were collected in flower or very early fruit, without mature

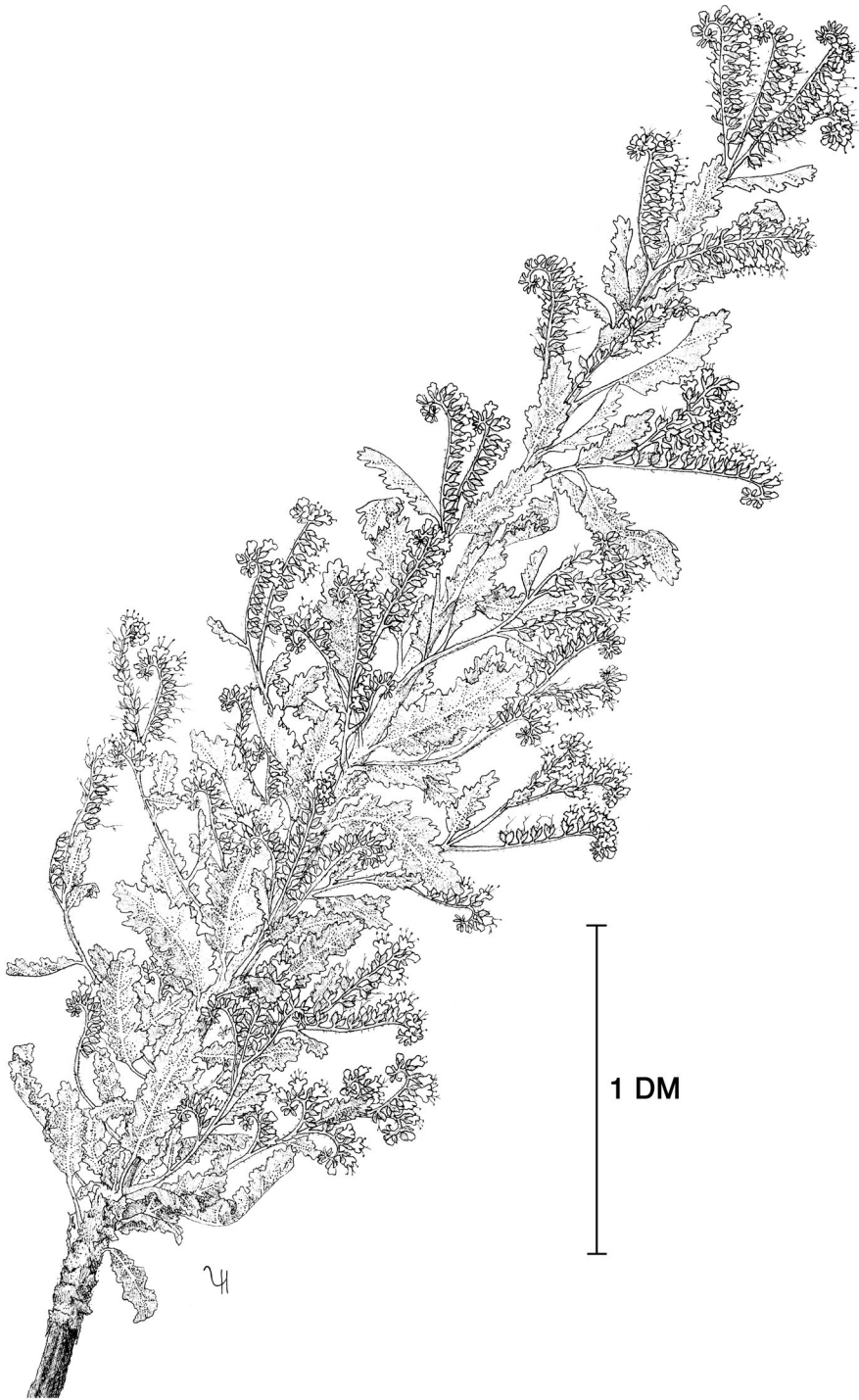


Fig. 2. *Phacelia sivicinskii* N. D. Atwood & T. Lowery, *sp. nov.* Drawn from holotype collection (N. D. Atwood 30757 [BRY]).

seeds for comparison with related taxa. A concerted effort has been made over the last few years to secure good material for the type, an effort that finally met with success.

Phacelia sivinskii N. D. Atwood, P. Knight & T. Lowery, **sp. nov.** (Fig. 2)

TYPE here designated: USA. New Mexico: **Sandoval Co.**, 6 miles N of San Ysidro on Hwy 44, 35°39'53"N, 106°53'41"W, 27 September 2004, *N. D. Atwood 30757* (holotype, BRY; isotypes, ASU, BRY, CAS, GH, MO, NMC, NY, RM, SJNM, UNM). Paratypes: New Mexico: **Cibola Co.**, ca. 1 mile N of I-40/Hwy 6 jct, 35°00'18"N, 107°08'89"W, 5 August 2004, *N. D. Atwood & Arnold Clifford 30545*; **Sandoval Co.**, vicinity of San Ysidro, 10 August 1926, *Bro. G. Arsene & Bro. Benedict 17617* (GH); just W of San Ysidro on White Mesa, 35°30'9"N, 106°50'29"W, 1 September 1992, *P. Knight & T. Lowery 4189* (BRY, UNM); 6 miles N of San Ysidro along Hwy 44, 22 August 1996, *N. D. Atwood 21548* (BRY, UNM); ca. 12 miles N of San Ysidro on Hwy 550, 35°39'528"N, 106°53'69"W, 4 September 2002, *N. D. Atwood 28914*; ca. 3 miles due W of San Ysidro, 35°39'59"N, 106°53'47"W, 3 August 2004, *N. D. Atwood 30523*; Bureau of Land Management lands W of Hwy 544 and ca. 4 miles W of San Ysidro, 35°32'71"N, 106°51'14"W, 3 August 2004, *N. D. Atwood 30525*; 6 miles N of San Ysidro on Hwy 44, 35°39'51"N, 106°53'44"W, 27 September 2004, *N. D. Atwood 30761*; 2.5 miles S of San Ysidro, thence W on Cabeyon Rd to Gasco, thence 1.6 miles N to windmill, 35°30'95"N, 106°51'20"W, 28 September 2004, *N. D. Atwood 30806 and 30811*; **Socorro Co.**, ca. 20 miles W of Carrizosa on Hwy 380, 33°45'97"N, 106°08'12"W, 6 September 2002, *N. D. Atwood 28989*; 19.7 miles W of Carrizo on Hwy 380, 33°45'96"N, 106°8'10"W, 22 July 2003, *N. D. Atwood & Blaine Furniss 29678*.

Similis *P. constancei* N. D. Atwood in habita et semine morphologia sed in seminibus parvioribus et crista et margine corrugata minus regulariter sed cristatis dorsalis lateralis distincte, et foliis latioribus brevioribus, panis, non-revolutis differt.

Biennial, 2.0–3.7 dm tall; **stems** solitary to several, leafy, densely covered with nearly sessile to 3-celled, light-colored capitate glands, some short and longer simple nonglandular

hairs, and with white to light brown silica-like grains; **leaves** lanceolate to oblong, 1–6 cm long, 0.5–2 cm wide, irregularly crenate-dentate, densely covered with short, light-colored, stipitate glands, the basal with petioles 12 mm long, the upper short petiolate to sessile; **inflorescence** in terminal cymes on the main stem and short lateral branches, somewhat virgate with some plants flowering from the base up; cymes to 5.5 cm long in fruit, reddish, leafy bracteate; **flowers** tubular to tubular-campanulate, light violet, (3.7) 4.5–5 mm long, the lobes 1.5–2 mm long, puberulent; **stamens** and style exerted 5–6 mm, darker violet filaments; **anthers** bronze, style divided 3/5 its length, hirsutulous to the forks; **calyx** lobes elliptic in flower, 3.3 mm long, 0.8–1.3 mm wide, linear to narrowly oblanceolate in fruit, 3.1–3.6 mm long, 1–1.4 mm wide, stipitate glandular and spreading hirsute; **capsule** 2.6–2.8 mm long, 1.8–2.1 mm wide, short, glandular, and hispidulous; mature **seeds** oblong, black, 2.2–2.7 mm long, 1.1–1.3 mm wide, margins and ridge entire to corrugated, excavated ventrally, pitted, dorsal surface cross-corrugated.

Phacelia sivinskii is most closely related and similar to *P. constancei* Atwood in general habit and seed morphology. However, it is easily distinguished from this species by the smaller seeds, which are less regularly corrugated on the ridge and margin of the seeds but more distinctly cross-corrugated on the dorsal surface, and by the broader and shorter, flat, non-involute leaves.

HABITAT AND DISTRIBUTION.—Restricted to Todilto gypsum in a scattered juniper-desert shrub community. Associated with *Juniperus monosperma*, *Mentzelia punila*, *Lepidium montanum*, *Chrysothamnus viscidiflorus*, *Tiquilia hispidissima*, *Selenocarpus lanceolatus*, *Calylophus hartwegii* var. *filifolius*, *Astragalus albulus*, *Astragalus kentrophyta* var. *neomexicana*, *Gaillardia pinnatifida*, *Erigeron* aff. *divergens*, *Eriogonum rotundifolium*, and *Dalea frutescens*. Known from northwestern New Mexico in Cibola, Sandoval, and Socorro Counties.

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LITERATURE CITED

- DARLINGTON, JOSEPHINE. 1934. A monograph of the genus *Mentzelia*. *Annals of the Missouri Botanical Garden* 21:103–226.
- HOLMGREN, NOEL H., AND PATRICIA K. HOLMGREN. 2002. New mentzelias (Loasaceae) from the Intermountain region of western United States. *Systematic Botany* 27:747–762.
- MARTIN, WILLIAM C., AND CHARLES R. HUTCHINS. 1981. *Mentzelia*. Pages 1299–1307 in *A flora of New Mexico*, Volume 2.
- SCHOLLE, PETER A. 2003. New Mexico Bureau of Geology and Mineral Resources, geologic map of New Mexico, 1:500,000. New Mexico Bureau of Geology and Mineral Resources, Socorro.

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