



***Geranium dodecatheoides*, A New Species from New Mexico, U.S.A**

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GERANIUM DODECATHEOIDES, A NEW SPECIES FROM
NEW MEXICO, U.S.A.

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ABSTRACT. *Geranium dodecatheoides* P.J. Alexander & Aedo (Geraniaceae), a new species from the Sierra Blanca in Lincoln Co., New Mexico, is described and illustrated. This new species is related to North American species of sect. *Caespitosa* R. Knuth, which have dichasial inflorescences and petals that are hairy on the adaxial surface. It is distinguished from other members of *Caespitosa* primarily by having narrow, reflexed petals.

Key Words: Geraniaceae, *Geranium*, United States, taxonomy

The genus *Geranium* L. comprises about 350 species distributed throughout most of the world. The Americas have the greatest diversity with over 130 species, most of them endemic to the Andes. In North America (including Mexico) there are 45 native and 15 introduced species. All the native species from North America are members of subgen. *Geranium*. The genus was monographed by Knuth (1912). Aedo (2000, 2001) revised *Geranium* in North America (Canada and U.S.A.) and Moore (1943) revised the genus in Mexico and Central America.

Knuth (1912: 45, 99) described the section *Caespitosa*. This group is easily recognized by having petals with long hairs on the adaxial side, dichasial inflorescences, usually opposite leaves, and well-developed, erect stems. Section *Caespitosa* is best represented in the Rocky Mountains although some species reach Central Mexico. In this paper, we describe a new species of this section that has reflexed petals, an unusual feature in *Geranium* that is otherwise found only in two species from the Balkans and five from China.

Geranium dodecatheoides P.J. Alexander & Aedo, *sp. nov.* TYPE:
U.S.A. New Mexico: Lincoln Co., west side of Sierra Blanca,
Three Rivers Trail (Tr. 44), 1.7 miles (linear) east of the trailhead,

2.6 miles northwest of Lookout Mountain, 1.9 miles southwest of White Horse Hill, Lincoln National Forest, west side of Sierra Blanca, Three Rivers Trail, 1.7 mi E of the trailhead, 2.6 mi NW of Lookout Mountain, 1.9 mi SW of White Horse Hill, 33°24' 20.52"N, 105°51'13.32"W, 2300 m, 12 Sep 2010, *P.J. Alexander 1230* (HOLOTYPE: MA-821121!; ISOTYPES: MO!, NMC!, UNM!). Figure 1.

A simili specie *Geranium caespitosum* E. James differt nova nostra petalis reflexis, angustioribus, fructuumque rostribus apicali constrictione aperte longiore praeditis.

Herbs perennial, 40–100 cm tall. Rootstock 5.1–9.7 mm in diameter, vertical, not turnip-shaped, without fusiform roots. Stem erect, leafy, not rooting at nodes, stolon absent, without vegetative stems, pubescent with patent, eglandular hairs 0.6–0.7 mm long and patent, glandular hairs 0.3–0.5 mm long. Basal leaves in a \pm persistent rosette; lamina 3.7–4.4 cm long, 4.8–5.6 cm wide, polygonal in outline, cordate, palmatifid (ratio main-sinus length/middle-segment length = 0.65–0.75), not coriaceous, pilose, with appressed, eglandular and glandular hairs; segments 5, in one plane, middle segment obtriangular, 8.9–12.8 mm wide at the base (ratio middle-segment width at the base/middle-segment length = 0.30–0.36), 5–7-lobed in distal half (ratio second-sinus length/middle-segment length = 0.15–0.23); cauline leaves opposite; petioles to 22 cm, without abscission zone, with patent, eglandular hairs 0.1–1 mm long and patent, glandular hairs 0.2–0.6 mm long; stipules 5–17 mm long, lanceolate, free, papery, reddish, with eglandular and glandular hairs on abaxial surface and on the margin, glabrous adaxially. Inflorescence in a dichasial cyme; cymules 2-flowered, solitary; peduncles 27–46 mm long, with patent, eglandular hairs 0.2–0.3 mm long and patent, glandular hairs 0.5–0.6 mm long; bracteoles 5.2–8.4 mm long; pedicels 41–59 mm long, with patent, eglandular hairs 0.1–0.3 mm long and patent, glandular hairs 0.3–0.6 mm long; pedicel and peduncle together overtopping the subtending leaf (ratio cymule length/leaf length = 1.3–2.5). Sepals 9.1–10.7 mm long, 2.9–3.3 mm wide, lanceolate, smooth, not accrescent, with mucro 1.4–1.6 mm long, with antrorse to patent, eglandular hairs 0.1–0.5 mm long and patent and glandular hairs 0.5–0.8 mm long on the abaxial side, usually hairy on the base of the adaxial side. Petals 11.9–13.8 mm long, 2.8–4.7 mm wide, reflexed, entire, with a claw 0.8–1.1 mm long, hairy on 1/5–1/4 of their adaxial surface and on the base of the abaxial one, ciliate on the basal margin, with hairs 2.1–3 mm long, purplish. Stamens 10, both whorls bearing anthers; filaments

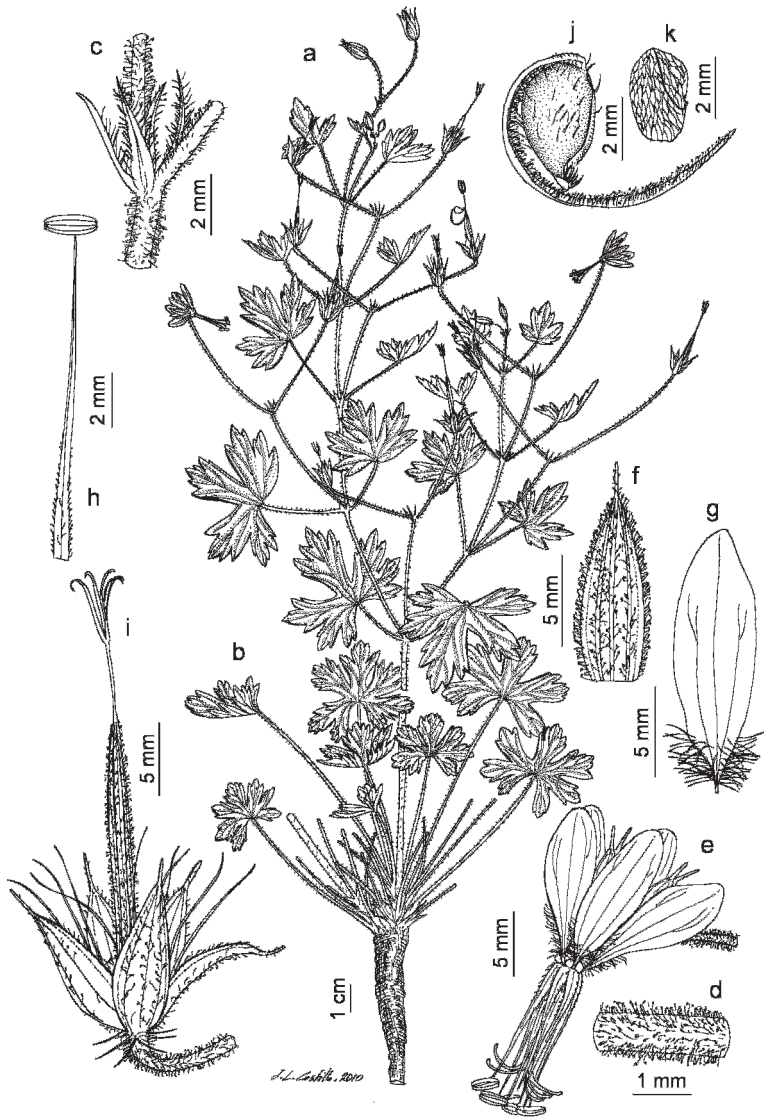


Figure 1. *Geranium dodecatheoides* P.J. Alexander & Aedo. a. Inflorescence. b. Stem base and rootstock. c. Bracteoles. d. Pedicel indumentum. e. Flower. f. Sepal. g. Petal. h. Stamen. i. Fruit. j. Mericarp. k. Seed. (a, c: from Alexander 1230, MA; b, d–k: from Alexander 1232, MA).

10.9–12.8 mm long, lanceolate, pilose on the abaxial side, ciliate on the proximal half, with hairs 0.3–0.8 mm long; anthers 2–2.4 mm long, yellow with purplish strips. Nectaries 5, hemispheric, glabrous. Gynoecium 9.8–12.7 mm, purplish. Fruit 29.9–35.8 mm long, elastically dehiscent with the seeds ejected from the mericarps while the mericarps remain attached to the columella, erect when immature; mericarps 3.9–4.1 mm long, smooth, without basal beak, with a basal callus, without a basal prong, without a strand of fibers, brownish, with \pm patent eglandular hairs 0.5–0.9 mm long and glandular hairs 0.4–0.7 mm long; rostrum 19.1–24 mm long, with a narrowed apex 6.3–7.3 mm long; stigmatic remains 4.6–5.3 mm long, with 5 glabrous lobes. Seeds 2.6–3.1 mm long, 1.5–1.9 mm wide, reticulate, glabrous, uniformly brownish. Cotyledons entire.

DISTRIBUTION AND HABITAT. *Geranium dodecatheoides* is presently known only from Three Rivers Canyon in the Sierra Blanca, Lincoln County, New Mexico (Figure 2). It grows primarily among andesitic boulders and outcrops near the edge of riparian forest in the canyon bottom along the Three Rivers Trail (T44) in Lincoln National Forest, between 2300 and 2500 m. Dominant trees in this habitat are *Pseudotsuga menziesii* (Mirb.) Franco, *Pinus strobiformis* Engelm., and *Quercus gambelii* Nutt. Other trees found less abundantly in the riparian zone include *Acer grandidentatum* Nutt., *Acer negundo* L., *Fraxinus velutina* Torr., *Holodiscus dumosus* (S. Watson) A. Heller, and *Rhamnus betulifolia* Greene. Slopes above the riparian zone are generally dominated by *Pinus edulis* Engelm. and *Juniperus* spp. on south exposures, and *Pseudotsuga menziesii* and *Pinus ponderosa* P. Lawson & C. Lawson on north exposures. *Geranium dodecatheoides* was not seen in similar habitat in nearby Eagle Creek, Argentina, and Little Bonito Canyons, but the area has not been thoroughly surveyed for additional populations.

PHENOLOGY AND POLLINATION. *Geranium dodecatheoides* was observed beginning to flower in early July, and with both flowers and fruit in mid-September. In mid-September, flowers were visited frequently by *Apis mellifera* L. Although observations were brief, no additional pollinators were seen.

ETYMOLOGY. With reflexed petals, the flowers of this *Geranium* resemble those of the predominately North American genus *Dodecatheon* L. (Primulaceae).

PARATYPES: U.S.A. New Mexico: Lincoln Co., west side of Sierra Blanca, Three Rivers Trail (Tr. 44), 2.1 miles (linear) ENE of the trailhead, 2.4 miles

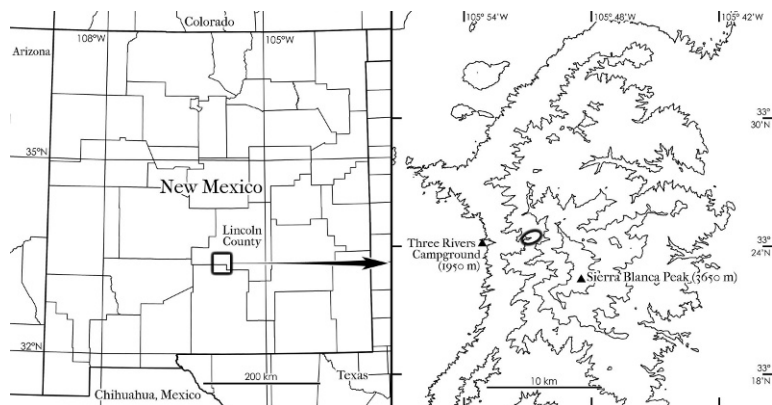


Figure 2. Distribution of *Geranium dodecatheoides* P.J. Alexander & Aedo. At right, contour lines are at 400 m intervals and the known distribution of *G. dodecatheoides* is indicated by the black oval.

northwest of Lookout Mountain, 1.5 miles SSW of White Horse Hill, Lincoln National Forest, west side of Sierra Blanca, Three Rivers Trail, 2.1 mi ENE of the trailhead, 2.4 mi NW of Lookout Mountain, 1.5 mi SSW of White Horse Hill, 33°24' 33.1"N, 105°50' 51"W, 2450 m, 12 Sep 2010, *Alexander 1232* (MA-821120, MO, NMC); Lincoln Co., west side of Sierra Blanca, Three Rivers Trail (Tr. 44), 2.0 miles (linear) east of the trailhead, 2.4 miles northwest of Lookout Mountain, 1.7 miles SSW of White Horse Hill, Lincoln National Forest, 33°24'23.4"N, 105°50' 54.6"W, 2350 m, 12 Sep 2010, *Alexander 1231* (MA-821122, ARIZ, NMC).

DISCUSSION

Endemism in the Sierra Blanca and adjacent mountains. The Sierra Blanca are part of a group of mountain ranges, including the Capitan Mountains and the Sacramento Mountains, which are a notable center of endemism in New Mexico. These mountains have a well-developed montane flora that is widely separated from similar habitats. The nearest mountain ranges where *Pseudotsuga menziesii*, *Pinus strobiformis*, and *Quercus gambelii*, the three dominant trees in the area where *Geranium dodecatheoides* is found, are the Magdalena Mountains ca. 130 km west-northwest, and the Manzano Mountains ca. 140 km north-northwest. Due in part to this isolation, these mountain ranges are home to 22 endemic plant taxa, including another recently described species, *Heuchera woodsiaephila* P.J. Alexander (Alexander 2008). *Geranium dodecatheoides* further increases the known endemism of these mountain ranges.

Similar species in section *Caespitosa*. *Geranium dodecatheoides* is quite similar to *G. caespitosum* E. James, a representative of sect. *Caespitosa* distributed from South Wyoming to Nevada and North Coahuila and Chihuahua. The two differ most obviously in petal orientation, with the petals reflexed in *G. dodecatheoides* and patent in *G. caespitosum*, but the two are also distinct in a number of other characters of the leaves and flowers. The leaves of *G. dodecatheoides* are less deeply divided than in *G. caespitosum* (ratio main-sinus length/middle-segment length: 0.65–0.75 vs. 0.72–0.92, respectively) and have the middle segment broader at the base [8.9–12.8 mm vs. 2.2–7.7(10) mm wide]. Petals of the two are of similar length but significantly narrower in *G. dodecatheoides* (ratio petal width/length: 0.23–0.35 vs. 0.54–0.63). The indumentum of the petals is also different. In *G. caespitosum* the hairs can reach halfway up the adaxial petal surface, whereas in *G. dodecatheoides* they are restricted to the proximal quarter, and are usually longer. Staminal filaments of *G. dodecatheoides* are longer than those of *G. caespitosum*, although with some overlap. The filaments of the former are straight and remain more or less applied to the stigmatic column during both male and female phases of the flower. In contrast, in *G. caespitosum* the stamens soon arch out. Nectaries of the new species are glabrous, whereas *G. caespitosum* usually have a tuft of hairs at the apex. Additionally, the narrowed apex of the rostrum is substantially longer in *G. dodecatheoides* than in *G. caespitosum* (6.3–7.3 mm vs. 2–3.8 mm). Both species are found together along the Three Rivers Trail but no intermediate specimens were found. This strongly supports the independence of the new species.

Geranium californicum G.N. Jones & F.F. Jones is another species of sect. *Caespitosa*, endemic to California, and quite similar to *G. caespitosum*. It shares with *G. dodecatheoides* a fruit-rostrum with a long, narrowed apex. However, *G. californicum* is well characterized by its longer peduncles and pedicels. *Geranium richardsonii* Fisch. & Trautv. is also found in the area where the new species was located, although it grows at higher altitude. *Geranium richardsonii* is easy to differentiate from *G. dodecatheoides* by its longer and more deeply divided leaves, which have more lobes per segment; shorter sepals; longer and wider petals, usually white, erect-patent, and with hairs that reach the half; shorter staminal filaments; nectaries dorsally lanate; rostrum with a shorter narrowed apex; and shorter stigmatic remains.

Other *Geranium* with reflexed petals. In the Balkans there are two species with reflexed petals, *Geranium aristatum* Freyn & Sintenis and *G. reflexum* L., both in subgen. *Erodioidea* (Picard) Yeo. This subgenus is characterized by “*Erodium*-type” fruit dispersal, in which the mericarp containing the seed is thrown attached to the awn. In contrast, *G. dodecatheoides* has fruits of the “seed ejection-type” which are characteristic of subgen. *Geranium* (Yeo 1984). In this type of fruit, a single seed is discharged by the explosive recurvature of the awn, with the rest of the awn and the mericarp wall remaining attached to the columella.

In China there is another group of species also with reflexed petals: *Geranium delavayi* Franch., *G. pogonanthum* Franch., *G. shensianum* R. Knuth, *G. sinense* R. Knuth, and *G. refractum* Edgew. & Hook. f. (Aedo 2008). They belong to subgen. *Geranium*, and compared to *G. dodecatheoides* they have longer leaves [(3.2)5–10.9 cm vs. 3.7–4.4 cm] with the segments rhombic and many-lobed; connate stipules; petals wider [(3.2)4–8.4 mm vs. 2.8–4.7 mm], sometimes hairy but then with shorter hairs than *G. dodecatheoides*; nectaries usually with a tuft of hairs at the top (or glabrous but forming a ring around the base of the ovary); and fruit reflexed when immature, with shorter stigmatic remains.

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