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VILLARREALIA (APIACEAE), A NEW GENUS FROM NORTHERN MEXICO

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ABSTRACT

Villarrealia Nesom, gen. nov., is described primarily to include **Villarrealia** (*Aletes*) **calcicola** (Mathias & Constance) Nesom, comb. nov., of Coahuila and western Nuevo León, Mexico. Its close relatives have been indicated by molecular data to be the essentially eastern USA genera *Polytaenia*, *Thaspium*, and *Zizia*, and a set of floral features provides a synapomorphy for the group of four genera. Illustrations and distribution maps are provided for both species.

KEY WORDS: *Villarrealia*, *Polytaenia*, *Thaspium*, *Zizia*, Coahuila, Nuevo León, Mexico

Recent molecular-morphological study of endemic western North American Apiaceae subfamily Apioideae (Downie et al. 2002; Sun et al. 2004; Sun & Downie 2010) opens perspectives toward understanding relationships among those genera and species. Morphological study of the group by R.L. Hartman and G.L. Nesom (in prep., in connection with taxonomic treatments for the developing Flora of North America) brings additional insights.

In particular for the present study, a strongly supported monophyletic subgroup (fide Sun & Downie 2010) within the American Apioideae comprises the mostly eastern and central North American genera *Polytaenia* DC. (Keith 2012; Nesom 2012), *Thaspium* Nutt., and *Zizia* Koch (e.g., Cooperrider 1985; Lindsey & Bell 1985) as well as the single species *Aletes calcicola* Mathias & Constance of north-central Mexico. The "*Thaspium* group" arises from within Clade 3 (see Fig. 2 of Sun and Downie, a strict consensus tree based on molecular and morphological characters), which is strongly supported by molecular data, less so morphologically. Cladistic relationships within the group are this: (*Aletes calcicola* (*Polytaenia* (*Thaspium*, *Zizia*))).

The *Thaspium* group, however, in the Sun & Downie analysis, is defined by a non-homoplasious synapomorphy — erect and only slightly divergent style branches — as well as a homoplasious one — distally hirtellous rays. The present study adds another apparently non-homoplasious synapomorphy (within American Apioideae) for the *Thaspium* group — the distal half of each petal is permanently sharply folded down to the inside (induplicate) (see Fig. 2c; Bell 1971; Lindsey & Bell 1985). In *Polytaenia*, the induplicate portion is like a narrowed appendage and is adnate near its apex to the erect proximal portion; in *Thaspium* and *Zizia*, the induplicate portion is free. In other genera, the petals may be rolled inward, but they are not sharply bent.

As in the other species of the group, *Aletes calcicola* has erect style branches and hirtellous rays and the petals are permanently induplicate. It differs from the other species in having 3 oil tubes per dorsal interval (vs. 1 per interval in *Polytaenia*, *Thaspium*, and *Zizia*) as well as an accessory oil tube at the apex of each rib. *Thaspium* and *Zizia* are distinct within the endemic Apioideae in their fascicled roots and they also share (as homoplasious) entirely scarious involucel bractlets. *Polytaenia* is distinct in its much taller, caulescent habit and larger leaves. All of the species, including *A. calcicola*, have non-winged fruitis.

In the orginal description of *Aletes calcicola*, the authors noted that they had previously "attempted to refer it the genera *Aletes*, *Musenion*, *Ligusticum*, and *Tauschia*" before settling on

Aletes, where it still did not fit unambiguously. Subsequent to the publication of a study of Aletes (Theobald et al. 1963), the addition of the caulescent (though inconsistently) *Aletes filifolius* Mathias, Constance, & W.L. Theob. to *Aletes* (Mathias et al. 1969) made it possible to consider *A. calcicola*, which is similar in habit to *A. filifolius*. Like most other *Aletes* and *Cymopterus*, however, *A. filifolius* has winged fruits.

Weber (1984) broadened the concept of *Aletes*, apparently accepting the species of Theobald et al. (1963) and adding 14 more, including *Neoparrya*. He did not mention either *A. calcicola* or *A. filifolius* but both apparently could have been included in his *Aletes* circumscription, judging from his account of a constellation of diagnostic morphological characters, especially including these: pseudoscape lacking; plants strongly scented; flowers yellow, white, or purple; mericarps trapezoidal (x.s.), not or variably dorsally compressed; oil tube variable in number, size, and disposition; and lack of stylopodium. Weber's recognition of a densely caespitose, strictly acaulescent habit as diagnostic presumably would have weighed against his acceptance of *A. calcicola*.

Cronquist (1997) suggested informally that *Aletes* and *Musineon* might be considered congeneric, further broadening the concept of the potentially resultant genus—*Musineon divaricatum* (Pursh) Nutt. (the type of *Musineon*) is caulescent and commonly produces a pseudoscape, and *Musenion* species have non-winged fruits. The molecular study by Sun and Downie (2010) indicates that a weakly supported monophyletic group is indeed formed by *Aletes* (fairly close to the concept of Theobald et al.), though it also includes *Pseudocymopterus* and other species. The species of *Musineon* are not phyletically coherent and the broader group does not include those species added by Weber. Nor, as implied above, does this "*Aletes* group" include *A. calcicola*.

In view of its molecular and morphological distinction, *Aletes calcicola* is recognized here as a distinct genus. The new genus is named for José A. Villarreal-Quintanilla of the Universidad Autónoma Agraria Antonio Narro in Saltillo, Mexico—an excellent botanist in the field and herbarium and in documentation of his studies through publications.

VILLARREALIA G.L. Nesom, **gen. nov. TYPE**: *Villarrealia calcicola* (Mathias & Constance) Nesom

Similar to *Polytaenia*, *Thaspium*, and *Zizia* in its staminate and bisexual flowers within an umbellet, lack of a stylopodium, style branches filiform, flexuous and erect to ascending-erect, dorsally compressed (slightly) and non-winged schizocarps, and permanently sharply induplicate petal apices. Distinct in its combination of taprooted habit and 3 oil tubes per dorsal interval as well as an accessory oil tube at the apex of each rib.

VILLARREALIA CALCICOLA (Mathias & Constance) Nesom, **comb. nov.** *Aletes calcicola* Mathias & Constance, Brittonia 33: 342, fig. 1. 1981. **TYPE: MEXICO. Coahuila**. Sierra de la Gloria, SE of Monclova, steep, gravelly limestone slopes in pine-oak woodland and chaparral, 1250-3000 m, Jul 1939, *E.G. Marsh 1895* (holotype: GH, photo-UC; isotype: TEX!).

Plants perennial from a thick taproot, caespitose from a branching root crown bearing old leaf sheaths, acaulescent or with 1–2 cauline leaves on a short stem (e.g., Fig. 1); stems and leaves slightly scaberulous; "whole plant with flavor and smell of celery" (*Johnston et al. 10305A*) or "odor like chuchupastle mixed with celery" (*Johnston et al. 12059A*). **Stems** (0–)1–4 dm, erect. **Leaves**: blades ovate to ovate-lanceolate in outline, 3–12 cm x 3–15 cm, ternately pinnately compound; leaflets ovate to lanceolate, 5–40 mm x 2–40 mm, usually pinnately lobed to pinnatifid with oblong to lanceolate, mucronulate ultimate divisions, scaberulous on veins beneath; petioles 3–15 cm long, scarious-sheathing at base. **Peduncles** 6–15 cm, longer than leaves, scaberulous at base of umbel. **Involucre bracts** absent. **Rays** 4–7, 1.5–3 cm, unequal, spreading ascending, scaberulous. **Involucel**

bractlets 2–8, linear-lanceolate, 1.5–3 mm, sometimes with very narrow scarious margins proximally, distinct to slightly connate at base. **Umbellets** 10–20-flowered, pistillate flowers 2–6; pedicels 3–5 mm, unequal. **Sepals** triangular-ovate. **Petals** narrowly ovate, apices extended into an appendage half as long as the petal and folded under and adnate near the apex to the abaxial surface, yellowish to light yellow-cream or greenish-white. **Styles** ca 2 mm, filiform, flexuous and essentially erect. **Stylopodium** absent. **Carpophore** divided in distal 1/3. **Schizocarps** oblong to oblong-oval, 5–6 mm, ribs subequally prominent and corky but unwinged; mericarps with oil tubes mostly 3 per dorsal interval, 1 at the apex of each rib, 2 on the commissure. **Seeds** subterete in transection, face plane.

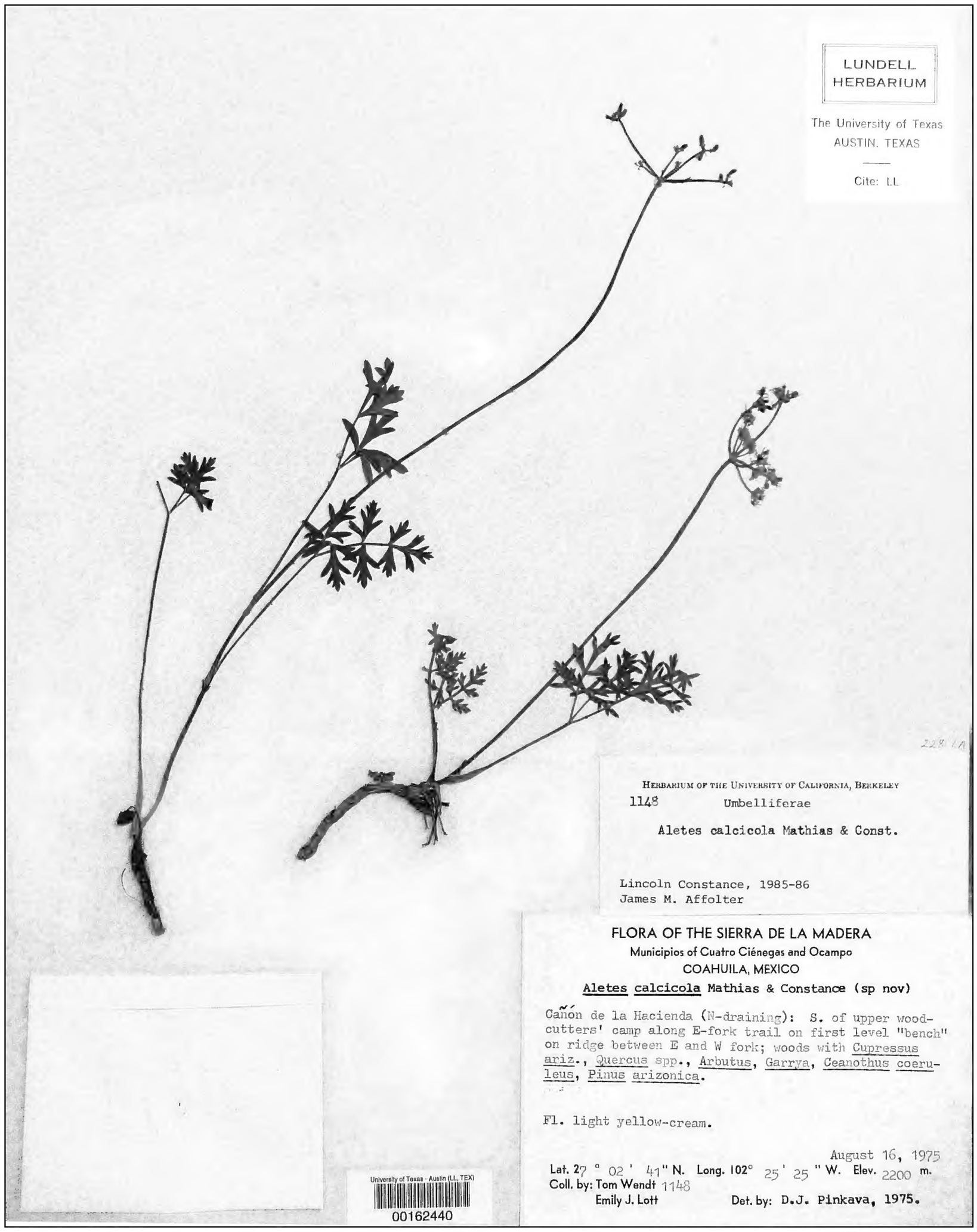

Figure 1. Representative collection of *Villarrealia calcicola*. Note variation in habit, caulescent (left) and acaulescent (right).

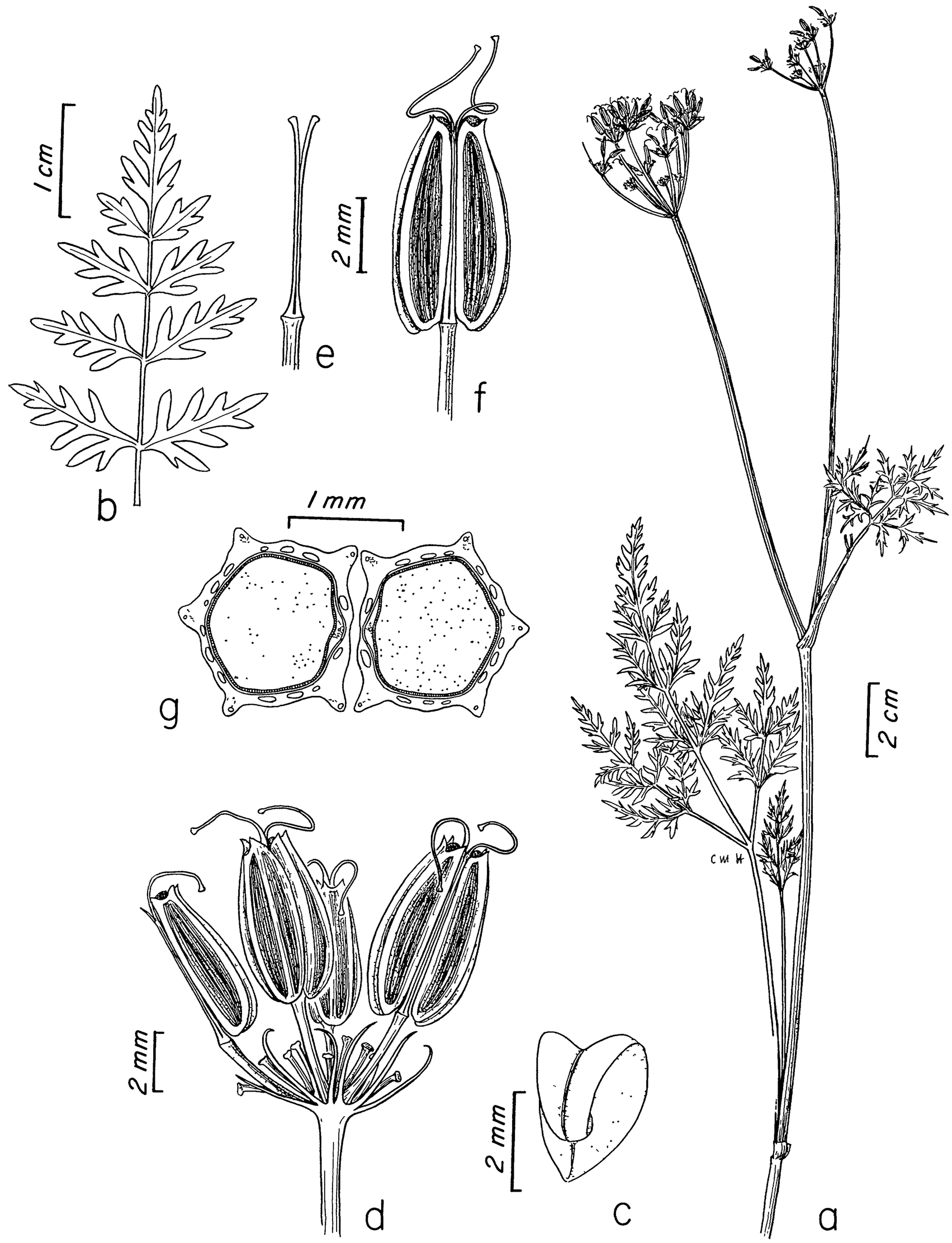

FIG. 1. *Aletes calcicola*. A. Habit. B. Detail of foliage leaf. C. Petal. D. Fruiting umbellet. E. Carpophore. F. Lateral view of fruit. G. Transection of fruit. A, D–G, from *Marsh 1895*; B, from *Johnston et al. 10,952a*; G, from *Pinkava et al. 6117*.

Figure 2. *Villarrealia calcicola*. Reproduced from Mathias and Constance (1981) with permission of the publisher. © The New York Botanical Garden Press, Bronx.

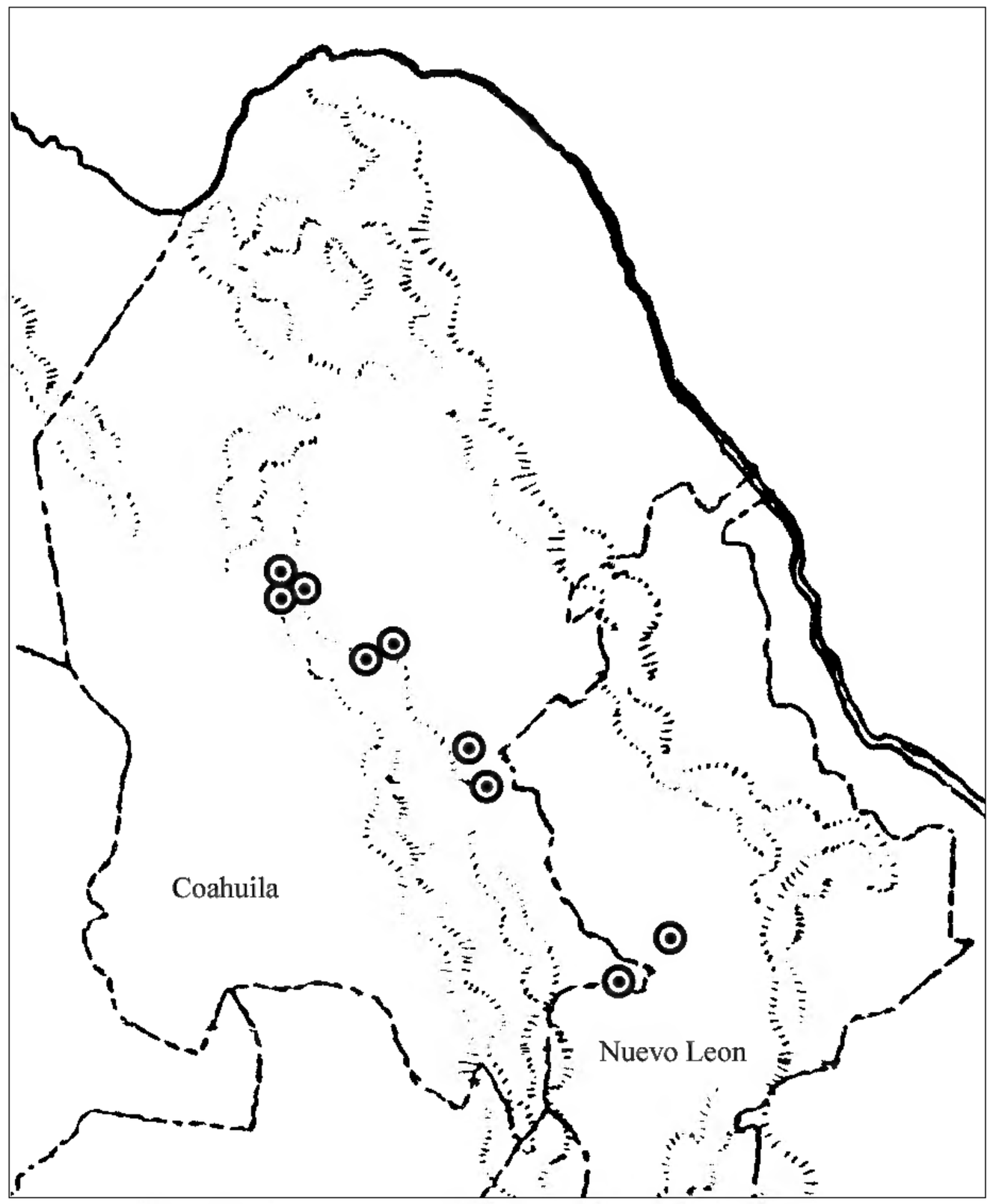

Figure 3. Distribution of *Villarrealia calcicola.*

Additional collections. **MEXICO**. **Coahuila**. Ca. 30 km WNW of Cuatro Cienegas on the N side of Sierra de la Madera, at the mouth of Cañon Desiderio, ca. 8-10 mi W of Rancho Cerro de la Madera, in *Pinus arizonica*, *Quercus*, *Arbutus*, *Fraxinus* woodland with *Garrya*, *Rhamnus*, etc., 2000-2600 m, 27° 07' N, 102° 31' W, 2 May 1977, *Henrickson 16009a* (TEX); E slope of the Sierra de San Marcos, ca. 6 km S of Ejido La Noria, 26° 28' 30"–26° 26'N, 101° 35' W, steep limestone slopes, *Dasylirion*, *Agave lechuguilla*, *Agave asperrima*, *Yucca carnerosana*, *Quercus*, *Pinus*, 1400-2275 m, 20 Mar 1973, *Johnston et al. 10305a* (TEX); Sierra de la Madera, middle and upper reaches of Cañon de la Hacienda, 27° 02' 30"–27° 03' 30" N, 102° 26' 30" W, steep limestone and shaly limestone slopes, *Pinus* spp., *Pseudotsuga*, *Quercus* spp., *Cercocarpus*, *Arctostaphylos*, 1850-2550 m, 10 May 1973, *Johnston et al. 10952a* (TEX); Cañon de la Gavia above (S of) Rancho de la Gavia, 26° 18' 30"–26° 20' N, 101° 15'–101° 18' W, steep-sided limestone mountain, *Quercus* sp., *Dasylirion*, *Agave lechuguilla*, *Cercocarpus*, *Fraxinus greggii*, *Pinus cembroides*, 1250-2200 m, 2-3 Aug 1973, *Johnston et al. 12059a* (TEX); Cuatro Cienegas Basin, Sierra de San Marcos, opposite Los Fresnos, NE-facing slope, 4 Apr 1969, *Pinkava et al. P-6117* (ASU digital image!, UC); Cañon de la Hacienda, Sierra la Madera, NW of Cuatro Cienegas, conifer-oak forest above log-cutter's camp, 23 Jun 1976, *Pinkava et al. P-13638* (ASU digital image!, UC); Sierra de Arteaga, Las Vigas, Cañon de Jamé, 25° 20' N, 100° 39' W, bosque de *Pinus*, *Pseudotsuga*, *Abies*, *Quercus*, y *Ceanothus*, vegetacion subalpina con *Pinus culminicola*, 2600-3300 m, 16 Sep 1989, *Villarreal & Carranza VQ5166* (TEX); Sierra de la Madera, Cañon de la Hacienda (N-draining) S of upper woodcutters' camp along E-fork

trail on first level "bench" on ridge between E and W fork, 27° 02' 41" N 102° 25' 25" W, woods with *Cupressus arizonica*, *Quercus* spp., *Arbutus*, *Garrya*, *Ceanothus coeruleus*, *Pinus arizonica*, 2200 m, 16 Aug 1975, *Wendt 1148* (LL). **Nuevo León**. Sierra Madre Mts., Monterrey, 29 Jul 1933, *Mueller 216* (TEX).

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