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Two New *Loeselia* (Polemoniaceae) Species from Michoacán, Mexico

J. Mark Porter[1,3] and Victor W. Steinmann[2]

[1]Rancho Santa Ana Botanic Garden, 1500 North College Ave., Claremont, California 91711 U.S.A.
[2]Instituto de Ecología, A.C., Centro Regional del Bajío, A.P. 386, 61600 Pátzcuaro, Michoacán, Mexico
[3]Author for correspondence: (j.mark.porter@cgu.edu)

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Abstract—Two new species of *Loeselia* (Polemoniaceae) from central Mexico are described and illustrated. Both are known only from small areas in the Balsas Depression of the state of Michoacán. ***Loeselia tancitaroensis*** occurs in pine-oak forest on the foothills of Cerro Tancítaro. It is similar to the Oaxacan endemic *L. ruprestis*, from which it differs in possessing linear to linear-lanceolate inflorescence bracts, entire to rarely one-toothed floral bracts and sepals, shorter sepals and ovaries, and carpels with two ovules. ***Loeselia spectabilis*** is restricted to tropical deciduous forest in the Infiernillo region. It is distinguished from the closely related *L. grandiflora* by possessing petiolate leaves, shorter sepals, glandular-ciliate corolla margins, and carpels with a single ovule.

Keywords—Balsas Depression, *Loeselia*, Mexico, Michoacán, Polemoniaceae.

Loeselia L. is a relatively small genus of Polemoniaceae incorporating 15 species and three subspecies (Porter and Johnson 2000). Although largely Mexican, it ranges from southwestern U.S.A. (Arizona and Texas) to Colombia and Venezuela. One polymorphic species, *L. glandulosa* (Cav.) G. Don, accounts for much of the range of the genus, extending from Arizona, south through Mexico and Central America, to Colombia and Venezuela. In addition, two other species have ranges that extend from Mexico into Texas: *L. mexicana* (Lam.) Brand and *L. greggii* S. Watson, and two species, *L. ciliata* L. and *L. pumila* (M. Martens & Galeotti) Walp., range from Mexico into Central America. The remaining species are endemic to Mexico. Several of these are either uncommon (e.g. *L. purpusii* Brandegee) or quite rare and local (e.g. *L. grandiflora* Standl., *L. rupestris* Benth., and *L. rzedowskii* McVaugh). The center of diversity appears to be the Balsas Depression of southwestern Mexico, where eight species occur, three of which (including the two described herein) are endemic.

Loeselia possesses an unusual suite of morphological characters within Polemoniaceae. The leaves are relatively broad, simple, serrate, and are usually opposite, except in the inflorescence where phyllotaxy generally shifts to a helical arrangement. The flowers are usually bilaterally symmetrical, with the stamens exserted well beyond the corolla tube. However, one of the most distinctive features is pollen morphology. Pollen is spherical, pantoporate, pertectate, punctuate, and bearing spinule processes.

Systematic investigations of *Loeselia* are somewhat limited. Most species were described from the late 1700s to the late 1800s (e.g. *L. amplectans* (Hook. & Arn.) Benth., *L. caerulea* (Cav.) G. Don, *L. cordifolia* Hemsl. & Rose, *L. glandulosa*, *L. greggii*, *L. involucrata* G. Don, *L. mexicana*, and *L. pumila*. Brand (1907) provided a detailed treatment of the genus in his monograph of the family; however, he also included two species currently treated in *Ipomopsis* (i.e. *I. effusa* (A. Gray) Moran and *I. tenuifolia* (A. Gray) V. E. Grant). Several distinct species have been described subsequently (e.g. *L. purpusii*, *L. grandiflora*, and *L. rzedowskii*). Unfortunately, no recent comprehensive treatment is available for *Loeselia*. Turner (1994) reviewed the genus, described one new species [*L. hintoniorum* B. L. Turner = *L. amplectans* (Hook & Arn.) Benth.], and provided a key to species, but he included no descriptions and only limited synonymy.

Grant (1959) recognized two sections for the genus: sect. *Loeselia* and sect. *Glumiselia* V. E. Grant. Section *Glumiselia* included only one species, *L. grandiflora*, and was characterized by the following features: shrubs with large opposite leaves throughout, the leaves of the inflorescence reduced, paniculate inflorescences, closely appressed, chartaceous floral bracts that surround the calyx and corolla tube, and salverform corollas with linear clawed lobes. The remainder of the species were placed in sect. *Loeselia*, a group characterized as low shrubs, basally woody perennials or annuals with small to medium alternate leaves, upper ones not much reduced, axillary flowers, spreading, green and leaf-like bracts, and funnelform corollas with oval lobes. However, molecular evidence (Porter et al. unpublished results) infers that sect. *Glumiselia* is nested within section *Loeselia*, and even morphological data do not support its recognition. For example, *L. purpusii* possesses chartaceous appressed bracts, but was excluded from sect. *Glumiselia* by Grant (1959).

Recent field investigations in association with monographic studies in *Loeselia* and floristics of Michoacán, Mexico have resulted in the discovery of two narrowly endemic and previously undescribed species of *Loeselia*.

Taxonomic Treatment and Key to Species of *Loeselia*

1. Corolla 20–30 mm long, lobes 12–22 mm long 2
   2. Corolla white or cream-colored, lobes spreading 3
      3. Cauline leaves broadly lance-ovate, acuminate, 3–9 cm long, sessile and somewhat aplexicaulous, gray-green; corolla lobes minutely ciliate, vasculature lacking anastomoses ..... *L. grandiflora*
      3. Cauline leaves linear-lanceolate to lanceolate, acute, 1.5–3.2 cm long, distinctly petiolate, bright green; corolla lobes long ciliate, vasculature usually with anastomoses ..... *L. spectabilis*
   2. Corolla bright to pale yellow, the lobes erect, held together by tangled floccose hairs, forming a pseudo-tube ..... *L. rzedowskii*
1. Corolla 8–22(30) mm long, if greater than 20 mm then lobes 3.5–10 mm long 4
   4. Inflorescence bracts all closely appressed, chartaceous in texture, straw-colored, tinged with purple ..... *L. purpusii*
   4. Inflorescence bracts loose to clustered, only the innermost appressed, outer bracts herbaceous, sometimes fenestrate (i.e. membranous between veins), green, sometimes purple 5

5. Trichomes of inflorescence generally glandular (eglandular in some races of *L. glandulosa*); leaves and branches alternate; leaf margins green; largest bracts elliptic or ± lanceolate, bract length >2–10 × width 6
   6. Largest bracts with spreading lobules or coarse teeth, or if finely serrate, then only above middle and the membranous areoles roundish; corolla lobes lavender, often with purple spots or marks near base 7
      7. Pedicels 20–40 mm long; bracts numerous, closely spaced beneath flower; largest bracts narrowly lanceolate, finely serrate above middle; flowers 1 per cymule ..... *L. pumila*
      7. Pedicels 4–6 mm long; bracts few, loosely spaced; largest bracts broadly lanceolate and coarsely toothed; flowers several per cymule 8
         8. Inflorescence bracts linear to linear-lanceolate; calyx length 3.5–4.5 mm, the lobes entire; ovary 1–1.5 mm ..... *L. tancitaroensis*
         8. Inflorescence bracts lanceolate to ovate; calyx length 4.5–6 mm, the lobes 3-toothed; ovary 2–2.5 mm ..... *L. rupestris*
   6. Largest bracts unlobed but finely serrate throughout, the membranous areoles longer than wide; corolla color as above, or red or rarely yellow 9
      9. Corolla 17–30 mm long, red, with or without paler spots in the throat, rarely yellow or white, lobes lanceolate ..... *L. mexicana*
      9. Corolla 8–22 mm long, lavender to pinkish, blue-violet or white, generally with purple spots or marks in the throat, lobes spatulate ..... *L. glandulosa*
5. Trichomes of inflorescence eglandular; leaves and branches opposite or alternate or mixed; leaf margins white; largest bracts ± ovate, bract length ca. 1 × width (bract length sometimes > 1 × width in *L. caerulea*) 10
   10. Bract margins generally lacking setae between teeth; lower leaves evenly serrate, not biserrate; upper leaves ± like the lower, not bract-like; filaments puberulent or ciliate near base 11
      11. Cymules narrowly obovoid to somewhat broader in fruit; outer bracts completely fenestrate; bracts elliptic to ovate, teeth ascending, finely spinescent, spines to 0.5 mm long; corolla lobes gradually tapered to base, not clawed; upper leaves alternate ..... *L. caerulea*
      11. Cymules ± spheric; outer bracts partly fenestrate, i.e. membranous between veins in lower 2/3rds, not to apex; bracts broadly ovate, teeth spreading, aristate, with awns 1–3 mm long; corolla lobes with definite claw; upper leaves mostly opposite ..... *L. greggii*
   10. Bract margins generally bearing setae between teeth; lower leaves unevenly serrate or ± biserrate; upper leaves often different from the lower, becoming bract-like; filaments glabrous 12
      12. Bracts few, the outer puberulent on the abaxial side; corolla blue-violet ..... *L. involucrata*
      12. Bracts numerous; the outer glabrous; corolla generally yellow or cream 13
         13. Corolla unspotted; anthers yellow; major floral bracts numerous (> 5), closely imbricate; peduncle generally naked below, devoid of bracts or nearly so; upper cauline leaves petiolate, cuneate, puberulent ..... *L. ciliata*
         13. Corolla spotted red or purple; anthers blue or purple; major floral bracts few (ca. 5), clasping at base, spreading above; peduncle bearing several to numerous, well-spaced bracts; upper cauline leaves sessile, cordate, glabrous 14
            14. Lower and upper branches and leaves opposite; bracts of peduncle opposite; corolla throat glabrous or sparsely glandular pubescent, the lobes glabrous; sinuses of lobes all at same level ..... *L. cordifolia*
            14. Lower branches and leaves opposite, the upper alternate; bracts of peduncle alternate; corolla throat and lobes pubescent; sinuses of lobes at several different levels ..... *L. amplectens* (including *L. hintoniorum*)

Loeselia tancitaroensis J. M. Porter & V. W. Steinm., sp. nov.—TYPE: MEXICO. Michoacán: municipio de Tancítaro, foothills of Cerro Tancítaro, 1.5 km E of Tancítaro along the road to Zirimóndiro, 19°20′31″N, 102°21′10″W, clay soil, secondary scrub derived from pine-oak forest, 18 Mar 2004, *J. M. Porter & V. W. Steinmann 14012* (holotype: RSA!; isotypes: IEB!, MEXU!, SJNM!, BRY!).

Similis *Loeselia rupestris* Benth. sed differt bracteaea integra, lineari-lanceolata, exteriores foliaceae, interiores nervo medio excepto hyalinae, et calyx loba integra.

Herbaceous perennials from a slender, branching taproot; stems slender, 42–150 cm tall, 0.9–2.2 mm in diameter, unbranched or branched at base, erect and openly spreading, young branches green or suffused with purple, glandular-pilose with trichomes 0.2–1.2 mm long, with 5–21 stalk cells, terminating in a 1- to 4-celled, bulbous to truncate gland, trichomes often deciduous. Lateral branches 8–34 cm long, opposite on the proximal primary stem, alternate distally. Leaves opposite to subopposite, rarely whorled, sometimes becoming alternate distally, stiffly spreading to deflexed; cauline leaves shortly petiolate, the petioles 1–7 mm long, blades ovate to lanceolate, 21–60 mm long, 9–25 mm broad, acute, green, sometimes anthocyanic, the blade somewhat decurrent along the petiole, margin serrate with 5–22 teeth per side, larger leaves not persistent on flowering branches, glandular-villous, trichomes much like those of the stem, 0.1–1.0 mm long, with 3–17 stalk cells, terminating in a 1- to 4-celled, bulbous to truncate gland; upper cauline leaves reduced in size distally and on flowering branches, 4–15 mm long, 1.5–7 mm broad, acuminate at base and apex, tip cuspidate, serrulate with 1–8 coarse teeth, bearing short, aristate setae, 0.2–0.5 mm long, glandular-pilose, trichomes like those of the lower leaves. Inflorescences terminating primary and lateral branches, the branches 7–100 mm long, with 1 flower per bracteate inflorescence unit. Bracts linear-lanceolate, 2.5–7 mm long, 0.5–1 mm broad, entire, rarely with 1 lateral lobe, terminal aristate setae to 0.5 mm long, outermost bracts herbaceous, innermost bracts white-hyaline from the margin to the central vein of the proximal 1/4–1/3, green and herbaceous at the distal tip, glandular-puburulent, trichomes 0.07–0.5 mm long, with 2–10 stalk cells, terminating in a 1- to 4-celled, bulbous to truncate gland. Calyx 3.5–4.5 mm long, hyaline except for the central vascular strands of each lobe and the distal lobes; lobes 2–3.5 mm long, entire, attenuate, with a terminal aristate seta 0.2–0.6 mm long, glandular-pilose throughout, trichomes 0.07–0.45 mm long, with 2–8 stalk cells, terminating in a 1- to 2-celled, bulbous gland. Corolla bilaterally symmetrical (Fig. 1A, 1D), 9–14.6 mm long, with unequal sinuses, two short lobes and three long lobes, the lobes ovate to narrowly oblong, 4–8 mm long, 1.6–3.0 mm broad, rounded at the apex, glabrous internally, sparsely to moderately glandular-pilose externally, the trichomes 0.09–0.35 mm long, with 3–8 stalk cells, terminating in a single-celled, bulbous gland, trichomes more abundant on the vasculature and distal margin, blue-lavender, pink or rose, usually with purple flecking near the orifice of the corolla throat; tube 1.8–2.2 mm long, glabrous on both adaxial and abaxial surfaces, rarely with

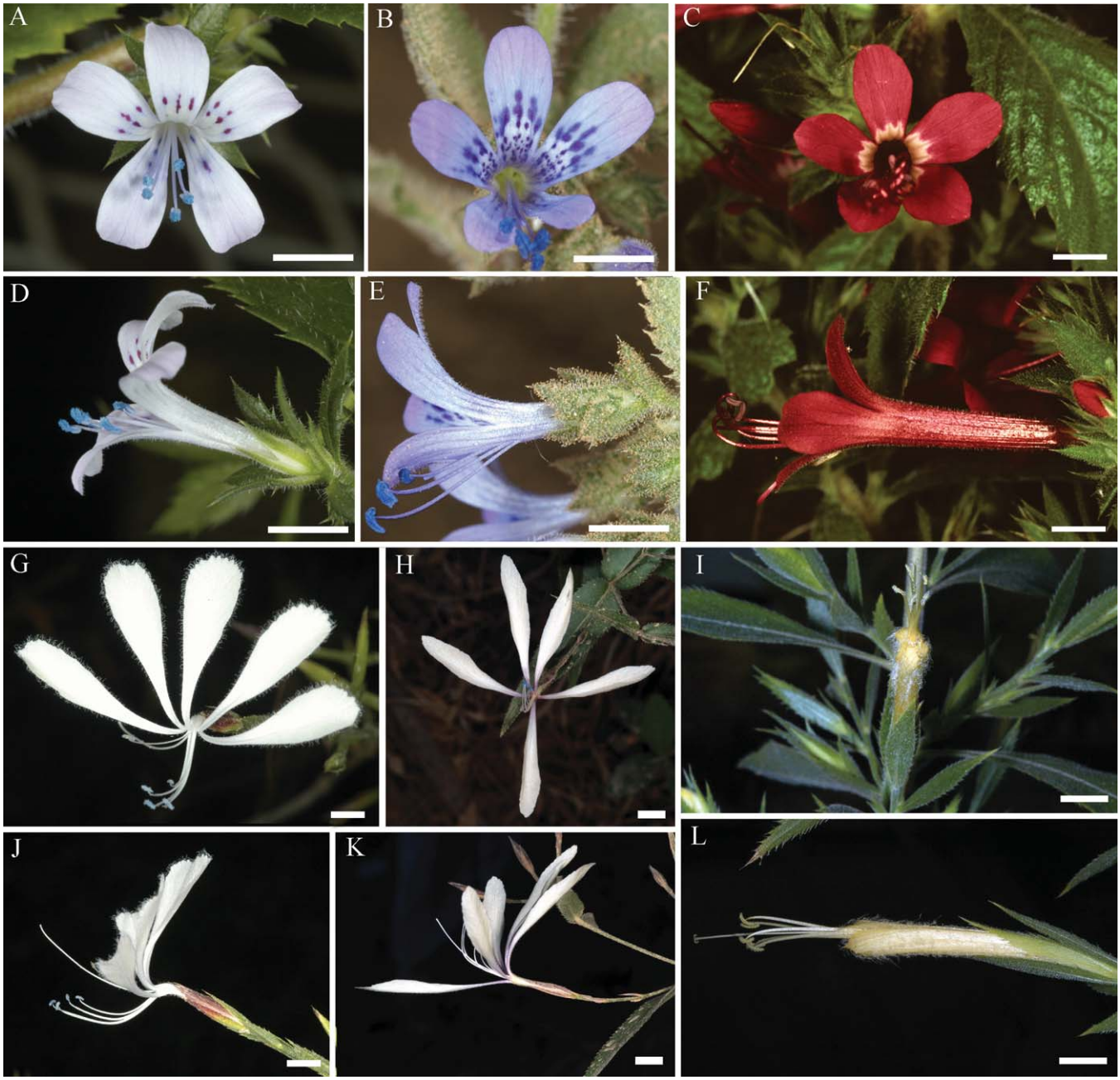

Fig. 1. Comparative floral morphology of *Loeselia tancitaroensis*, *L. rupestris*, *L. mexicana*, *L. spectabilis*, *L. grandiflora,* and *L. rzedowskii*. Scale bar = 5 mm. A. Frontal view of *L. tancitaroensis*. B. Frontal view of *L. rupestris*. C. Frontal view of *L. mexicana*. D. Lateral view of *L. tancitaroensis*. E. Lateral view of *L. rupestris*. F. Lateral view of *L. mexicana*. G. Frontal view of *L. spectabilis*. H. Frontal view of *L. grandiflora*. I. Frontal view of *L. rzedowskii*. J. Lateral view of *L. spectabilis*. K. Lateral view of *L. grandiflora*. L. Lateral view of *L. rzedowskii*.

1 or 2 trichomes; throat 2.2–4.8(–5.2) mm long, slightly conic, adaxially glabrous, glandular puburulent on the distal half of the abaxial throat; filaments straight or slightly declinate, insertion equal, the free portion 6.9–11.7 mm long, glabrous; anthers 1.0–1.8 mm long, 0.4–0.7 µm wide. Pollen grains blue, 36–48 µm in diameter, spheroidal (Fig. 2A); apertures pantoporate, with 22–30 pores (Fig. 2B), 3.2–4.8 µm in diameter, circular or slightly oval, often irregular, operculate, the operculum bearing 0–4 spinule like processes; exine ca. 2.7 µm thick; sexine ca. 1.3 µm thick, pertectate; tectum ca. 0.5 µm thick, suprastriate, punctate, with irregularly distributed spinule-like processes, standing 0.4–0.6 µm tall and 0.1–5.4 µm apart (Fig. 2C); punctae less than 0.5 µm in diameter, sparsely and irregularly spaced, sometimes absent; bacula supporting tectum densely spaced, standing 0.2–0.7 µm apart, ca. 0.8 µm tall, 0.4–0.5 µm thick; nexine ca. 1.0 µm thick, thickest at the pore margins, to 1.4 µm. Ovary 1.0–1.5 mm long, densely glandular on the distal 1/3–3/4, the trichomes 0.06–0.11 mm long, with 3–5 stalk cells, terminating in a single-celled, bulbous gland; 2 ovules per carpel; style 6.6–15 mm long, filiform, stigma lobes 0.5–0.7 mm long. Fruit ovoid, 2.2–2.7 mm long, 1.5–1.8 mm diameter; seeds 1 or 2 per locule (Fig. 2D–F), 1.2–2.3 mm long, 0.9–1.8 mm wide, reddish brown, ellipsoid, rarely somewhat angled, more or less flattened and lenticular, with a very narrow wing or lacking a wing entirely, funicular scar centrally located, linear, short.

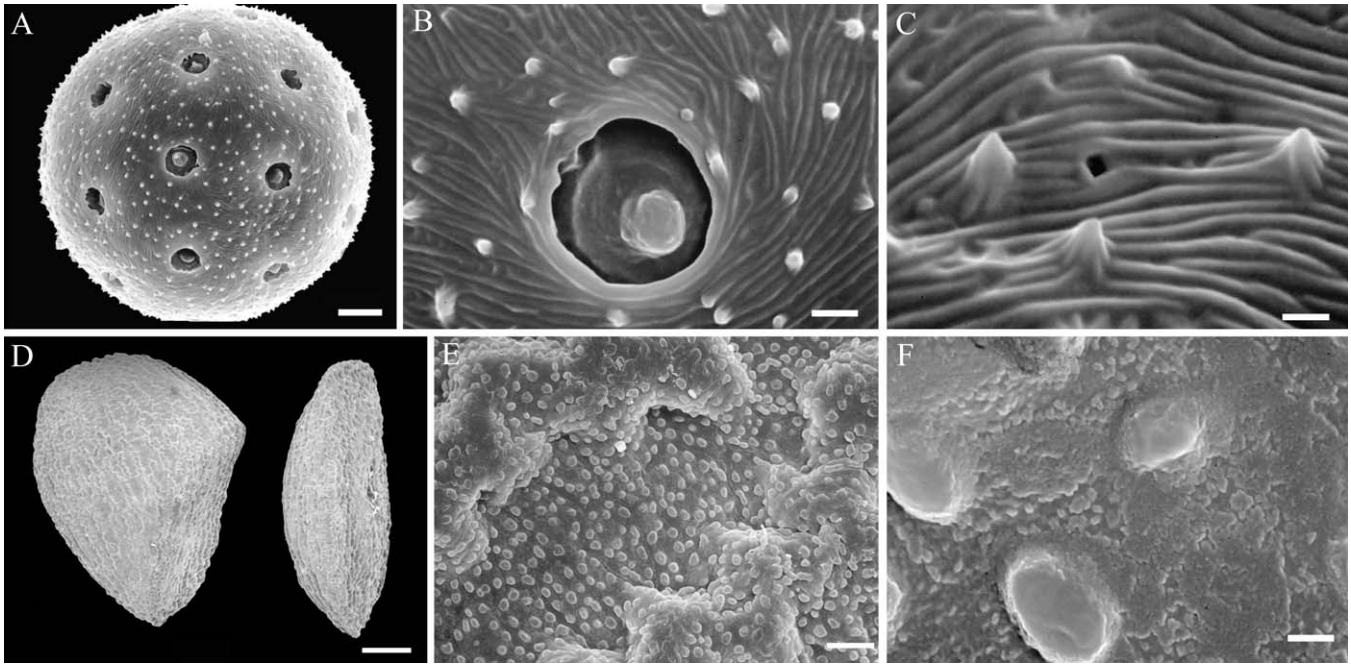

Fig. 2. Scanning electron micrographs of pollen and seeds of *Loeselia tancitaroensis*. A. Pantoporate pollen grain; scale = 5 mm. B. Aperture; scale = 1 μm. C. Exine surface, illustrating spinule processes, microstriations, and punctae; scale = 0.5 μm. D. Two views of entire seeds; scale = 200 μm. E. Seed surface, showing sinuous, periclinal seed coat walls and microsculpting; scale = 10 μm. F. Close-up of seed coat microsculpture elements; scale = 1 μm.

Distribution and Habitat*—Loeselia tancitaroensis* has been collected along roadsides, in ravines and canyons, on slopes, in disturbed soils, and along irrigation canals. It is associated with moist forests dominated by pine (*Pinus pseudostrobus* Lindl.) and oak (*Qurecus* spp.), at elevations of 1,720–2,250 m. As far as is known, this species is endemic to the slopes of Cerro Tancítaro, in municipios of Tancítaro and Uruapan, west-central Michoacán, Mexico.

***Phenology*—**Flowering occurs from January to March (rarely through April), and fruiting is most common from March to early May.

***Etymology*—**The specific epithet acknowledges the mountain range, Cerro Tancítaro, Michoacán, on whose foothills this species is apparently restricted.

Phylogenetic Relationships and Similar Species*—Loeselia tancitaroensis* is inferred to share common ancestry with *L. rupestris* and *L. mexicana*, based upon analyses of comparative nuclear ribosomal ITS and chloroplast *trnL-F* DNA sequences (Porter et al. unpublished results). Although there is considerable morphological similarity between *L. tancitaroensis* and *L. rupestris*, a Oaxacan endemic, the latter is actually sister to *L. mexicana,* a species with funnelform, red flowers (Fig. 1A–1F). Differences among *L. mexicana, L. rupestris*, and *L. tancitaroensis* are presented in Table 1. Their known distributions are depicted in Fig. 3.

***Pollen Morphology*—**The first survey of *Loeselia* pollen was conducted by Hüller (1907), as part of a comparative anatomy survey in Polemoniaceae. This investigation sampled five species, *Loeselia careulea*, *L. ciliata*, *L. glandulosa*, *L. involucrata*, and *L. mexicana*. Hüller accurately described the pollen as spherical with pores evenly distributed over the surface. The exine was characterized as finely granular (likely referring to the bacula beneath the tectum) and bearing warts or spines. In addition, he noted that the pores had a spine-bearing cover, i.e. an operculum.

Stuchlik (1967), in his study of pollen variation in Polemoniaceae, included nearly the same species as Hüller: four from section *Loeselia* (*Loeselia caerulea*, *L. ciliata*, *L. glandulosa*, *L. mexicana*), and one from section *Glumiselia* (*L. grandiflora*). Stuchlik found the pollen to be consistent across the genus. He described the pollen as spherical, pantoporate, pertectate, punctuate, and bearing spinule processes. This pollen morphology was termed "*Loeselia*-type" pollen. Stuchlik also classified the genus *Allophyllum* with *Loeselia*-type pollen; however, the single species sampled had tectate rather than pertectate sexine. In addition, *Allophyllum*

Table 1. Morphological comparisons of *Loeselia rupestris*, *L. tancitaroensis,* and *L. mexicana*.

Character	*L. rupestris*	*L. tancitaroensis*	*L. mexicana*
Inflorescence bracts	lanceolate to ovate	linear to linear-lanceolate	elliptic to narrowly lanceolate
Floral bracts	3-toothed	entire or rarely with 1 tooth	entire or 1–9 toothed
Calyx length	4.5–6.0 mm	3.5–4.5 mm	7.2–10.0 mm
Calyx lobes	3-toothed	entire	entire or 2–5-toothed
Corolla color	lobes pink, maroon flecking proximally; tube pink to white	lobes white to pale violet, maroon flecking proximally; tube white	lobes red, white patch proximally, tube red
Ovary length	2.0–2.5 mm	1.0–1.5 mm	1.2–3.0 mm
Number of ovules per carpel	3	2	4–5

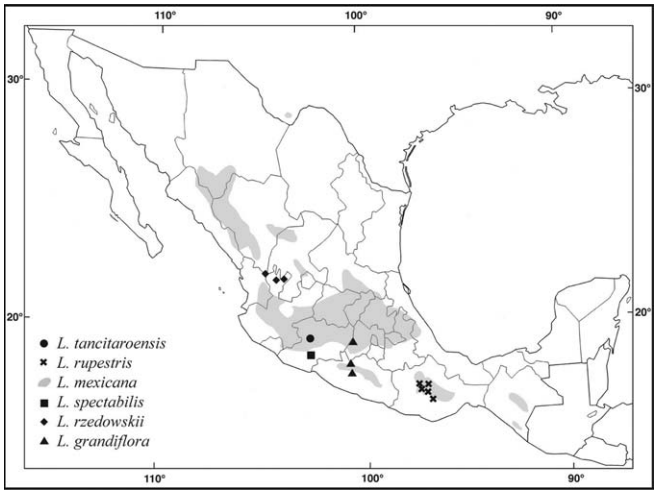

FIG. 3. Known geographical distributions of *Loeselia tancitarensis*, *L. rupestris*, *L. mexicana*, *L. spectabilis*, *L. rzedowskii*, and *L. grandiflora*. The distribution of the widespread *L. mexicana* is represented by shading rather than by a symbol.

pollen lacks the suprastriations, ubiquitous in *Loeselia*. We would suggest that *Allophyllum* does not possess the "*Loeselia*-type" pollen; rather, it has its own unique pollen type, the "*Allophyllum*-type."

Subsequent investigations have verified these findings, but have done little to improve the species sampling. Taylor and Levin (1975) included only two species, *L. glandulosa* and *L. grandiflora*, in their SEM survey of Polemoniaceae. As part of a study of the palynology of the state of Veracruz, Mexico, Ludlow-Wiechers (1982) examined pollen of the five species that are native to Veracruz: *Loeselia caerulea*, *L. ciliata*, *L. glandulosa*, *L. mexicana*, and *L. pumila*. Similarly, Quiroz García et al. (2002) conducted a pollen survey of Polemoniaceae in the state of Queretaro, Mexico, examining *Loeselia caerulea* and *L. mexicana*.

Our examination of pollen of *Loeselia tancitaroensis* (Fig. 2A–2C, and see above) reveals conformity with the earlier descriptions (e.g., Stuchlik 1967). This lends support that the *Loeselia*-type pollen is a putative synapomorphy for *Loeselia*. While the general form of pollen of *L. tancitaroensis* is the same as other species of *Loeselia*, the pollen is not identical. There appear to be quantitative differences in pollen size (diameter), number of apertures, number of spinule processes on the operculum, as well as the size and density of spinule processes on the exine. For example, pollen grains of *L. tancitaroensis* are smaller than those of *L. grandiflora* (42–56 mm, Stuchlik 1967; Taylor and Levin 1975) and *L. spectabilis* (see below); however, in general pollen diameter is similar to most species. The most closely related species to *L. tancitaroensis* that has been examined is *L. mexicana*. While these two species have overlapping ranges in pollen diameter, *L. mexicana* tends to have larger grain diameter (43–64 μm, Stuchlik 1967). While pollen size of *L. tancitaroensis* tends to be slightly smaller than *L. mexicana*, the later species tends to have fewer apertures per grain (12–30, Stuchlik 1967; Taylor and Levin 1975; Ludlow-Wiechers 1982; Quiroz García et al. 2002).

Corolla Vascular Architecture—Patterns of corolla vasculature have been suggested to be of value for comparative systematics in Polemoniaceae (Crampton 1945; Grant 1959; Day and Moran 1986). These limited surveys show that corolla vasculature varies primarily in three ways. First, there is variation in the initial division of the central vascular strand of the corolla lobes. In most species, this vascular strand immediately divides into three strands at the proximal end of the corolla tube, but in some this division does not occur until about midtube, rarely the division is absent altogether. Second, there is considerable variation in the location of subsequent (secondary, tertiary, etc.) divisions of the vascular strands. Third, there is great variation in the presence and position of anastomoses or fusions of adjacent secondary and/or tertiary vascular strands. We find that within *Loeselia* there are species-specific patterns of variation in corolla vasculature and that this variation may be helpful in species identification or inferences of phylogeny.

Corolla venation of *Loeselia tancitaroensis* is strikingly uniform in all collections. The primary vein trifurcates at the proximal end of the corolla tube. The three, second-order veins depart, until they are nearly equidistant from one other and the vasculature of the androecia, at the point of filament divergence. At the region where the lobes separate, the three strands have not bifurcated. The central vein first bifurcates distal to or at about half the length of the lobe. There is nearly always a second bifurcation of the central vein, closely following the first. Occasionally, an additional bifurcation occurs in one of the lateral, third-order veins derived from the central vein. The two lateral veins of the lobe either remain undivided or possess a single bifurcation in the distal half of the lobe. The veins of the corolla lobe generally possess no anastomoses in the lobe; however, rarely, a single anastomose will be present.

This pattern of corolla vasculature is not uncommon in *Loeselia*. It occurs in *Loeselia cordifolia*, *L. glandulosa*, *L. involucrata*, and *L. rupestris*, as well as some populations of *L. amplectans*, *L. caerulea*, and *L. ciliata*. The remaining species all possess anastomoses involving the central and lateral veins of the lobes. The sole exception is *L. grandiflora*, which lacks anastomoses, but has a different vascular pattern, discussed below. In addition, *L. mexicana* displays a pattern nearly identical with that of *L. tancitaroensis* and *L. rupestris*. *Loeselia mexicana* differs in that the primary, central vascular strand trifurcates just above the proximal end of the corolla tube, but remains closely adjacent, then gradually separating up to the point of filament divergence. The corolla vasculatures of *L. mexicana*, *L. tancitaroensis*, and *L. rupestris* are nearly identical in other aspects. While this pattern of corolla vascular architecture is unlikely to be a synapomorphy of the three species, given its distribution in *Loeselia*, it is consistent with the inference of common ancestry among *L. mexicana*, *L. tancitaroensis*, and *L. rupestris*.

Additional Specimens Examined—MEXICO. Michoacán: municipio de Uruapan, Cuesta de la Parranda, C. E. F. "Barranca de Cupatitzio," 6 Apr 1979, *X. Madrigal S. 3249* (IEB); municipio de Tancítaro, Cerro Tancítaro, 27 km W en linea recta, approx. 2 km E de Apo, camino Parastaco, 11 Mar 1998, *I. García Ruiz 5037* (IEB); municipio de Tancítaro, Cerro Tancítaro, 27 km W en linea recta, approx. 2 km E de Tancítaro-Zirimondiro, 12 Mar 1998, *I. García Ruiz 5098* (IEB); municipio de Tancítaro, Cerro Tancítaro, 27 km W en linea recta, approx. 3 km N Tancítaro, 30 Apr 1998, *I. García Ruiz 5182* (IEB); municipio de Tancítaro, 1 km E Tancítaro, 17 Jan 1999, *C. Medina G. 3731* (IEB); municipio de Tancítaro, 2 km E of Tancítaro, 19°19′28″N, 102°20′52″W, 25 Jan 2004, *J. M. Porter & V. W. Steinmann 13878* (IEB, RSA); municipio de Tancítaro, foothills of Cerro Tancítaro, 1.5 km E of Tancítaro along the road to Zirimondiro, 19°20′31″N, 102°21′10″W, 25 Jan 2004, *J. M. Porter & V. W. Steinmann 13882* (IEB, RSA).

Loeselia spectabilis J. M. Porter & V. W. Steinm., sp. nov.—TYPE: MEXICO. Michoacán: municipio de La Huacana, Sierra Las Cruces, 6.5 km (by air) SW of Los Ranchos,

Cañada Las Cruces, 18°39′59″N, 102°03′46″W, ca. 650 m, tropical deciduous forest, 15 Mar 2003, *V. W. Steinmann 3190* (holotype: RSA; isotypes: IEB, MEXU).

Similis *Loeselia grandiflora* Standl. sed differt foliis petiolatis, calycibus brevibus, corollae lobis ciliatis.

Suffrutescent perennial; stems slender, branched at base, erect and openly spreading, 1.0–2.5 m long, young branches green, becoming whitish or gray, glandular-pilose with glandular hairs 0.3–0.8 mm long, trichomes often deciduous in age. Leaves opposite, stiffly spreading to deflexed; cauline leaves shortly petiolate, blades lance-oblong to lanceolate, 30–48 mm long, 10–20 mm broad, broadest toward the proximal end, distal end attenuate, tip subulate, bright green, margin finely serrate-toothed, spinulose tipped, finely glandular-puberulent on both surfaces, larger leaves not persistent on flowering branches; upper cauline leaves reduced in size and slightly if at all crowded distally on flowering branches, linear-lanceolate to lanceolate, 15–32 mm long, 1.5–12.0 mm broad, acuminate at apex, tip cuspidate, serrulate with 9–18 teeth, bearing short, aristate setae along each edge; glandular-puberulent. Inflorescences paniculate, reduced cymes terminating primary and lateral branches, with 1 flower subtended by (3–)4–5 bracts, borne on few-leafed branches 24–53(–65) mm long. Bracts linear-lanceolate, 8–12 mm long and 1.5–2.8 mm broad, denticulate and with marginal, aristate setae to 0.2 mm long, the outermost bracts chlorophyllous to chartaceous, greenish to white; inner bracts more or less white-hyaline throughout; proximal margins white to hyaline for 0.5–1.0 mm. Calyx 3.0–3.6 mm long, hyaline along the margins of each lobe and slightly so in the sinuses, lobes 1.1–1.5 mm long, 0.7–0.9 mm broad, entire, triangular acute, with a terminal arista, calyx tube 2.0–2.3 mm long, 1.5–1.9 (–2.3) mm in diameter, glabrous. Corolla strongly bilaterally symmetrical (Fig. 1G, 1J), 20–25 mm long, the lobes lanceolate to narrowly oblong, apex obtuse, 12–15 mm long, 2.5–4.5 mm broad, entire to denticulate, glandular-ciliate along the margin, villous on abaxial surface, glabrous on adaxial surface, pale violet, the claw purplish; tube narrow, 7.5–9.0 mm long, glandular-pilose abaxially, nearly the entire length, glabrous adaxially; four filaments declinate, one erect, free from tube 7–8 mm above the base of tube, equally inserted at the sinuses of the corolla lobes, the free portion 8–11 mm long, glabrous; anther 1.5–1.7 mm long, 0.4–0.8 mm broad, pollen white. Pollen grains 45–51 μm in diameter, spheroidal (Fig. 4A); apertures pantoporate, with 22–28 pores, 2.8–5.3 μm in diameter, circular or slightly oval, often irregular, operculate, the operculum bearing 3–6 spinule like processes (Fig. 4B); exine ca. 2.4 μm thick; sexine ca. 1.0 μm thick, pertectate; tectum ca. 0.5 μm thick, suprastriate, punctate, with irregularly distributed spinule-like processes, standing 0.2–0.4 μm tall and 0.2–3.9 μm apart; punctae less than 0.5 μm in diameter, few and irregularly spaced; bacula supporting tectum densely spaced, standing ca. 0.5 μm apart, ca. 0.8 μm tall, 0.3–0.5 μm thick; nexine ca. 1.0 μm thick, thickest at the pore margins, to 2.4 μm. Ovary pyriform, 1.2–1.5 mm tall, ca. 0.6 mm at widest point, ca. 0.5 mm at 1/2 height, glabrous throughout, 1 ovule per carpel; style 21–30 mm long, stigma lobes 0.1–0.3 mm long. Nectary gland an undulate disk at the base of the ovary, ca. 0.4 mm in diameter, ca. 0.3 mm high, and ca. 0.25 mm deep, bright green. Fruit 7.0–8.5 mm long, 1.5–2.7 mm wide. Seeds 1 per locule, 6.5–8.0 mm long, narrowly ovate to narrowly lanceolate in outline, about 5 times as long as wide, somewhat flattened in cross-section.

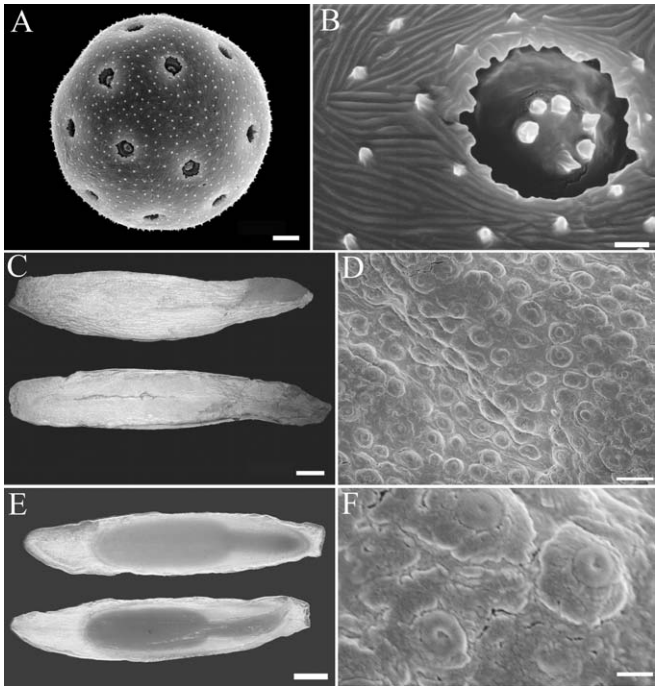

Fig. 4. Scanning electron micrographs (SEM) and light micrographs (LM) of pollen and seeds of *Loeselia spectabilis*. A. Pantoporate pollen grain (SEM); scale = 7 mm. B. Aperture (SEM); scale = 1 mm. C. Two views of entire seeds (SEM); scale = 700 mm. D. Seed surface, showing nearly straight, periclinal seed coat walls and microsculpting (SEM); scale = 5 mm. E. Two views of entire seeds (LM), showing shape of embryo; scale = 700 mm. F. Close-up of seed coat microsculpting elements (SEM); scale = 1 mm.

Distribution and Habitat—*Loeselia spectabilis* has been collected on nearly vertical rock faces in partially shaded ravines and canyons and on steep rocky slopes in full sun in the Infiernillo region of central Michoacán. It occurs in tropical deciduous forest with *Albizia*, *Heliotropium*, *Casearia*, *Cocholospermum*, *Lagascea*, *Ficus*, *Randia*, *Dioscorea*, *Pisonia*, *Bursera*, *Acacia*, *Celtis*, *Combretum*, *Physodium*, and *Tillandsia* at elevations of 640–700 m.

Phenology—Flowering occurs from January to March, and fruiting is most common from late February through May.

Etymology—The specific epithet, *spectabilis*, refers to the spectacular floral display of this large-flowered *Loeselia.*

Phylogenetic Relationships and Similar Species—Preliminary molecular phylogenetic analyses based upon comparative nuclear ribosomal ITS and chloroplast *trnL-F* DNA sequences (Porter et al. unpublished results), strongly support a close relationship between *Loeselia spectabilis* and *L. rzedowskii*. The latter is readily distinguished by its yellow, pseudotubular flowers, which possesses long tangled trichomes on the corolla lobe margins, uniting the lobes. In contrast, the white flowers of *L. spectabilis* have widely spreading corolla lobes with sparse marginal trichomes. This affinity is somewhat surprising, given the suggestion of close relationship between *L. rzedowskii* and *L. mexicana* (McVaugh 1990). *Loeselia spectabilis* is morphologically most similar to *L. grandiflora*, a rare species known only from the states of Guerrero and Mexico. These two share various morphological features such a suffrutescent habit; open, large, divaricate inflorescences with appressed bracts; and large, white flowers with spreading lobes. However, they are distinguished from one another and *L. rzedowskii* by the features in Table 2.

Table 2. Morphological comparisons of *Loeselia grandiflora*, *L. spectabilis* and *L. rzedowskii*.

Character	*L. grandiflora*	*L. spectabilis*	*L. rzedowskii*
Leaves	amplexicaulous	shortly petiolate	petiolate
Calyx length	4.5–6.0 mm	3.0–3.6 mm	(5.0–)7.0–10.0 mm
Corolla color	cream	white	yellow
Corolla lobe margin	not ciliate	glandular-ciliate	densely floccose
Ovules per carpel	2	1	1

Comparative photographs of the flowers of these three species are provided in Fig. 1G–1L. Their known distributions are depicted in Fig. 3.

Pollen Morphology—Examination of pollen of *Loeselia spectabilis* (Fig. 4a, 4b, and above) further reinforces the hypothesis that the *Loeselia*-type pollen is a putative synapomorphy for *Loeselia*. As noted with *L. tancitaroensis*, the general form of pollen of *L. spectabilis* is the same as other species of *Loeselia*, but the pollen differs quantitatively from most other species. Pollen size (diameter) of *L. spectabilis* is larger than all other *Loeselia* species that have been investigated, except *L. grandiflora* (42–56 µm, Stuchlik 1967; Taylor and Levin 1975). Interestingly, while the pollen grains are larger, the number of apertures for *L. spectabilis* is not higher than observed in most species of *Loeselia*, as is found for *L. grandiflora* (28–37, Stuchlik 1967; Taylor and Levin 1975) In addition, the size of spinule processes on the exine are smaller than for nearly all other *Loeselia* species. Together, these traits distinguish *L. spectabilis* pollen from that of other members of *Loeselia*.

Corolla Vascular Architecture—Corolla venation of *Loeselia spectabilis* is uniform in the few existing collections. The primary vein trifurcates immediately upon entering the proximal end of the corolla tube. The three, second-order veins depart, until they are nearly equidistant from one other and the vasculature of the androecia for nearly the entire length of the corolla tube. At the point where the lobes separate, the three strands have not bifurcated, and continue along the clawed portion of the lobe. As the lobe begins to broaden, the lateral veins first bifurcate proximal to the middle of the lobe. The central vein bifurcates slightly distal to the point of bifurcation of the lateral veins. Generally, both the central and lateral veins undergo a series of about three consecutive bifurcations. These bifurcations result in an anastomosing of the central and lateral veins, at a point slightly distal to the middle of the lobe.

Corolla vascular architecture of *L. grandiflora* and *L. rzedowskii*, the closest relatives of *L. spectabilis*, differ markedly. Like *L. spectabilis*, the primary vein of *L. grandiflora* trifurcates immediately upon entering the proximal end of the corolla tube; the three, second-order veins depart, until they are nearly equidistant from one other and the vasculature of the androecia; and at the point where the lobes separate, the three strands have not bifurcated, and continue into the clawed portion of the lobe. Here the similarity ends. Unlike *L. spectabilis*, in *L. grandiflora* the central vein does not bifurcate, but continues to the lobe apex undivided. The lateral veins of *L. grandiflora* bifurcate at or slightly proximal to the middle of the lobe, and undergo two successive bifurcations. No anastomoses are produced between the central and lateral veins of the lobe. The corolla vasculature of *L. rzedowskii* differs to a greater degree; unlike other *Loeselia* species, three primary veins enter each corolla alternating with the staminal veins and continue equidistant up the corolla tube. The veins do not begin bifurcating until the proximal quarter of the corolla lobe, with the lateral veins dividing first and the central vein dividing at a point proximal to half the length of the lobe. The lateral veins divide once or twice again and the central vein may bifurcate again. Unlike *L. grandiflora* and *L. spectabilis*, some of the veins terminate at the margins of the corolla lobe as teeth.

These descriptions make the point that corolla venation differs fundamentally among *Loeselia spectabilis* and its two most closely related species, *L. grandiflora* and *L. rzedowskii*. The differences are great enough that each of the species can be discriminated by corolla vasculature alone. This variation reinforces the suggestions from previous authors that comparative corolla venation patterns are of taxonomic value. We further suggest that a thorough survey in *Loeselia* would be of considerable systematic value.

Additional Specimens Examined—MEXICO. Michoacán: municipio de La Huacana, ca. 2 km (by air) ENE of Los Ranchos, base of cliffs on the S side of Cerro El Barril; 18°42′35″N, 102°59′55″W, 700 m, 11 Dec 2003, *V. W. Steinmann 3960* (IEB, RSA); municipio de La Huacana, Sierra Las Cruces, ca. 6 km al O de Los Ranchos, alrededores de Los Cueramos, 18°42′30″N, 102°04′15″W, 700 m, 13 Mar 2004, *V. W. Steinmann 4177* (IEB, RSA); municipio de La Huacana, Sierra Las Cruces, 6.5 km (en línea recta) al suroeste de Los Ranchos, Cañada Las Cruces; 18°39′59″N, 102°03′46″W, ca. 650 m, 03 Sep 2005, *V. W. Steinmann & Y. Ramírez-Amezcua 5267* (IEB, RSA); municipio de La Huacana, Cañada Las Cruces, ca. 6–6.5 km (air) SW of (San Francisco de) los Ranchos; 18°39′59″ N, 102°03′40″ W; ca. 645 m, 24 Jan 2004, *J. M. Porter & V. W. Steinmann 13872* (RSA).

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