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A New Rare Species of *Lobelia* (Campanulaceae, Lobelioideae) from Mexican Lowland Rainforest

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Abstract. *Lobelia lithophila* Senterre & Castillo-Campos (Campanulaceae, Lobelioideae) is described as a new species from the lowland tropical evergreen rainforest of the region of Uxpanapa, in southern Veracruz, Mexico. This species is only known from the type locality and probably represents a microendemic. The species described is most closely related to *L. orientalis* Rzedowski & Calderón, another local endemic from Querétaro, Mexico. Both taxa combine the herbaceous life form with leaves more or less in a rosette at ground level and a completely superior ovary, and are from specialized habitats. The new species is easily distinguished by its longer leaf blade and smaller petiole, and by its reduced leaf pubescence. Its habitat is also unusual, as it is restricted to limestone rocks in the understory of lowland tropical rainforest. *Lobelia lithophila* belongs to subsection *Leiospermae* E. Wimmer within the section *Lobelia*, subgenus *Lobelia* L.

Resumen. Se describe como nueva especie para la ciencia a *Lobelia lithophila* Senterre & Castillo-Campos. Esta es una especie conocida solamente de la localidad tipo y probablemente corresponde a un taxa microendémico para la selva alta perennifolia de la zona de Uxpanapa al sur de Veracruz, México. La especie aquí descrita esta más relacionada con *L. orientalis* Rzedowski & Calderón, otro microendémico en este caso de Querétaro, las cuales se destacan por ser especies herbáceas con hojas arrosetadas en el suelo con ovario totalmente súpero y que también son de hábitats muy restringidos. Es fácil distinguir a la especie nueva por sus hojas grandes pero de pecíolos pequeños, y por su pubescencia menos desarrollada. Asimismo, es una especie que se localiza en un hábitat especial, en sustratos rocosos calizos de bajas altitudes, en el sotobosque de la selva alta perennifolia. Esta especie pertenece a la subsección *Leiospermae* E. Wimmer, sección *Lobelia* del subgénero *Lobelia* L.

Key words: Campanulaceae, *Diastatea*, IUCN Red List, *Lobelia*, Lobelioideae, Mexico, subsection *Leiospermae*, Veracruz.

The Lobelioideae, which are best understood at the subfamily level (Lammers, 1992, 1998, 2007; APG II, 2003), are characterized by the gathering of the stamens around the style, the connate anthers forming a definite tube, and the presence of articulated lactifers. Within the subfamily, the genus *Lobelia* L. is the largest, with probably more than 400 species (Lammers, 2004a, b). It is easily recognized by its bilabiate corolla, which is cleft dorsally. This genus is almost cosmopolitan but is most diverse in the tropics and subtropics (commonly at higher elevations). About 29% of the species are from North America and more than 30 species (8%) are from South America, including many local endemics (Lammers, 2004b). Mexico is a center of diversity for this genus, with more than 40 species (McVaugh, 1940; Ayers, 1987; Wilbur, 1991; Turner, 1995; Rzedowski & Calderón, 1997, 2001; Lammers, 2004b). In the most recent monograph (Wimmer, 1943, 1953, 1968), the genus *Lobelia* was subdivided into three subgenera, and the sections have recently been recircumscribed by Murata (1995) with further comments by Lammers (1993, 2000, 2004b, 2007).

While studying the Campanulaceae for the Flora of Veracruz, many specimens were examined from the relevant national and international herbaria for the flora of Mexico. Some of the specimens examined did not match any previously described species within the family and are described here as a new species. This

species combines some rare features, such as the small semi-rosette herbaceous habit and the completely superior ovary, as well as its wide leaves and strongly reflexed calyx lobes. The superior position of the ovary is a rare character, even in the family, and is observed mainly in a small group of southern and central Mexican species of *Lobelia*. Moreover, the new species is found in a very specialized habitat, growing on limestone rocks in the understory of wet lowland rainforest. This lithicolous growth form is also characteristic of the species that is most closely related to the new species, *L. orientalis* Rzedowski & Caldéron, which is a narrow endemic found in the extreme northeast of Querétaro, Mexico, at 2000 m. Owing to its ellipsoid-ovoid, tuberculate-striate seeds and its small white to dark blue flowers, *L. lithophila* belongs to the subsection *Leiospermae* E. Wimmer, in the section *Lobelia* L. (previously section *Hemipogon* Bentham) and the subgenus *Lobelia* L.

Lobelia lithophila Senterre & Castillo-Campos, sp. nov. TYPE: Mexico. Veracruz: Hidalgotitlán, camp. Hermanos Cedillo, camino a La Escuadra, Río Solosuchil, 17°16′N, 94°37′W, selva alta perennifolia, primaria, suelo arcilloso, rocoso, 150 m, 9 Nov. 1974 (fl., fr.), *M. Vázquez T. 1367* (holotype, ENCB; isotypes, ENCB, XAL). Figure 1.

Herba verisimiliter perennis, semirosulata, caule strigoso tortuoso 3–5 cm alto, internodiis 2–5 mm longis, radicibus fasciculatis; *Lobeliae orientali* Rzedowski & Calderón affinis sed differt lamina foliari longiore plus minusve elliptica 3.5–6 cm longa et petiolo breviore, ad 25 mm, nervis lateralibus 4 ad 7 paribus adscendentibus, plus minusve bifurcatis ca. 5 mm ante marginem vel aliquando prope nervum centralem ramosis; pedicellis (1.2–)1.5(–2.2) cm longis, adscendentibus et plus minusve glabratis; hypanthio plano subnullo dense hirsuto; calycis lobis reflexis anguste triangularibus 2.5–3.5 mm longis; capsula late ovoidea 3–4 mm longa, omnino superiore; seminibus ca. 0.5 mm longis brunneis longistrorsum striatis et tuberculatis.

Herb, probably perennial, locally abundant, ca. 10–12 cm high, internodes ca. 2–5 mm, semi-rosette hemicryptophyte; shoot unbranched, but individuals generally closely clustered and joined underground by rhizomatous ramifications; shoot shortly raised to 2–3(–5) cm height, slightly tortuous or zigzag, deeply fluted, regularly covered with hirsute to setose, white, triangular, flat, multiseptate, uniseriate hairs; roots fasciculate at the base of the shoot, all < 0.2 mm diam.; leaves exstipulate, alternate, simple, on the top of the shoot when this is developed, but mostly appearing as a basal semi-rosette; smaller leaves sometimes present at the base of the semi-rosette; normal leaves mostly microphyllous (< 20 cm^2), blade 3.5–6 $\times$ 1.5–3 cm, mostly elliptic but also some oblong to lanceolate, smaller leaves to 1.5 $\times$ 0.9 cm; petiole ca. 1/2 the blade length, 15–25 mm; blades on dried specimens yellowish green to olive adaxially pale green abaxially, the secondary nerves and their main bifurcations typically discolored yellowish white, at least at the enlarged base of the central nerve; blade papyraceous, plane; venation plane adaxially, raised abaxially mainly for the central nerve, which is enlarged near the base and marked with longitudinal lines; blade pubescence similar to shoot extending along petiole and abaxially on central and secondary nerves, less abundant to nearly absent on the blade and adaxially; blade margin ciliate with the same hirsute-setose white long hairs, very slightly revolute (10×), and marked with very thin teeth derived from the end of the secondary nerves and their main prolongations (2 teeth/cm); blade apex progressively acute, most often rounded, sometimes acute to subacuminate and then acumen as long as wide, rounded, < 5 mm; leaf base generally slightly more rounded than apex, some leaves appearing nearly ovate, clearly decurrent on the petiole for ca. 3–6 mm; venation pinnate, with 4 to 7 pairs of secondary nerves ascending and forming an acute angle with central nerve; secondary nerves typically ramified, generally bifurcated ca. 5 mm from the margin, sometimes ramifications starting near the central nerve and appearing fasciculate; wide network of tertiary nerves only slightly visible abaxially. Inflorescence a loose terminal raceme, probably polytelic with 12 to 19 flowers, sometimes with a pair of small leafy bracts at the base but well differentiated from the shoot, ca. (12–)15(–22) cm, including 4–6 cm peduncle, with long white hirsute hairs progressively less abundant distally to the subglabrous pedicels; inflorescence axis slightly compressed, longitudinally striate; pedicel bracts persistent, narrowly acute, 2–2.8 $\times$ ca. 0.5 mm at base, apex mucronulate, sometimes concave and the margin slightly revolute adaxially, pale green at the base and generally purple on the distal part or the margin; pedicel minutely bibracteolate at base, (1.2–)1.5(–2.2) cm, ca. 0.2 mm diam., glabrous or sparsely hirsutulous but never scabrous or puberulent, arcuate-ascending, becoming strongly recurved distally in fruit so that the capsules are facing the ground. Flowers bisexual, tetracyclic, pentamerous, zygomorphous, white to dark blue, ca. (7–)9–11 mm, including hypanthium; gamosepalous calyx of 5 sepals prolonged downward by a wide flattened hypanthium typically covered with long white hirsute hairs; calyx lobes narrowly acute, 2.5–3.5 mm, becoming reflexed and generally perpendicular to the flower's pedicel or rarely divergent in some developing flowers, pale green, glabrous, central nerve raised abaxially, margins slightly recurved

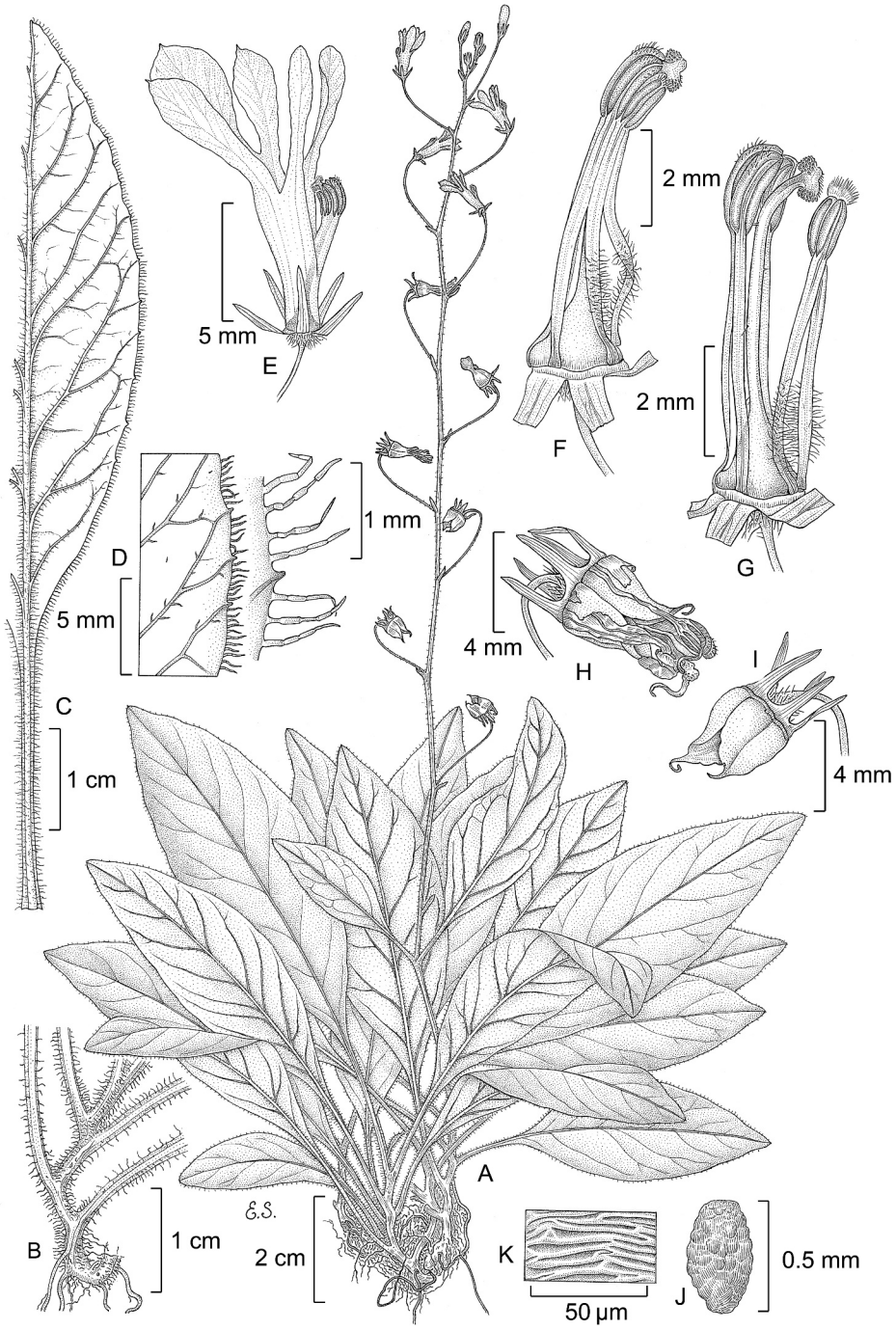

Figure 1. *Lobelia lithophila* Senterre & Castillo-Campos. —A. Habit. —B. Stem base. —C. Leaf venation and pubescence (abaxial face). —D. Details of the leaf margin. —E. Flower. —F, G. Details of the androecium and gynoecium. —H, I. Mature capsule. —J. Seed. —K. Detail of the seed surface. Drawn from the holotype *M. Vásquez T. 1367* (ENCB).

adaxially and purple-blue punctate; corolla gamopetalous, zygomorphic, bilabiate, cleft dorsally to its base or < 1.5 mm from base (since flowers of Lobelioideae are resupinate at anthesis, i.e., rotated 180° via torsion of the pedicel, the dorsal face corresponds to the visually ventral one), not fenestrate; 2 dorsal lobes relatively narrow though sometimes enlarged distally, ascending right in the floral axis; 3 ventral lobes more

typically spatulate with the apex rounded to short acuminate, forming a small angle with the tube; corolla white to dark blue, especially on the lobes; lower lip of medium lobe to (3.3–)5–5.5 mm, the lateral lobes shorter, mostly 3.3 mm; the 2 dorsal lobes ca. 5 mm; corolla tube slightly enlarged distally, generally just shorter than lobes, ca. 4.2–4.5 mm, or rarely slightly longer than the lower lip, ca. 2 mm diam. at top, glabrous; androecium pentamerous, antisepalous, the 5 filaments connate distally 1/3 or less their total length, forming a tube around the style; filaments white, ca. 4.5 mm, their free section densely pilose on the external face of the two ventral ones, filament free sections winged, ca. 0.3 mm wide, slightly narrower near base; androecium inclined dorsally through the cleft in the corolla; anthers tetrasporangiate, dithecal, basifixed, connate, forming a black tube ca. 1.2 × 0.7 mm diam., dehiscent introrsely via longitudinal slits; flowers proterandrous, with an introrse discharge of pollen onto stylar structures preceding the elongation of the style and maturation of the stigma (secondary pollen presentation); the two ventral anthers (appearing dorsal because of the resupinate flowers) shorter than the other three so that the anthers' tube is curved ventrally; 3 dorsal anthers glabrous or with sparse long white hairs; 2 ventral smaller anthers nearly glabrous but white-tufted at tip; ovary gamocarpous, never more than 1/3 inferior, 2-carpellate; 2-locular; flattened at the base and then conical, quickly becoming wide and ovate, as wide as long, 0.5–2 mm in the developing flower; placentation axile; ovules anatropous, numerous; style unique, rubanate, ca. 4.5 × 0.3 mm; dense pubescence of short stout stylar hairs for the secondary pollen presentation observed on the lateral parts of the minutely 2-lobed stigma, lobes rounded, ca. 0.15 mm (observed on developing fruits). Fruit a loculicidal capsule, appearing completely superior at maturity, shape similar to the floral ovary, the base truncate on the flat hypanthium, 3–4 mm, as long as wide, glabrous; apex with 2 acute lobes corresponding to the opening of the upper part of carpels, remainder of the style ± short; pedicel as long as in mature flowers, 1.5(–2.2) cm; calyx persistent, completely reflexed and parallel to the floral axis; corolla and androecium also persistent, ± dry and wrinkled at the base of the capsule; seeds numerous, ca. 30 per locule, brown to dark brown, elliptic-oblong in longitudinal section, elliptic in cross section, ca. 0.5 × 0.24 mm, rounded at apex, obliquely subtruncate at base, the surface (40×) longitudinally striate, punctate.

Distribution and habitat. *Lobelia lithophila* is probably a very narrow endemic from the south of the state of Veracruz, Mexico. It is only known from the type locality, with three collections from 1974 all by the same collector. It was collected in old growth lowland tropical rainforest (selva alta perennifolia), on very superficial soil, with limestone rocks on the surface, and grows on rocky steep slopes. This forest type is characterized in the tree layer by the following species: *Bernoullia flammea* Oliver, *Brosimum alicastrum* Swartz, *Dialium guianense* (Aublet) Sandwith, *Ficus lapathifolia* (Liebmann) Miquel, *Lonchocarpus guatemalensis* Bentham, *Pleuranthodendron lindenii* (Turczaninow) Sleumer, and *Simira salvadorensis* (Standley) Steyermark (Vásquez, 1991). The shrub layer is dominated by *Ardisia wendtii* (Lundell) Pipoly & Ricketson, *Bunchosia lindeniana* A. Jussieu, *Crossopetalum densiflorum* Lundell, *Ouratea pyramidalis* L. Riley, *Piper amalago* L., *P. hispidum* Swartz, and *Psychotria veracruzensis* Lorence & Dwyer.

IUCN Red List category. *Lobelia lithophila* has been seen only three times, in the same locality and habitat. We therefore have no idea of its population extent. Nevertheless, we know that its habitat and distribution are probably limited to the type locality. Because the forests of this region have been much reduced, *L. lithophila* should probably be considered a threatened species, most likely, Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001). On an expedition to the type locality in January 2007, we did not find any individuals of this species, but we do not think that it could be extinct.

Etymology. The epithet *lithophila* refers to the specialized habitat of the described species, which seems to be restricted to limestone rocks on very superficial soil, in the understory of tropical rainforest. It is derived from the Greek "lithos" (stone) and "philos" (loving).

Relationships. *Lobelia lithophila*, owing to its completely superior ovary, is related to some taxa from central and southern Mexico. It is clearly distinguishable from all other *Lobelia* because of the unique combination of the superior ovary with the semi-rosette herbaceous habit, the wide elliptic leaves, and the calyx lobes completely reflexed in fruit.

As mentioned by Rzedowski and Calderón (1997), the tendency to reduction of the hypanthium resulting in the nearly superior ovary seems to have occurred several times within the subsection *Leiospermae* of *Lobelia*, and is mainly represented by narrow endemic species from south and central Mexico. This trend is noticeable in a group of narrow-leaved *Lobelia* including *L. dielsiana* E. Wimmer, *L. hintoniorum* B. L. Turner, *L. occidentalis* McVaugh & Huft, and *L. sublibera* S. Watson. Another group with a superior

Table 1. Main diagnostic features distinguishing species of *Lobelia* with superior ovary and rosette to semi-rosette herbaceous habit.

	L. lithophila	*L. orientalis*	*L. pulchella*
Habit	semi-rosette	rosette	rosette
Shoot pubescence	hirsute-setose	white hoary	hirtellous
Shoot ramification	none	at base	none
Blade length (cm)	5	2	5
Blade shape	elliptic	ovate	obovate
Petiole (mm)	20	40	5
Margin teeth	entire with some callosities	entire with some callosities	large obtuse teeth
Pedicel pubescence	sparsely setose	hirsutulous	glabrescent
Hypanthium shape	discoid	discoid	conical
Hypanthium pubescence	hirsutulous	glabrous	not observed
Calyx lobe orientation	reflexed	ascending	ascending
Ovary position	superior	superior	< 1/3 inferior
Seed surface	striate-tuberculate	foveolate-reticulate	smooth
Distribution	SE Veracruz	NE Querétaro, near San Luis Potosí	from Oaxaca to Guerrero
Vegetation type	tropical lowland evergreen rainforest, on limestone rock, 150 m	*Cupressus–Pinus* upper montane forest, on limestone rock, 2000 m	oak and pine forest, rocky slopes, 2300 m

ovary is based on plants with wide leaves and a tendency to a prostrate semi-rosette habit, in which *L. lithophila* has to be placed next to *L. orientalis* and *L. pulchella* Vatke (Table 1). One of the problematic species in Mexico, *L. sartorii* Vatke, is somewhat related to that group in the aspect of its leaves and its general habit, at least for some forms with mostly basal leaves, but it is clearly different owing to the position of the ovary, which is always approximately half inferior. There is a complex of species related to *L. sartorii* including *L. caeciliae* E. Wimmer, which may also have a nearly superior ovary and deflexed calyx lobes but never present a semi-rosette, and *L. tarsophora* Seaton ex Green, which is characterized by its strongly divaricate pedicels. A third group with a superior ovary is made up of plants with a weedy aspect such as *L. xalapensis* Kunth, *L. cliffortiana* L., *L. diastateoides* McVaugh, and *L. hypnodes* E. Wimmer ex McVaugh, and probably indicates some relationship with the genus *Diastatea* Scheidweiler, which also has a superior ovary but without the cleft corolla.

The seed surface is another important character in the subdivision of *Lobelia*. In the subsection *Leiospermae*, most species have seeds smooth to faintly striate longitudinally. Three *Leiospermae* species from central and southern Mexico have been reported as exceptions, having foveate-reticulate seeds (McVaugh, 1940; Rzedowski & Calderón, 1997), including *L. orientalis*. Nevertheless, these seeds are not as deeply foveate as those of the subsection *Lobelia*. The seeds of *L. lithophila* are intermediate between the foveate-reticulate seeds and the typical *Leiospermae* striate seeds, having a remarkable striate-tuberculate surface.

Paratypes. MEXICO. **Veracruz**: Hidalgotitlán, Río Solosuchil, SW of Hermanos Cedillo camp, 17°16′N, 94°37′W, 2 Apr. 1974 (fr.), *M. Vázquez T. 300* (XAL), 30 Mar. 1974 (fl., fr.), *M. Vázquez T. 236* (XAL).

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