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Salvia carreyesii, *Salvia ibugana* y *Salvia ramirezii* (Lamiaceae), tres nuevas especies de Jalisco, México

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Abstract. Three new species from Jalisco, Mexico, are described and illustrated. These species grow in tropical or in tropical and temperate transitional forests. The 3 species belong to *Salvia* L. subgenus *Calosphace* (Benth.) Benth. *Salvia carreyesii* J. G. González is morphologically similar with section *Briquetia* Epling. It is characterized by the contrasting vegetative morphology between mature and immature individuals, its relatively large and sessile or sub-sessile leaves (the uppermost amplexicaul), glandular-capitate hairs on the floral axis and calyx, and dark violet corollas. The characters of *Salvia ibugana* J. G. González correspond to those of the species of section *Angulatae* (Epling) Epling, within which *S. ibugana* is distinguished by the digitiform papillae disperse on its stems, petioles and floral axis. *Salvia ramirezii* J. G. González fits well within section *Sigmoideae* Epling by means of the sigmoid shape of the lower branch of its style. It is morphologically similar to *Salvia crucis* and *S. quercetorum*, from which it can be distinguished by the triangular, slightly succulent, shorter, glabrous, lustrous leaves.

Key words: digitiform papillae, endemic, Jalisco, section *Angulatae*, section *Briquetia*, section *Sigmoideae*, *Salvia* subgenus *Calosphace*.

Resumen. Se describen e ilustran 3 especies nuevas de Jalisco, México. Estas especies crecen en bosques tropicales o en bosques transicionales entre tropicales y templados. Las 3 especies pertenecen a *Salvia* L. subgénero *Calosphace* (Benth.) Benth. *Salvia carreyesii* J. G. González es morfológicamente similar a la sección *Briquetia* Epling. Se caracteriza por la morfología vegetativa contrastante entre individuos maduros e inmaduros, sus hojas relativamente grandes, sésiles o subsésiles (las superiores amplexicaules), tricomas capitado-glandulares sobre el eje floral y el cáliz, y corolas violeta oscuro. Las características de *Salvia ibugana* J. G. González corresponden a aquellas de las especies de la sección *Angulatae* (Epling) Epling, dentro de la que *S. ibugana* se distingue por las papilas digitiformes que presenta en el tallo, peciolo y eje floral. *Salvia ramirezii* J. G. González se ubica bien dentro de la sección *Sigmoideae* Epling debido a la forma sigmoide de la rama inferior del estilo. Es morfológicamente similar a *Salvia crucis* Epling y *S. quercetorum* Epling, de las que se distingue principalmente por las hojas triangulares, ligeramente succulentas, más cortas, glabras y lustrosas.

Palabras clave: papilas digitiformes, endémico, Jalisco, sección *Angulatae*, sección *Briquetia*, sección *Sigmoideae*, *Salvia* subgénero *Calosphace*.

Introduction

A revision of the Lamiaceae family in the state of Jalisco (western Mexico) as part of the project “Flora de Jalisco y Áreas Colindantes”, allowed us to uncover 3 distinct populations of *Salvia* that were not referable to any of the previously described species in the genus. We therefore describe 3 new species, one related to section

Briquetia Epling, and the others belonging to sections *Angulatae* (Epling) Epling and *Sigmoideae* Epling, respectively, according to the classification proposed by Epling and coworkers (Epling, 1940, 1941, 1944, 1947, 1951; Epling and Mathias, 1957; Epling, 1960; Epling and Játiva, 1963, 1966, 1968).

Specimens of the new species were collected and recorded their morphological variability, distribution and habitat requirements. From January to March 2011, some individuals of each species were dug up and cultivated

at the botanical garden of the Instituto de Botánica, Universidad de Guadalajara, Zapopan, Jalisco.

Descriptions

Salvia carreyesii J. G. González sp. nov. Type: **Mexico.** Jalisco. Municipio de Puerto Vallarta: La Laja stream, 0.75 km WNW of Las Mesas, 20°30'39" N, 105°6'28" W, 1 100 m, 11 Nov 2009 (fl.), *P. Carrillo R., D. Cabrera T. and C. Gallardo 5842* (holotype: IBUG; isotype: IEB). Fig 1.

Salviae sectione *Briquetiae* aemulans, sed corollarum labio inferior quam superior longior; *S. mexicanae* affinis sed habitu prostrato, petiolis 0-3.5 mm (vs 1-10 cm) longis, foliis juvenilibus dense albo-tomentosis, pedicellis 3-4 mm (vs 3-20 mm) longis et glandulosis, calycibus 8-9 mm (vs 8-20 mm) longis et glandulosis, corollis atroviolaceis (vs atrocaeruleis), filis 2-3 mm (vs. 4-7 mm) longis, connectivis 7-8 mm (vs. 8-30 mm) longis, thecis 2-2.2 mm (vs. 3.6-5 mm) longis, stylis 2-2.2 mm (2.8-4 mm) longis notabilis.

Perennial herbs, erect when young and gradually inclined till reach a prostrate habit which roots at the nodes, 30-80 cm long, stem sparsely puberulent to glabrous in mature individuals (puberulent to densely hirsute with white or often yellow hairs in immature ones), internodes 6-12 cm long. Petioles 0-3.5 mm long (the uppermost leaves always sessile), usually glabrous or sometimes puberulent. Leaf blades ovate to broadly oblong-lanceolate, (6-)11-18 cm × (3-)6-8.5 cm, green, acuminate at the apex, rounded, slightly cordate or sometimes oblique at the base (the uppermost leaves occasionally amplexicaul), the margin serrate, both surfaces essentially glabrous or sparsely puberulent, and smooth (in immature individuals the leaves are densely covered with erect yellow or white hairs in the adaxial surface, and bullate, the abaxial surface densely covered with whitish-silver appressed hairs). Inflorescences arranged in terminal racemes, (2-)4.5-10.5 cm long, with 4-9 verticillasters, each verticillaster 6 to 12-flowered, floral axis with erect simple hairs and sparsely shorter glandular capitate ones. Floral bracts deciduous, ovate, (6-)11-18 × (3-)6-8.5 mm, green, glabrous except at the margin which is short and sparsely ciliated, acuminate to cuspidate at the apex, truncate at the base, the margin entire. Pedicels 3-4 mm long, hirtellous and with tiny glandular capitate hairs. Calyces 8-9 × 5-6 mm, not accrescent, green, hirtellous and with glandular capitate hairs on the veins, sparsely covered with conical tiny hairs at the inner surface, upper lip 3-veined, lips equal in length and acute. Corollas dark violet with white nectar guides on the lower lip at the throat, sparsely pilose in the upper lip and in the abaxial surface of the lower one, tube 1.7-1.8 × 4-5 mm, ventricose, not invaginated, internally naked;

upper lip 5-6 mm long, lower one 5-8 × 6 mm. Stamens included; filaments 2-3 mm long; connective 7-8 mm long, not geniculate, not evidently dentate; theca 1-2 mm long; staminodes present, represented by a tiny papilla above and behind the insertion point of each filament to corolla tube. Gynobasic horn 1-1.2 mm long; styles 2-2.2 cm long, slightly sigmoid (the curves follow the shape of the corolla), sparsely pilose at the apex, lower branch acute. Nutlets ovoid, 1.5-1.8 × 1-1.3 mm, pale brown marbled with dark brown stains, glabrous and smooth.

Taxonomic summary

Distribution, habitat and phenology. *Salvia carreyesii* is only known from the dirt road between Puerto Vallarta and El Cuale, near to El Nogalito stream, Jalisco, Mexico (Fig. 2). It inhabits in ecotones between tropical subdeciduous and oak forests from 980 to 1 100 m, generally near to perennial watercourses. It shares habitat with *Ardisia compressa* Kunth, *Cecropia obtusifolia* Bertol., *Croton suberosus* Kunth, *Hedyosmum mexicanum* C. Cordem., *Myrica cerifera* (L.) Small, *Podocarpus reichei* J. Buchholz et N. E. Gray, and *Euphorbia peritropoides* (Millsp.) V. W. Steinm. *Salvia carreyesii* probably blooms and sets fruits from September to early December.

Etymology. The specific epithet of this plant is a fusion of surnames that honors the first collector: Pablo Carrillo Reyes, long distance runner and photographer by hobby, and botanist by profession, as describes himself; but above all, he is a good friend and an enthusiastic botanist.

Additional material examined. **Mexico.** Jalisco. Municipio de Puerto Vallarta: Las Lajitas stream, south of Las Mesas, dirt road from Puerto Vallarta to El Cuale, 20°30'36.3" N, 105°6'29.7" W, 1 049 m, 30 Dec 2010 (ster.), *González et al.* 798 (IBUG); by a stream on dirt road Puerto Vallarta to El Cuale, ahead of El Nogalito stream, 22 km from El Remance bridge, 20°31'42.84" N, 105°5'51.32" W, 980 m, 12 Feb 2011 (ster.), *González et al.* 871 (IBUG).

Remarks. *Salvia carreyesii* is not clearly related to any of the sections defined by Epling and co-workers (Epling, 1940, 1941, 1944, 1947, 1951; Epling and Mathias, 1957; Epling, 1960; Epling and Játiva, 1963, 1966, 1968). However, most of the characters exhibited by *S. carreyesii* are shared by the species included in section *Briquetia* Epling. This section is characterized by wide leaves, rounded to attenuated, sometimes truncate or cordate at the base, lips of the calyces subequal in length, 3-veined upper lips, dark blue corollas, ventricose and mostly invaginated tubes, internally naked, upper corolla lip longer than the lower one, stamens included, connectives with a small ventral tooth or subentire, pilose styles, upper branch of the style longer than the lower one. Nevertheless, there is only one divergent character; the upper lip of the corolla is equal or shorter than the lower one in *S. carreyesii*.

Salvia carreyesii is distinctive by the 2 striking different vegetative morphologies between mature and immature plants. Young individuals are erect, possess puberulent to densely hirsute stems, leaves bullate and densely covered with yellow or white hairs above and whitish appressed hairs below. Mature (flowering) individuals are declined and tend to be prostrate, lack of hairs, and the leaves are smooth. Other characters that help to distinguish *S. carreyesii* are the relatively large and sessile or subsessile leaves (the uppermost amplexicaul), glandular-capitate

hairs on the floral axis and calyces, and dark violet corollas. The unique member of section *Briquetia* growing in Jalisco is *S. mexicana* L., which can be distinguished by longer petioles, cuneate to attenuated leaf base, longer floral structures (pedicel, calyx, corolla (the tube and upper lip length), corolla lips, filament, connective, theca and style), and the absence of glandular capitate hairs in pedicel and calyx (Table 1). Furthermore, *S. carreyesii* has a tendency to grow in more tropical forests and warmer lowlands than *S. mexicana*.

Key for *Salvia mexicana* and *S. carreyesii*

- 1a. Base of the leaf blades cuneate or long attenuated, petioles 1-10 cm long; pedicels 3-20 mm long, moderate to densely covered with eglandular hairs; calyces sparse to densely covered with eglandular hairs; corolla upper lip 13-14(-19) mm long, lower one 12-17 mm long; filaments 4-7 mm long, connectives 8-30 mm long, thecae 2.8-4 mm long; style 3.6-5 cm long.....*S. mexicana*
1b. Base of the leaf blades rounded, slightly cordate or sometimes oblique, petioles 0-0.35 cm long; pedicel 3-4 mm long, covered with glandular capitate hairs; calyces covered with glandular capitate hairs; corolla upper lip 5-6 mm long, lower one 5-8 mm long; filaments 2-3 mm long, connective 7-8 mm long, thecae 1-2 mm long; style 2-2.2 cm long.....*S. carreyesii*

Table 1. Character comparison between *Salvia mexicana* and *S. carreyesii*

Characters	<i>S. mexicana</i>	<i>S. carreyesii</i>
Leaves		
Petiole length (cm)	1-10	0-0.35
Leaf blade shape	Ovate to ovate-elliptic	Ovate to oblong-lanceolate
Leaf blade size (cm)	6-18(-20) × 2.5-12	(6-)11-18 × (3-)6-8.5
Apex shape	Acute or acuminate	Acuminate
Base shape	Cuneate to attenuated (rarely subcordate)	Rounded, slightly cordate or sometimes oblique
Inflorescence		
Flowers per verticillaster	10 to 12	6 to 12
Floral bract		
Shape	Ovate	Ovate
Size mm	6-12 (-20) × 3-5	(6-)11-18 × (3-)6-8.5
Pedicel		
Length (mm)	3-20	3-4
Glandular capitate hairs	Absent	Present
Calyx		
Length (mm)	8-17(-20)	8-9
Glandular capitate hairs	Absent	Present
Corolla		
Color	Dark blue	Dark violet
Tube length (mm)	15-25	17-18
Upper corolla lip length (mm)	13-14(-19)	5-6

Table 1. Continues

Characters	<i>S. mexicana</i>	<i>S. carreyesii</i>
Lower corolla lip length (mm)	12-17	5-8
Androecium		
Filament length (mm)	4-7	2-3
Connective length (mm)	8-30	7-8
Theca length (mm)	2.8-4	1-2
Gynoecium		
Style (cm)	3.6-5	2-2.2
Vegetation	Pine, pine-oak, oak, montane cloud, and tropical deciduous forests	Ecotones between tropical subdeciduous and oak forests
Geographical range	Mexican Pacific slope from Durango, Zacatecas and San Luis Potosí to Oaxaca and Puebla	Jalisco
Altitudinal range (m)	(800-)1 000-2 900	900-1 100

Salvia ibugana J. G. González sp. nov. Type: **Mexico.** Jalisco. Municipio de Cabo Corrientes: road from Refugio de Suchitán to El Chimo, 20°26'52.49" N, 105°35'11.4" W, 605 m, 13 Mar 2011 (fl., fr.), J. G. González, J. A. Vázquez and E. De Castro. 939 (holotype: IBUG; isotypes: IEB, MEXU, ZEA, ENCB). Fig. 3.

Salviae section *Angulatae* adscribenda, species insignis caulibus, petiolis et axibus inflorescentiarum suis papillatis distincta (papillae habitum lichenis viridis leniter referentia), a speciebus nobis notis bene.

Perennial herb or subshrub, erect, 1.5-2 m tall, stems sparsely puberulent, profusely ornate with digitiform or lichenoid papillae, 1-2 mm long (such papillae also present on petioles and in lesser extent on floral axis). Petioles (1-)4-6(-8.5) cm long, puberulent and sparsely covered with appressed hairs. Leaf blades ovate, 6-12(-15.5) × 4-7(-10.5) cm, green, acuminate at the apex, slightly truncate or rounded and then abruptly cuneate at the base, the margin serrate (entire near the base), both surfaces glabrous except for the primary and secondary veins which are covered with tiny appressed hairs, abaxial surface densely covered with glandular dots. Inflorescences arranged in terminal and subterminal racemes, (5-)10-18(-30) cm long, with 18-35 verticillasters, 0.7-1.5 cm apart towards the base, each verticillaster 10 to 18-flowered. Floral bracts deciduous, ovate, (1-)1.3-1.5(-2.4) × 1-1.7 mm, green, puberulent, attenuated at the apex, truncate at the base, margin entire, venation not obvious. Linear bracteoles present at the base of each pedicel, 1-2 mm long. Pedicels 1.5-3.1 mm long, covered with short conical hairs. Calyces 3.1-3.8(-5) × (1.7-)2.3-2.5 mm, slightly accrescent, reaching up to 5.2 × 3.3 mm during fructification, green and bluish towards the apex, puberulent or hispidulous mainly on the veins and

internally glabrous, the upper lip 3-veined, lips equal in length, the upper lip and the lobes of the lower one acute. Corolla sky blue with white nectar guides on the lower lip and paler tube towards its base, essentially glabrous except the upper lip which is moderately to densely pilose; tubes 5-5.5 × 2 mm, ventricose and invaginated, internally naked at the base; upper lip 4-4.5 mm long, lower one 4-5.6 × 4-5 mm. Stamens included; filaments 1.4-1.5 mm long; connectives 4.5-5.5 mm long, with a triangular retrorse tooth at its middle portion; thecae 1-1.3 mm long; staminodes present above and behind the insertion point of each filament to the corolla tube. Gynobasic horn 1-1.1 mm long, obtuse at the apex; styles 7-9 mm long, pilose towards the apex, slightly exerted (only the branches). Nutlets ovoid, 1.2-1.3 × 0.7-1 mm, pale ocher, concolor, sometimes pilose when immature, with the hairs concentrated towards the junction with the gynophore, smooth and sparsely covered with dark amber and black glandular dots.

Taxonomic summary

Distribution, habitat and phenology. *Salvia ibugana* is endemic to Jalisco, Mexico (Fig. 2). It grows in tropical subdeciduous forest or secondary palm grove, from 550 to 600 m. It shares habitat with *Begonia jaliscana* Burt-Utley, *Brosimum alicastrum* Sw., *Calophyllum brasiliense* Cambess., *Cecropia obtusifolia*, *Clusia salvinii* Donn. Sm., *Cryosophila nana* (Kunth) Blume, *Dalechampia scandens* L., *Hura polyandra* Baill., *Ipomoea neei* (Spreng.) O'Donell, *Orbignya guacuyule* (Liebm. ex Mart.) Hern.-Xol., *Oreopanax peltatus* Linden, *Piper hispidum* Kunth, *Ardisia* sp., *Miconia* sp., *Peperomia* sp., *Russelia* sp. and *Bursera* spp. This species blooms and fructifies from middle February to March.

Etymology. *Salvia ibugana* is named after the acronym of Herbario Luz María Villarreal de Puga del Instituto de Botánica (IBUG), Universidad de Guadalajara, Mexico. This Institution has been conducive to the formation of new botanists and to increase the knowledge and documentation of the flora of western Mexico.

Additional material examined. **Mexico.** Jalisco. Municipio de Cabo Corrientes: road down from La Pitarilla, between Guázima and Agua Caliente, 20°27'10" N, 105°34'30" W, 550 m, 2 Mar 1993 (fl.), *Castillo et al. 10630* (XAL); road Refugio de Suchitán-Chimo, 20°27'2.8" N, 105°35'24.2" W, 560-600 m, 19 Feb 1998 (fr.), *Ramírez et al. 5076* (IBUG). Municipio de Puerto Vallarta: Las Guacas, 600 m, 22 Feb 1998 (fl.), *Ramírez et al. 5239* (IBUG); Las Guacas (San Sebastián del Oeste), 5 Mar 2000, *Villarreal 17782* (IBUG-2 sheets).

Remarks. *Salvia ibugana* is well enclosed into the definition of section *Angulatae* (Epling) Epling. However, it is worth to highlight that this section is one of the richest and most complicated defined by Epling within the subgenus *Calosphace* (1939, 1940, 1941, 1963). He included 48 species, most of them difficult to delineate and several probably will prove to be conspecific. The characters shared by these species, which define the section, are: ovate, elliptic or sometimes deltoid-ovate leaves, cuneate to long attenuated at base or sometimes rounded and abruptly and shortly cuneate, 3-veined upper lip of the calyx, white or sky blue corolla, ventricose tube, internally naked, lower corolla lip longer than the upper one, stamens included,

connective with a retrorse tooth in the middle, pubescent or rarely glabrous style. A relevant factor that is hard to deal with is the relatively broad geographical range of this group. They spread from northern Mexico to northern Argentina through the Andean Mountain Range, and southern Brazil. This can partially explain the absence of a recent taxonomic treatment particularly for this section. Fortunately, *S. ibugana* is strikingly different in having the digitiform or lichenoid papillae throughout its stems, petioles and floral axis, and bracteoles present together with the typical floral bracts. These characters clearly differentiate it from its closest similar species, *S. longispicata* M. Martens and Galeotti and *S. roscida* Fernald (Table 2). The green papillae that characterize this species are unique in the genus.

The habit and general aspect of this new taxon resemble those of what we consider as the *S. roscida* complex, which includes the formerly valid species *S. fallax* Fernald, *S. muscidiflora* Fernald, *S. remissa* Epling, and *S. roscida*. In the local area this complex occupies mainly temperate habitats like pine-oak, oak and cloud montane forests. It is highly probable that *S. ibugana* has diverged from the core of this complex by means of the pressure of warmer and wetter environments.

Salvia ibugana was collected near *S. ramirezii* at Las Guacas zone in Puerto Vallarta Municipality by *R. Ramírez Delgadillo et al. 5239* (Feb. 1998). However, we could not find any of them in such locality during 2 different expeditions (22 Oct 2010 and 11 Feb 2011). No other sage has been observed growing together with *S. ibugana*.

Key for *Salvia ibugana* and morphologically similar taxa

- 1a. Papillae digitiform or lichenoid present in the stems, petioles and floral axis; floral bract always deciduous and bracteoles present; calyces 3.1-3.8(-5) mm long; corolla tubes 5-5.5 mm long.....*S. ibugana*
- 1b. Papillae absent throughout the plant surface; floral bracts deciduous or persistent and bracteoles absent; calyces 4-7(-9) mm long; corolla tubes 6-9.7 mm long
- 2a. Verticillasters 10 to 24-flowered; floral bracts generally deciduous.....*S. longispicata*
- 2b. Verticillasters 4 to 12-flowered; floral bracts always persistent.....*S. roscida*

Table 2. Character comparison between *Salvia ibugana* and morphologically most similar taxa

Characters	<i>S. longispicata</i>	<i>S. roscida</i>	<i>S. ibugana</i>
Digitiform or lichenoid papillae	Absent	Absent	Present in the stems, petioles and floral axis
Leaves			
Petiole length (cm)	3-5	1-4(-7)	(1-)4-6(-8.5)
Leaf blade shape	Ovate to ovate-lanceolate	Ovate	Ovate
Leaf blade size (cm)	4-7(-10) × 2.5-4(-6.5)	7.5-12 × 5-6	6-12(-15.5) × 4-7(-10.5)
Apex shape	Long acute	Acute to acuminate	Acuminate
Base shape	Cuneate to attenuated	Cuneate	Slightly truncate to rounded and then abruptly cuneate

Table 2. Continues

Characters	<i>S. longispicata</i>	<i>S. roscida</i>	<i>S. ibugana</i>
Margin shape	Serrate	Serrate	Serrate
Inflorescence			
Flowers per verticillaster	10 to 24	(4-)8 to 12	10 to 18
Floral bract			
Shape	Ovate to ovate-lanceolate	Triangular, ovate or narrow lanceolate	Ovate
Size (mm)	(1.7-)2-3(-6.8) × 0.5-1.2(-3.7)	1.1-2.6 × 1-2	(1-)1.3-1.5(-2.4) × 1-1.7
Pedicel			
Length (mm)	1.5-2.3	2-3	1.5-3.1
Calyx			
Length (mm)	5-7(-9)	4-5.5	3.1-3.8(-5)
Corolla			
Color	Sky blue to dark blue with white macules at the throat	Sky blue with white macules at the throat	Sky blue with white macules at the throat
Tube length (mm)	6-7(-9.7)	(6.8-)7-8	5-5.5
Upper lip length (mm)	4-5.5	4-5	4-4.5
Lower lip length (mm)	5-6.5	5.2-7	4-5.6
Androecium			
Filament length (mm)	1.2-1.6(-2)	1.2-1.5	1.4-1.5
Connective length (mm)	4.5-5(-9)	4-5	4.5-5.5
Theca length (mm)	1.1-1.3	1-1.3	1-1.3
Gynoecium			
Style length (mm)	9-10	8-9	7-9
Nutlet			
Length (mm)	1.1-1.2 × 0.7-0.8	1-1.1 × 0.6	1.2-1.3 × 0.7-1
Vegetation	Tropical deciduous, secondary vegetation of pine-oak and pine forests, and subtropical shrub	Pine-oak, oak, montane cloud and tropical subdeciduous forests	Tropical subdeciduous forests and secondary palm grove
Geographical range	Almost all the Mexican states except for those from the California and Yucatán Peninsulas	Sinaloa, Durango, Nayarit, Jalisco, Michoacán, Guerrero and Oaxaca	Along the cost of Bahía de Banderas, Jalisco
Altitudinal range (m)	400-200(-3 050)	(600-)1 000-1 950(-2 637)	550-600

Salvia ramirezii J. G. González sp. nov. Type: **Mexico**, Jalisco. Municipio de Mascota: by El Cabro hill, 9.7-9.9 km SW of San Juan del Mosco on dirt road to Puerto Vallarta, Los Sauces y Agujes, 20°31'37.2" N, 104°57'9.2" W, 1 628 m, 21 Jul 2011 (fl., fr.), *J. G. González-G., A. Castro-C., R.*

Guerrero-H., I. Guerrero and C. Beltrán 1042 (holotype: IBUG; isotypes: IEB, MEXU, ZEA, XAL). Fig. 4.

Salviae sectione *Sigmoideae* adscribenda, a *S. quercetorum* et *S. crucis* foliis sessilibus, brevioribus (6-23 × 5-8 mm vs. 9-30(-55) × (6-)12-22 mm), triangularibus,

triangulo-lanceolatis vel lanceolatis, floribus 2 in verticillastris (vs. 2-12) differt.

Perennial herbs up to 1 m tall; stems emerging from a subterranean cylindrical tuber, highly branched, markedly quadrangular, sparsely pilose and sometimes farinaceous between the ribs and in the junction of the petioles and between them (particularly on the young branches and on the floral axis), sparsely ornate with orange or ocher glandular dots (invisible to the naked eye). Leaves subsessile or with petioles 0.3-1(-3.8) mm long; leaf blades triangular, triangular-lanceolate to lanceolate, (6-)9.4-15(-23) × (2.2-)5-13.3 mm, often slightly succulent, acuminate to acute at apex, slightly cordate at base, the margin entire or sparsely crenate, short revolute when dried, adaxial surface green, smooth and usually lustrous, abaxial surface paler and densely glandular punctate and sometimes densely farinaceous (then the secondary veins hidden by the granules), the glands ocher or dark orange. Inflorescence arranged in terminal and subterminal lax racemes, (2-)10-20 cm long, each floral axis with (5-)10-27 verticillasters, these 2-flowered, floral nodes 5-15 mm apart towards the base. Floral bracts late deciduous, lanceolate to ovate-lanceolate, (1.7-)2-2.5 × 0.5-1 mm, acute at the apex, truncate at the base, the margin entire, green, glabrous except the margin which is sometimes covered with erect short hairs (there are erect hairs also at the junction between the bract and the floral axis), densely glandular punctate and sometimes farinaceous, the glands dark orange or ocher. Pedicels 1-2(-3) mm long, densely covered with short conical hairs and farinaceous. Calyx 3-5 × 2-3.5 mm, poorly accrescent, it reaches 5-6 × 4-5 mm, green, heavily covered with dark orange or ocher glandular dots, essentially glabrous with short erect hairs on the margin of the lips, farinaceous, the upper lip 5 or 7-veined, lips acute and subequal in length. Corollas blue with white nectar guides, densely pilose and ornate with dark orange sessile glands toward the throat, tube (3-)5-6 × 2 mm, slightly ventricose and invaginated at the base, internally ornate with 2 ventral folds; upper lip (3-)4-5 mm long, lower lip 4-5 × 6.4-6.6 mm. Stamens included; filaments 1-1.5 mm long; connectives 1.8-2.5 mm long, geniculate; thecae (7-)1-1.3 mm long; staminodes present above and behind the insertion point of each filament to the corolla tube, globose at the apex. Gynobasic horn 1 mm long; styles 7-8 mm long, pilose, included except the style branches, the lower branch sigmoid. Nutlets ovoid, 1.5-2 × 1-1.3 mm, grayish-brown and dark-brown marbled, glabrous and smooth.

Taxonomic summary

Distribution, habitat and phenology. *Salvia ramirezii* is endemic to Jalisco, Mexico (Fig. 2). It inhabits tropical deciduous forests or ecotones of this vegetation with oak

or oak-pine forests, from 600-1 640 m. It grows together with *Brosimum alicastrum*, *Cecropia obtusifolia*, *Clusia salvinii*, *Cryosophila nana*, *Euphorbia calcarata* (Schltdl.) V. W. Steinm., *Hura polyandra*, *Pinus oocarpa* Schiede ex Schltdl., *Quercus glaucescens* Humb. and Bonpl., *Q. glaucoides* M. Martens and Galeotti, *Q. uxoris* McVaugh, *Orbignya* sp., *Piper* sp., and *Ficus* sp. This species blooms and fructifies from late July to late April, as evidenced by the specimens collected.

Etymology. *Salvia ramirezii* is named in honor of Raymundo Ramírez Delgadillo (1968-2011), one of the few people who mastered the knowledge of the flora of Jalisco, Mexico. Dear friend for his students. He contributed greatly to the emergence of a new generation of Mexican botanists.

Additional material examined. **Mexico.** Jalisco. Municipio de Mascota: El Cabro hill, by El Terrero, 31 Jul 2005 (fl., fr.), *Cházaro and Ascencio 8521* (XAL); 8.7-8.8 km SW of San José del Mosco on the dirt road to El Cabro-Zapotán, Los Sauces y Agujes, 20°31'32.9" N, 104°57'12.3" W, 1 640 m, 22 Apr 2011 (fl., fr.), *González and Guerrero 1002* (IBUG, IEB); 9.4 km SW of San José del Mosco dirt road to El Cabro-Zapotán, Los Sauces y Agujes, 20°31'39.2" N, 104°57'19.3" W, 1 638 m, 23 Apr 2011 (fl., fr.), *González and Guerrero 1005* (IBUG, MEXU). Municipio de Puerto Vallarta: Las Guacas, 600 m, 22 Feb 1998 (fl., fr.), *Ramírez et al. 5212* (IBUG); mountains of Puerto Vallarta towards El Cuale, 23 Sep 2009 (fl., fr.), *Romero s.n.* (IBUG); Ojo de Agua Ranch, 1 400-1 600 m, 11 Feb 2010 (fl., fr.), *Romero 72* (IBUG). Municipio de Talpa de Allende: on road from Talpa de Allende to Tomatlán, 26.2 km S of Talpa, 1 440 m, 9 Nov 1975 (fl., fr.), *Peterson and Broome 428* (IBUG).

Remarks. *Salvia ramirezii* corresponds undoubtedly to section *Sigmoideae* Epling because of the sigmoid shape of the lower branch of the style. This character is only present as far as we know in that section. *Sigmoideae* is endemic to Mexico. According to Espejo and Ramamoorthy (1993), it includes 11 species. They suggest the state of Jalisco as the possible center of diversification and dispersion of this group since 6 of the species grow there; so, the discovery of the new taxon in this Mexican state is not surprising and supports the Espejo and Ramamoorthy's hypothesis. The new species is morphologically similar to *S. crucis* Epling and *S. quercetorum* Epling. It differs from the first one in having evident triangular or narrow lanceolate leaves, generally shorter, sessile or rarely with petioles up to 3.8 mm long, glabrous, smaller floral bracts, verticillasters always 2-flowered and shorter lower corolla lips (Table 3). The following characters of *S. quercetorum* establish the difference from *S. ramirezii*: lanceolate to elliptic-lanceolate leaves, 1.3-7.4 × 1-1.8 cm, cuneate at the base, margin serrate, petiole up to 2-9 mm long,

Table 3. Character comparison between *Salvia ramirezii* and morphologically similar taxa

Characters	<i>S. crucis</i>	<i>S. quercetorum</i>	<i>S. ramirezii</i>
Leaves			
Petiole length (cm)	(0.2-)1.6-2.3	0.2-0.5(-0.9)	0-0.1(-0.38)
Leaf blade shape	Ovate to rhombic-deltoid	Lanceolate to elliptic-lanceolate	Triangular, triangular-lanceolate to lanceolate
Leaf blade size (cm)	0.9-3(-4.56) × 0.2-2.5(-3.5)	(1.3-)3-5(-7.4) × 1-1.5(-1.8)	(0.6-)0.94-1.5(-2.3) × (0.22-)0.5-1.33
Apex shape	Acute to rounded	Acute	Acuminate to acute
Base shape	Truncate to slightly cordate	Cuneate	Slightly cordate
Margin shape	Serrate	Serrate	Entire or sparsely crenate and shortly revolute
Pubescence	Present	Absent	Absent
Inflorescence			
Flowers per verticillaster	2 to 12	2 to 10	2
Floral bract			
Shape	Ovate to lanceolate	Lanceolate to ovate-lanceolate	Lanceolate to ovate-lanceolate
Size (mm)	(2.7-)3-3.8(-5) × 1.5-2.1	1.9 × 0.8	(1.7-)2-2.5 × 0.5-1
Pedicel			
Length (mm)	2-2.1	2-3	1-2(-3)
Calyx			
Length (mm)	4.5-6	5-6	3-5
Corolla			
Color	Sky blue with white macules at the throat	Sky blue with white macules at the throat	Sky blue with white macules at the throat
Tube length (mm)	4-5	4.5-6	(3-)5-6
Upper lip length (mm)	2-2.9	3-3.1	(3-)4-5
Lower lip length (mm)	6-10	5.5-8	4-5
Androecium			
Filament length (mm)	0.8-1.5	2-2.5	1-1.5
Connective length (mm)	1.9-2.5	1.5-3.6	1.8-2.5
Theca length (mm)	1.5	1.2-1.4	(0.7-)1-1.3
Gynoecium			
Style length (mm)	5.2-7	6.5	7-8
Style pubescence	Glabrous	Glabrous	Pilose
Nutlet			
Length (mm)	1.6-2 × 1.4-1.6	1.2-1.8 × 0.9	1.5-2 × 1-1.3
Vegetation	Pine-oak forests	Oak forest	Tropical deciduous and ecotones with pine-oak and oak forests
Geographical range	Sinaloa, Durango and Northern Jalisco	Western Jalisco	Western Jalisco
Altitudinal range (m)	2 230-2 533	1 500-2 500	600-1 640

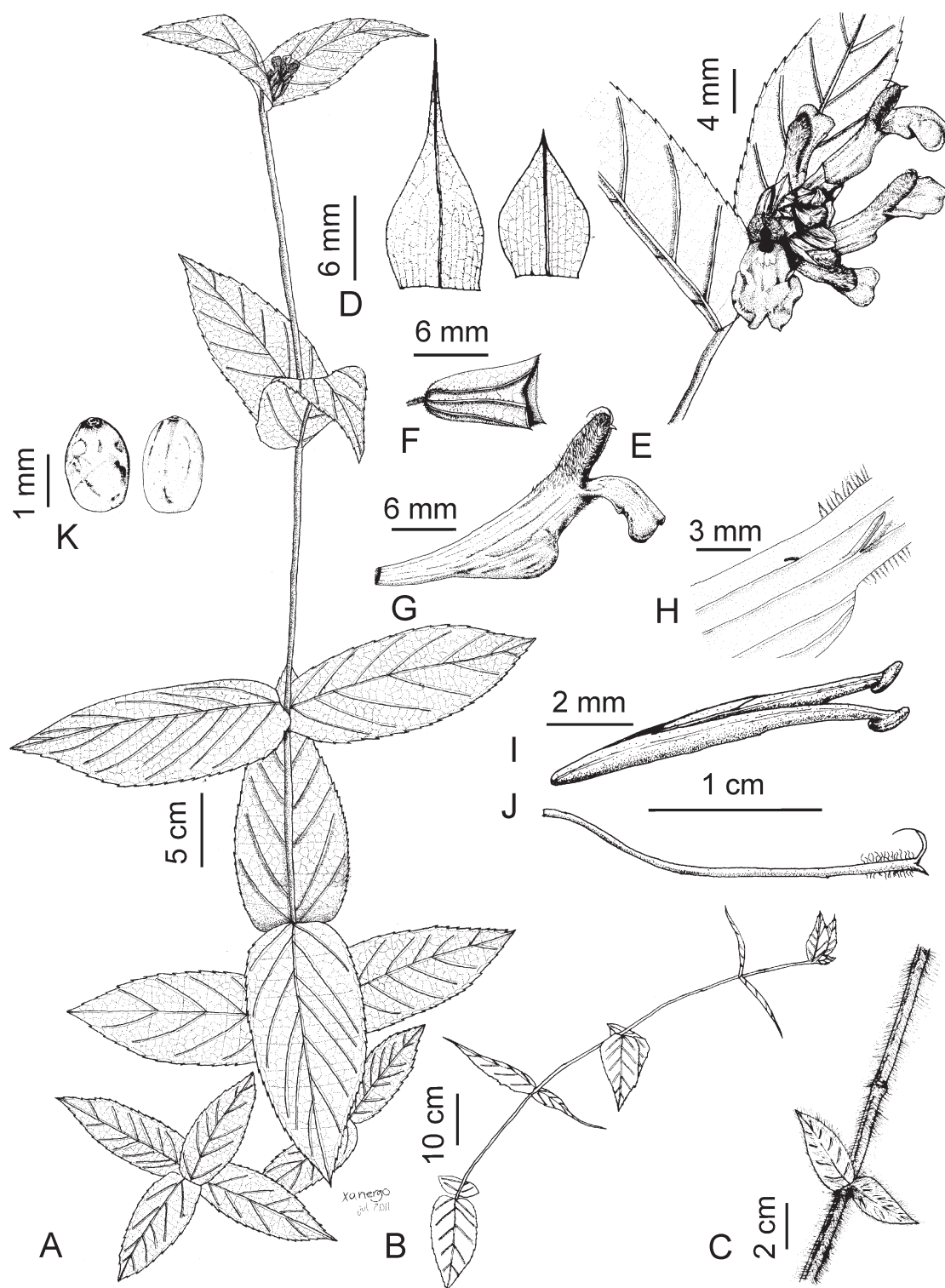


Figure 1. *Salvia carreyesii* J. G. González. A, general aspect, upper view; B, general aspect lateral view; C, fragment of a young stem; D, floral bracts; E, inflorescence; F, calyx; G, corolla; H, corolla dissection showing the filament toward the throat and minute staminodes behind; I, connectives and thecae; J, style; K, nutlets. (Drawn from the holotype and living plants at botanical garden del Instituto de Botánica, Universidad de Guadalajara).

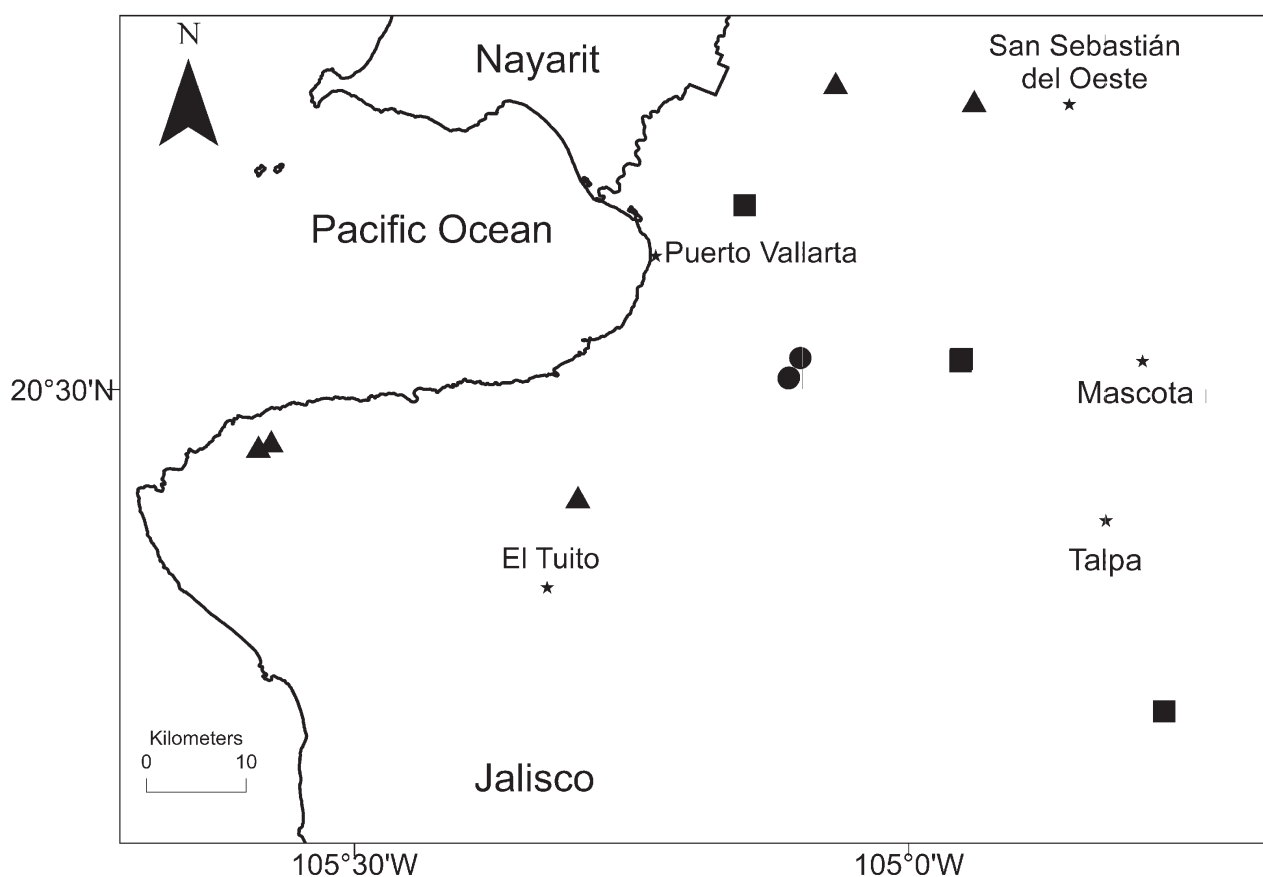


Figure 2. Distribution of the 3 new species: *Salvia carreyesii* J. G. González (dots); *S. ibugana* J. G. González (triangles), and *S. ramirezii* J. G. González (squares).

verticillasters 2 to 8-flowered, and 6-8 mm long calyces (Table 3).

The new taxon represents an interesting extension of the altitudinal and vegetational distribution of the species of section *Sigmoideae*. None of the 11 species recognized by Espejo and Ramamoorthy (1993) grows under 1 000 m and in tropical subdeciduous forest as *S. ramirezii* does.

The populations of this species from the municipality of Puerto Vallarta tend to exhibit lanceolate and longer leaves (up to 23 mm long), while the populations from Cabo Corrientes and Mascota have triangular and shorter leaves (up to 13 mm long). However, the variation in these characters between the populations is not discontinuous, so they cannot be clearly separated as to establish infraspecific taxa.

Key for *Salvia ramirezii* and allies

- 1a. Leaf blades cuneate at the base.....*S. quercetorum*
- 1b. Leaf blades rounded or slightly cordate at the base
- 2a. Petioles 0-3.8 mm long; leaf blades triangular, triangular-lanceolate to lanceolate, up to 2.3 × 1.33 cm, glabrous, margin entire or sparsely crenate; verticillasters 2-flowered; lower corolla lips 4-5 mm long, style pilose.....*S. ramirezii*
- 2b. Petioles (2-)16-23 mm long; leaf blades ovate to rhombic-deltoid, up to 4.56 cm × 3.5 cm, pubescent, margin serrate; verticillasters 2 to 6-flowered; lower corolla lips 6-10 mm long, style glabrous.....*S. crucis*

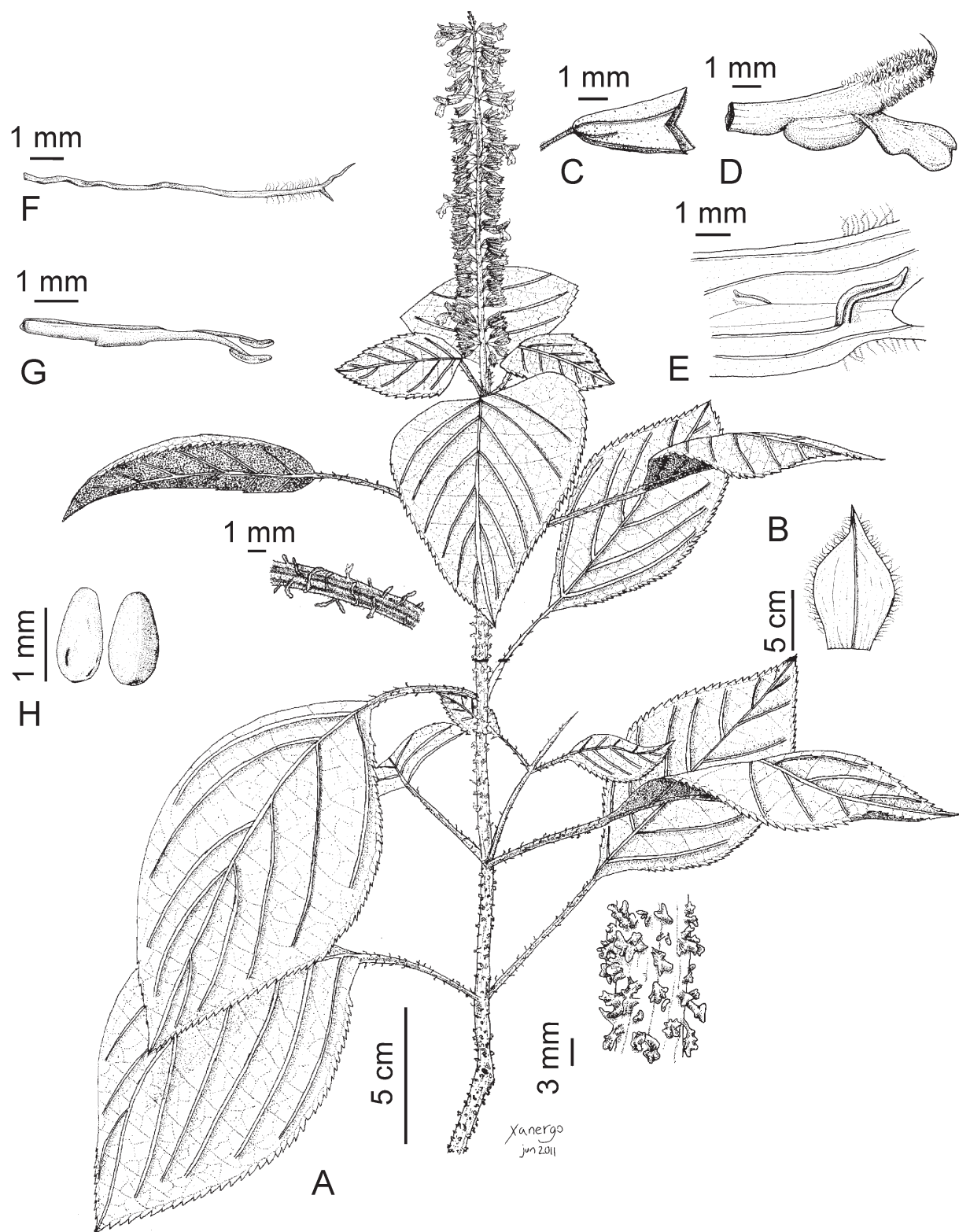


Figure 3. *Salvia ibugana* J. G. González. A, general aspect with petiole and stem showing the digitiform or lichenoid papillae; B, floral bract; C, calyx; D, corolla; E, corolla dissection showing the filament toward the throat and staminode above and behind the insertion point of the filament to the corolla tube; F, style; G, connectives and thecae; H, nutlets (drawn from the holotype).

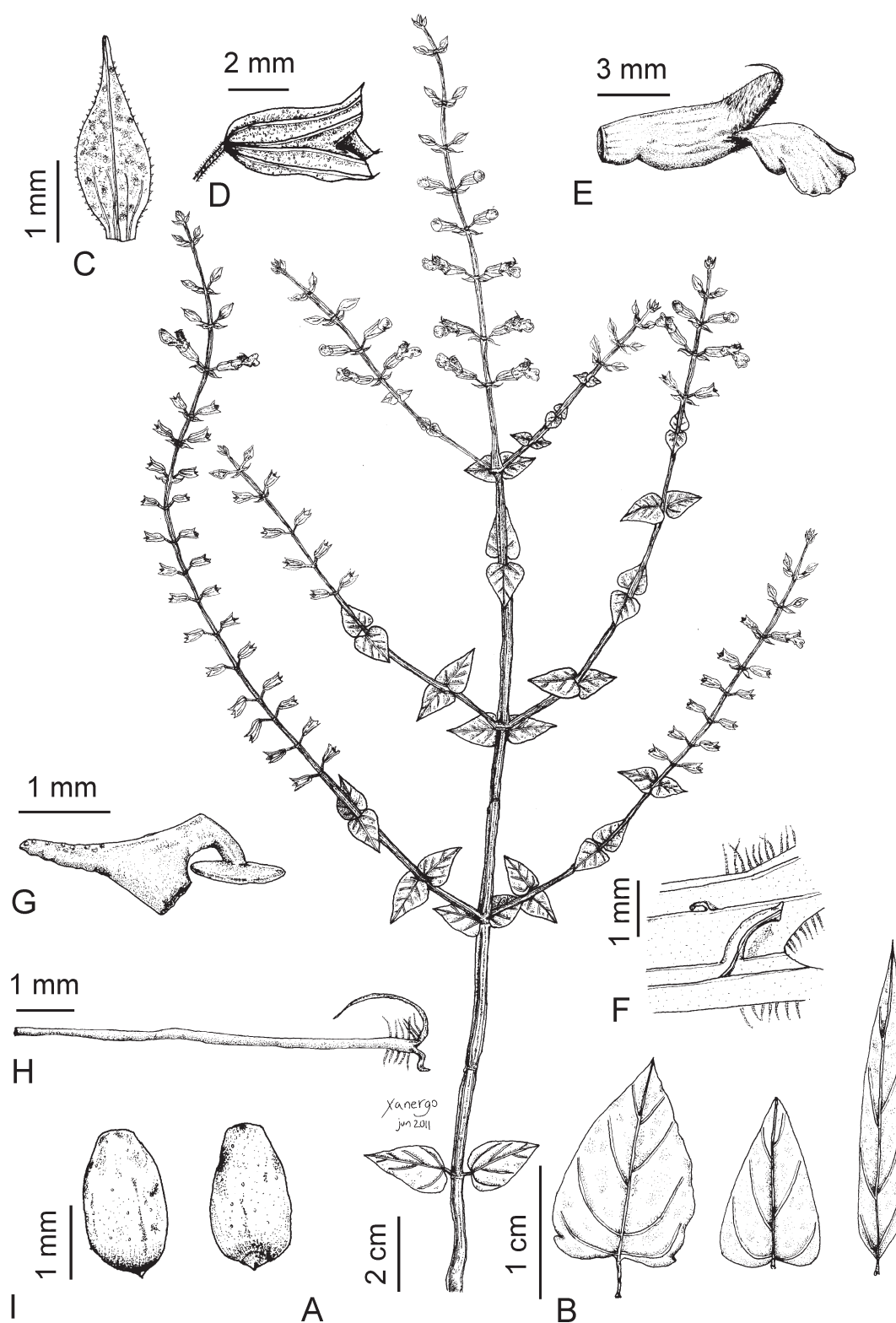


Figure 4. *Salvia ramirezii* J. G. González. A, general aspect; B, leaves; C, floral bract; D, calyx; E, corolla; F, corolla dissection showing the filament toward the throat and the staminode above and behind the insertion point of the filament to the corolla tube; G, stamen; H, style; I, nutlets (drawn from the holotype and Ramírez *et al.* 5212).

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