



## *Salvia cacomensis* (Lamiaceae), a new species from Jalisco, Mexico

### *Salvia cacomensis* (Lamiaceae), una nueva especie de Jalisco, México

Jesús Guadalupe González-Gallegos<sup>1✉</sup>, José Guadalupe Morales-Arias<sup>2</sup> and José Luis Rodríguez-Hernández<sup>2</sup>

<sup>1</sup>Herbario Luz María Villarreal de Puga (IBUG), Instituto de Botánica, Departamento de Botánica y Zoología, Universidad de Guadalajara-CUCBA, km 15.5 carretera Guadalajara-Nogales, Las Agujas, Nextipac, Zapopan, 45110, Jalisco, México.

<sup>2</sup>Instituto Manantlán de Ecología y Conservación de la Biodiversidad, Universidad de Guadalajara-CUCSUR, Av. Independencia Nacional 151, 48900 Autlán de Navarro, Jalisco, México.

✉ xanergo@hotmail.com

**Abstract.** A new species from a botanically little known region of Jalisco, Mexico, is described and illustrated. The morphology of *Salvia cacomensis* J. G. González, J. Morales et J. Rodríguez is related to that of the species of sections *Briquetia* Epling and *Tubiflorae* (Epling) Epling of subgenus *Calosphace* (Benth.) Benth. The new taxon is distinguished by the combination of its essentially glabrous surface, the 2-flowered verticillasters, the pink to magenta corollas, and the particular dimensions of the floral bract, the calyx and the corolla.

Key words: endemic, Jalisco, *Salvia* section *Briquetia*, *S.* section *Tubiflorae*.

**Resumen.** Se describe e ilustra una especie nueva procedente de una región botánicamente poco conocida de Jalisco, México. La morfología de *Salvia cacomensis* J. G. González, J. Morales et J. Rodríguez está relacionada con aquella de las especies de las secciones *Briquetia* Epling y *Tubiflorae* (Epling) Epling del subgénero *Calosphace* (Benth.) Benth. El nuevo taxón se distingue por la combinación de su superficie esencialmente glabra, sus verticilastros bifloros, el color rosa o magenta de sus corolas y las dimensiones particulares de la bráctea floral, el cáliz y la corola.

Palabras clave: endémica, Jalisco, *Salvia* sección *Briquetia*, *S.* sección *Tubiflorae*.

### Introduction

*Salvia* L. includes at least 900 species worldwide, with main centers of diversity in SW Asia, Southern North, Central and South America (Harley et al., 2004); it is 1 of the 3 richest genera of vascular plants in Mexico with approximately 292 species in the country (Villaseñor, 2004), and at the same time one of the most poorly understood. In the last 3 decades, a new impulse in the study of Mexican sages has resulted in the description of several new taxa (Ramamoorthy, 1983, 1984a, 1984b, 1984c; Ramamoorthy and Lorence, 1987; Levin and Moran, 1989; Espejo and Ramamoorthy, 1993; Turner, 1995, 1996, Klitgaard, 2007; Turner, 2008a, 2008b, 2008c, 2009a, 2009b, 2010; Bedolla et al., 2011; Martínez-Gordillo and Lozada-Pérez, 2011; Turner, 2011). However these efforts have been insufficient, because there are still new taxa to be described and some species that need to be reevaluated.

While conducting floristic research, Morales and Rodríguez discovered an interesting population of *Salvia* at Villas de Cacoma, Jalisco, Mexico, one of the least

botanically explored areas of Western Mexico. We tried to identify the specimens using the publications of Epling and coworkers (1939, 1940, 1941, 1944, 1947, 1951; Epling and Mathias, 1957; Epling and Játiva, 1966), and those papers highlighted in the last paragraph, where new taxa were recently described. We have examined, since September 2008 to September 2011, *Salvia* collections from large and relatively small Mexican herbaria, according to the number of specimens that they harbor. In small herbaria (CIIDIR, CHAPA, CREG, GUADA, HEM, HUMO, OAX, SERO, USON, UAGC, ZEA, XALU), we examined the entire collections of *Salvia* including those specimens not yet identified. In large herbaria (ENCB, IEB, MEXU, XAL), we restricted the revision to specimens collected in Jalisco, those belonging to the sections related to the *Salvia* found at Cacoma (*Briquetia* Epling and *Tubiflorae* (Epling) Epling), and non-identified specimens. In both cases the specimens examined were photographed. All *Salvia* specimens from IBUG herbarium were also examined. We analyzed the type specimens of the species in sections *Briquetia* and *Tubiflorae* through a collection of digital photographs obtained from the web pages of the following herbaria: K, LD, LL, MA, MICH, MO, NY, UC, US, WU. As a result of the revision of literature and examination of

herbarium specimens and photographs, the finding of Morales and Rodríguez could not be referred to any known species of *Salvia*. Here, we describe it as a new taxon related to the sections *Briquetia* and *Tubiflorae* of subgenus *Calosphace* (Benth.) Benth.

## Description

*Salvia cacomensis* J. G. González, J. Morales et J. Rodríguez, sp. nov. (Figs. 1, 2).

Type: **Mexico**, Jalisco: municipio de Villa de Purificación, Villas de Cacoma, 19°49'53" N, 104°31'57" O, 1 360 m alt., 26 Aug. 2010 (fl, fr), *J. L. Rodríguez, J. G. Morales and M. G. Gama 340* (holotype: ZEA; isotypes: IBUG, MEXU).

*S. venulosae* similis sed petiolibus (0.9)1.2-1.9(2.2) mm longis, floribus 2 in verticillastris, bracteis floralibus 7.5-9 x 3.5-4 mm, pedicellis 4-5 mm longis, calycibus sine pilis glandularibus et 5 venis in labio superiore calycum.

Perennial suffrutex up to 2 m tall, erect, stems essentially glabrous. Petioles (9-)1.2-1.9(-2.2) cm long, diffusely covered by simple multicellular hairs with dark-red septa; blades elliptic-lanceolate to lanceolate, 5.5-8.5 cm long, (2-)2.5-3.5 cm wide, cuneate to short cuneate and sometimes oblique at the base, acuminate to long-acuminate at the apex, margin serrate and sparsely bordered by simple multicellular hairs with dark-red septa, green and glabrous above, glaucous and glabrous beneath, only with the main vein covered with simple multicellular hairs. Inflorescence (8-)11-18 cm long, nodes 0.5-1 cm apart toward the base, 9 to 19 verticillasters at each floral axis, the verticillasters 2-flowered, floral axis purplish red, glabrous. Floral bracts narrow ovate to oblanceolate, 7.5-9 x 3.5-4 mm, purplish red, caudate at the apex, attenuate and truncate at the base, the margin entire and bordered with hairs similar to those of the blade margin, the rest glabrous, foliose, veins not visible, deciduous. Pedicels 1.5-2.5(-3) mm long, moderately covered with simple multicellular hairs with dark-red septa. Calyces 7-13 mm long, 2.5-3 mm wide at the throat, upper lip 3-veined, margin of the throat covered with tiny conical hairs and with some simple hairs at the apex of the upper lip, the rest glabrous, purplish red throughout its surface, the lobes acute, the upper one entire. Corolla pink to magenta, covered with long flexible, simple hairs with dark-red septa, these concentrated mainly on the lips; tube 15-17 mm long, (3-)4-5 mm wide at its widest portion, ventricose, not invaginated at the base, internally naked (epapillate); upper lip 6-6.5 mm long, lower one 5-6(-6.5) mm long, 1.4-1.6(-1.8) mm wide. Stamens included; filaments 1.5-1.6(-2.3) mm long; connective 1-1.1 cm long, with an acute little tooth just after the insertion with

the filament; theca 0.6-1 mm long; a pair of staminodes present above and behind the insertion point of the filament to the corolla tube. Gynobasic horn 0.3-0.4 mm long; style 2-2.1 cm long, pilose at the apex, branches slightly exerted, the upper one longer and arcuate. Nutlets ovate, 0.8-1.2 mm long, 0.5-0.7 mm wide, light brown, and dark brown marbled, surface smooth and sparsely covered with whitish flexible hairs at the base on immature nutlets.

## Taxonomic summary

*Distribution, habitat and phenology.* *Salvia cacomensis* is, to our knowledge, an endemic species restricted to 1 locality on the Pacific slope of the Sierra de Cacoma, Jalisco, Mexico. It is locally scarce. It inhabits montane cloud forest with *Quercus* L., *Sebastiania* Spreng., *Ficus* L., *Clusia* L. and *Fuchsia* L., at 1 300-1 400 m. It flowers and fructifies in August (- September).

*Etymology.* The specific epithet of this taxon refers to the area that embraces its distribution, the Sierra de Cacoma, Jalisco, Mexico.

*Remarks.* There are 2 *Salvia* subgenus *Calosphace* sections with species morphologically similar to the new taxon: *Tubiflorae* and *Briquetia*. *S. cacomensis* fits well with every character of the species in *Tubiflorae*: shrubs or subshrubs, blades ovate, acuminate at the apex, rounded to attenuated at the base, (2-)6 to 12-flowered verticillasters, bracts deciduous, 3-veined upper lips of the calyces or sometimes 5-veined, pink to magenta corollas, epapillate corolla tubes, upper corolla lips longer than the lower ones, connectives entire or toothed and styles pilose. Among the species of *Tubiflorae*, *S. tubifera* Cav. and *S. venulosa* Epling are the morphologically closest relatives. The first one differs in having ovate, rounded at the base blades, (0.5-)1-3.3(-7) cm long petioles, lower blade surface slightly white pubescent, 6 to 8-flowered verticillasters, 3.5-5(-8) mm long pedicels, short glandular-capitate hairs on the calyces, 24-25 mm long corolla tubes, (1.8-)2-2.6 cm long connectives, 1.8-1.9 mm long nutlets (table 1). The second one can be distinguished by its 5-10 mm long petioles, lower blade surface with purplish reticulate prominent veins, 2-6-flowered verticillasters, 2-3 x 2-2.5 mm floral bracts, 4-5 mm long pedicels, 5-veined upper lip of the calyces and those covered with capitate glandular hairs (table 1). All characters in the species of *Briquetia* also matches with the characters in the new taxon: thick herbs, blades acuminate at the apex and rounded to attenuate at the base (sometimes truncate or cordate), 3-veined upper lips of the calyces, dark blue corollas, corolla tubes ventricose, invaginated at the base, and internally epapillate, connectives entire or toothed, and styles pilose; excluding the color of the corolla (purple vs. magenta or

**Table 1.** Comparison of characters between *S. cacomensis* and morphologically similar species

<i>Character</i>	<i>S. cacomensis</i>	<i>S. venulosa</i>	<i>S. tubifera</i>	<i>S. mexicana</i>
HABIT	Suffrutex up to 2 m tall	Decumbent suffrutex up to 1.5 m tall	Perennial herb up to 2 m tall	Perennial herb to shrub up to 3 m tall
LEAVES				
Petiole length (cm)	(0.9-)1.2-1.9(-2.2)	0.5-1	(0.5-)1-3.3(-7)	1-10
Blade shape	Elliptic-lanceolate to lanceolate	Narrowly ovate to ovate-elliptic	Widely ovate (rarely orbicular)	Rhomboid-ovate to ovate
Blade size (cm)	5.5-8.5 × (2-)2.5-3.5	6-9.6 × 3-4	5-16 × 4-11	6-18 × 2.5-12
Shape of the leaf base	Cuneate to short cuneate and sometimes oblique	Cuneate to attenuate	Cuneate to attenuate and sometimes oblique	Long attenuate, cuneate, subcordate to rarely rounded
Shape of the leaf apex	Acuminate to long-acuminate	Acute to acuminate	Acute to shortly acuminate	Acute to acuminate
Shape of leaf margin	Serrate	Crenate-serrate	Crenate-serrate	Crenate-serrate
INFLORESCENCE				
Length (cm)	(8-)11-18	5-15	8-13(-18)	30-50
Distance between the lowermost nodes (cm)	0.5-1	1-1.5(-2)	1-2.7	1-3
Number of verticillasters	9-19	7-10	7-13	(8-)10-20
Flowers per verticillaster	2	2-6	6-8	(8-)10-12(-20)
FLORAL BRACTS				
Shape	Narrow ovate to oblanceolate	Ovate	Lanceolate to ovate	Ovate
Size (mm)	7.5-9 × 3.5-4	2-3 × 2-2.5	9-12 × 4-4.5	6-12 × 3-5
Apex shape	Caudate	Acuminate to caudate	Caudate	Acuminate
Base shape	Truncate	Truncate	Truncate	Truncate
Duration	Deciduous	Deciduous	Deciduous	Deciduous
PEDICEL				
Length	1.5-2.5(-3)	4-5	3.5-5(-8)	3-20
CALYCES				
Size (mm)	7-13 × 2.5-3	8-9.3 × 4-5.5	(6.5-)8-11 × 3.4-5	8-17(-20) × 3-5
Number of Veins in the upper lip	3	5	3	3
Pubescence	Glabrous	Glandular-capitate	Pilose and with short glandular-capitate hairs	Pilose, mainly on the veins
COROLLA				
Color	Pink to magenta	Wine-red	Red to magenta	Dark blue to purple
Tube size (cm)	1.5-1.7 × (0.3-)0.4-0.45	1.5-1.8 × 0.4-0.5	(1.8-)2.1-2.5 × 0.4-0.5	1.5-2.5 × 0.5-0.7
Length of the upper lip	6-6.5	6-6.5	5-8	12-16
Length of the lower lip	5-6(-6.5)	5.5-6.3	2.5-5(-6)	12-16
NUTLETS				
Shape	Ovate	Not seen	Ovate	Ovate
Size (mm)	0.8-1.2 × 0.5-0.7	Not seen	1.8-1.9 × 1-1.2	2.6-3 × 1.8-1.9

**Table 1.** Continues

Character	<i>S. cacomensis</i>	<i>S. venulosa</i>	<i>S. tubifera</i>	<i>S. mexicana</i>
ALTITUDINAL RANGE (m)	1 300-1 400	1 500-2 000	(1 900-) 2 400-2 800 (-3 000)	(850-) 1 400-2 200 (-2 900)
HABITAT	Montane cloud forest	Sub-Andean cloud forest	Montane cloud forest	Oak, pine-oak, montane cloud and in tropical deciduous forests
DISTRIBUTION	Villas de Cacoma, Jalisco, Mexico	Western and Central Cordillera, Risaralda and Antioquia, Colombia	Highlands from Belize, Guatemala and Mexico	Widely distributed in Mexico

**Figure 1.** *Salvia cacomensis* J. G. González, J. Morales et J. Rodríguez. General appearance (drawn from the holotype).

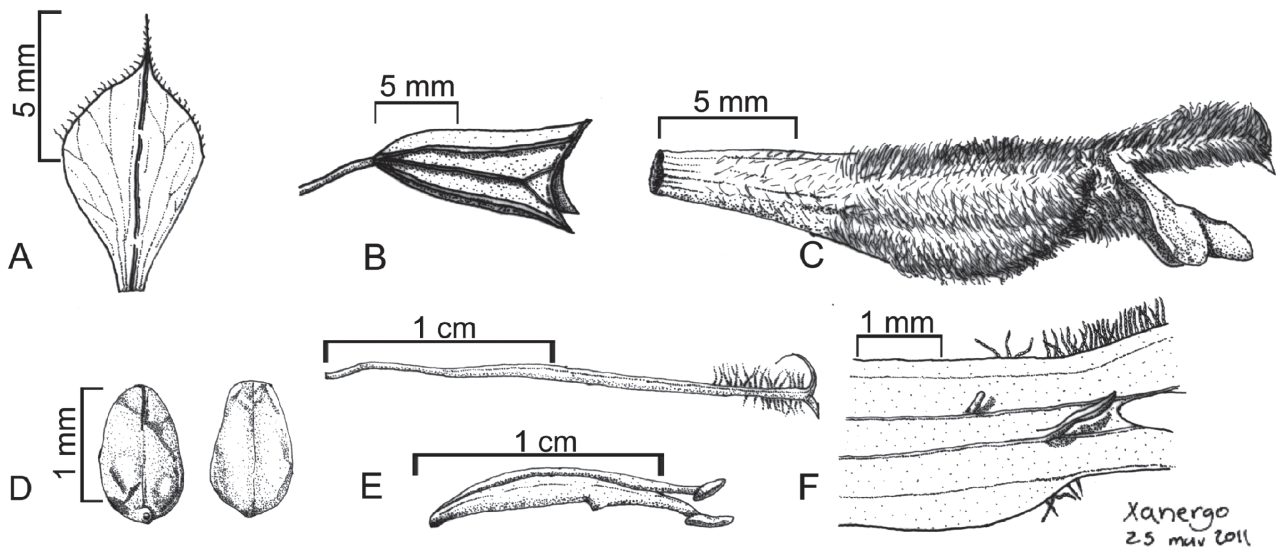
pink magenta in *S. cacomensis*) and the invagination at the base of the corolla tube. However, there is a member of *Briquetia* which does not present invaginated corollas at the base, *S. ecuadorensis* Briq; and other one, which very rarely can exhibit magenta corollas, *S. mexicana* L. *S. cacomensis* differs from the rest of the species of section *Briquetia* because of its 2-flowered verticillasters (vs. 3-12-flowered), magenta or magenta-pink corollas (vs. purple ones), the length of the calyx (7-13 mm vs.

(7-)12-15 m) and corolla tube (15-17 mm vs. (11-)15-25 mm).

*Salvia cacomensis* can be distinguished by the combination of its 0.5-1 cm long petioles, elliptic-lanceolate to lanceolate blades with short to short cuneate, sometimes oblique bases and acuminate to long-acuminate apices, 2-flowered verticillasters, 7.5-9 mm long floral bracts, calyces without glandular capitate hairs, 3-veined upper lips of the calyces, pink to magenta corollas, with the lower lip as long as the upper one and straight.

In the region where *S. cacomensis* inhabits (Jalisco), only 2 members of section *Tubiflorae* (*S. pringlei* B. L. Rob. and Greenm. and *S. tubifera*), and only 1 of section *Briquetia* (*S. mexicana*) are found. None of them share habitat with *S. cacomensis*. *Salvia pringlei* inhabits tropical lowlands, from 400-920 m altitude. It can be found near the coast of Jalisco, Nayarit and Sinaloa, and in an area of the Barranca del Río Santiago in Jalisco and Nayarit. *Salvia tubifera* has an affinity for a colder and wetter habitat. It grows in high montane cloud forests mainly from 2 400-2 800 m altitude (Table 1). In Jalisco, this species is only known from Cerro Viejo, North of Lago de Chapala. In contrast, *S. mexicana* can occupy oak, pine-oak, montane cloud and even tropical deciduous forests, from 850-2 900 m altitude in a wide area of Jalisco. *Salvia venulosa*, which is the morphologically most similar species to *S. cacomensis* inhabits also cloud forests and exhibits a narrow geographical range; however, this species grows in Colombia at a distance of 3 500 km from Cacoma, Jalisco (Table 1).

As we can conclude from the above mentioned, the affinity between *S. cacomensis* with either of the 2 sections alluded is not clear. Therefore, we prefer not to assign it to either of them, and wait for new evidence and a new more natural classification than that proposed by Epling and coworkers (1939, 1940, 1941, 1944, 1947, 1951; Epling and Mathias, 1957; Epling and Játiva, 1966).



**Figure 2.** *Salvia cacomensis* J. G. González, J. Morales et J. Rodríguez. A, floral bract; B, calyx; C, corolla; D, nutlets, ventral (left) and dorsal (right) views; E, style (up) and stamens (down); F, corolla dissection showing the filament (right) and the staminode (left) (drawn from the holotype).

**Key for *Salvia cacomensis* and closest morphologically relatives**

- 1a Corolla dark blue to purple .....*S. mexicana*
- 1b Corolla pink to magenta.....2
- 2a Lower corolla lip shorter than the upper one and bent backward.....*S. tubifera*
- 2b Lower corolla lip as long as the upper one and straight, directed forward.....3
- 3a Petioles 0.5-1 cm long; blades narrowly ovate to ovate-elliptic, long attenuate at the base; verticillasters 2 to 6-flowered; floral bract 2-3 mm long; calyces with glandular capitate hairs, the upper lip 5-veined. Endemic to Western and Central Cordillera, Risaralda and Antioquia, Colombia .....*S. venulosa*
- 3b Petioles (9-)1.2-1.9(-2.2) cm long; blades elliptic-lanceolate to lanceolate, cuneate to short cuneate at base (sometimes oblique) verticillasters 2-flowered; floral bract 7.5-9 mm long; calyces without glandular capitate hairs, the upper lip 3-veined. Endemic to Sierra de Cacoma, Jalisco, Mexico.....*S. cacomensis*

**Acknowledgments**

We thank the curators and colleagues from the following herbaria, who kindly gave permission and helped us with the examination of herbarium specimens: CHAPA, CIIDIR, CREG, ENCB, GUADA, HUMO, IBUG, IEB, HEM, MEXU, OAX, SERO, UAGC, USON, XAL, XALU, and ZEA. We also thank the authorities of K, LD, LL, MA, MICH, MO, NY, UC, US, and WU, who provided online photographs of type specimens harbored in their collections through their herbaria web pages. Robin Middleton reviewed and helped to improve the writing and spelling of the document. The latin specialist, Juan Acosta Aguilar, improved our diagnoses. Economic support was provided by Consejo Nacional de Ciencia y Tecnología (CONACYT) and the Universidad de Guadalajara.

**Literature cited**

Bedolla-García, B. Y., S. I. Lara-Cabrera and S. Zamudio. 2011. Dos nuevas especies de *Salvia* (Lamiaceae) del Centro Occidente de México. *Acta Botanica Mexicana* 95:51-63.

Epling, C. 1939. A revision of *Salvia* subgenus *Calosphace*. *Feddes Repertorium Specierum Novarum Regni Vegetabilis*, Beihefte 110:1-383.

Epling, C. 1940. Supplementary notes on American Labiatae. *Bulletin of the Torrey Botanical Club* 67:509-534.

Epling, C. 1941. Supplementary notes on American Labiatae—II. *Bulletin of the Torrey Botanical Club* 68:552-568.

Epling, C. 1944. Supplementary notes on American Labiatae—III. *Bulletin of the Torrey Botanical Club* 71:484-497.

Epling, C. 1947. Supplementary notes on American Labiatae—IV. *Bulletin of the Torrey Botanical Club* 74:512-518.

Epling, C. 1951. Supplementary notes on American Labiatae—V.

- Brittonia 7:129-142.
- Epling, C. and C. Játiva. 1966. Supplementary notes on American Labiatae—IX. Brittonia 18:255-265.
- Epling, C. and M. E. Mathias. 1957. Supplementary notes on American Labiatae—VI. Brittonia 8:297-313.
- Espejo S., A. and T. P. Ramamoorthy. 1993. Revisión taxonómica de *Salvia* sección *Sigmoideae* (Lamiaceae). Acta Botanica Mexicana 23:65-102.
- Harley, R. M., S. Atkins, A. L. Budantsev, P. D. Cantino, B. J. Conn, R. Grayer, M. M. Harley, R. de Kok, T. Krestovskaja, R. Morales, A. J. Paton, O. Ryding and Upson. 2004. Labiatae. In The Families and Genera of Vascular Plants VII. Flowering Plants. Dicotyledons. Lamiales (except *Acanthaceae* including *Avicenniaceae*), J. W. Kadereit (ed.). Springer, Berlin. p. 167-275.
- Klitgaard, B. B. 2007. Three new species in *Salvia* subgenus *Calosphace* (Lamiaceae) from Mesoamerica. Novon 17:206-211.
- Levin, G. A. and R. Moran. 1989. The vascular flora of Isla Socorro. Memoirs of the San Diego Society of Natural History 16:5-71.
- Martínez-Gordillo, M. and L. Lozada-Pérez. 2011. Una nueva especie de *Salvia* (Lamiaceae) de Guerrero, México. Brittonia 63:211-214.
- Ramamoorthy, T. P. 1983. Two new species in Lamiaceae from Mexico. Anales del Instituto de Biología de la Universidad Nacional Autónoma de México. Serie Botánica 54:157-158.
- Ramamoorthy, T. P. 1984a. A new species of *Salvia* (Lamiaceae) from Mexico. Brittonia 36:297-299.
- Ramamoorthy, T. P. 1984b. A new species of *Salvia* (Lamiaceae) from the Sierra de los Tuxtlas, Mexico. Plant Systematics and Evolution 146:141-143.
- Ramamoorthy, T. P. 1984c. Notes on *Salvia* (Labiatae) in Mexico with three new species. Journal of the Arnold Arboretum 65:135-142.
- Ramamoorthy, T. P. and D. H. Lorence. 1987. Species vicariance in the Mexican flora and description of a new species of *Salvia* (Lamiaceae). Bulletin du Muséum National d'Histoire Naturelle. Section B, Adansonia: Botanique Phytochimie 9:167-175.
- Turner, B. L. 1995. *Salvia booleana* (Lamiaceae), a new species from Northeastern Mexico. Phytologia 79:289-292.
- Turner, B. L. 1996. A new species of *Salvia* (sect. *Caducae*) from Guerrero, Mexico. Phytologia 81:329-332.
- Turner, B. L. 2008a. *Salvia acerifolia* (Lamiaceae), a new species from Michoacán, Mexico. Phytologia 90:138-140.
- Turner, B. L. 2008b. A new species of *Salvia* (Lamiaceae) from Guerrero, Mexico. Phytologia 90:141-143.
- Turner, B. L. 2008c. Recension of *Salvia* sect. *Farinaceae* (Lamiaceae). Phytologia 90:163-175.
- Turner, B. L. 2009a. Recension of the Mexican species of *Salvia* (Lamiaceae), section *Scorodonia*. Phytologia 91:256-269.
- Turner, B. L. 2009b. Recension of the Mexican species of section *Uliginosae* of *Salvia* (Lamiaceae). Phytologia 91:440-465.
- Turner, B. L. 2010. Recension of the Mexican species of *Salvia* (Lamiaceae), sect. *Peninsularis*. Phytologia 92:20-26.
- Turner, B. L. 2011. Recension of Mexican species of *Salvia* sect. *Standleyana* (Lamiaceae). Phytoneuron 23:1-6.
- Villaseñor, J. L. 2004. Los géneros de plantas vasculares de la flora de México. Boletín de la Sociedad Botánica de México 75:105-135.