



A new species of *Salvia* section *Uliginosae* (Lamiaceae), from Oaxaca, Mexico

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Abstract

A new species from Oaxaca is described and illustrated. *Salvia tetramerioides* belongs to section *Uliginosae* as it shares with the species of this section the presence of a 5-veined, 3-mucronate posterior calyx lobe and a laterally flattened style. However, the morphology of the inflorescence of the new species differs from all the previously described taxa in the section; although the vegetative morphology resembles that of *Salvia laevis*. The new species is distinguished by the dense inflorescence, the peduncle longer than the rachis and broadly ovate, persistent bracts, with decussate phyllotaxy and two flowers per node. A key is provided to distinguish it from the species of the section found in Oaxaca.

Key words: *Calosphace*, Tehuacán-Cuicatlán

Resumen

Una nueva especie de Oaxaca se describe e ilustra. *Salvia tetramerioides* pertenece a la sección *Uliginosae* porque comparte con las especies de este grupo la presencia del labio posterior del cáliz 5-venado, 3-mucronado y un estilo lateralmente aplastado. Sin embargo, la morfología de la inflorescencia de la nueva especie difiere de todos los taxa previamente descritos en la sección, aunque la morfología vegetativa se asemeja a *Salvia laevis*. La especie nueva se distingue por la inflorescencia densa, con el pedúnculo más largo que el raquis y brácteas ampliamente ovadas, persistentes con filotaxia decusada y dos flores por nudo. Se presenta una clave para distinguirla de las especies de la sección que se encuentran en Oaxaca.

Introduction

Salvia Linnaeus (1753: 23) is the most diverse group of Lamiaceae, a family with a cosmopolitan distribution (Harley *et al.* 2004). The most outstanding feature of the genus is the 2-stamen androecium with an elongated connective. Generally, the posterior branch of the connective (regarding the filament) is modified into a structure that is involved in pollen deposition on the pollinator (Claßen-Bockhoff *et al.* 2003). Due to the singularity of the masculine structure the genus has been considered monophyletic, with four subgenera: *Salvia* Bentham (1876: 1195), *Leonia* Bentham (1876: 1196), *Sclarea* Bentham (1876: 1195) and *Calosphace* Bentham (1833: 198). However, molecular studies (Walker *et al.* 2004, Walker & Sytsma 2007) recovered *Salvia* as paraphyletic, which implies that the modification of the androecium has arisen independently at least three times during the evolution of the group (Walker *et al.* 2004). *Salvia* subgenus *Calosphace* is distributed exclusively in America, although some of its species have been naturalized in other parts of the world. *Calosphace* is a group with about 600 species (Santos 1995), more than 50% of them are distributed in México and 75.5% of the Mexican *Calosphace* are endemic to the country, where they thrive mainly in montane forests (Martínez-Gordillo *et al.* 2013). Oaxaca is the state with the greatest biological diversity in Mexico due to its latitudinal position and the uneven orography of its territory, which provides a great diversity of microenvironments (García-Mendoza 2011). In this state, at least 84 species of *Salvia* can be found (García-Peña &

Medina 2011), nine of which belong to the section *Uliginosae* (Epling) Epling (1939: 54). This section includes 28 Mexican species (Turner 2009) that are mostly herbs, with the posterior lobe of the calyx 3-mucronate, 5–7-veined, blue corollas, a more or less deltoid, geniculate gubernaculum and a flattened pubescent style, widened at apex (Epling 1939). Among the collections made for the Tehuacán-Cuicatlán Flora project, which includes parts of the states of Puebla and Oaxaca, some unidentified specimens were determined as members of *Salvia* sect *Uliginosae* based on morphological characters, but could not be referred to any of the current species in that group. Hence, this taxon is distinguished as a new species and differs from the other species of *Uliginosae* by the presence of a dense and compact inflorescence, with a peduncle longer than the rachis, and persistent, broadly ovate bracts [decussate, resembling those of the genus *Tetramerium* Nees (1844: 147; Acanthaceae)], and a blue corolla with the inferior lobe at least three times longer than the posterior lobe.

Taxonomy

Salvia tetramerioides Mart.Gord., Fragoso & García-Peña, *sp. nov.* (Fig. 1)

Species insignis inflorescentiis suis a speciebus nobis notis bene distincta; differt pedunculis 4.2–10 cm longis, rhachidibus 0.6–1.9 cm longis, bracteis decussatis ample ovatis, ciliatis, floribus duobus per nodum, corollarum labio antico 2.2–3.4 mm, labio postico 8.4–8.9 mm.

Type:—MEXICO. Oaxaca: Zapoquila, Montaña Verde, ladera sur del Cerro Chicamole, norte de Guadalupe Membrillos, 1 October 2001, Tenorio & Kelly 21182 (Holotype MEXU!).

Annual herbs, erect stem, 30–40 cm tall, slightly branched; stems pilose with multicellular trichomes. Leaf blades triangular-lanceolate to lanceolate, 1.7–3.5 × 0.8–1.4 cm, apex acute, margin serrate, base cuneate, upper surface hirsute, lower surface pubescent with appressed hairs, mostly on the nerves, brown spherical glands; petioles 0.1–0.8 cm long. Inflorescences terminal, spiciform, dense, 10.2–14 cm long; peduncle (4.2–) 9.5–10 cm long; rachis (0.6–) 0.8–1.9 cm; occasionally in the mature inflorescence the proximal nodes 0.6–1.1 cm apart. Bracts persistent, two per node, 5–9.1 × 4.1–6.9 mm, decussate, widely ovate, upper and lower surfaces glabrous, apex caudate, margin entire, densely ciliate with multicellular trichomes, 1–1.5 mm long, base cuneate, purple. Flowers 2 per node; pedicel 1 mm long or less, erect, hirsute. Calyx bilabiate, green, tube 4–5.6 mm long, pilose with appressed hairs, mostly on the nerves, glabrous within; posterior lip 2–3 mm long, 5-veined, 3-mucronate, the middle tooth longer than the laterals, margin ciliate; anterior lip 2 mm long, shorter than the posterior, apex acuminate, margin ciliate. Corolla lilac or blue, tube 3.9–5.3 mm long, straight, the same size or slightly longer than the calyx tube; posterior lip 2.2–3.4 mm long, hirsute, with brown spherical glands, anterior lip 8.4–8.9 mm long, trilobate at the apex, extended. Stamens included in the posterior lip, filament and connective 1.7–2.6 mm long, connective geniculate, with a dorsal tooth near the joint with the filament, ventral surface of the gubernaculum with minute trichomes, geniculum lobate at the apex; filament ending in a tooth; thecae 1.2–1.5 mm long. Nectary horn shorter than the mericarps; style bilobate, 6.4–6.9 mm long, dorsally pubescent, posterior branch at least three times longer than the anterior branch, the anterior branch short and laterally flattened. Mericarps ovoid, 1.6 × 0.9 mm, smooth, brown.

Distribution, habitat and phenology:—*Salvia tetramerioides* is endemic to Zapoquila, in Oaxaca. It has been collected in oak forests and mixed *Quercus-Juniperus* forests at 2000 to 2310 m elevation. Flowering and fruiting from September to November.

Etymology:—*tetramerioides* denotes the morphological similarity of the inflorescences of the new *Salvia* species to the inflorescences of the species of *Tetramerium* from the Acanthaceae family.

Discussion:— The most notorious feature of the new species are the broadly ovate floral bracts in a congested disposition, that resemble those of the species from section *Membranaceae* (Bentham) Epling (1939: 143), which are reniform and persistent. Nevertheless, when examined in detail, it is noted that the new species has characteristics that are not found in the species of section *Membranaceae*, such as the posterior lip of the calyx 3-mucronate and a laterally flattened style; this combination of characteristics are distinctive of the taxa from section *Uliginosae*. Some of the most important characters that were used for species identification in this section are the habit of the plant and the presence of subterranean structures for perennation. Within section *Uliginosae* two series were recognized by Epling (1939), the first one comprises species with ovate or obovate leaf blades and petioles shorter than 1 cm long; on the other hand the other series contains species with deltoid, rhomboid or linear leaf blades and petioles of 0.8–2 cm long (Epling, 1939).

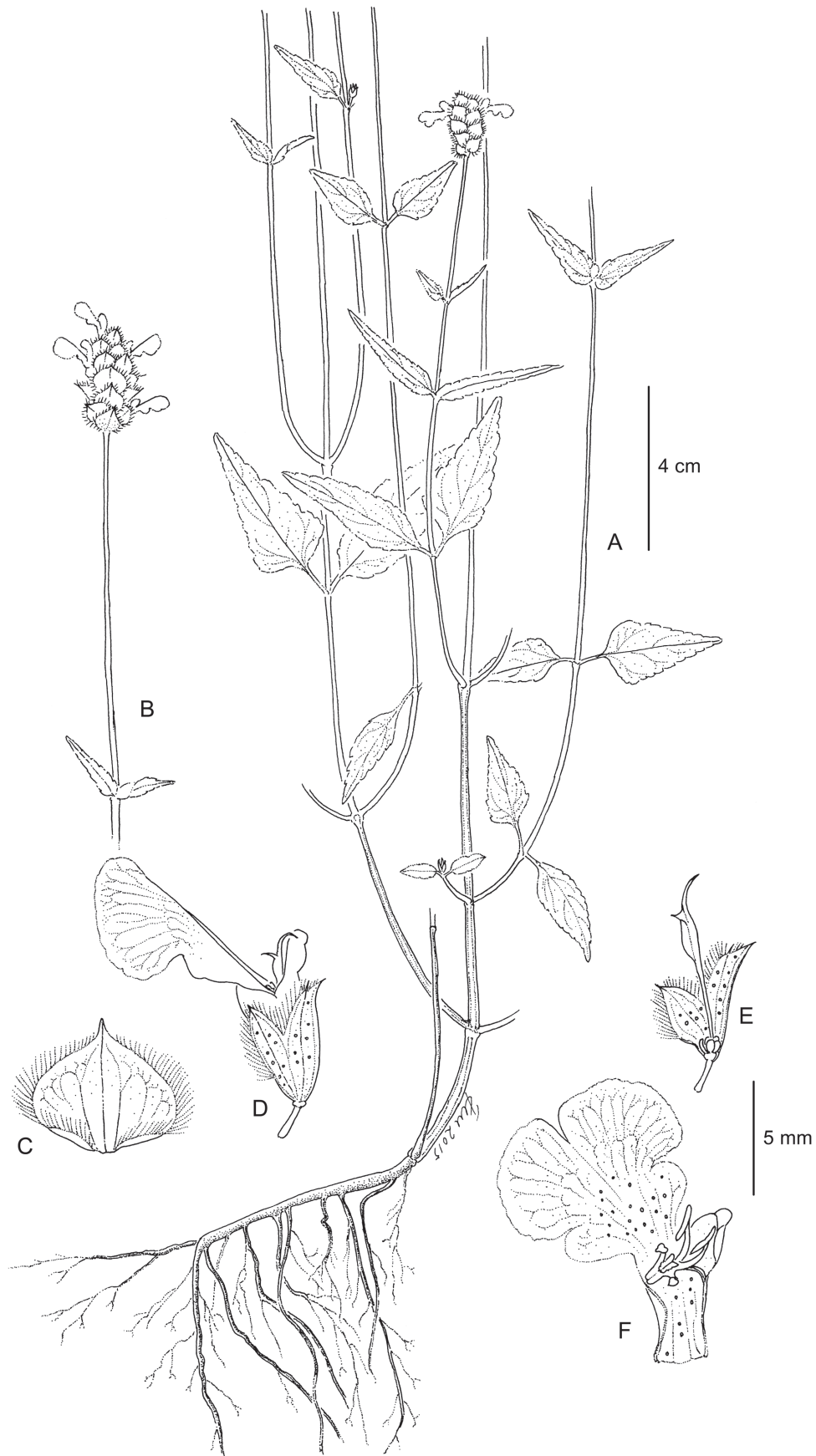


FIGURE 1. *Salvia tetramerioides*. A) Plant with branches and inflorescence. B) Inflorescence with peduncle. C) Bract. D) Lateral view of the flower. E) Dissected calyx with style, gynobase and nectary horn. F) Dissected corolla with gubernaculum and staminodes. Illustration drawn from *Tenorio et al. 18100 (MEXU)* by Ramiro Cruz Durán.

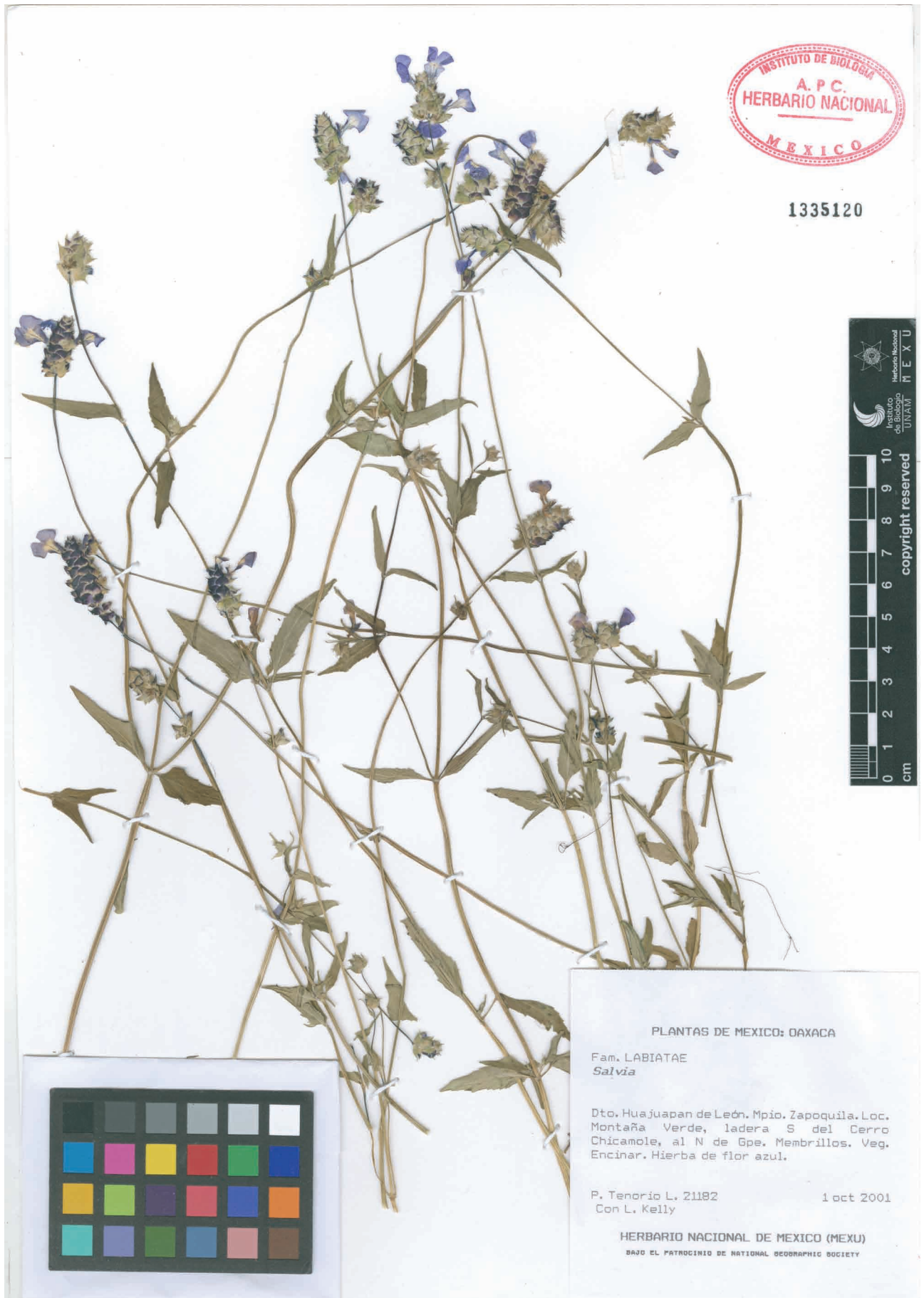


FIGURE 2. *Salvia tetramerioides*, scanned image of the holotype at the MEXU herbarium.

TABLE 1. Comparative table between *Salvia tetramerioides* and four morphologically similar species of section *Uliginosae*.

Character	<i>S. tetramerioides</i>	<i>S. pusilla</i>	<i>S. laevis</i>	<i>S. setulosa</i>	<i>S. prunelloides</i>
Life form	herb	herb	herb	suffruticose	herb
Stem	erect	prostrate	erect	erect	procumbent
Duration	annual	perennial	perennial	perennial	perennial
Plant size (m)	0.3–0.4	0.15–0.35	0.1–0.5	0.3–1	0.3
Underground perennation structures	absent	present	present	unreported	present
Pubescence on the stem surface	pubescent	setose	glabrous	setose	pubescent
Glandular trichomes on the stem surface	absent	present	absent	absent	absent
LEAF					
Size (cm)	1.7–3.5 × 0.8–1.4	0.8–1.5 × 1	4–8 × 0.2–1.2	2–5 × 1–3	2–8 × 1–3.5
Shape	triangular-lanceolate	deltate-ovate	lanceolate or linear	deltate-ovate	rhombic
Apex	acute	acute	acute	obtuse	obtuse
Margin	serrate	crenulate	serrulate	crenate-serrate	crenate-serrate
Base	cuneate	cuneate	attenuate	truncate-cuneate	cuneate
Pubescence in the upper surface	hirsute	pubescent	glabrous	pubescent	pubescent
Pubescence in the lower surface	pubescent	pubescent	glabrous	glabrescent	pubescent
Petiole length (cm)	0.1–0.8	0.3–0.7	0–0.3	0.05–0.2	0.05–0.15
INFLORESCENCE					
Peduncle size (cm)	4.2–10	2.6–8.2	6.6–16.4	3.5–10.5	6.5–9.8
Length (cm)	10.2–14	4.5–8.6	9.2–21.2	12.2–25.6	12.5–16
Distance between nodes (cm)	0.6–1.1	0.5–2.8	1.7–4.2	0.5–3.6	0.2–2.5
Number of flowers per node	2	1–3	3	4–8	3–6
BRACT					
Length (mm)	5–9.1	2.1–3.6	8–12	1.6–6.5	4.5–9
Shape	broadly ovate	ovate	ovate	ovate	ovate
Duration	persistent	persistent	deciduous	late-falling	deciduous
Pubescence	glabrous	glabrescent	glabrous	glabrous	pubescent
Apex	caudate	acute	caudate	caudate	acute
FLOWER					
Calyx length (mm)	4–5.6	3–5	5–6.5	6–10	5–8
Corolla color	blue or lilac	blue or purple	blue	blue	blue
Corolla tube length (mm)	3.9–5.3	3.5–4	5–7.5	6.5–8	6.5–8
Length of the posterior corolla lip (mm)	2.2–3.4	2.5–3	3–4.5	5–5.5	5–6
Length of the anterior corolla lip (mm)	8.4–8.9	4.5–5	8–10	7–8	10–13

Following these criteria, *Salvia tetramerioides* can be placed in the second series with *S. laevis* Benth (1833: 251), which shares with the new species the shape of the leaf blade. Albeit it differs from it mainly by being a perennial herb (vs. annual), with the presence of subterranean structures (vs. absence), 3 flowers per node (vs. 2 flowers per node) and caducous bracts when fruiting (vs. persistent bracts in fruiting) (Table 1). Other morphologically similar species to *S. tetramerioides* are: 1) *S. pusilla* Fernald (1900: 495), that shares the presence of bracts during fruiting but differs chiefly in characters such as the presence of subterranean perennation structures, glandular indumentum, and an acute bract apex (Table 1); 2) *S. setulosa* Fernald (1901:499) which occasionally presents bracts during fruiting but differs primarily in the presence of 3–8 flowers per node and a longer flower than the new species (Table 1); 3) *S. prunelloides* Kunth

(1818:289) that also shares the absence of glandular trichomes on the stem and pubescent lower surface of the blade; but can be differentiated by being an herbaceous perennial plant with rhomboid leaves and the presence of 3–6 flowers per node, with bracts absent during the fruiting stage (Table 1). In the phylogenetic tree obtained by Jenks *et al.* (2013) section *Uliginosae* is polyphyletic; hence, our decision of placing *S. tetramerioides* within this section is provisional, since it is evident that in the near future a complete reevaluation of Epling's sections (Epling 1939, 1940, 1941, 1944, 1947, 1951, Epling y Jativa 1966) will be a necessary to ease the study of this species-rich subgenus. A key is proposed here to distinguish it from the species of the sect. *Uliginosae* growing in Oaxaca.

Additional specimens examined:—MEXICO. Oaxaca: Zapotilla, La Zotolera, E de Guadalupe Membrillos, 2000 m, 4 November 1991, *Tenorio et al. 18100* (MEXU!); Guadalupe Membrillos, 2310 m, 18°1' N, 97°33' W, 10 September 2001, *Tenorio & Alvarado 20848* (MEXU!); Rincón del Capulín, entre los cerros Quiote Blanco y La Zotolera, SE de Guadalupe Membrillos, 1 October 2001, *Tenorio & Kelly 21136* (MEXU!).

Key to the species of *Salvia* subgenus *Calosphace* section *Uliginosae* from Oaxaca, México

1. Bracts persistent, 2 flowers per node..... *S. tetramerioides*
- Bracts early or lately deciduous, 3–6 flowers per node.....2
2. Plants mainly with basal leaves, broadly ovate.....*S. nana*
- Plants mainly with caulinar leaves with varied shapes but not broadly ovate.....3
3. Corolla tube 3.5–5 mm long, posterior lip up to 2.5 mm.....*S. pusilla*
- Corolla tube 6–8 mm long, posterior lip > 3 mm.....4
4. Leaves lanceolate, lower surface densely pubescent.....*S. textitlana*
- Leaves rhomboid, ovate, deltoid or deltoid-ovate, lower surface glabrescent, except in the veins.....5
5. Petiole 5–8 cm long, stems with appressed trichomes..... *S. tricuspidata*
- Petiole 0.5–3 cm long, stems with erect trichomes.....6
6. Stems with long glandular trichomes, both blade surfaces also with glandular trichomes..... *S. villosa*
- Stems with short or long trichomes, eglandular, both blade surfaces with eglandular trichomes.....7
7. Anterior corolla lip 10–13 mm long, blades rhomboid to narrowly ovate.....*S. prunelloides*
- Anterior corolla lip 7–8 mm long, blades deltate or deltate-ovate.....8
8. Bracts with the apex long-acuminate.....*S. setulosa*
- Bracts with the apex acute.....9
9. Blades with margins serrate-crenate; rhizomatous plants..... *S. oreopola*
- Blades with margins crenate; non-rhizomatous plants.....*S. glechomifolia*

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