

# *Salvia rupestris* (Lamiaceae), a new species endemic to Arapuá Mountain in Pernambuco State, Brazil

MICHELLE MOTA<sup>1</sup>, BRYAN T. DREW<sup>2</sup>, AND J. FLORIANO B. PASTORE<sup>3</sup>

<sup>1</sup> Programa de Pós-Graduação em Biologia de Fungos, Algas e Plantas, Universidade Federal de Santa Catarina, Centro de Ciências Biológicas, Trindade, Florianópolis, SC 88040-900, Brazil; e-mail: mcamota@outlook.com

<sup>2</sup> Department of Biology, University of Nebraska-Kearney, Kearney, NE 68849, USA

<sup>3</sup> Universidade Federal de Santa Catarina, Campus Curitibanos, Rodovia Ulisses Gaboardi, km 3, Curitibanos, Santa Catarina 89520-000, Brazil

---

**Abstract.** *Salvia rupestris* (Lamiaceae), from the Caatinga region of Pernambuco State, Brazil, is described and illustrated. Photos of the specimen dissected in stereo microscope and a distribution map are provided. The new species is compared to *S. fruticetorum*, a morphologically allied species.

**Keywords:** Caatinga, endemic species, South America, taxonomy.

**Resumen.** *Salvia rupestris* (Lamiaceae), da região da Caatinga no estado de Pernambuco, Brasil, é descrita e ilustrada. São fornecidas fotos do espécime dissecado em lupa estereoscópica e um mapa de distribuição. A nova espécie é comparada a *S. fruticetorum*, uma espécie morfologicamente aliada.

---

*Salvia* L. is a worldwide genus of nearly 1000 species with three main centers of diversity: Mexico and Central/South America, southwest Asia and the Mediterranean region, and eastern Asia (Walker et al., 2004). *Salvia* are of great economic importance as ornamentals, e.g., *S. splendens* Sellow ex Wied-Neuw., and aromatic herbs, e.g., *S. officinalis* L. (sage). The genus had been traditionally characterized by modified lever-like stamens, with a significant elongation of the connective tissue in the two expressed anthers. However, recent phylogenetic and taxonomic studies (e.g., Drew et al., 2017) suggest that *Salvia* should also include five other related genera in its delimitation, including *Rosmarinus* L., which has an elongated connective but does not have lever-like stamens. The mostly neotropical subgenus *Calosphace*, the most species-rich subgenus of *Salvia* with ca. 600 species (Jenks et al., 2012, Drew et al., 2017), has been shown to be monophyletic (Walker & Sytsma, 2007). In Brazil, the only comprehensive treatment of *Salvia* was conducted by Epling (1939), but several new species of Brazilian *Salvia* have subsequently been described (Harley, 1974; Santos, 1993, 1994;

Santos & Harley, 2004). *Salvia* is represented by 68 species in Brazil (BFG, 2018), with most species occurring in the Atlantic Forest biome. The two regions with the most species of *Salvia* in Brazil are the Serra da Mantiqueira range (Rio de Janeiro, São Paulo and Espírito Santo states) and the Serra Geral range (Southern region of Brazil). Conversely, only four species of *Salvia* occur in Northeast Brazil: *S. coccinea* Buc'hoz ex Etli., *S. farinacea* Benth. (cultivated), *S. fruticetorum* Benth. and *S. splendens* (also considered cultivated in the region, despite being native to southeast and south Brazil); the first two being introduced (BFG, 2018). In this paper we describe a new species from Pernambuco State that belongs to the subgenus *Calosphace*.

## Material and methods

Morphological studies were performed based on specimen duplicates kept in the following herbaria: CTBS, HUEFS, and RB. Dissected samples were imaged using a stereomicroscope, with digital capture using TopView™ and edited

with Corel® PHOTO-PAINT™ X7. The map was produced using the Qgis 2.18.13 (2016) software, and later edited in Corel® PHOTO-PAINT™ X7. The conservation status of the species was

inferred in the GeoCAT program (Bachman et al., 2011) based on the categories and criteria of the IUCN (2012) and the IUCN Standards and Petitions Subcommittee (2017).

### Identification key for the species of *Salvia* in Northeast Brazil

1. Calyx conspicuously colored, red, blue or yellow; flowers white, red or yellow; cultivated.
  2. Flowers red or yellow; lower lip of corolla concave, shorter than upper lip.....*S. splendens*
  2. Flowers blue and white; lower lip of corolla deflected, longer than upper lip.....*S. farinacea*
1. Calyx green to pale green; flowers red, reddish-orange; native or cultivated.
  3. Leaves distinctly deltate; cultivated.....*S. coccinea*
  3. Leaves ovate or elliptic to lanceolate, native.
    4. Stamens exserted; corolla tube 3.2–4 cm, leaves elliptic to lanceolate.....*S. fruticetorum*
    4. Stamens included; corolla tube 2.1–2.3 cm, leaves ovate.....*S. rupestris*

### New species

**Salvia rupestris** M. Mota & J.F.B.Pastore, sp. nov. Type: Brazil. Pernambuco: Carnaubeiras da Penha, Serra do Arapuá, nas imediações do Sítio Boa Vista, 08°25'39"S 38°45'18"W, 840 m, 28 Aug 2014, Costa-Lima, Raimundo & Silva 1627 (holotype: CTBS-1493; isotypes: HUEFS-220571, PISF-1207, not seen, RB-660759) (Fig. 1).

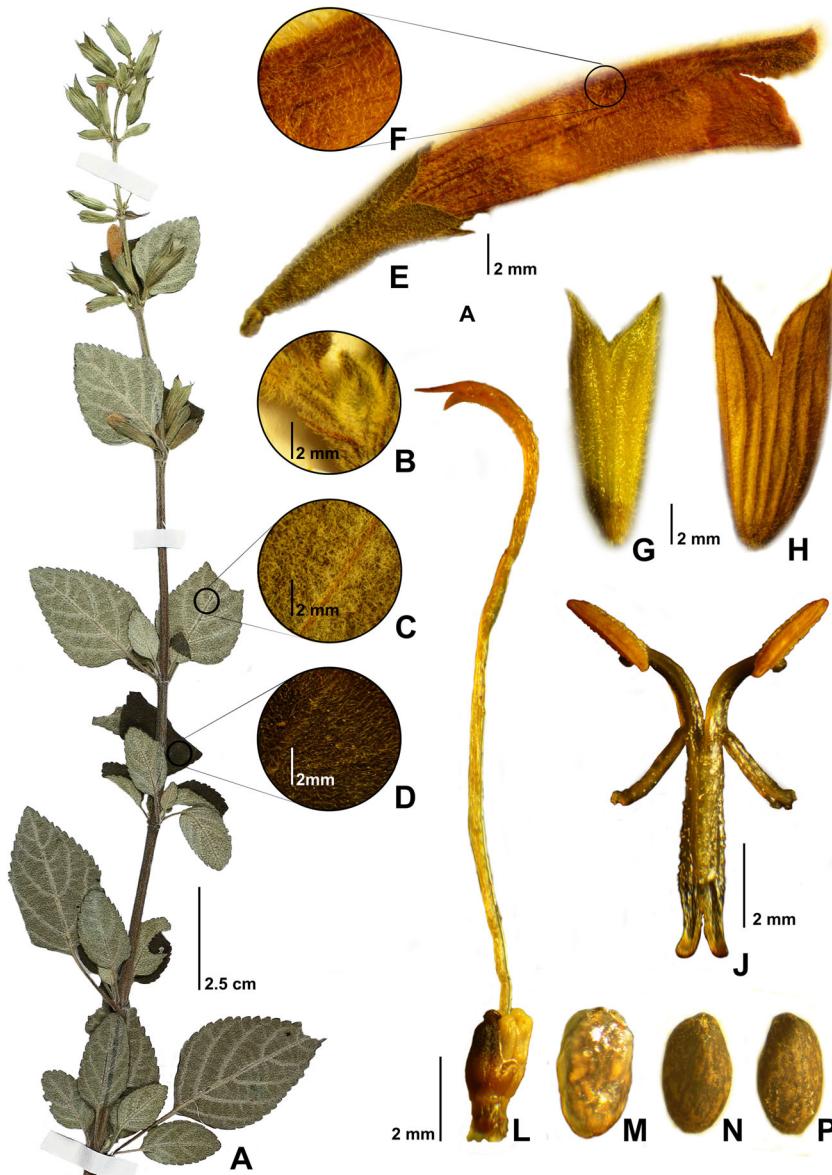
*Shrub*, ca. 1.5 m tall; stems quadrangular in section, brown-greyish, pubescent, internodes 1.5–6.5 cm, longer towards the base. Leaves opposite, petioles 0.5–2 cm, tomentose; blades ovate, 2.7–3.4 × 1.9–2.2 cm, chartaceous, apex cuneate, base obtuse to rounded, margin crenate, discolorous, upper surface adpressed tomentose, brownish, lower surface velvety tomentose, greyish. *Verticillasters* subtended a whorl of leaf-like bracts 2.7–3.4 × 1.9–2.2 cm, ovate, apex cuneate, base obtuse to rounded, margin crenate, discolorous, upper surface adpressed tomentose, brownish, lower surface velvety tomentose, greyish, these progressively deciduous from base toward apex of inflorescence, nodes 9–22 mm apart. Bracteoles 3–4 × 2 mm, ovate, densely hirsute, deciduous. *Flowers* 2–4(–6) per whorl, pedicels 4–5 mm long, hirsute. Calyx bilabiate, accrescent, tube 7 mm long, externally hirsute, internally scabrous except for the glabrous basal portion; calyx lobes obtuse-apiculate, lobes 4 mm long. Corolla reddish-orange, tube 2.1–2.3 cm long, external surface velvety, internal surface

glabrous, without annulus; upper lip 7 mm long; lower lip 5 mm long, incurved-concave. Stamens included; filaments 3 mm long; connectives ca. 1 cm long, glabrous; thecae 3 mm long, 2 posterior thecae sterile, connate, forming a gubernaculum. Style 2.3–2.5 cm long, pubescent near branches; stigma with unequal branches, 1 mm. *Mericarp* ovoid, smooth, ca. 2 × 1 mm long.

*Distribution and habitat*.—*Salvia rupestris* is known only from the type collection on Arapuá Mountain, in the municipality of Carnaubeiras da Penha, Pernambuco State. It is the first record for a native occurrence of *Salvia* in Pernambuco State (Fig. 2). *Salvia rupestris* was collected during inventory work for the project “Integration of the San Francisco River to the river basins of the northern Northeast” (Projeto de Integração do Rio São Francisco com as Bacias do Nordeste Setentrional). Recent expeditions to the mountains of Pernambuco have also resulted in the discovery of other new species, such as *Pleurophora pulchra* J.A.Siqueira, V.M.Cotarelli, J.F.B.Pastore & T.B.Cavalcanti (Siqueira-Filho et al., 2015). *Salvia rupestris* occurs in rocky fields on Arapuá Mountain, at 840 m elevation, in the Caatinga biome, part of the Brazilian Seasonally Tropical Dry Forest domain, in Pernambuco.

*Phenology*.—*Salvia rupestris* blooms in the middle of the dry season (April–September). It is likely that the environment near the top of the Arapuá Mountain in the dry season is more humid than in the lower-lying areas in this semi-arid region.

*Etymology*.—The specific epithet refers to the rocky field habitat of the species.



**FIG. 1.** *Salvia rupestris*. **A.** Habit with immature flower. **B.** Detail of bracteoles. **C.** Detail of the abaxial surface of leaf. **D.** Detail of the adaxial surface of leaf. **E.** Mature corolla. **F.** Detail of corolla indumentum. **G.** calyx in flower; **H.** Calyx in fruit. **J.** Stamens. **L.** Gynoecium. **M.** Mucilaginous epidermis of nutlet (wet). **N–P.** Nutlet (dry) in two views. (Scale bars: A = 2.5 cm, B–P = 2 mm; all images from Costa-Lima et al. 1627; A, from online image of isotype at RB [<http://reflora.jbrj.gov.br/reflora/geral/ExibeFiguraFSIUC/ExibeFiguraFSIUC.do?idFigura=99636561>], B–P, photos of holotype by J. Floriano B. Pastore & Michelle Mota.)

**Conservation Status.**—Considering the extent of occurrence (EOO) 0 km<sup>2</sup> and the area of occupation (AOO) 4 km<sup>2</sup> of *S. rupestris*, this species should be considered “Critically endangered” according to IUCN criteria [CR B1 + 2a (2), b (iii)]. Furthermore, the species is

known only from the type collection and is likely a narrow endemic to Arapuá mountain, which is not a protected region.

**Discussion.**—*Salvia rupestris* is morphologically most similar to *S. fruticetorum*. However, it is readily distinguished by its reddish-orange

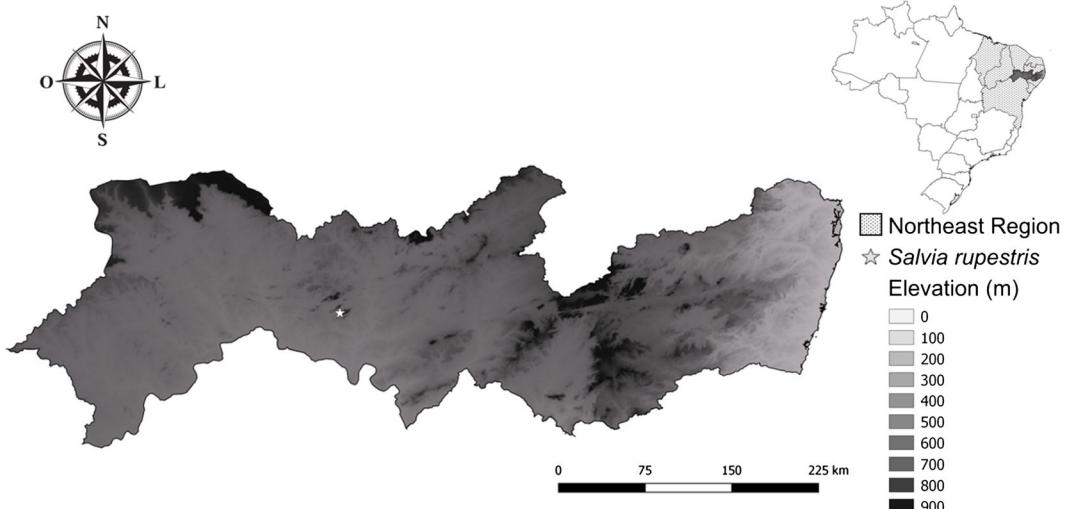


FIG. 2. Distribution map of *Salvia rupestris* in Pernambuco state, Brazil.

corolla (vs. red in *S. fruticetorum*) that is 2–2.1 cm long (vs. 3.2 cm long in *S. fruticetorum*). *Salvia rupestris* may also be recognized by its smaller leaves 2.7–3.4 × 1.9–2.2 cm (vs. 5–8 × (2–) 2.4–4 cm), ovate (vs. elliptic to lanceolate) leaves that are apically cuneate (vs. acuminate) with crenate (vs. serrate) margins margins). *Salvia rupestris* also resembles *S. neovidensis* Benth., but it can be readily distinguished from that species by the bracts, which are ovate and similar to the leaves (vs. linear to subulate and dissimilar to the leaves in *S. neovidensis*), style that is pubescent (vs. glabrous) near the stigma, and included (vs. exserted) stamens. Furthermore, *S. rupestris* occurs in rocky fields of the Caatinga, whereas *S. neovidensis* occurs in more humid Atlantic forests.

The type collection of *S. rupestris* was misidentified as *S. coccinea* Buc'hoz ex Etlinger. It resembles *S. coccinea* only superficially by the similarly hirsute stems, red flowers, and crenate leaves. However, *S. rupestris* is easily distinguished from *S. coccinea* by the upper lip of the corolla longer (ca. 7 mm) than the lower lip (ca. 5 mm), whereas in *S. coccinea* the upper lip is shorter (3.5–5 mm) than the lower lip (7–10 mm).

### Acknowledgments

The authors thank Alex Popovkin for the English review of the manuscript and the two anonymous reviewers for their helpful comments. JFBP thanks CNPq for fellowship support (302452/2017-6).

### Literature cited

Bachman, S., J. Moat, A. Hill, J. de la Torre & B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: Geospatial Conservation Assessment Tool. ZooKeys 150: 117–126.

BFG. 2018. Brazilian Flora 2020: Innovation and collaboration to meet Target 1 of the Global Strategy for Plant Conservation (GSPC). Rodriguésia 69: 1513–1527.

Drew, B. T., J. G. González-Gallegos, C. Xiang, R. Kriebel, C. P. Drummond, J. B. Walker & K. J. Sytsma. 2017. *Salvia* united: The greatest good for the greatest number. Taxon 66: 133–145.

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

Harley, R. M. 1974. New collections of Labiateae from Brazil. Notes on New World Labiateae, III. Kew Bulletin 29: 125–140.

IUCN (International Union for Conservation of Nature). 2012. IUCN Red List categories and Criteria. Version 3.1. Second edition. Gland, Switzerland and Cambridge, UK.

IUCN Standards and Petitions Subcommittee. 2017. Guidelines for using the IUCN Red List Categories and Criteria. Version 13. Gland, Switzerland and Cambridge, UK.

Jenks, A. A., J. B. Walker & S. C. Kim. 2012. Phylogeny of New World *Salvia* subgenus *Calosphace* (Lamiaceae) based on cpDNA (*psbA-trnH*) and nrDNA (ITS) sequence data. Journal of Plant Research 126: 483–496.

QGIS Development Team. 2016. QGIS Geographic Information System. Open Source Geospatial Foundation Project. Available from: <http://qgis.osgeo.org>.

Santos, E. P. 1993. Duas espécies novas de *Salvia* L. (Lamiaceae) do Brasil. Bradea 6(30): 259–264.

Santos, E. P. 1994. Contribution à la systématique du genre *Salvia* L., subg. *Calosphace* (Benth.) Benth. (Lamiaceae): description de deux espèces nouvelles du Brésil. Bulletin

du Museum National d'Histoire Naturelle de Paris 16(1): 155–161.

**Santos, E. P. & Harley, R. M.** 2004. Notes on *Salvia* section Nobiles (Lamiaceae) and two new species from Brazil. Kew Bulletin 59: 103–109.

**Siqueira-Filho, J. A., V. M. Cotarelli, J. F. B. Pastore, S. A. Graham & T. B. A. Cavalcanti.** 2015. Remarkable new species of *Pleurophora* (Lythraceae) from Caatinga of Pernambuco, Brazil. Systematic Botany 40: 185–190.

**Walker, J. B., K. J. Sytsma, J. Treutlein & M. Wink.** 2004. *Salvia* (Lamiaceae) is not monophyletic: implications for the systematics, radiation, and ecological specializations of *Salvia* and tribe Mentheae. American Journal of Botany 91 (7): 1115–1125.

**Walker, J. B. & K. J. Sytsma.** 2007. Staminal evolution in the genus *Salvia* (Lamiaceae): molecular phylogenetic evidence for multiple origins of the staminal lever. Annals of Botany 100: 375–391.