Stemodia perfoliata (Plantaginaceae): A 200 year old new species from the Caatinga of Minas Gerais, Brazil

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Abstract. A new species of *Stemodia* (Plantaginaceae) from the Caatinga of northern Minas Gerais, Brazil, is described and illustrated. ***Stemodia perfoliata*** was first collected by Auguste de Saint-Hilaire, ca. 200 years ago, and remained unnamed until now. The new species is characterized by the connate-perfoliate leaves, a unique feature in the genus. We provide notes on morphology, geographic distribution and conservation status of S. perfoliata, along with a key to differentiate it from the similar species that occur in Brazil: *S. durantifolia*, *S. hyptoides*, *S. maritima*, *S. palustris* and *S. stricta*.

Keywords: Gratioleae, Saint-Hilaire, São Francisco river, Scrophulariaceae, Sertão.

Gratioleae is a mainly tropical tribe of the Plantaginaceae, comprising between 16 and 40 genera and ca. 320 species. *Stemodia* L., with ca. 50 species, is one of the largest genera within this tribe, exhibiting a pantropical distribution, with ca. 30 species in the Neotropics (Turner & Cowan, 1993a, 1993b; Souza & Giulietti, 2009). In Brazil, 16 species of *Stemodia* were recognized (BFG, 2015; Souza & Hassemer, 2015), but the description of a new species brought this number to 17 (Scatigna et al., 2017). The genus presents high morphological diversity, but is generally characterized by a terrestrial herbaceous habit, four anthers with two separated thecae, and equal to sub-equal sepals (Souza & Giulietti, 2009).

While examining herbarium specimens of Scrophulariaceae sensu lato, in 2001, for a taxonomic study of the family, an interesting specimen collected in Minas Gerais, Brazil, was found at the herbarium of the National Museum of Natural History of Paris (P). The material was collected by Auguste de Saint-Hilaire between 1816 and 1817 (see the Saint Hilaire virtual herbarium; Pingal et al., 2013), and remained identified only at the family level (Scrophulariaceae) for the following ca. 200 years. Only in 2016, we found a similar specimen, among a loan from the BHZB Herbarium, Belo Horizonte, and realized that together with the Saint-Hilaire specimen it represented a new entity. Both specimens have anthers with separated thecae and a calyx with equal sepals, like in other species of *Stemodia*, but also present connate-perfoliate leaves, a feature not observed previously in the genus or even in the whole tribe. Its general morphology (an erect herb, with sessile and relatively long leaves, and bi-bractelolate flowers) is consistent with a group of species that occur in Brazil composed of *S. durantifolia* (L.) Sw., *S. hyptoides* Cham. & Schltdl., *S. maritima* L., *S. palustris* A.St.Hil., and *S. stricta* Cham. & Schltdl. (Souza & Giulietti, 2009).

Here we describe and illustrate the new species of *Stemodia*, discuss its morphological affinities, geographic distribution and conservation status, and provide a key to differentiate it from the similar species that occur in Brazil.

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Material and methods

Description and morphological comparisons are based on the literature (Turner & Cowan, 1993b; Souza & Giulietti, 2009) and detailed examination of herbarium specimens from ALCB, BHCB, BHZB, CEN, CEPEC, CGMS, COR, CPAP, CTES, CVRD, DIAM, EAC, ESA, HCJS, HRB, HUEFS, IAC, IAN, ICN, MBM, MBML, MG, OUPR, PACA, R, RB, SP, SPF, UB, UEC and UPCB; and also on-line images from K, NY, MO and P.

For the conservation status assessment we followed the IUCN Red List categories and criteria (IUCN, 2012) and subsequent guidelines (IUCN Standards and Petitions Subcommittee, 2017). We estimated the extent of occurrence (EOO) and area of occupancy (AOO) with the Geospatial Conservation Assessment Tool (GeoCAT; Bachman et al., 2011) using a cell width of 2 km and based on the coordinates provided by Dr. Inês Ribeiro, curator of BHZB, who participated in the expedition that resulted in the collection of the paratype.

Taxonomic treatment

Stemodia perfoliata Scatigna & V. C. Souza, **sp. nov.** Type: Brazil. Minas Gerais. 1816–1818 (fl., fr.), *A. de Saint-Hilaire B1–1879* (holotype: P barcode P03889474 [digital image available from https://science.mnhn.fr/institution/mnhn/collection/p/item/p03889474?listIndex=3&listCount=36]) (Fig. 1).

Diagnosis: *Stemodia perfoliata* is characterized by the connate-perfoliate leaves. It is most similar to *S. durantifolia*, but differs in the opposite, connate-perfoliate leaves (vs. opposite to whorled, not connate-perfoliate), and in the longer pedicel (0.5–1.2 cm vs. up to 0.2 cm).

Herbs, ca. 50 cm tall. *Stems* terete to sub-quadrangular, branched, entirely glandular-pubescent. *Leaves* opposite, connate-perfoliate; blades ovate to lanceolate, 0.6–3 × 0.5–1.3 cm, apex acute, base wide, narrowing at the base of the plant, connate-perfoliate, margin subentire to serrate, abaxial surface sparsely glandular-pubescent, with trichomes concentrated on veins, adaxial surface entirely glandular pubescent. *Flowers* axillary, single or geminate; pedicel 0.5–1.2 cm long, densely glandular-pubescent; bracteoles 2, opposite, linear, ca. 2 mm long, glandular-pubescent, inserted close to the calyx. *Sepals* subequal, lanceolate, ca. 3.5 × 1 mm, apex acute to acuminate, glandular-pubescent. *Corolla* bilabiate, purplish; tube ca. 4.5 mm long, externally minutely glandular-pubescent, internally pubescent; upper lip shallowly 2-lobed, ca. 3.5 × 3 mm, glabrous; lower lip 3-lobed, throat pubescent, 2-canaliculate, lobes orbicular, ca. 1.5 mm diam., glabrous. *Stamens* 4, didynamous, reaching the throat, filaments filiform, apex capitate; anterior pair ca. 3 mm long, posterior pair ca. 2 mm long, glabrous; anthers with two thecae, separated, minutely stipitate, stipe thickened above filament, thecae ca. 0.5 mm long, glabrous, dehiscence longitudinal. *Carpels* 2; ovary superior, syncarpous, 2-locular, ovoid, ca. 1.5 mm long, glabrous; placentation axilar, ovules numerous; style terminal, solitary, filiform, 1.7 mm long, glabrous, apex obdeltoid, ca. 0.7 mm long, curved downwards, glabrous. *Capsule* ovoid, ca. 4.5 × 2.3 mm, dehiscence septicidal with bisected valves; seeds obovoid to cylindrical, 0.3–0.4 × 0.1–0.25 mm, base acuminate, shallowly foveolate.

Distribution, habitat and phenology.—*Stemodia perfoliata* occurs in the northern portion of Minas Gerais state, Brazil, in the São Francisco river basin. According to Saint-Hilaire's field notes (Saint-Hilaire virtual herbarium; Pignal et al., 2013), the holotype was collected near Capão [do Cleto], a location near Matias Cardoso, at the margins of the São Francisco river (Pignal et al., 2013). The paratype was collected in a location referred to as Lajedão, in the municipality of Matias Cardoso, on a limestone outcrop in an area of Caatinga. The paratype was collected with flowers and fruits in August.

Etymology.—The specific epithet refers to the unusual connate-perfoliate leaves (Fig. 1B), a feature not observed in any other species of *Stemodia*.

Conservation status.—Despite a lack of information on the current condition of the occurrence locality, observed mining activity (I. Ribeiro, pers. comm.) is a possible threat to the quality and extent of the habitat. In addition, the location is not encompassed by any of the protected areas (state parks) included in the municipality of Matias Cardoso. Following IUCN (2012) and IUCN Standards and Petitions Subcommittee

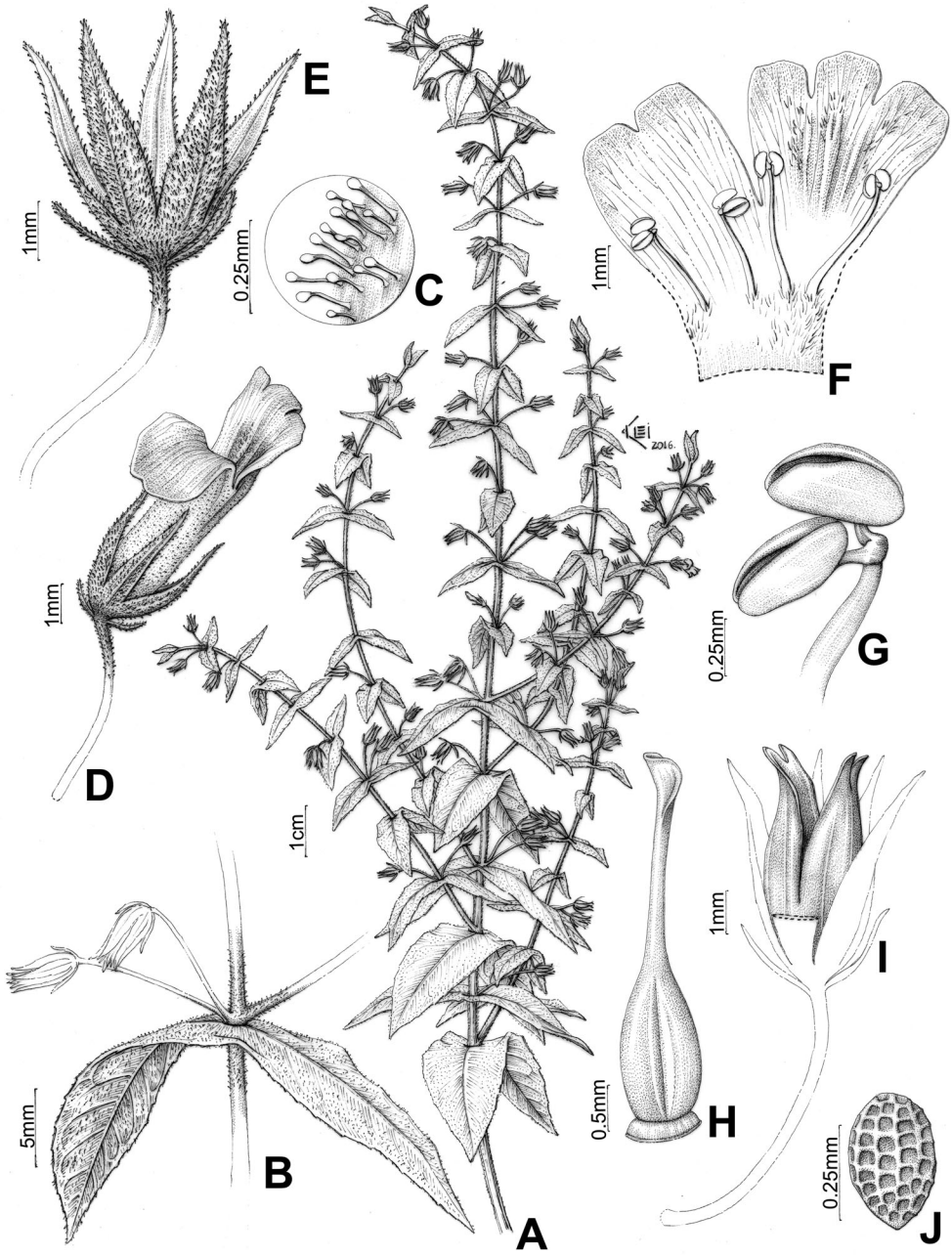

Fig. 1. *Stemodia perfoliata*. **A.** Reproductive branch. **B.** Detail of the connate-perfoliate leaves and pedicel insertion. **C.** Detail of the glandular-pubescent surfaces. **D.** Flower in lateral view. E. calyx and subtending bracteoles with glandular-pubescent indument. **F.** Artificially opened corolla and androecium. **G.** Detail of anther with separated thecae. **H.** Gynoecium. **I.** Fruit. **J.** Seed. Drawn by Klei Sousa from *M.G.C. Fernandes s.n.* (BHZB3865).

(2017), *Stemodia perfoliata* should be considered Critically Endangered (CR) under criteria B1ab(i, ii, iii) and B2ab(i, ii, iii), exhibiting the AOO and EOO of 4 km^2, and known from only one location. New efforts to identify natural populations of the new species are encouraged and would provide valuable information for a more precise evaluation.

Additional specimen examined. BRAZIL. Minas Gerais: Matias Cardoso, Vale do Rio São Francisco, Lajedão [14°53′29”S, 43°45′47”W], 28 Aug 2003 [fl, fr], *M. G. C. Fernandes s.n.* (BHZB 3865).

Stemodia perfoliata presents an erect habit, sessile leaves and a pair of bracteoles, a set of features consistent with a group of species that occur in Brazil, as stated by Souza and Giulietti (2009), composed of *S. durantifolia*, *S. hyptoides*, *S. maritima*, *S. palustris* and *S. stricta*. The circumscriptions of some of these taxa differ depending on the concepts of the authors (Turner & Cowan, 1993b; Souza & Giulietti, 2009; Sosa & Dematteis, 2013, 2014), and in some cases there is overlap among taxa. Nevertheless, *S. perfoliata* is easily distinguished by the pedicel length of 0.5–1.2 cm long (vs. up to 0.2 cm) and phyllotaxy (opposite vs. opposite to whorled), in addition to the connate-perfoliate leaves (vs. not connate-perfoliate).

It is quite surprising that *Stemodia perfoliata* remained undescribed for 200 years, because A. de Saint-Hilaire already described *S. palustris* and, therefore, was familiar with the genus. On the other hand, Souza also laid the description aside for more than 15 years, until Scatigna found the specimen in the BHZB collection. This is the second new species of *Stemodia* found in this herbarium (Scatigna et al., 2017). While P houses around 8 million specimens, BHZB has ca. 11,000, which highlights the importance of the study of specimens housed in small collections.

Key to *Stemodia perfoliata* and similar Brazilian species (Adapted from Souza & Giulietti, 2009)

1. Leaves connate-perfoliate, opposite; pedicel 0.5–1.2 cm long . . . . . *Stemodia perfoliata*
1. Leaves not connate-perfoliate, opposite to whorled; pedicel usually up to 0.2 cm long 2
2. Stamens exserted, thecae conspicuously stipitate; bracts often longer than the sepals. . . . . *S. maritima*
2. Stamens included or reaching the throat, thecae obscurely stipitate; bracts shorter than the sepals 3
3. Stem glabrous to glabrescent; leaves glabrous, margin entire or subserrate, base not clasping . . . . . *S. palustris*
3. Stem pubescent to tomentose; leaves pubescent, margin usually serrate, base usually clasping 4
4. Inflorescences axillary, densely spicate; sepals with long, minutely capitate or short, glandular trichomes. . . *S. hyptoides*
4. Inflorescences terminal, laxly spicate; sepals with exclusively short, glandular trichomes. 5
5. Leaves subcoriaceous, abaxial surface densely glandular-pubescent, 0.2–3 cm wide . . . . . *S. stricta*
5. Leaves membranaceous, abaxial surface sparsely glandular-pubescent, 0.25–0.8 cm wide . . .*S. durantifolia*

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Literature cited

Bachman S., J. Moat, A. W. Hill, J. de la Torre & B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. ZooKeys 150: 117–126.

BFG (The Brazil Flora Group). 2015. Growing knowledge: an overview of seed plant diversity in Brazil. Rodriguésia 66: 1085–1113.

IUCN. 2012. The IUCN Red List categories and criteria. Ver. 3.1. Second ed. IUCN, Gland, Switzerland & Cambridge, UK. Available from: http://cmsdocs.s3.amazonaws.com/keydocuments/Categories_and_Criteria_en_web%2Bcover%2Bbckcover.pdf (Accessed 21 June 2017).

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

Available from: http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf (Accessed 21 June 2017).

Pignal, M., S. Romaniuc-Neto, S. de Souza, S. Chagnoux & D. A. Lange Canhos. 2013. Saint-Hilaire virtual herbarium, a new upgradeable tool to study Brazilian botany. Adansonia 35: 7–18.

Scatigna, A. V., V. C. Souza & A. O. Simões. 2017. *Stemodia cipoensis* (Plantaginaceae): a new species from Serra do Cipó, Minas Gerais, Brazil. Systematic Botany 42: 371–377.

Sosa, M. M. & M. Dematteis. 2013. Taxonomic position and identity of *Stemodia scoparioides* (Gratiolae, Plantaginaceae). Phytotaxa 135: 34–42.

——— **&** ———. 2014. *Stemodia diplohyptoides* (Plantaginaceae, Gratiolae): a new diploid species from South America. Phytotaxa 186: 271–278.

Souza, V. C. & A. M. Giulietti. 2009. Levantamento das espécies de Scrophulariaceae sensu lato nativas do Brasil. – Pesquisas, Botânica 60: 7–288.

——— **& G. Hassemer.** 2015. Plantaginaceae. *In:* Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Available from: http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB191 (Accessed 21 June 2017).

Turner, B. L. & C. C. Cowan 1993a. Taxonomic overview of *Stemodia* (Scrophulariaceae) for North America and the West Indies. Phytologia 74: 61–103.

——— **&** ———. 1993b. Taxonomic overview of *Stemodia* (Scrophulariaceae) for South America. Phytologia 74: 281–324.