



Taxonomic position and identity of *Stemodia scoparioides* (Gratiolae, Plantaginaceae)

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Abstract

In recent floristic and taxonomic studies, *Stemodia scoparioides* (Gratiolae, Plantaginaceae) has been considered a synonym of *S. lanceolata* or a synonym of *S. stricta*. However, a detailed analysis of the type material and additional specimens clearly indicates that this is a different species, which can be distinguished by the aspect of the plants, the size of the leaves, the shape of the blades, and the length of the corollas. Consequently, in this contribution *Stemodia scoparioides* is resurrected from the synonymy as an independent species based on the analysis of morphological features. Additionally, complete description (including the pollen grains), geographic distribution, ecological observations, and a key to distinguish the related species are also reported, together with an illustration of *S. scoparioides*.

Introduction

Stemodia Linnaeus (1759: 1118) belongs to the tribe Gratiolae Benth (1846: 340) of the large plant family Plantaginaceae Jussieu (1789: 89) and comprises about 49 species (Dawson 1968, Turner & Cowan 1993, 1994, Barringer & Burger 2000). For the New World 29 species are recognized, 16 of them are exclusive from South America (Turner & Cowan 1994). In southern South America nine species have been reported, but just *Stemodia verticillata* (Miller 1768: 5) Hassler (1909: 110) has a wide distribution, while the remaining eight taxa are typically endemic of Argentina, Paraguay, Uruguay, extreme south of Bolivia, and southern Brazil.

Stemodia scoparioides Hassl. ex Minod (1918: 208) was validly published by Minod (1918) based on material collected by Hassler near the Apa river in northern Paraguay. The author distinguished the species from its allied taxa by the leaf shape and the general appearance of the plant. According to Minod (1918) this species differs from the rest of the genus by having smaller leaves and more abundant branching (“C’est, de tout le genre, l’espèce qui possède les feuilles les plus réduites et la ramification la plus abondante”). However, Turner & Cowan (1994) considered *Stemodia scoparioides* as a synonym of *S. lanceolata* Benth. in Benth (1846: 384), while Souza (2008) and Souza & Giulietti (2009) considered *S. scoparioides* as a synonym of *S. stricta* Chamisso & Schlechtendal (1828: 10). The main goal of this work is to clarify this situation, if *Stemodia scoparioides* is a synonym of *S. lanceolata* or *S. stricta* or if it is an independent species.

Materials and Methods

This study was based on morphological analysis of the type specimens and additional material deposited at BM, CTES, G, G-DEL, and K.

Additionally, a comparative study of the pollen grains of the involved species was conducted. Pollen grains were acetolyzed according to the procedure suggested by Erdtman (1960). For the observation with the light microscope (LM) the pollen samples were mounted in glycerin jelly on glass slides, sealed with paraffin

and then examined with a Wild M 20 microscope. Permanent slides were deposited at the Palynological Laboratory of the Universidad Nacional del Nordeste (PAL-CTES). For observation on the scanning electron microscope (SEM) acetolyzed pollen grains were washed in alcohol 96°, followed by washing in absolute alcohol. Then, the pollen grains were air dried on aluminum plates, sputtered with gold palladium and observed with a JEOL 5800 LV. The description of pollen grains follows the terminology suggested by Punt et al. (1994, 2007).

The samples used for palynological studies of *Stemodia scoparioides* were obtained from Cowan et al. 4196 & 4185B at CTES (see below, under “Additional specimens examined” for this species). For *S. lanceolata* and *S. stricta*, the description of the pollen grains was taken from Sosa et al. 2012.

Results

Stemodia species are annual or perennial marshy herbs, shrublets or small scrambling shrubs up to 3 m high with opposite subpinnate or pinnately veined leaves, flowers axillary, solitary or grouped in terminal spikes, calyx with equal sepals, almost, separate at the base, linear-lanceolate. The corollas are mostly lavender or purple colored, zygomorphic, having well developed tubes, anther thecae glabrous, divergent, with swollen connectives, or shortly stalked, styles 2–4 times long as the stigmatic area; stigmatic area enlarged and usually curved, bifid; capsule mostly loculicidally 4 valvate, ovoid to orbicular; pedicellate seeds, ellipsoid to subpyramidal (Turner & Cowan 1993).

A detailed examination of the type material and additional specimens showed that *S. scoparioides* is certainly different from *S. lanceolata* and *S. stricta* (characters resumed in Table 1), especially in the size and shape of the leaves and the length of the corolla. *Stemodia scoparioides* has longer corollas than *S. stricta* (12 mm vs. 5–10 mm) and differs from *S. lanceolata* by the shape and size of the leaves (linear to linear-lanceolate 10–40 × 0.5–3 mm vs. lanceolate to oblanceolate 40–80 × 5–18 mm). The comparative analysis of pollen grains allowed to differentiate *S. scoparioides* from *S. lanceolata* and *S. stricta* by the shape and size: *S. scoparioides* presents prolate-spheroidal grains, larger (19.04–27.2 µm) than the other two studied species (13.6–17.70 µm).

TABLE 1. Comparison between *S. scoparioides* and allied species

Character/Species	<i>S. scoparioides</i>	<i>S. lanceolata</i>	<i>S. stricta</i>
Plant high	40–70 cm	30–70 cm	10–50 cm
Stem outline	Cylindrical	4-side	cylindrical to 4-side
Leaf shape	linear to linear-lanceolate	lanceolate to oblanceolate	ovate to ovate-elliptic
Leaf length	10–40 mm	40–80 mm	20–50 mm
Leaf wide	0.5–3 mm	5–18 mm	5–30 mm
Corolla length	12 mm	12–16 mm	5–10 mm

Taxonomic treatment

Key to distinguish *Stemodia scoparioides* and sympatric species

1. Leaves bi-pinnatifid; corolla irregularly campanulate *S. hassleriana* Chodat (1904: 287)
- Leaves entire; corolla bilabiate, upper lip emarginate, lower lip with three lobes 2
2. Small herbs up to 25 cm, decumbent; flowers solitary, axillary 3
- Plants erect, over 20 cm; flowers arranged in clusters or spiciform inflorescences 4
3. Leaves ovate, petiolate (petiole 4–8 mm); calyx ebracteolate *S. verticillata*
- Leaves linear, sessile; calyx with two bracteoles
..... *S. ericifolia* (Kuntze 1898: 239) K. Schumann (1900: 395)
4. Stems and leaves with pedicellate trichomes 5
- Stems and leaves exclusively with punctate trichomes 9

5. Corolla 12–16 mm; floral bracts mostly long as 2 times as long as the subtended flowers; leaves linear, linear-lanceolate, lanceolate or oblanceolate, apex attenuate 6
- Corolla 5–10 mm; floral bracts shorter than the subtended flowers; leaves obovate to oblong-lanceolate, attenuate at base, apex acute..... 7
6. Leaf blades linear to linear-lanceolate, 10–40 × 0.5–3 mm, basally attenuate *S. scoparioides*
- Leaf blades lanceolate to oblanceolate, 40–80 × 5–18 mm, basally auriculate, clasping the stem *S. lanceolata*
7. Herbs up to 50 cm; leaves obovate to ovate-elliptic, base clasping and somewhat flanged *S. stricta*
- Herbs up to 150 cm; leaves lanceolate to oblong-lanceolate, base slightly auriculate 8
8. Herbs 30–80 cm, inflorescence branched; leaves 20–80 × 5–20 mm, margin slightly serrate (less than 20 teeth on each side).....
- ...*S. durantifolia* var. *chilensis* (Benth. 1831: tab. 1470) C. C. Cowan in B. L. Turner & C. C. Cowan (1994: 290)
- Herbs 60–150 cm, inflorescence simple; leaves 60–100 × 15–45 mm; margin tightly serrate (more than 20 teeth on each side)..... *S. hyptoides* Chamisso & Schlechtendal (1828: 8)
9. Leaf margin entire or barely denticulate, not amplexicaul *S. palustris* A. Saint-Hilaire (1824: 216)
- Leaf margin sharply serrated, basally amplexicaul *S. lobelioides* Lehmann (1837: 91)

1. *Stemodia scoparioides* Hassl. ex Minod (1918: 208). Type:—PARAGUAY. Amambay: “in regione calcarea cursus superioris fluminis Apa”, 1912–1913, *E. Hassler 11019* (lectotype G!, designated by Turner & Cowan 1994, isoelectotypes BAF, BM!, G!, G-DEL!, K!). Figures 1, 2.

Erect mostly perennial herbs 40–70 cm high. Stems cylindrical, 3–4 mm in diameter, leafy on the upper portion, internodes 4–6 cm, with glandular and eglandular trichomes. Leaves verticillate, leaf blades linear to linear-lanceolate, 10–40 × 0.5–3 mm, subulate, basally attenuate, glandular hairy. Flowers axillary, shortly pedicellate, grouped in terminal spikes, floral bracts lanceolate, mostly as long as 2 times as long as the subtended flowers. Calyx 2-bracteolate, bracts filiform, shorter than the sepals; sepals subulate, 4–5 mm. Corollas 14 mm, anterior lip trilobate, superior lip emarginate, subquadrangular. Anthers 4, anterior 6 mm and posterior 3 mm, inserted above. Ovary ovoid, style straight, 9 mm. Stigma leafy, laterally broadened. Capsules ovoid, 4–5 mm, 4-valvate. Seeds ellipsoid.

Pollen grains prolate-spheroidal or rarely prolate, 3-colporate. Colpi long, reaching the poles to form an apocolpium of around 7 µm long, ora circular or slightly lalongate with irregular margins. Polar diameter 19.04–27.2 µm, equatorial axis 14.96–20.4 µm, amb (in polar view) sub-circular. Exine 1 µm thick, uniform across the surface of the grain, tectate or foveolate, sexine and nexine of equal thickness.

Phenology:—Flowering between December and April.

Distribution and habitat:—It grows in northeastern Paraguay (Amambay) and north of Argentina (Corrientes), commonly found on low moist calcareous soils or close to water streams.

Additional specimens examined:—ARGENTINA. Prov. Corrientes: Bella Vista, km 5,1 N of the bridge of the Santa Lucía river (San Roque on the route 12), 160 m, 28 December 1983, *C. P. Cowan et al. 4196* (CTES, M); Saladas, km 20,4 SE of Saladas on the route 17, near to the Santa Lucía river, 27 December 1983, *C. P. Cowan et al. 4185B* (CTES).

2. *Stemodia lanceolata* Benth. in De Candolle (1846: 384). *Stemodiocris lanceolata* (Benth.) Kuntze (1891: 466). Type:—ARGENTINA. Mendoza: “in andibus Mendoza”, s. d., *J. Gillies s. n.* (lectotype K!, designated by Turner & Cowan 1994, isoelectotype OXF).

Stemodia lanceolata Benth. fo. *angustifolia* Chodat & Hassler (1904: 287). *Stemodia lanceolata* Benth. var. *angustifolia* (Chodat & Hassl.) Minod (1918: 210). Type:—PARAGUAY, “ad ripam lacus Ypacaray”, 1898–1894, *E. Hassler 3035* (lectotype G!, designated by Turner & Cowan 1994; isoelectotypes BM!, G-DEL!, GH, UC).

Stemodia lanceolata Benth. fo. *latifolia* Chodat & Hassler (1904: 287). *Stemodia lanceolata* var. *latifolia* (Chodat & Hassl.) Minod (1918: 211). Type:—PARAGUAY. “in stagnis pr. Concepción”, September 1901–1902, *E. Hassler 7473* (lectotype G-DEL!, designated by Turner & Cowan 1994, isoelectotypes BM!, G!, GH, K!, MICH, MO, PHIL, UC).

Stemodia lanceolata Benth. fo. *laxiflora* Chodat & Hassler (1904: 287). Type:—PARAGUAY. “in palude pr. Tobaty”, September 1900, *E. Hassler 6385* (lectotype G!, designated by Turner & Cowan 1994, isoelectotypes BM!, G-BOISS!, UC).

Stiffly erect perennial herbs, rhizomatous, mostly 30–70 cm high. Stems 4-ribbed, slightly marked, densely glandular hairy. Leaves sessile, inferior opposite, superior verticillate, progressively shorter towards the apex of the stems; leaf blades lanceolate to oblanceolate, 40–80 × 5–18 mm, basally auriculate clasping the stem, glandular hairy. Flowers arranged in a terminal bracteate interrupted spike, bracts lanceolate, mostly as long as or 2 times as long as the subtended flowers. Calyx with 5 sepals, linear lanceolate, 4–5 mm, glandular hairy, subtended by 2 long basal bracteoles. Corollas 12–16 mm, violet, glandular hairy, corolla lobes 3–5 mm. Anthers thecae purple, separated by a small ovoid connective. Capsule ovoid, 4–5 mm, 4-valvate, apically shortly curved. Seeds ellipsoid, 4–5 mm, stipitate.

Pollen grains spheroidal, 3-colporate. Colpi long, reaching the poles to form an apocolpium of around 5 µm long, ora circular or slightly lalongate with irregular margins. Polar diameter 13.60–17.64 µm, equatorial axis from 13.60–16.3 µm, amb (in polar view) sub-circular. Exine 1 µm thick, uniform across the surface of the grain, tectate-foveolate, sexine and nexine of equal thickness.

Iconography citation:—Descole & Borsini (1954: 125): Lam LVII

Phenology:—Flowering between September and June.

Distribution and habitat:—It grows from 20° S in Cordillera (Bolivia) to 37° S in Buenos Aires (Argentina) including north and center of Paraguay; commonly found in grasslands having low soils.

Additional specimens examined:—ARGENTINA. Ciudad Autónoma de Buenos Aires: Jardín Zoológico, 27 February 1898, *C. Hicken* 132 (SI). Prov. Buenos Aires: Without locality, 1846, *Tweedie s.n.* (BM); Conesa, cerca de canal 9, km 80, 26 February 1972, *A. Burkart* 28979 (SI); Guaminí, Estancia “Los Platanos”, 23 July 1978, *León et al.* 28 (BAA, CTES). Prov. Chaco: 1° de Mayo, Colonia Benítez, 10 December 1947, *A. G. Schulz* 6797 (LIL); 19 April 2001, *M. M. Sosa et al.* 41 (CTES); Pindo, Bermejo river, 14 March 1947, *M. Alvarez* 1262 (K, LIL). Prov. Córdoba: Ascochinga, Los Mogotes, *E. Nicora* 1845 (SI); 13 February 1938, *M. L. Giardelli* 1075 (K); San Francisco, 21 July 1950, *O. Borsini* 1256 (K, LIL). Prov. Corrientes: Berón de Astrada, 44 km W Itá Ibaté, 15 July 1977, *O. Ahumada* 499 (CTES); Capital, Barrio San José, 4 November 1998, *M. M. Sosa* 5 (CTES); Hipódromo Gral. San Martín, 18 December 1999, *M. M. Sosa* 27 (CTES); Barrio San Jerónimo, 9 April 2001, *M. M. Sosa* 36 (CTES); Riachuelo, 3 February 2001, *M. M. Sosa & G. Seijo* 37 (CTES); Concepción, Paso Naranjito, 26 October 1976, *A. L. Cabrera* 28218 (SI). Saladas, San Lorenzo, 8 November 1998, *M. M. Sosa* 17 (CTES, SI); San Cosme, Paso de la Patria, 5 December 1998, *M. M. Sosa* 15 (CTES); San Miguel, 12 km S of Caá Catí, 13 March 1978, *O. Ahumada* 1716 (CTES). Prov. Entre Ríos: Paraná, Isla Puente, 1 July 2002, *H. Keller* 1537 (CTES); La Paz, Isla Curuzú Chali, 8 November 1973, *A. Burkart et al.* 30166 (SI); Victoria, Isla del Pillo, 20 December 1937, *A. Burkart* 8745 (SI). Prov. Formosa: Patiño, Ibarreta, 12 December 2005, *M. M. Sosa et al.* 218 (CTES, BAB, G); route 81, 12 December 2005, *M. M. Sosa et al.* 219 (CTES); Pilcomayo, route 86, km 73, 28 October 1948, *P. Morel* 6369 (K); 3 km of Sol de Mayo, 28 October 1949, *P. Morel* 8745 (K, LL). Prov. Salta: Capital, Salta, November 1981, *A. L. Cabrera* 32789 (SI). Rivadavia, 1 km of Page, 13 December 2005, *M. M. Sosa et al.* 222 (CTES); Orán, Tabacal, 15 December 2005, *M. M. Sosa et al.* 228 (CTES). Prov. Santa Fe: Gral. Obligado, Villa Ana, 31 December 1972, *C. Quarín* 719 (CTES). BOLIVIA. Dpto. Santa Cruz: Prov. Cordillera, Parque Nacional Kaa-Iya del Gran Chaco, 19°06'51"S 61°42'11"W; 318 m, Ibasiri Izozog, 19 May 1999, *R. de Michel* 2596 (GB, LPB). PARAGUAY. Dpto. Boquerón: Loma Pyta, 8 April 1974, *P. Arenas* 597 (CTES); 8 km NW of the Mariscal Estigarribia, 12 December 1992, *A. Krapovickas & C. L. Cristóbal* 44382 (CTES). Dpto. Central: Trinidad, Puerto Antequera, December 1916, *T. Rojas* 1865 (SI); Itá Enramada, 5 September 1971, *A. Krapovickas & C. L. Cristóbal* 19780 (CTES); 1 km E of the Paraguay river, 25° 30'S 57° 30'E, *E. Zardini & T. Tellería* 29243 (SI); Limpio, 1897, *E. Hassler* 3248 (G, BM). Dpto. Concepción: 22.1 km of Concepción, 17 December 1983, *C. P. Cowan et al.* 4173 (CTES). Dpto. Cordillera: San Bernardino, 1897, *E. Hassler* 3447 (BM); in regione Lacus Ypacarai, *E. Hassler* 12407 (K, BM); río Salado, to Limpio a Emboscada, 13 June 1984, *M. M. Arbo et al.* 2621 (CTES). Dpto. Presidente Hayes: Estación Loma Porá, 15 km W of the Concepción, 8 June 1995, *F. Mereles & R. Degen* 6014 (CTES); Pozo Colorado, 9 November 2001, *A. Schinini et al.* 35612 (CTES). Dpto. San Pedro: Alto Paraguay, Primavera, 22 February 1959, *T. Woolston* 1061 (SI K).

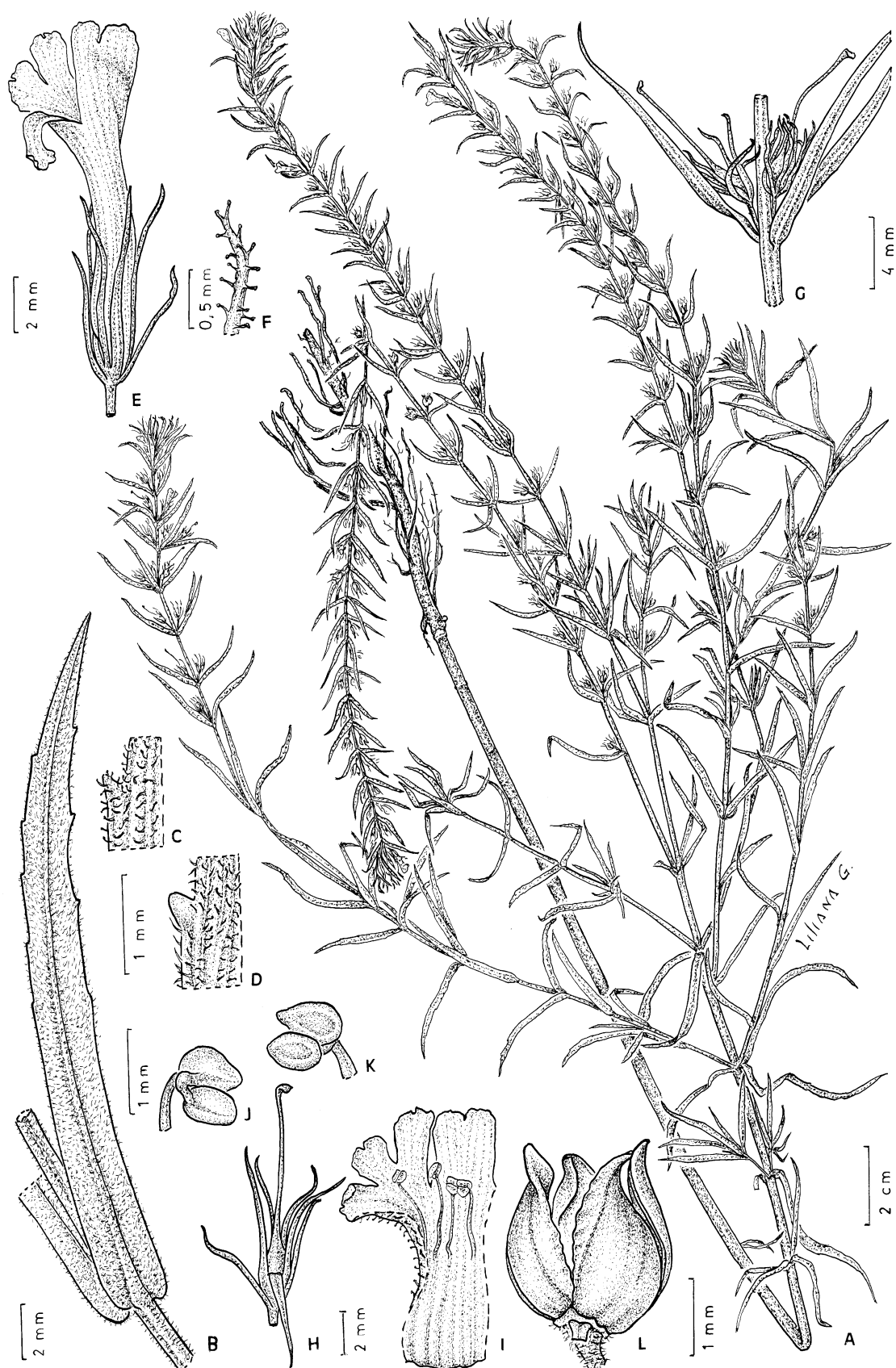


FIGURE 1. *Stemodia scoparioides*. A. Plant. B. Detail of a stem node. C-D. Detail of leaf margin. E. Flower. F. Detail of sepal. G. Detail of node with immature fruits. H. Gynoecium. I. Corolla (inner view). J. Short anther. K. Large anther. L. Fruit (A-L from Cowan *et al.* 4185B, CTES; illustrated by Mirtha L. Gómez).

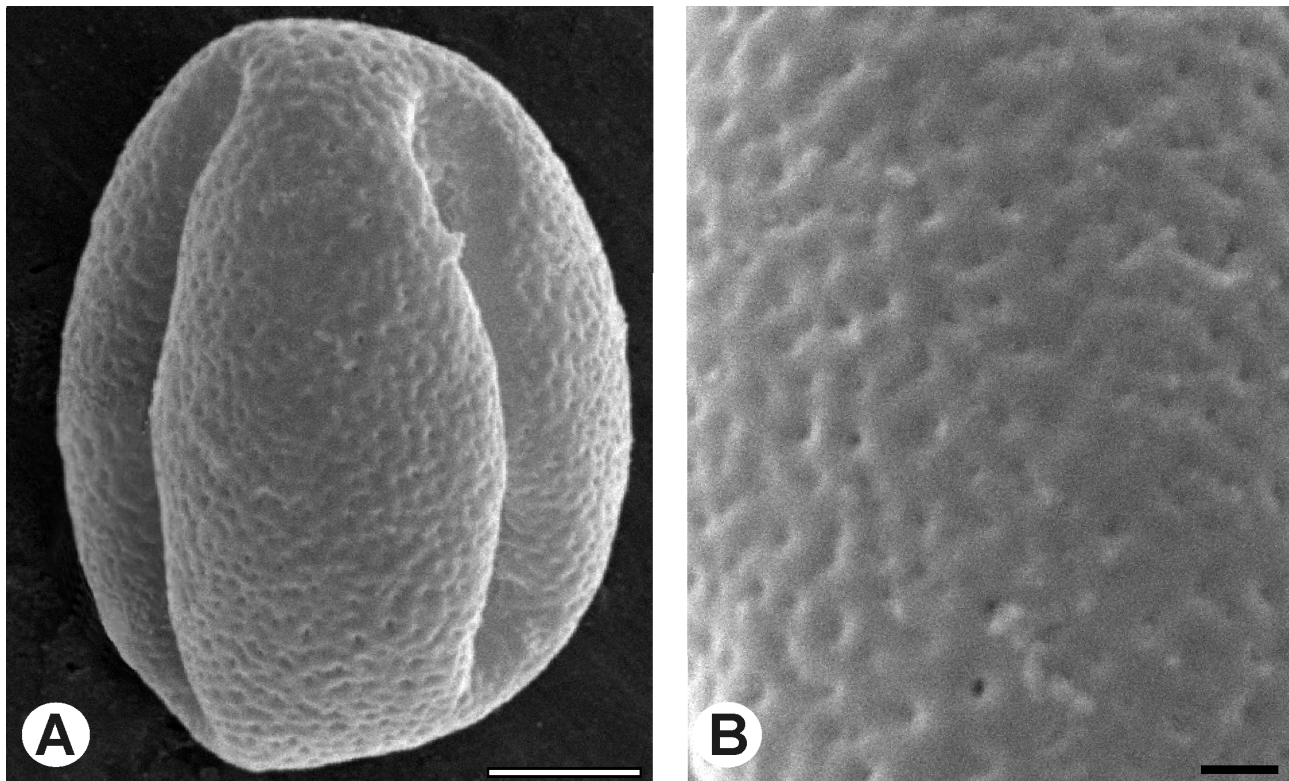


FIGURE 2. Pollen grains of *Stemodia scoparioides*. A. Equatorial view. B. Detail of the exine (A–B from Cowan *et al.* 4196, CTES). Scale bar = 10 μ m.

3. *Stemodia stricta* Chamisso & Schlechtendal (1828: 10). *Stemodiocras stricta* (Cham. & Schltdl.) Kuntze (1891: 466). *Stemodia hyptioides* Chamisso & Schlechtendal (1828: 8) var. *stricta* (Cham. & Schltdl.) G.Dawson in Burkart (1979: 470). Type:—BRAZIL. (“semel e Brasilia tropica Sellowius misit specimina florere incipientia”) Rio Pardo, camino de Caçapava a Bagé, *F. Sellow 1514* (lectotype B, photo F!, GH!, MO!, designated by Turner & Cowan 1994; isoelectotype K!).

Stemodiocras stricta var. *glabriuscula* Kuntze (1891: 240). Type:— PARAGUAY. Sudeste de Paraguay, September 1892, *O. Kuntze s. n.* (holotype NY!, isotype US).

Stemodia stricta fo. *minor* Chodat & Hassler (1904: 287). *Stemodia stricta* var. *multidentata* Minod (1918: 222). Type:— PARAGUAY. “in campis of San Bernardino, 1885–1895, *E. Hassler 1180* (lectotype G, photo F, GH, MO, designated by Turner & Cowan 1994 ; isoelectotypes G, K).

Stemodia stricta var. *paucidentata* Minod (1918: 222). Type:—PARAGUAY. “in regione calcarea cursus superioris fluminis Apa”, 1912–1913, *E. Hassler 11018* (lectotype G, designated by Turner & Cowan 1994; isoelectotypes BAF, G).

Annual or rhizomatous perennial herbs, 10–50 cm high, glutinose-pilose. Stems rounded to quadrangular with 4 ribs, densely to moderately pubescent, with glandular or eglandular trichomes. Leaves sessile, opposite at the base of the stems, 2–3 in each node at the upper part, 20–50 \times 5–30 mm. Leaf blades ovate to ovate-elliptic, glandular-dotted, clasping and somewhat flanged at the base. Flowers axillary, arranged in terminal bracteate interrupted spikes, bracts shorter than the subtended flowers. Sepals linear-lanceolate. Corollas 5–10 mm, tube externally glabrous and the inferior lip of the throat pilose. Anthers with unequal thecae, separated by a globose connective. Capsule ovoid, 4 valvate, seeds ellipsoid to ovoid, pedicellate.

Pollen grains spheroidal, 3-colporate. Colpi long, reaching the poles to form an apocolpium of around 5 μ m long, ora circular or slightly lalongate with irregular margins. Polar diameter 13.60–17.70 μ m, equatorial axis from 14.90–17.70 μ m, amb (in polar view) circular. Exine 1 μ m thick, uniform across the surface of the grain, tectate-foveolate, sexine and nexine of equal thickness.

Iconography citation:—Descole & Borsini (1954: 126-127): Tab. LVIII.

Phenology:—Flowering and fruiting from September to March.

Distribution and habitat:—North of Argentina, southeastern Bolivia, south of Brazil, Paraguay and northern Uruguay. This species grows from 21° S in Villamontes (Bolivia) to 31° S in Paysandú (Uruguay) in low moist and preferably acid soils.

Additional specimens examined:—ARGENTINA. Prov. Corrientes: Alvear, route 36, 26 March 2006, *M. M. Sosa et al.* 246 (CTES); Ituzaingó, route 12-route 1183, 12 October 1951, *T. Bertoni* 5002 (LIL); Mburucuyá, Estancia Santa Teresa, 3 December 1983, *C. P. Cowan et al.* 4091 (CTES); Cañada Fragosa, 7 July 2004, *M. M. Sosa* 129 (CTES); Parque Nacional Mburucuyá, 7 July 2004, *M. M. Sosa* 130 (CTES); Saladas, San Lorenzo, 8 November 1998, *M. M. Sosa* 8 (CTES, cult.); *Sosa* 43 (CTES); San Miguel, Estancia Curuzú Laurel, 31 March 1974, *A. Krapovickas et al.* 24718 (CTES); 19 December 2002, *M. M. Sosa* 92 (CTES); Santo Tomé, Estancia San Francisco, 2 December 1970, *A. Krapovickas et al.* 16852 (BAA, CTES). Prov. Jujuy: Ledesma, Zapla river, 16 December 2005, *M. M. Sosa et al.* 230 (CTES); San Pedro, San Francisco river, 14 July 1929, *S. Venturi* 9630 (K). Prov. Misiones: Candelaria, route 12, 14 September 1998, *S. G. Tressens et al.* 6001 (CTES); Loreto, 6 September 1946, *L. Montes* 2115 (SI); Santa Ana, 9 November 1946, *L. Montes* 2268 (SI); Campo San Juan, 23 February 2006, *M. M. Sosa & M. E. Rodríguez* 242 (CTES); Apóstoles, Escuela Agrotécnica Don Bosco, 14 October 1978, *S. A. Renvoize et al.* 3100 (K, L, SI); Oberá, 23 km W of Oberá, 4 February 1976, *M. C. Romanczuk et al.* 733 (SI); Posadas, 12 November 1907, *E. L. Ekman* 1809 (K); Eldorado, 8 December 1948, *G. Schwarz* 6874 (LIL, K); San Javier, Uruguay-streams, 10 December 1945, *T. Bertoni* 2531 (LIL). Prov. Salta: Santa Victoria, near to Angosto de Baritú, 1 December 1998, *O. Ahumada et al.* 8333 (CTES); Toldos bei Bermejo, 17 March 1903, *K. Fiebrig* 2415 (BM, K); Parque Nacional Baritú, Lipeo, Naranjo river, 20 December 1980, *O. Zuloaga et al.* 1141 (SI); Metán, Piedras river, 18 December 2005, *M. M. Sosa et al.* 237 (CTES); Orán, Aguas Blancas, 15 December 2005, *M. M. Sosa et al.* 227 (CTES); San Martín, Campo Durán, 14 December 2005, *M. M. Sosa et al.* 225 (CTES); Carapaí river, 14 December 2005, *M. M. Sosa et al.* 226 (CTES). BOLIVIA. Dpto. Chuquisaca: Hernando Siles, Cañon Heredia to 10 km of Monteagudo-Sucre, 26 November 2003, *J. R. Wood et al.* 20126 (K); 14 April 1995, *J. R. Wood* 9718 (K). Dpto. Santa Cruz: Ibañez, 13 July 1997, *J. R. Wood* 12449 (K), German Busch, 28 April 2008, *J. R. Wood et al.* 24572 (K). Dpto. Tarija: Villa Montes, Quebrada de Tampinta, 28 May 1971, *A. Krapovickas et al.* 19407 (CTES); between Narváez and Entre Ríos, 24 October 1980, *F. O. Zuloaga et al.* 1309 (SI). BRASIL. Edo. Paraná: Mun. Tres Barras do Paraná, Canion do Rio Guarani, 16 October 1997, *J. C. Silva et al.* 2131 (CTES); Rio Iguaçu, Barra do rio Jordao, 28 April 1963, *G. Hatschbach* 9948 (K). PARAGUAY. Dpto. Amambay: in regione cursus superioris fluminis Apa, November 1901-1902, *E. Hassler* 7975 (BM). Dpto. Central: Areguá, 25 November 2005, *M. M. Sosa et al.* 217 (CTES). Dpto. Cordillera: San Bernardino, 25 November 2005, *M. M. Sosa et al.* 216 (CTES); Tobatí hill, September 1900, *E. Hassler* 6326 (BM, K); 1888-1890, *T. Morong* 833 (BM). Dpto. Guairá: Iturbe, 8 October 1953, *J. E. Montes* 12753 (M); 23 March 1976, *B. Balansa* 2165, (BM, BR, K). Dpto. Itapúa: Cantera, Colonia Alborada, 23 November 1948, *J. E. Montes* 3281 (SI); Encarnación, September 1915, *E. Hassler* 1461 (SI); Mbay cae, 18 November 1945, *M. Bertoni* 2390 (LIL). Dpto. Paraguari: Paraguari, next of the route Cerro León, 30 October 1973, *P. Arenas* 73 (CTES). URUGUAY. Dpto. Artigas: Cañada Brem, 26 November 2001, *M. M. Sosa et al.* 75 (CTES). Dpto. Paysandú: route 3, Chapicuy Chico stream, 4 December 2001, *M. M. Sosa et al.* 79 (CTES).

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