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Sphinctanthus hasslerianus and *S. microphyllus* (Rubiaceae): taxonomic identity, lectotypifications and conservation assessment and chorology

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Abstract

As part of a series of taxonomic and floristic studies of Rubiaceae from Southern Cone of South America, here we focus our attention on the genus *Sphinctanthus*. The genus has five species mostly distinguished by their hermaphrodite flowers, corollas with an internal moniliform ring of hairs, and pollen grains released in monads. In the study area, only *Sphinctanthus hasslerianus* was mentioned as native, however, most of the specimens are identified by the specialists either as *S. microphyllus* or *S. hasslerianus*. After a detailed study of all original available and numerous herbarium specimens, we formally treat *S. hasslerianus* as a new synonym of the older name *S. microphyllus*. Additionally, lectotypes for both names are designated. The species is described, illustrated, all specimens studied are cited, and conservation status and comments on its geographic distribution are provided.

Keywords: Gardenieae, nomenclature, Pantanal Matogrosense, Paraguay, taxonomy

Introduction

Sphinctanthus Benth (1841: 212) comprises five South American species of shrubs and small trees. It was originally described by Benth (1841) based on the Amazonian *Sphinctanthus rupestris* Benth (1841: 212) [= *Sphinctanthus striiflorus* (Candolle 1830: 378) Hooker (1873: 84)]. The genus can be distinguished from other genera of the tribe Gardenieae by the following combination of morphological traits: hermaphroditic flowers, cream-white, yellow, yellowish orange to bright orange corollas, corolla tube with a ring of hairs at the middle or near the base inside, corolla lobes contorted to the left (Delprete & Persson 2012), and triporate pollen grains released in monads (Persson 1993, p. 578, fig. 8A–B). Phylogenetic analyses based on molecular and morphological data confirmed that *Sphinctanthus* belongs to Gardenieae, falling as sister group of the genus *Rosenbergiodendron* Fagerlind (1948: 150–152) (Gustafsson & Persson 2002). At the present, no taxonomic review is known for *Sphinctanthus*, only a small number of species has been studied in regional floras (Schumann 1889, Steyermark 1972, 1974, Delprete & Cortes-B 2006). Wallberg (1999) produced a taxonomic review of the genus in an unpublished undergraduate thesis.

Recently, Delprete & Persson (2012) described the new species *Sphinctanthus fluvii-dulcis* Delprete & Persson (2012: 174–175) with bright orange corollas, the authors also added relevant information regarding the ovary, studying material preserved in alcohol. They concluded that the ovary of this species is bicarpellar, unilocular, and its placentation is basally axial and distally parietal.

As part of taxonomic studies of the family Rubiaceae from Southern Cone of America and neighbour countries, we continue our studies in genera of Gardenieae tribe (Judkevich *et al.* 2015, 2016, 2020; Salas, 2021). In this opportunity, we focus our attention on the genus *Sphinctanthus*. For the Southern Cone of America, it has been mentioned only one species (Chodat & Hassler 1904, Bernardi 1985), *Sphinctanthus hasslerianus* Chodat in Chodat & Hassler (1904: 170), which inhabits in lowland open forest of Paraguay River. During the analysis of specimens of the genus from Paraguay we noticed that most of the specimens are identified either as *S. microphyllus* K. Schumann (1889: 354) or as *S. hasslerianus*. For the Flora of Southern Cone of America, we consider *S. hasslerianus* as a new synonym

of *S. microphyllus*. Lectotypes for both names are selected. Additionally, illustration and conservation status, with comments on geographic distribution of *S. microphyllus* are provided.

Material and Methods

The morphological analyses and species description were based on personal examination and online observations of digital images of herbarium specimens from JSTOR Global Plants (<https://plants.jstor.org/>) from the following herbaria: AS, BM, BR, C, CEN, CEPEC, CGMS, COR, CPAP, CTES, E, ESA, F, FCQ, G, INPA, HUFU, JPB, K, MBM, MO, NY, P, PY, S, SI, SP, UB, UEC, US, and USZ. Herbarium codes follow Thiers (2021, continuously updated). Information concerning the habitat, distribution data, flowering period, and qualitative characteristics, such as flower colours, were compiled from herbarium labels and fields observations.

The data of collection localities used to compile the distribution of *Sphinctanthus* species were obtained from the labels of the specimens studied and from digital images available at the following websites: SpeciesLink (<https://specieslink.net/>), Tropicos (<http://www.tropicos.org/>), Catalogue of Life (<http://www.catalogueoflife.org/>), and Flora do Brasil 2020 (<http://floradobrasil.jbrj.gov.br/>) databases. All the collection localities obtained were georeferenced using Google Earth Pro (2018), version 7.3.2 and plotted in QGIS (2021) version 3.10. To determine the environments in which the species are found, we superimposed the locations of occurrence with the layers of terrestrial ecoregions (Olson *et al.* 2001).

The conservation status was assessed following IUCN guidelines and criteria (IUCN 2019), using georeferenced data from cited collections. The area of occupancy (AOO) and extent of occurrence (EOO) were calculated using GeoCAT (Geospatial Conservation Assessment Tool, Bachman *et al.* 2011), available at <http://geocat.kew.org/>, using a grid size of ca. 2 km (cell area of 4 km²).

Results

Taxonomic treatment

Sphinctanthus microphyllus K. Schumann (in Martius *et al.* 1889: 354).

Type:—BRAZIL. Mato Grosso: Cuiabá, “Cuyaba, in umbrosis humidis”, October 1827 (fl, fr), *L. Riedel 1201* (**Lectotype** K! [barcode K000424497] **designated here**; isoelectotypes BR! [barcode BR000000552339, left-hand branch], F! [barcode F0071137F]). (Figs. 1, 2)

Sphinctanthus hasslerianus Chodat (1904: 170), **syn. nov.**

Type:—PARAGUAY. Concepción: “Prope Concepcion, in sabulosis ad fluminis ripam Paraguay”, September 1901–1902, *E. Hassler 7297* (**Lectotype** G [barcode 00307480, 3 sheets], **designated here**; isoelectotypes BM! [barcode 000549095], C!, F [barcode F0071135F], G! [barcodes G00307479 (2 sheets), G00307481, G00307482], P! [barcode 00753856], K! [barcode K000424498], MPU [barcode MPU021748], P [barcode P02273255], UC [barcode UC944181]).

Shrub or *treelet* 0.5–3 m tall, with leaves and inflorescences at the tip of brachyblasts; bark smooth to slightly striated, greyish brown, with some irregularly shaped patches; terminal branchlets terete, 2–3 mm in diam., greyish beige, with distal internodes sparsely pubescent; older internodes with scarcely visible lenticel, sparsely pubescent. *Stipules* ovate, long acuminate, 2–4 mm long, puberulous or pubescent outside, with colleters intermingled with long hairs at the base inside, persistent, apex spinescent. *Leaves* short-petiolate; petioles 3–5 mm long; blades elliptic to obovate, 2.2–5.9 × 1–2.4 cm, base acute, apex obtuse, with or without a mucro, coriaceous, lustrous and glabrous adaxially, glabrous or only with dispersed hairs at the base abaxially, concolorous, bright green, dark olive-green when dry; secondary veins 3–7 on each side of midrib, curved towards the margins; domatia absent. *Inflorescences* uniflorous, subsessile to short pedunculate; peduncle 1.5 mm long, minutely puberulous. *Flower buds* pale yellow-green; corolla lobes contorted to the left. *Flowers* hermaphroditic, 5-merous without scent; pedicels 1 mm long, retrorse pubescent. *Hypanthium* subglobose to broadly obovoid, 4–5 mm long, minutely pubescent, retrorse; ovary 2-carpellar, 1-locular; placentation parietal; ovules numerous. *Calyx* subcoriaceous, pubescent; tube cupular, 1.8–3 mm long; lobes triangular to broadly



FIGURE 1. *Sphinctanthus microphyllus*.—**A.** Portion of a branch with fruits and flower. **B.** Detail of a branch with flower in anthesis. **C.** Flower in anthesis, top view. **D.** Hypanthium and calyx lobes, top view (arrow). **E.** Flower bud. **A:** photo by Lidia Perez de Molas, downloaded with permission from Tropicos.org; **B:** photo by María Vera (reproduced with permission). **C-E:** photo by Rich Hoyer downloaded with permission from <https://www.inaturalist.org>.

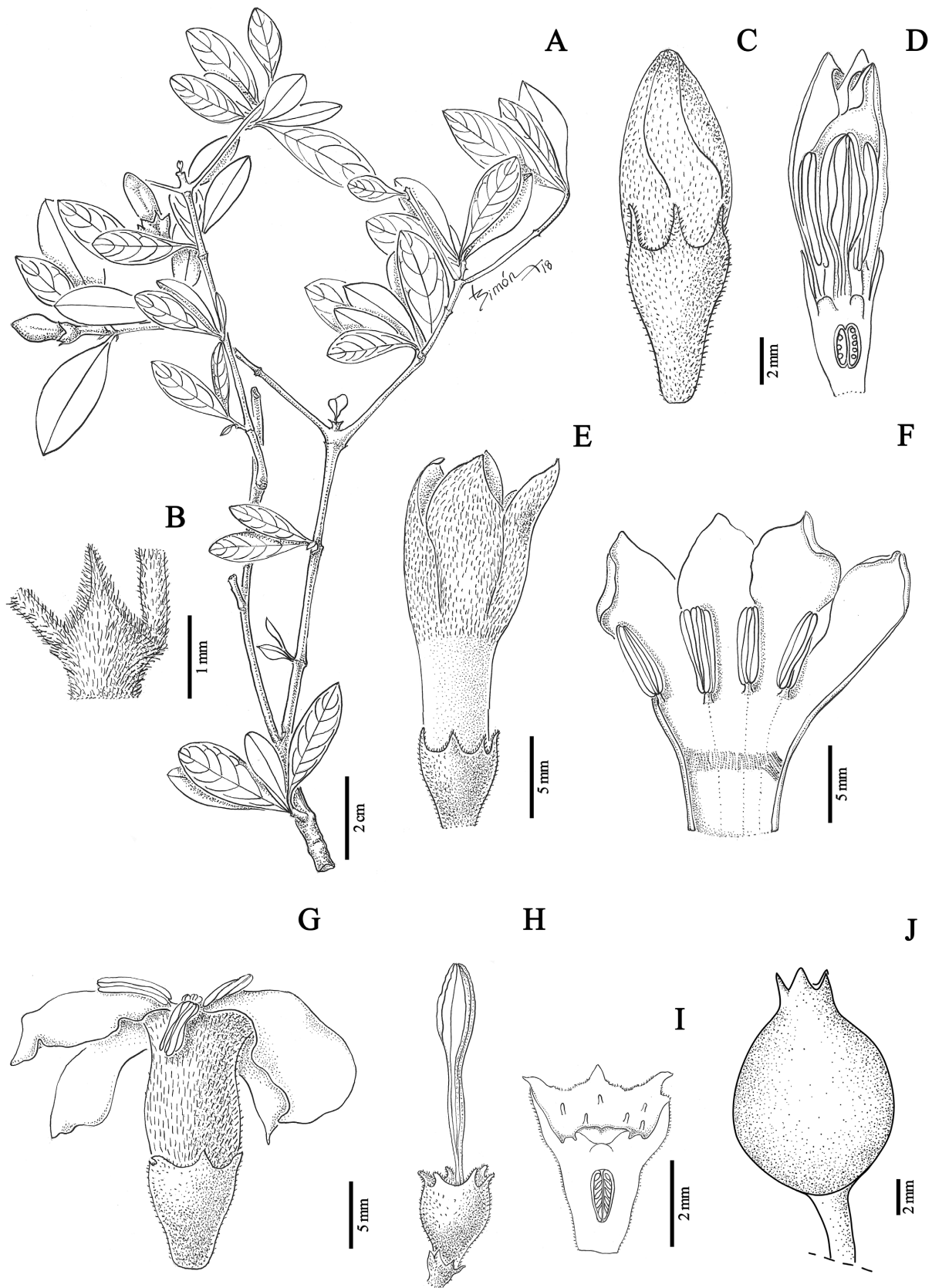


FIGURE 2. *Spinctanthus microphyllus*. **A.** Branch with flower buds. **B.** Node with stipule and base of petioles. **C.** Flower bud, side view. **D.** Flower bud, longitudinal section. **E.** Flower at early stage of anthesis, side view. **F.** Dissected corolla. **G.** Flower in anthesis. **H.** Hypanthium, calyx, and style. **I.** Longitudinal section of the ovary showing the disposition of colleteres on internal side of the calyx. **J.** Immature fruit. **A-B, F-I:** from Beck 5148 (CTES); **C-D:** from Quintana 717 (CTES); **J:** from Pérez de Molas 7531 (FCQ)—Illustration by L. Simón and M. Nuñez Florentin (fruit).

triangular, 2.4–3.5 × 1.5–2 mm, retrorse pubescent inside, glabrous to puberulous outside. *Corolla* hypocrateriform, 35–60 mm long, somewhat fleshy when fresh, bright to pale yellow; tube funnel-shaped, subcylindrical, 17–48 mm long, densely antrorsely sericeous outside, with a ring of erect hairs near the base, the rest of the throat glabrous; lobes ovate, asymmetrical, 13–15 × 8–10 mm, apex obtuse, densely sericeous, hairs antrorse outside, glabrous inside. *Stamens* partially exerted; anthers subsessile, oblong, gradually narrower toward the apex, apex obtuse and then shortly mucronate, base obtuse. *Pollen grains* triporate. *Style* about as long as corolla tube at the final stage of anthesis, 20–48 mm long, glabrous, stalk smooth, 2-lobed; the lobes connivent, 3–5 ridged abaxially. *Fruit* globose or ovoid, fleshy, yellow-orange, brownish, with a crustaceous pericarp when dry, 15–20 × 15–18 mm, many-seeded. *Seeds* discoid to irregular, embedded in a juicy gelatinous pulp.

Distribution and ecology:—According to the collections plotted on the map of Figure 3, *Sphinctanthus microphyllus* grows in the Pantanal Matogrossense, in the states of Mato Grosso do Sul and Mato Grosso, Brazil. All Brazilian collections came from flooded shrubby grasslands, in where it has been frequently mentioned as an aggressive weed (*Allem* 2587, 2599, 2526, CEN, CTES). In Bolivia it is known by only a few collections, all from Santa Cruz and Beni Departments. In this country, it grows in Cerrado, Chiquitano dry Forests, and savannas of Beni ecoregions. It also grows in seasonally waterlogged grasslands, frequently with *Paspalum fasciculatum* Willdenow ex Flüggé (1810: 69) (grass up to 1.6 m alt., *Orellana & Beck* 177, CTES & LPB). In Paraguay, it is restricted to the Paraguay River Basin, especially to the western part of the country. In dry Chaco, all collections came from Timané River, near or in the National Park Defensores del Chaco, along riverine vegetation. In addition to *S. microphyllus*, Santos (2020) recognised other five species for the Brazilian flora, of which three represents endemisms of the country: *Sphinctanthus acutilobus* Huber (Huber 1914: 202) from Pará and Amapá, *S. fluvii-dulcis* in Minas Gerais, and *S. insignis* Steyermark (1981: 400) from Bahia.

Taxonomic notes:—Schumann (1889: 354–355) described *Sphinctanthus microphyllus* and cited the collections *Riedel* 942 and 1201. We here designate the specimen *Riedel* 1201 at K, barcode 000424497, as the lectotype of this name. The duplicates at BR (barcode BR000000552339), and F (barcode F0071137F) are isolectotypes. On the sheet where *Riedel* 1201 (BR000000552339) is mounted, is also mounted a specimen of *Riedel* 942 (barcode BR000000552372).

Chodat (1904: 170) described *Sphinctanthus hasslerianus* and cited the collections *Hassler* 7297 and *Balansa* 1751. The specimen *Hassler* 7297 at G with barcode G00307480, mounted on three sheets, is here designated the lectotype of this name due to the excellent state of conservation of the abundant material. The duplicates in BM, C, G, P, and K are isolectotypes. *Sphinctanthus hasslerianus* was provisionally treated as a synonymous of *S. microphyllus* in the context of the Flora of Brazil 2020 (Santos 2020), therefore, it is formally listed as such.

Conservation status:—**Least concern (LC).** This species has an extent of occurrence (EOO) of 611.606 km², and an area of occupancy (AOO) of 156 km². It is known from 39 collection localities (GeoCAT points). According to the estimated EOO it should be classified as Least Concern (LC) and according to the estimated AOO it should be classified as endangered (EN). *Sphinctanthus microphyllus* grows associated with water bodies, as well as in humid areas of the open shrubby grasslands. Although it is subject to widespread threats, such as habitat loss, these threats do not represent any immediate threats for the species at the present (kml file available at <https://figshare.com/s/63a1589a18c65bb13522>). Based on IUCN guidelines, and the estimated EOO, the currently status should be considered as LC.

Common name:—“Rebenta-laço” (Portuguese, Brazil).

Additional specimens examined:—**BOLIVIA. Beni:** 150 m, sine data, *M.H. Nee* 34281 (MO); Ballivián, Espíritu, en la zona de influencia del Río Yacuma, sabana húmeda, Tajibal de Lucumos, 200 m, 17 October 1980 (fl), *S.G. Beck* 5148 (CTES, LPB, MO, US); Ballivián, Estancia “La Asunta”, región suroeste del departamento del Beni, a 4 horas desde el puerto de Santa Rosa por el río Yacuma, bosque de galería, 180 m, 14°14'40"S, 66°58'41"W, 5 July 2007 (fr), *A. Antezana* 951 (MO); Yacuma, Espíritu, Río Yacuma, Llanos de Moxos, bosque de galería, 189 m, 14°08'S, 66°24'W, 18 February 1990 (fr), *M. Moraes, J. Sarmiento & W. Hanagarth* 11207 (MO); Cercado, a 1 km de Puerto Almacén, sabanas benianas del Norte, pastizal de *Paspalum fasciculatum* de 1.6 m, 14°51'S, 64°57'W, 200 m, 3 June 1999 (fr), *M.R. Orellana & S.G. Beck* 177 (CTES, LPB, MO). **Santa Cruz:** Andrés Ibáñez, 6 km SE of San Lorenzo, on sandy ground, 420 m, 17°50'S, 62°50'W, 19 October 1996 (fl), *C. Persson* 353 (MO, S); plain around Santa Cruz that is bound by the 700 m contour of the Andean foothills to the west, and the Río Grande to the east, 300 m, 17°44'30"S, 63°12'00"W, 17 November 1991 (fl), *M.H. Nee* 39997 (LPB, NY); idem, 310 m, 17°44'30"S, 63°12'00"W, 22 November 1991 (fl), *M.H. Nee* 40205 (LPB, NY); Ñuflo de Chávez, Ea. San Miguelito, 200 km NE de la ciudad de Santa Cruz; puesto San Miguelito, llanura de inundación del Río San Julián, 1 km al E del puesto, 280 m, 17°01'S, 61°52'W, 28–29 July 1995 (fr), *A. Fuentes* 767 (CTES, USZ); Sara, Laguna Juan Chulo, 16 km al NW de Santa Rosa del Sara, 250 m, 17°00'S, 63°44,6'W, 9–10 March 1996 (fr), *A. Fuentes* 1580 (CTES, USZ).

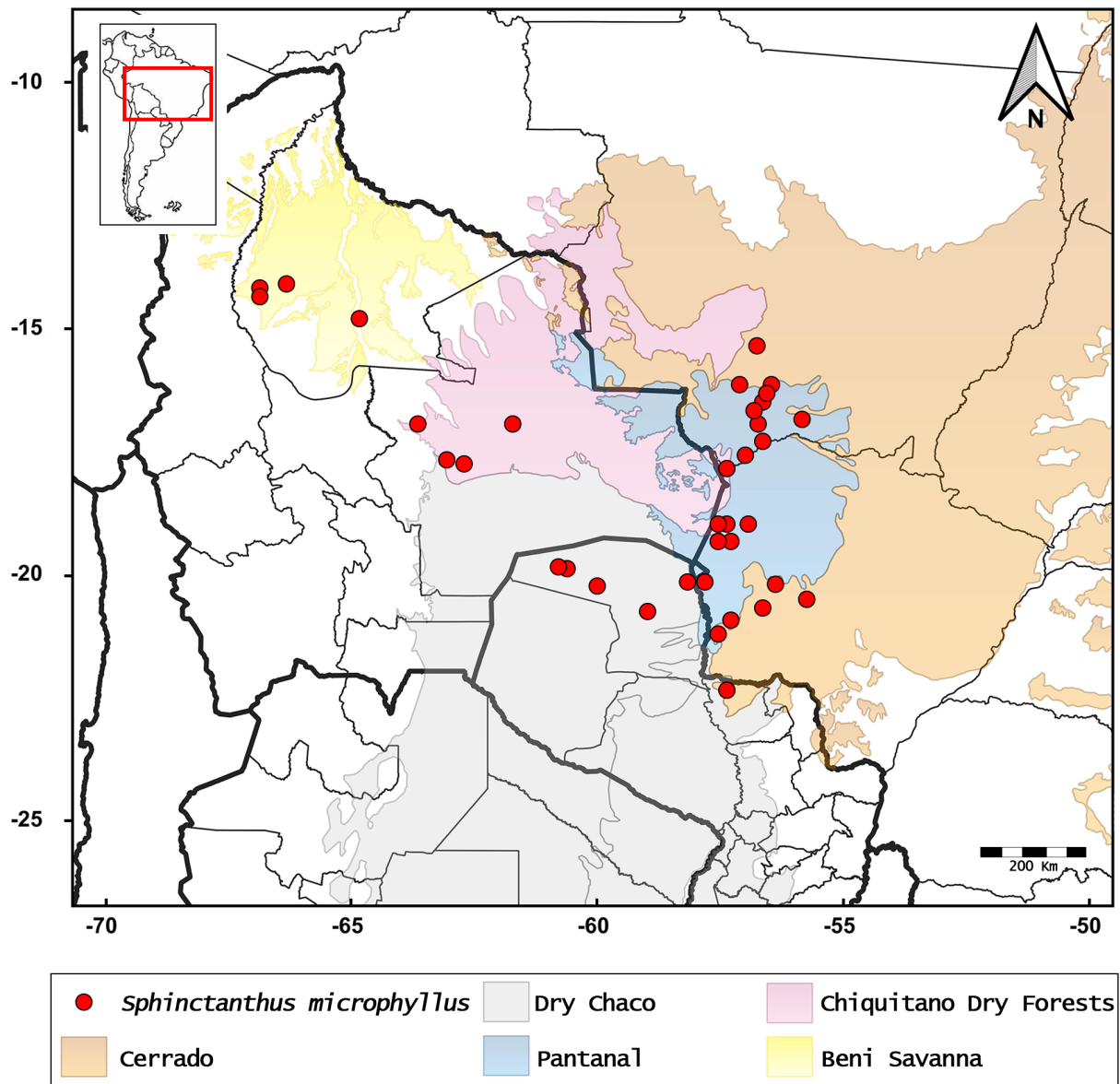


FIGURE 3. Geographical distribution of species of *Sphinctanthus* in southern Brazil, Bolivia and Paraguay.

BRAZIL. Mato Grosso: Sine loco, 1833, *C. Gaudichaud* 298 (P); Cuyabá [Cuiabá], 8 November 1920 (fl), *G.O.A. Malme s.n.* (S-V726833); Barão de Melgaço, Fazenda Santa Lúcia, 4 October 1979 (fr), *A.C. Allem* 2526 (CEN); Cáceres, estação Ecológica do Taiamã, 2 December 1980 (fl), *J.J. Soares* 6 (SP); idem, 19 November 1980 (fl), *G. Guarim Neto* 318 (UB); Poconé, PARNA do Pantanal, lado leste da sede do Parque, marmequezal com *Aspilia latissima*, 21 March 2001 (fl), *A. Pott, A.L.B. Sartori, C.N. da Cunha, E.A. Silveira & L. Amorim* 8622 (CGMS, CPAP); Baía do Burro, 15 September 2001, *E.A. Silveira C.N. da Cunha, H. Ferreira & E.C. Arruda* 1707 (CGMS); idem, lado oeste da Baía dos Burros, 15 September 2001 (fl), *A. Pott, V.J. Pott, L.C.P. Lima, C.N. da Cunha, E.A. Silveira & E.C. Arruda* 9390 (CGMS, CPAP); idem, transpantaneira, 18 September 2001 (fl), *G. Guarim Neto* 318 (UB); Faz. Campo Jofre, campo sazonalmente alagável, proximidades da rodovia Transpantaneira, Km 133, Poconé-P, 27 November 1993 (fl), *A.L. Prado* 2725 (UEC); Faz. Ipiranga, 10 km south of Poconé; floodplains south of the farmhouses, 6 December 1991 (fl), *M. Schessl* 2488 (UFMT, US); Morrinho, estrada da Integração, 28 December 1978 (fl), *V. Neiden* 34 (NY); Faz. Santa Izabel, 19 November 1979, *A.C. Allem* 2587 (CTES, CEN); idem, 10 November 1979 (fl), *A.C. Allem* 2599 (CEN, CTES); Faz. Santa Isabel, Campo sazonalmente alagável, solo argiloso, compacto, 13 Km da rodovia Transpantaneira, Km 117-120, Poconé-Jofre, 25 April 1992 (fr), *A.L. Prado, C.R. Soares, J. M. França & D. L. Prado* 2805 (UEC); Terceira parte ao sul do rio Pixaim, Transpantaneira MT-060, sub-região de Poconé, 11 November 2005 (fl), *A. Pott & V. J. Pott* 13533 (CGMS, JPB); Faz. Uval, ao lado da transpantaneira-pantanal, 08 September 1979 (fl), *C.N. Cunha* 10482 (UEC); Porto Jofre, road to Santa Isabel from Jofre, 13 June 1979 (fr), *G.T. Prance, J.B. Schaller & M. Becker* 26184 (CEN, NY); Transpantanal Highway, Fazenda Jofre, 15 November

1978 (fl), *G. Schaller 270* (NY); Fazenda Ecotrópica, 18 September 2001 (fl), *E.A. Silveira 1739* (CGMS). **Mato Grosso do Sul:** Corumbá, entre a Albuquerque e o Rio Paraguai, 90 m, 19°23'53"S, 57°23'21"W, 11 October 1985 (fl), *J.F.M. Valls 9125* (CEN); idem, Terras, 19°00'27"S, 57°35'13"W, 23 November 1987(fl), *J.A. Ratter, A. Pott, V. J. Pott, F. Martins & J. Tamashiro R6098* (COR, CPAP, E, UEC); idem, margem esquerda do rio Paraguai em frente ao CEUC, 21 October 2005 (fl), *J. Saab II* (COR); idem, estrada MS 228 de Corumbá ao Porto da Manga, entre segunda ponte y areial, planície do Rio Paraguai, pantanal, 90 m, 19°11"S, 57°28"W, 4 October 1984 (fl), *A. Pott, G. L. Webster, V. J. Pott & C. A. Conceição 163* (CPAP, CTES); idem, Rod. Br-262, 10–20 km W of Rio Paraguai, 22 October 1988 (fl), *G. Hatschbach, M. Hatschbach & J.M. Silva 52494* (CTES, G, INPA, MBM, NY, US); idem, Rio Paraguai, 27 November 2010 (fl), *M.T. Oliveira, C.O. Dourado; T.S. Yule & R.H. Silva 43* (CGMS); idem, 2 November 1993 (fl), *C. Proença 993* (CEPEC, ESA, NY, UB); idem, 19°00'S, 57°39'W, 1 January 1987 (fr), *S.M. Salis, R. A. Mauro & W. M. 159* (CPAP); idem, 17 June 1998 (fr), *S.M. Salis & D. Calheiros 1037* (CPAP); Morro no Amolar, Área da ECOA, 90 m, 17°53'S, 57°29'W, 1 November 2004 (fl), *I.M. Bortolotto 1440* (COR); idem, Fazenda Rio Vermelho, 28 October 1992 (fl), *C.A. Conceição 2861* (CGMS); “Baía do Braz.”, 19 October 2002 (fl), *G.A. Damasceno-Júnior, I.M. Bortolotto, I.H. Ishii, J.N. Nakajima, A. Sciamarelli, E.L.M. Assis, J.S. Velasques, P.V. Gonçalves, H.D. Cruz, G.E.O. Porfírio, D.P. Rodriguez, V.L. Nascimento, F.M. Alves & J.L. Sales 2557* (CGMS, COR, HUFU, JPB, UEC); idem, beira da estrada, estrada direita, próximo do MENCK, direção Corumbá-Campo Grande, 30 November 2006 (fl), *F. Matos-Alves, A.L.B. Sartori, C.A. Polido, L.C. Costa & F.M. Alves 247* (CGMS); idem, sine loco, 22 November 1988 (fl), *A. Pott, A. Boock, M. A. Araujo & G. A. Damasceno Júnior 4506* (CPAP); Pantanal, 90 m, 28 September 1987 (fl), *A. Pott, V. J. Pott, M. R. Araujo, M.P. Silva & A. Boock 3478* (CPAP); idem, Miranda, Pantanal, 100m, 7 May 1987 (fr), *A. Pott & C.J.A. Ferreira 2675* (CPAP); idem, 90m, 4 October 1984 (fl), *A. Pott, G. L. Webster, V. J. Pott & C. A. Conceição 1630* (CPAP); Ladário, Baía Negra, 30 November 1993 (fl), *C. Baracot & R. Culau 62* (COR; UB); idem, Lagoa Negra, sine data, *M.A.O. Bezerra s.n.* (COR).

PARAGUAY: Without locality, *K. Fiebrig 1311* (AS, SI); Colonia Risso, prope Rio Apa, 23 September 1893 (fl), *G.O.A. Malme s.n.* (UPS-V-726847); The River La Plata and Adjacent Countries, *E. Palmer s.n.* (US02494263); Alto Paraguay, June 2001 (fl), *L. Pérez de Molas 7531* (FCQ); Bahía Negra, Chaco Paraguayo, 18 November 1946 (fl), *T. Rojas 13789* (CTES, LIL); Parque Nacional Defensores del Chaco, Lagerenza, 7 km del cruce hacia Línea 1, bosque alto, 12 October 1998 (fl), *M. Quintana 717* (CTES, PY); Costa del Río Timané, 19°53'30"S, 60°52'05"W, vegetación xerofítica, 22 May 1996 (fr), *F. Mereles & R. Degen 6399* (CTES, FCQ); idem, selva ribereña del Río Timané, 5 April 1978 (fr), *A. Schinini & E. Bordas 14892* (CTES, MO); Isla Alta, Km 15, *G. Schmeda 1554* (US); Olimpo, November 1991 (fl), *G. Schmeda 1464* (US).

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