

A new species of *Cuspidaria* (Bignoniaceae, Bignoniaceae) from Minas Gerais, Bahia, and Piauí, Brazil

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Abstract

Cuspidaria is a genus of lianas and shrubs with approximately 19 species distributed from Mexico to Argentina and Paraguay. Its complex taxonomy has been investigated using integrative approaches combining molecular and morphological data. A recent phylogenetic study recovered a small clade with a unique combination of characters, distinct from all currently recognized species. Based on a comprehensive review of the protologues, nomenclatural types, and herbarium specimens of morphologically similar taxa, this lineage is here recognized as a new species. The new species of *Cuspidaria* occurs in the Cerrado and Caatinga domains from the states of Minas Gerais, Bahia, and Piauí, Brazil. A diagnosis, detailed description, illustration, and information on phenology, distribution, habitat, and preliminary conservation status are provided.

Key words: Blepharitheca clade, cuspidarias, Espinhaço Range, campo rupestre, rocky outcrops

Introduction

Cuspidaria Candolle (1838: 125) is a complex genus of lianas and shrubs within the diverse neotropical tribe Bignoniaceae (Bignoniaceae). The genus is widely distributed from Mexico to Argentina and Paraguay, occurring in savannas and seasonally dry formations (e.g., Amazonian, Paraguayan and Bolivian savannas, Cerrado and Caatinga), as well as rainforests (Amazon and Atlantic Forest) and Pantanal wetlands (Lohmann & Taylor 2014). Its center of diversity lies in Brazil.

As currently circumscribed, *Cuspidaria* is characterized by simple tendrils, leaflets with straight-percurrent venation, and glands typically grouped in the axils of veins. The inflorescences are multiflorous, with flowers pink to magenta (rarely white, orange to red), whose calyx apex varies from denticulate, dentate, apiculate, cuspidate to irregularly lobed. Additional diagnostic features include the anthers with forward-curved thecae (rarely straight; also found in *Tynanthus* Miers (1863: 193) and some species of *Fridericia* Martius (1827: 7)), pollen in tetrads, capsules unwinged or winged, with a single and smooth ridge or bordered by two longitudinal ridges (Lohmann 2006, Lohmann & Taylor 2014, Francisco *et al.* 2023).

Molecular phylogenetic studies have helped clarify its classification, establishing *Cuspidaria* as a monophyletic group and identifying morphological synapomorphies (Lohmann 2006, Francisco *et al.* 2023), resulting in the recognition of 19 species (Lohmann & Taylor 2014, Kaehler *et al.* 2019, Francisco *et al.* 2023). These advances enabled the reevaluation of *Cuspidaria*'s diversity by incorporating herbarium data and phylogenetic analyses, ultimately leading to a clearer understanding of generic and some interspecific boundaries within the group.

Molecular phylogenetic evidence based on combined chloroplast genomic and targeted loci data (i.e., *ndhF*, *rpl32*, *PepC*) from broad sampling has recovered a small clade within the Blepharitheca clade, a clade thought to be composed solely of *Cuspidaria floribunda* (Candolle 1845: 201) Gentry (1973: 232), characterized mainly by lianescent habit, stems without interpetiolar gland fields, 2-foliate leaves, sometimes with a terminal tendril, the presence of domatia, and linear fruits with a single and inconspicuous ridge (Francisco *et al.* 2023). However, a more detailed morphological analysis revealed that members of this small clade exhibit a confused morphology that mixes features of *C. convoluta*

(Vellozo 1825: 248) Gentry (1975: 343) and *C. floribunda*. These specimens are found in Minas Gerais, Bahia, and Piauí, Brazil, and inhabits the Caatinga and Cerrado ecosystems at elevations of 360 m to 1304 m (Figure 1). We carried out a comprehensive review of the protologues, nomenclatural types, and herbarium specimens of morphologically similar taxa, thereby confirming that this is a taxonomic novelty. The species is described and illustrated here as *Cuspidaria dulciflora*, which differs from *C. convoluta* and *C. floribunda* by a suite of morphological characters. Additionally, information on taxonomic descriptions, flowering and fruiting, habitat, geographical distributions, and preliminary conservation status is provided.

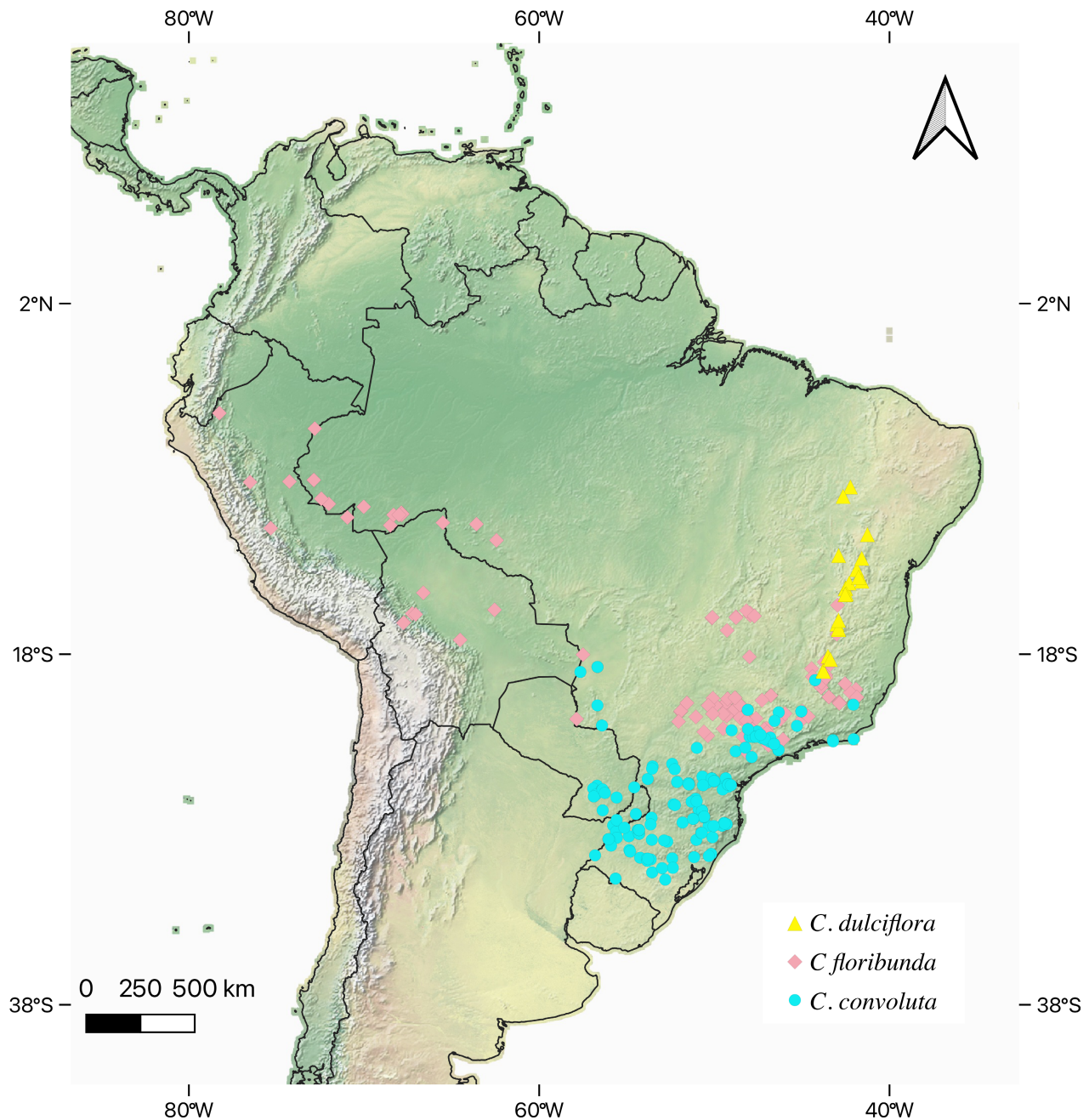


FIGURE 1. Geographic distribution of *Cuspidaria dulciflora*, *C. floribunda*, and *C. convoluta*.

Material and methods

Species delimitation:—The newly described species is identified as a distinct evolutionary lineage (de Queiroz *et al.* 2007), based on molecular divergence (Francisco *et al.* 2023) and a unique combination of morphological traits (Cracraft 1983), established through comparative analyses with similar taxa and a comprehensive literature review (Lohmann & Taylor 2014, Francisco & Lohmann in prep).

Taxonomic description:—We gathered data on morphology, phenology, habitat, and geographical distributions from collections deposited in the following herbaria: F, G, HUEFS, HVASF, K, MBM, MO, NY, RB, SPF, UPCB, and US. Specimens were examined during herbarium visits or through digital images available on JSTOR Global Plants (plants.jstor.org) and SpeciesLink (https://splink.cria.org.br/). The general terminology used for morphological descriptions follows Lohmann & Taylor (2014), with specific terminology adopted from Radford (1974), Gentry & Tomb (1979), Hesse *et al.* (2009), Hickey (1979), Nogueira *et al.* (2013), and Weberling (1992).

Distribution map:—Distribution map was generated using QGIS 3.38 (QGIS.org, 2024), with shapefiles sourced from Natural Earth (https://naturalearthdata.com) and georeferenced herbarium specimen data. A preliminary conservation status was assessed through IUCN (IUCN 2024) criteria and guidelines via Geospatial Conservation Assessment Tool (GeoCAT, Bachman *et al.* 2011), applying default parameters.

Taxonomy

Cuspidaria dulciflora J.N.C.Francisco & L.G.Lohmann, *sp. nov.* (Figures 2, 3).

Type:—BRAZIL. Bahia: Sento Sé, Riacho da Barra, margens do Riacho, Caatinga, solo arenoso, afloramento rochoso, 10°25'25.8"S, 41°32'04.59"W, 770 m elev., 27 January 2010 (fl. fr), *M. Oliveira 4716* (holotype HVASF!, isotypes HUEFS!, SPF!).

Diagnosis:—*Cuspidaria dulciflora* is similar to *C. convoluta*, but differs from the latter by the habit, which can be a liana or shrub (*vs.* always a liana in *C. convoluta*), absence of interpetiolar extrafloral nectaries (*vs.* interpetiolar extrafloral nectaries undivided or 2-parted), absence of leaves at the base of the branchlet (*vs.* a pair of simple leaves present at the base of the branchlet), glabrous anthers (*vs.* villous anthers), and flattened, unwinged fruits (*vs.* tetragonal, 4-winged), with each valve bearing a midrib bordered by two longitudinal ridges (*vs.* a midrib without longitudinal ridges).

Description:—*Liana* or shrub up to 2.5 m tall. *Stems* cylindrical, striated, sparsely lenticellate, without interpetiolar extrafloral nectaries, with a continuous or discontinuous transversal interpetiolar ridge, puberulous to tomentose, becoming glabrescent with age; with simple trichomes, prophylls of the axillary buds triangular and minute, <1.5 mm, glabrous to puberulous at apex; without simple leaves at base of shoots. *Leaves* 2, 3-foliate, the terminal leaflet sometimes replaced by a simple tendril; petioles 1.2–3 cm long, semicircular, with the upper surface canaliculated, sparsely lepidote, densely velutinous to puberulous on the upper surface and sparsely velutinous to puberulous on the lower surface; petiolules with unequal lengths, lateral petiolules 0.5–1.3 cm long, terminal petiolules 0.8–1.9 cm long, sparsely to densely velutinous (puberulous) at canalicule (throughout the surface), with simple trichomes; blades discolorous, chartaceous, ovate to elliptic (obovate), apex acuminate (acute), mucronate, base rounded to cuneate (subcordate), adaxial surface very sparsely lepidote, with peltate glandular trichomes, very sparsely to sparsely pubescent (velutinous), with simple trichomes distributed throughout surface or only on the veins, rarely with patelliform glands distributed near main vein, abaxial surface sparsely to densely pubescent to velutinous, with simple trichomes distributed throughout surface or only the veins, patelliform and peltate glandular trichomes distributed at base and near the main vein, tuft of hairs domatia present, primary venation order pinnate, secondary venation order brochidodromous, tertiary venation order weakly straight percurrent, margins entire (dentate or serrate), lateral leaflets 3.4–6 × 1.4–4.2 cm, terminal leaflets 3–5.5 × 1.8–5.5 cm. *Inflorescence* vinaceous, compound thyrses, pyramidal, sometimes umbelliform, lax, terminal, often subtended by a pair of poorly developed 2-foliolated leaves with a tendril, many-flowered, densely puberulous to tomentose, with simple trichomes, sparsely lepidote, with peltate glandular trichomes, rachis 5–14 cm long; bracts and bracteoles filiform, sometimes caducous, 0.4–1.2 × < 0.1 cm; pedicel vinaceous, 2–6 mm long. *Calyx* green to vinaceous, argent, cupular, shortly 5-parted, 5-cuspidate, 2–4 × 2–4 mm, apiculi 1.2–2.5 mm long, chartaceous, smooth, glabrous internally, puberulous externally, with simple trichomes, lepidote, with peltate glandular trichomes. *Corolla* pink, lilac to magenta, with white throat, dark pink or dark lilac nectar guides, infundibuliform, straight, dorso-ventrally compressed, 3–6.5 cm long, tube 2.2–5 cm long, 0.3–0.8 cm of max width, 0.2–0.3 cm of width at the base, 0.8–2 cm of width at the mouth, membranaceous, tube pubescent to tomentose externally, with simple trichomes, lepidote, with peltate glandular trichomes, glabrous internally, but villous at the insertion region of the stamens and staminode; lobes imbricate, orbicular-mucronate, 0.4–1.7 × 0.4–1.5 cm, lepidote internally, with peltate glandular trichomes. *Androeceum* didynamous, included, stamens inserted at the same height, with one staminode, shorter stamens 1–1.3 cm long, longer stamens 1.5–1.9 cm long, staminode



FIGURE 2. *Cuspidaria dulciflora*. **A.** Flowering branch. **B.** Interpetiolar region and prophylls of the axillary buds, minute and triangular. **C.** Simple tendril. **D.** Indumentum on adaxial surface of leaflet. **E.** Indumentum on abaxial surface of leaflet. **F.** Inflorescence bract. **G.** Flower bract. **H.** Flower. **I.** External view of open calyx. **J.** Internal view of open calyx. **K.** Open flower showing the androecium. **L.** Detail of villose indumentum at stamens insertion. **M.** Upper portion of stamen, showing glabrous and forward-curved thecae. **N.** Gynoecium. **O.** Linear and flattened fruit with two longitudinal ridges. **P.** Seed wings. A–P from the paratype collection (J.H.L. El-Ottra, P.F. Bueno, and A. Nogueira 27, SPF).

0.4–0.68 cm long, glabrous, anthers with curved forward thecae, glabrous, $1.2\text{--}3.3 \times 0.4\text{--}0.9$ mm; pollen in tetrads. *Gynoecium* included, 2.1–3.2 cm long, glabrous; ovary cylindrical, (5–)6-sulcate, $1.9\text{--}2.4 \times 0.8\text{--}1.1$ mm, glabrous, densely lepidote, with peltate glandular trichomes; ovules arranged in two series per locule, axial placentation; stigma lanceolate, $1.3\text{--}3 \times 0.9\text{--}1$ mm, glabrous; nectar disc well developed, $0.8\text{--}1.1 \times 0.8\text{--}2$ mm, cupular, glabrous. *Fruit* green to dark brown, unwinged, linear, flattened, coriaceous, smooth, $19.5\text{--}24 \times 0.5\text{--}0.8$ cm, glabrous to pubescent, with simple trichomes, lepidote, with peltate glandular trichomes throughout, with lenticels, each valve with a midrib bordered by two longitudinal ridges, calyx caducous. *Seeds* oblong, thin, chartaceous, $2.8 \times 0.6\text{--}0.7$ cm, glabrous, smooth, winged, with membranaceous and hyaline wings.



FIGURE 3. *Cuspidaria dulciflora*. **A.** Fruits and inflorescence (M. Oliveira 4716). **B.–C.** Inflorescences (B. J.H.L. El-Ottra 27, C. M. Oliveira 4716). Photos by J.A. Siqueira-Filho (A, B) and A. Nogueira (C).

Etymology—The species epithet refers to its sweet-smelling floral scent reported in herbarium labels.

Phenology—Flowering specimens were collected in January, March, September, November, and December. Fruiting specimens were collected in January, March, and April.

Distribution and habitat—This species is found primarily along the Espinhaço Range, in Cerrado and Caatinga enclaves as well as in transitional zones (ecotones) between these domains. It occupies a wide range of habitats, including rocky outcrops, white-sand areas, rupestrian grasslands (“campos rupestres”), gallery forests, *cerradão*, Cerrado *sensu stricto*, and both crystalline and sedimentary Caatinga vegetation. It occurs at elevations from 360 to 1304 m in Bahia, Minas Gerais, and Piauí, Brazil (Fig 1).

Preliminary conservation assessment—*Cuspidaria dulciflora* is currently known from 28 records. Most populations of the species occur outside protected areas, with only three documented occurrences within Parque Estadual do Grão Mogol, Parque Estadual Rio Preto, and Parque Estadual do Morro do Chapéu, all affected by recent fires (INPE, 2024). The species has a restricted area of occupancy (AOO = 92 km²) and exhibits a large extent of occurrence (EOO = 137,471.284 km²). According to IUCN criteria B2ab(iii) (IUCN 2012, 2022), *C. dulciflora* is classified as Endangered (EN). Key threats include habitat fragmentation, deforestation in unprotected areas, and recurrent fires, which could drive significant declines in population and habitat quality.

Additional specimens examined (Paratypes)—BRAZIL. **Bahia**: Abaíra, Distrito de Catolés, estrada de Ribeirão de Baixo para Barra, ca. 5 km de Ribeirão de Baixo, 13°10'20"S, 41°52'23"W, 1304 m elev., 30 December 2013 (fl.), R.M. Harley 56903 (HUEFS!); Caetité, Brejinho das Ametistas, 20 km de Caetité para Brejinho das Ametistas,

14°13'35"S, 42°30'34"W, 900 m elev., 13 March 2002 (fl. fr.), *T. Ribeiro* 252 (HUEFS!); *Ibid.*, Brejinho das Ametistas, entrada de chão Brejinho, 14°15'60"S, 42°31'37"W, 20 November 2006 (fl.), *M.M. Silva-Castro* 1057 (HUEFS!); Lagoa Real, Beira da estrada de chão para Lagoa Real, Caatinga, sobre afloramento rochoso, 13°56'34"S, 42°18'12"W, 968 m elev., 17 November 2013 (fl.), *L.H. Fonseca* 289 (HUEFS!, SPF!); Licínio de Almeida, estrada para Caetité, 14°36'12"S, 42°31'55"W, 852 m elev., 04 November 2006 (fl.), *A. Rapini* 1348 (HUEFS!); *Ibid.*, Serra Geral, Licínio de Almeida, Lagoa da Vereda, ecótono Caatinga/Cerrado, 14°34'11"S, 42°27'59"W, 738 m elev., 11 December 2009 (fl.), *F.S. Gomes* 392 (HUEFS!, MBM!); Morro do Chapéu, estrada do Prefeito para Brejões, Caatinga, solo arenoso, 11°10'41"S, 41°15'44"W, 803 m elev., 02 December 2006 (fl.), *F. França* 5572 (HUEFS!); Oliveira dos Brejinhos, estrada de chão para Chapada de Cima, ca. 6 km, 12°22'16"S, 42°54'17"W, 886 m elev., 22 January 2009 (fl.), *M.M. Silva-Castro* 1523 (HUEFS!); Palmeiras, caminho para Serra Preta, 12°31'55"S, 41°35'14"W, 800 m elev., 28 March 2003 (fr.), *E. Melo* 3629 (HUEFS!); Piatã, Morro dos Três Morros, Serra do Gentio, São Bartolomeu ("Bertolameu"), base NNW do Morro do Navio, 9.3 km N de Piatã na estrada Piatã-Boninal (BA 148) e 7.1 km W na estrada vicinal para Inúbia, 6.8 km NW desta última estrada, afloramentos rochosos planos com *Nanuza plicada*, *Vellozia tubiflora* e areais brancos, 13°02'04"S, 41°54'114"W, 1477 m elev., 28 December 2004 (fl.), *R. Mello-Silva* 2801 (SPF!, RB!); Rio de Contas, estrada para Água Suja depois de Arapiranga, subida do morro, 13°36'58"S, 41°45'45"W, 980 m elev., 21 November 2006 (fl.), *M.M. Silva-Castro* 1101 (HUEFS!); *Ibid.*, Serra do Rio de Contas, proximidades de Boa Sentença, Morro da Morceguinha, uma mata seca em transição com a caatinga arbórea, com rochas quartzíticas e de arenito metamórfica, 13°49'34"S, 41°35'4"W, 684 m elev., 05 December 2004 (fl.), *R.M. Harley* 55274 (HUEFS!). **Minas Gerais:** Serra do Espinhaço, 3.5 km SW of Rio Jequití and Mandanha, dense woods on hillside interrupted by quartzite rocks, 880 m elev., 14 April 1973 (fr.), *W.R. Anderson* 8901 (MO!, RB!, NY!, K!, US!, F!); Grão Mogol, BR 251, campo de plantio de Eucaliptos abandonado, em regeneração, em frente ao restaurante Serra Azul, Carrasco com cerrado, solo areno-pedregoso, campo queimado com afloramentos rochosos, próximo aos *Pinus* queimado no declive, 21 December 2009 (fl.), *R.F. Almeida* 357 (SPF); *Ibid.*, montanha a esquerda do riacho Ribeirão, trilha da Tropa, campo rupestre, 42°55'W, 16°32'30"S, 1150 m elev., 3 November 1987 (fl.), *I. Cordeiro* CFCR11464 (SPF!, MO!); *Ibid.*, trilha próxima a ponte do Rio Itambiruçu, 16°35'33.5"S, 42°54'01.9"W, 661m elev., 27 January 2009 (fr.), *J.H.L. El-Ottra* 26 (SPF!); *Ibid.*, *J.H.L. El-Ottra* 27 (SPF!); *Ibid.*, Vale do Rio Itacambiruçu, solo arenoso-fino com rochas com cerrado e vegetação da margem do rio, 16°36'S, 42°55'W, 12 December 1989 (fl.), *J.R. Pirani* CPCCR12542 (MO!, SPF!); Riacho dos Machados, estrada para a Fazenda Tapera, 11 January 2009 (fl.), *M. Kaehler* 400 (UPCB!); Santana de Pirapama, estrada do vilarejo Inhames para o distrito de São José da Cachoeira, Cerrado *sensu stricto*, solo argiloso seco, 18° 58' 7" S, 43° 46' 59.9" W, 750 m elev., 20 December 2024 (fl.), *G.M. Antar* 620 (RB!, SPF!); *Ibid.*, proximidades de Inhame, a norte da vila, estrada velha para a mina de manganês, Cerradão, 18° 55' 43.2" S, 43° 47' 46.29" W, 764 m elev., 9 November 2009 (fl.), *B.B. Klitgaard* 1165 (RB!, SPF!); *Ibid.*, Serra do Cipó, acesso pela Fazenda Inhame, Cachoeira do Quartel, mata de galeria, 18° 58' 28.26" S, 43° 46' 22.02" W, 666 m elev., 21 November 2009 (fl.), *D.C. Zappi* 2477 (RB!, SPF!); *Ibid.*, Serra do Cipó, acesso pela Fazenda Inhame, Cerrado, 20 March 2011 (fr.), *E.S. Cândido* 536 (K!, SPF!); *Ibid.*, Serra do Cipó, acesso pela Fazenda Inhame, beira do córrego, 20 March 2011 (fl.), *E.S. Cândido* 509 (SPF!); São Gonçalo do Rio Preto, estrada entre Currallinho e Covão, Cerrado com afloramentos rochosos, 18° 17' 52" S, 43° 22' 37" W, 950 m elev., 10 November 2019 (fl.), *G. Martinelli* 21339 (MBM!, RB!). **Piauí:** São João do Piauí, complexo solar fotovoltaico, área de supressão vegetal, coleta durante o resgate de germoplasma para construção da usina solar, Caatinga arbustiva- arbórea de solo arenoso e escurecido, 8°27'43"S, 42°14'09"W, 360 m elev., 14 November 2018 (fl.), *F. Hurbath* 950 (SPF!); São Raimundo Nonato, Sítio do Meio, 2 September 1984 (fl.), *L. Emperaire* 2699 (MO!).

Discussion—*Cuspidaria dulciflora* is a cryptic species often misidentified as *C. convoluta* or *C. floribunda*. It most closely resembles *C. convoluta* in its thyrsoid inflorescence bearing flowers with a cuspidate calyx, but differs in several key vegetative and reproductive traits, including growth habit, absence of simple leaves at the base of branchlets, absence of interpetiolar gland fields, prophyll morphology, domatia type, anther indumentum, and fruit morphology. The unwinged fruits with two longitudinal ridges observed in *C. dulciflora* is the main character shared with its sister species *C. floribunda* (Francisco *et al.* 2023). However, these species differ in leaf division, venation pattern, domatia type, and calyx shape (Table 1). Additionally, the distribution of *C. dulciflora* is restricted to the northern portion of the Southeast and the interior of the Northeast of Brazil. In contrast, *C. convoluta* occurs from southeastern and southern Brazil to Argentina, Paraguay, and Bolivia, whereas *C. floribunda* is widely distributed from Peru and Bolivia to central and southeastern Brazil (Figure 1). Therefore, despite sharing a partial geographic overlap with *C. convoluta* and *C. floribunda*, *C. dulciflora* is readily distinguished by a consistent set of morphological characters, supporting its recognition as a distinct species.

TABLE 1. Morphological comparison among *Cuspidaria dulciflora*, *C. convoluta* and *C. floribunda*.

Characters	<i>C. dulciflora</i>	<i>C. convoluta</i>	<i>C. floribunda</i>
Habit	liana or shrub	liana	liana
Lower leaves on branchlets	absent	1-foliolate	absent
Interpetiolar gland fields	absent	undivided or 2-parted	absent
Prophylls	small and triangular	absent, small and triangular, sometimes subulate near the inflorescence	absent or small and triangular
Leaf division	2, 3-foliolate	2, 3-foliolate	2-foliolate
Leaflet veins	pinnate	pinnate	actinodromous
Domatia type	tuft of hairs	tuft of hairs and pocket	pocket and pit
Calyx shape	cupular	cupular	tubular
Calyx apex	cuspidate	cuspidate	denticulate
Anther indumentum	glabrous	villous	glabrous
Fruit morphology	flattened and unwinged	tetragonal and 4-winged	flattened and unwinged
Fruit midrib	bordered by two longitudinal ridges	without longitudinal ridges	bordered by two longitudinal ridges

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References

- Bachman, S., Moat, J., Hill, A., de la Torre, J. & Scott, B. (2011) Supporting Red List threat assessments with GeoCAT: Geospatial Conservation Assessment Tool. *ZooKeys* 150: 117–126.
<https://doi.org/10.3897/zookeys.150.2109.figure1>
- Candolle, de, A.P. (1838) Revue sommaire de la famille des Bignoniacées. *Bibliothèque Universelle Genève* 17: 117–136.
- Candolle, de, A.P. (1845) *Prodromus systematis naturalis regni vegetabilis* 9. Fortin, Masson & Assoc., Paris, 573 pp.
- Cracraft, J. (1983) Species concepts and speciation analysis. *Current Ornithology* 1: 159–187.
https://doi.org/10.1007/978-1-4615-6781-3_6
- De Queiroz, K. (2007) Species concepts and species delimitation. *Systematic Biology* 56: 879–886.
<https://doi.org/10.1080/10635150701701083>
- Francisco, J.N.C., Fonseca, L.H.M. & Lohmann, L.G. (2023) Phylogeny and morphological evolution of the Neotropical genus *Cuspidaria* (Bignoniaceae, Bignoniaceae): combining high-throughput sequencing and targeted loci data. *Taxon* 72: 1057–1079.
<https://doi.org/10.1002/tax.13028>
- Gentry, A.H. (1973) Generic delimitations of central American Bignoniaceae. *Brittonia* 25: 226–242.
<https://doi.org/10.2307/2805585>
- Gentry, A.H. (1975) Identification of Vellozo's Bignoniaceae. *Taxon* 24: 337–344.
- Gentry, A.H. & Tomb, A.S. (1979) Taxonomic implications of Bignoniaceae palynology. *Annals of the Missouri Botanical Garden* 66:

756–855.

<https://doi.org/10.2307/2398917>

Hesse, M., Halbritter, H., Zetter, R., Weber, M., Buchner, R., Frosch-Radivo, A. & Ulrich, S. (2009) *Pollen terminology: an illustrated handbook*. Springer, Vienna, 264 pp.

Hickey, L.J. (1973) Classification of the architecture of dicotyledonous leaves. *American Journal of Botany* 60: 17–33.

<https://doi.org/10.1002/j.1537-2197.1973.tb10192.x>

IUCN Standards and Petitions Committee (2024) *Guidelines for Using the IUCN Red List Categories and Criteria. Version 16*. Prepared by the Standards and Petitions Committee. Available from: <https://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 24 August 2024)

Kaehler, M., Michelangeli, F.A. & Lohmann, L.G. (2019) Fine tuning the circumscription of *Fridericia* (Bignoniaceae, Bignoniaceae). *Taxon* 68: 751–770.

<https://doi.org/10.1002/tax.12121>

Lohmann, L.G. (2006) Untangling the phylogeny of neotropical lianas (Bignoniaceae, Bignoniaceae). *American Journal of Botany* 93: 304–318.

<https://doi.org/10.3732/ajb.93.2.304>

Lohmann, L.G. & Taylor, C.M. (2014) A new generic classification of tribe Bignoniaceae (Bignoniaceae). *Annals of the Missouri Botanical Garden* 99: 348–489.

<https://doi.org/10.3417/2003187>

Martius, C.F.P. (1827) *Fridericia*. *Nova Acta Physico-medica Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum Exhibentia Ephemerides sive Observationes Historias et Experimenta* 13: 7.

Miers, J. (1863) Report on the plants collected by Mr. Weir, especially the Bignoniaceae. *Proceedings of the Royal Horticultural Society of London* 3: 179–202.

Nogueira, A., El-Ottra, J.H.L., Guimarães, E., Machado, S.R. & Lohmann, L.G. (2013) Trichome structure and evolution in Neotropical lianas. *Annals of Botany* 112: 1331–1350.

<https://doi.org/10.1093/aob/mct201>

QGIS.org (2024) *QGIS Geographic Information System*. Open Source Geospatial Foundation Project. Available from: <http://qgis.org> (accessed 24 August 2024)

Radford, A.E., Dickison, W.C., Massey, J.R. & Bell, C.R. (1974) *Vascular plant systematics*. Harper & Row Publishers, New York, 891 pp.

SpeciesLink (2024) Sistema de informação distribuído para recuperação de dados de acervos de coleções biológicas e de observação em campo. Available from: <http://splink.cria.org.br/> (accessed 7 June 2025)

<https://doi.org/10.11606/D.55.2021.tde-11012022-102933>

Vellozo, J.M.C. (1825) *Florae Fluminensis*. National Press, Rio de Janeiro, 352 pp.

Weberling, F. (1992) *Morphology of flowers and inflorescences*. Cambridge University Press, Cambridge, 344 pp.