

## Article

# Taxonomic Synopsis of *Mascagnia* (Malpighiaceae) of Brazil

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## Abstract

*Mascagnia* (Malpighiaceae) is the lianescent genus with the most convoluted taxonomic history and polyphyly of Malpighiaceae, formerly comprising eight unrelated accepted genera and over 300 species. This genus currently encompasses 48 accepted Neotropical species, of which 20 are reported for Brazil in the taxonomic treatment presented herein. This synopsis was based on the morphological study of specimens deposited in over 80 herbaria using a stereomicroscope, the specialized literature, and consulting type specimens for all accepted species. A total of 20 species of *Mascagnia* are found in all biomes of Brazil. A taxonomic synopsis is presented for these species, including an identification key, notes on distribution, conservation and taxonomy, and photographic plates for 12 species. Two main morphological groups were identified based on the inflorescence architecture and petal color, and four species were identified as under a conservation threat.

**Keywords:** lianas; Malpighiales; Neotropics; taxonomy

## 1. Introduction

*Mascagnia* (Bertero ex DC.) Bertero is a mid-sized genus of Neotropical lianas of Malpighiaceae, comprising 48 species distributed throughout seasonally dry tropical forests (SDTFs), rainforests, and savannas from Mexico (North America), Antilles (Central America), to Argentina (South America) [1–3]. The genus is currently recognized by its flowers arranged in thyrses or corymbs, bracteoles 0–1-glandular, floral buds keeled, petals white, yellow, pink or lilac, if yellow not turning orange to red at post-anthesis, glabrous, mericarps with lateral wings connate into a single orbicular wing, membranous [2,4].

Several species currently accepted under *Mascagnia* were previously treated by many authors as part of a much wider and polyphyletic *Hiraea* Jacq., or of an also polyphyletic *Mascagnia* [4]. Based on recent systematic and taxonomic studies, we now know that these two artificial assemblages represent eight independent lineages in Malpighiaceae [1,5]. *Mascagnia* is monophyletic in its current circumscription and placed in a basal grade in tribe Malpighieae [2], alongside *Ectopopterys* W.R.Anderson, *Amorimia* W.R.Anderson, *Calicola* W.R.Anderson & C.Davis, *Malpighia* L., and a clade comprising several paleotropical lineages (i.e., *Aspidopterys* A.Juss. ex Endl., *Caucanthus* Forssk., *Diaspis* Nied., *Digoniopterys* Arènes, *Madagasikaria* C.Davis, *Rhynchophora* Arènes, *Microsteira* Baker, and *Triaspis* Burch.) [2].

Brazil is the diversity center for *Mascagnia* in South America, with the most significant number of new species described in the past two decades [6–8]. However, species identification in this genus remains challenging, as several genera have been segregated from it; however, subsequent works have failed to provide a recircumscription for Brazilian



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*Mascagnia*. After extensive field and herbarium studies over the past decade, we present the first taxonomic synopsis for *Mascagnia* of Brazil. An identification key to the species found in this country is presented alongside notes on their conservation, distribution, and taxonomy.

## 2. Materials and Methods

Morphological studies were based on herbarium specimens (ALCB, AMAZ, ASE, BAH, BM, BHC, BOTU, CEN, CEPEC, CESJ, CGMS, COL, CPAP, CVRD, CTES, CUZ, EAC, ESA, F, FLOR, FPS, FUEL, FURB, FZB, G, GH, GUA, HAS, HB, HCF, HEPH, HISA, HPAN, HRB, HRCB, HSJRP, HST, HUCP, HUCS, HUEFS, HUEM, HUESC, HUFG, HUFU, HUPG, HURB, HUT, HUVA, IAC, IAN, ICN, INPA, IPA, JPB, L, LIL, K, MAC, MBM, MBML, MG, MICH, MO, MOSS, MPU, NY, OUPR, P, PACA, PAMG, PEUFR, PMSP, R, RB, RBR, RFA, S, SI, SMF, SP, SPF, SPSE, TEPB, U, UB, UEC, UFP, UFMS, UFMT, UFRN, UPCB, US, USZ, W, VIC, and VIES), and field and spirit specimens [herbaria acronyms [9]]. We followed specialized literature for describing the indumenta terminology [10], structure shapes [11], the inflorescence terminology and morphology [12], fruit terminology [10,13], and the conservation threat risk [14] adopted in this study. Maps were made with GIS software, version 9.3.1 [15] based on geographical coordinates obtained from the consulted herbarium specimens and shapefiles [16].

## 3. Results

***Mascagnia* (Bertero ex DC.) Bertero**, Hortus Ripul. 85. 1824. nom. cons. prop. *Hiraea* sect. *Mascagnia* Bertero ex DC., Prodr. 1: 585. 1824. Lectotype, designated by Pfeiffer, Nom. 2: 238. 1872: *Mascagnia americana* Bertero, nom. superf. [*Mascagnia macradena* (DC.) Nied.], =*Triopterys* L., Sp. Pl. 428. 1753. Type: *Triopterys jamaicensis* L. [*Mascagnia lucida* (Kunth.) W.R.Anderson & C.Davis].

Shrubs to lianas, stems woody, slender to stout; stipules interpetiolar, minute, distinct and triangular; leaves decussate; petiole eglandular or biglandular at base or between base and apex; leaf blade in most species bearing glands embedded in abaxial surface. Inflorescences elongated or occasionally congested, flowers arranged in 1st to 2nd order compound thyrses or corymbs; bracts eglandular, persistent; bracteoles eglandular or one of each pair bearing one abaxial gland, persistent, borne at various heights on the well-developed peduncle. Flowers bilaterally symmetrical in all whorls, bisexual. Sepals leaving petals exposed in enlarging bud, the lateral 4 bearing large paired abaxial glands and the anterior eglandular; petals yellow, pink, white, or various shades of lilac, blue, or purple, glabrous, entire, erose or dentate, the posterior petal somewhat different in size, shape, and stance from the lateral 4; receptacle glabrous on both sides of filaments; stamens 10, all fertile, the filaments glabrous, connate at base, shortest opposite posterior petal, otherwise diverse but not rarely thicker opposite posterior-lateral petals, the anthers glabrous or hairy,  $\pm$  alike, the connective not exceeding locules at apex; gynoecium 3-carpellate, the carpels 1 anterior and 2 posterior, all fertile, connate their whole length in ovary; styles 3, distinct, alike or the anterior style shorter than the posterior 2, abaxially rounded, truncate, or uncinat at apex, stigma lateral. Fruit dry, breaking apart at maturity into 3 winged mericarps; mericarps mostly elliptical or orbicular (occasionally triangular) with the lateral wing well developed, membranous with a prominent reticulum of arching anastomoses, in most species continuous at base (divided to the nut in a few species) and entire to deeply cleft at the apex, in a few species strongly reduced or dissected, the dorsal crest or winglet very small or absent; fruit subtended by a fleshy 3-lobed disc, the disc sometimes much reduced.

**Etymology:** *Mascagnia* pays honor to Paolo Mascagni (1755–1815), an Italian physician known for his research on human anatomy.

**Distribution and habitat:** *Mascagnia* is a Neotropical genus comprising 48 accepted species occurring in rain/dry forests and savannas from Mexico, the Antilles, to Argentina.

**Notes:** The Brazilian species of *Mascagnia* can be divided into two main morphological groups based on compound inflorescence architecture [flowers grouped in corymbs vs. thyrses (1st order inflorescences), which might also be secondarily arranged in corymbs or thyrses (2nd order inflorescences)] and color of petals (white/pink/lilac petals vs. yellow petals). When comparing these traits with the most recent phylogenetic study, which sampled the largest number of *Mascagnia* species, inflorescence architecture may exhibit some phylogenetic signal, but petal color is most likely homoplastic within the genus [5]. Future studies assessing and mapping these morphological traits for the remaining species of *Mascagnia* in a phylogenetic context might shed some light on their phylogenetic relevance.

Key to the species of *Mascagnia* from Brazil

|                                                                                                                                                                                         |                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1. Flowers/fruits grouped in corymbs (1st order inflorescences).....                                                                                                                    | 2                     |
| 1. Flowers/fruits grouped in thyrses (1st order inflorescences).....                                                                                                                    | 13                    |
| 2. Corymbs solitary (1st order inflorescences).....                                                                                                                                     | 3                     |
| 2. Corymbs grouped in thyrses or in pairs (2nd order inflorescences).....                                                                                                               | 8                     |
| 3. Petals pink, lilac to reddish.....                                                                                                                                                   | 4                     |
| 3. Petals yellow.....                                                                                                                                                                   | 5                     |
| 4. Liana, leaves petioles up to 10 mm long, margin plane, veins adaxially impressed, abaxially sparsely tomentose, petals pink to lilac. ....                                           | <i>M. affinis</i>     |
| 4. Shrub, leaves petioles up to 3 mm long, margin revolute, veins adaxially bullate, abaxially densely whitish tomentose, petals pink to reddish. ....                                  | <i>M. aptera</i>      |
| 5. Leaves chartaceous, leaf blade wide-elliptic to obovate.....                                                                                                                         | 6                     |
| 5. Leaves membrane or coriaceous, leaf blade ovate. ....                                                                                                                                | 7                     |
| 6. Leaf base obtuse to rounded, veins adaxially impressed, tomentose; bracteoles 0.6–0.8 mm long; flowers with pedicels up to 14 mm long. ....                                          | <i>M. australis</i>   |
| 6. Leaf base cordate, veins adaxially bullate, velutine; bracteoles 1.2–1.8 mm long; flowers with pedicels up to 7 mm long. ....                                                        | <i>M. velutina</i>    |
| 7. Leaves coriaceous, conduplicate, apex acuminate, abaxially multiglandular, glabrous; peduncle + pedicel up to 14 mm long, bracteoles 2–2.4 mm long; mericarps up to 40 mm diam. .... | <i>M. bierosa</i>     |
| 7. Leaves membranous, plane, apex acute, abaxially 2-3-glandular, sparsely sericeous, peduncle + pedicel up to 9 mm long, bracteoles 0.7–1.1 mm long; mericarps up to 25 mm diam. ....  | <i>M. sepium</i>      |
| 8. Inflorescences born apically on branches. ....                                                                                                                                       | <i>M. lorentensis</i> |
| 8. Inflorescences born laterally on branches. ....                                                                                                                                      | 9                     |
| 9. Leaves tomentose or sericeous; thyrses of 2–5 corymbs (2nd order inflorescences). ...                                                                                                | 10                    |
| 9. Leaves glabrous; thyrses of 7–9 corymbs (2nd order inflorescences). ....                                                                                                             | 14                    |
| 10. Leaves sericeous to glabrescent; thyrses of 3–5 corymbs. ....                                                                                                                       | <i>M. arenicola</i>   |
| 10. Leaves tomentose; thyrses of 2 corymbs. ....                                                                                                                                        | 11                    |
| 11. Vegetative leaves with margins plane; apex of styles uncinat, lateral stigmas drying blackish. ....                                                                                 | <i>M. riparia</i>     |

11. Vegetative leaves with margin revolute; apex of styles truncate, lateral stigmas drying the same color as styles. .... 12
  12. Leaves with veins adaxially bullate; corymbs grouped in thyrses, bracteoles inserted near apex of peduncles, bracteole gland as long as bracteoles; pedicel up to 3 mm long. .... *M. tucuruensis*
  12. Leaves with veins adaxially impressed; corymbs grouped in pairs, bracteoles inserted near the middle of peduncles, bracteole gland half the size of bracteoles; pedicel up to 8 mm long. .... *M. cynanchifolia*
  13. Leaves associated with the inflorescence well-developed, lanceolate. .... *M. lugoi*
  13. Leaves associated with the inflorescence very-reduced, elliptic to filiform. .... *M. tenuifolia*
  14. Thyrses solitary (1st order inflorescences). .... 15
  14. Thyrses arranged in thyrses (2nd order inflorescences). .... 18
  15. Petals yellow, mericarps with dorsal wing inconspicuous. .... *M. schunkei*
  15. Petals pink to lilac, mericarps with dorsal wing conspicuous. .... 16
  16. Leaves orbicular, strigulose-tomentose, petals whitish lilac. .... *M. strigulosa*
  16. Leaves widely elliptic to ovate, sericeous to tomentose, petals pink. .... 17
  17. Leaves with base cordate, densely tomentose, bracteoles up to 2.5 mm long, Cerrado. .... *M. cordifolia*
  17. Leaves with base obtuse, sericeous to glabrate, bracteoles up to 1.5 mm long, Amazon. .... *M. conformis*
  18. Leaves coriaceous, oblong, discolor. .... *M. dissimilis*
  18. Leaves chartaceous to membranous, ovate, concolor. .... 19
  19. Leaves with petioles up to 10 mm long, leaf blades up to 7 cm long, apex acute, mericarps up to 20 mm long. .... *M. divaricata*
  19. Leaves with petioles up to 25 mm long, leaf blades up to 16 cm long, apex long-acuminate, mericarps up to 30 mm diam. .... *M. glabrata*
1. *Mascagnia affinis* W.R.Anderson & C.Davis, Contr. Univ. Michigan Herb. 24: 37–38. 2005. Type: **BRAZIL. State of Mato Grosso:** city of Porto Espiridião, MT265 road, km 60–70 of junction with BR174 road, 27 October 1995, fl., fr., *Hatschbach* 63949 (holotype: MBM barcode MBM374477!; isotypes: MICH barcode MICH1254374!, SPF barcode SPF179000!).

Notes: *Mascagnia affinis* is found in the Amazon rainforest biome in the states of Rondônia, Amazonas, and Pará (Figure 5). Not threatened [14].

Specimens examined: **BRAZIL. State of Mato Grosso:** city of Cáceres, BR174 road, 45 km S of Pontes and Lacerda, 30 October 1985, *Ferreira* 6573 (INPA, MICH, NY). **State of Pará:** city of Juruti, PA Translago Road, 12 December 2006, *Amaral* 3049 (INPA). **State of Tocantins:** city of Araguaina, UFT, Agrostology campus, 1 February 2014, *Santos-Silva et al.* 157 (HPAN).

2. *Mascagnia aptera* W.R.Anderson, Contr. Univ. Michigan Herb. 14: 17. 1980. Type: **BRAZIL. State of Mato Grosso:** Chapada dos Guimarães, road from city of Buriti to city of Cuiaba, rocky escarpment, amongst sandstone rocks, 720 m alt, 22 October 1973, fl., fr., *Prance et al.* 19274 (holotype: INPA accession 42766!; isotypes: MICH barcode MICH1102233!, NY barcode NY00067647!, US barcode US00108443!).

Notes: *Mascagnia aptera* is only known for its type specimen, being endemic to the Cerrado biome in the state of Mato Grosso (Figure 5). Threatened [14].

3. *Mascagnia arenicola* C.E.Anderson, Brittonia 53: 406. 2001. Type: **GUYANA. Pomeroon-Supenaam region:** Mainstay Village, 10 m alt, 21 April 1989, fl., Gillespie 1086 (holotype: MICH barcode MICH1244745!; isotypes: US barcode US00588020!, U?). Figure 1.

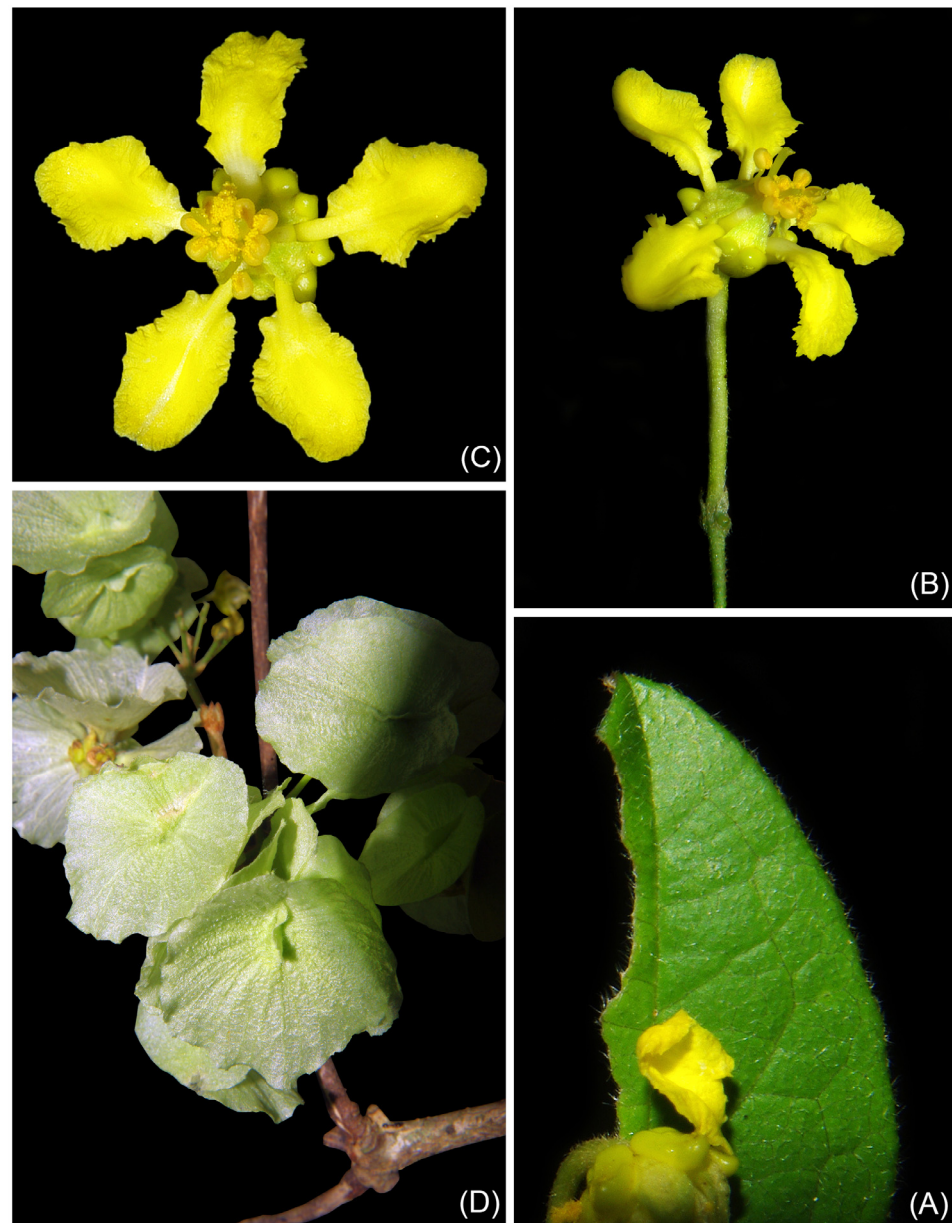


**Figure 1.** Field photographs of *Mascagnia arenicola*: (A) details of the stipules, petioles and leaf base, (B) corymbs bearing mature flowers and fruits, (C) detail of a flower in side view, (D) detail of a flower in frontal view (photographs by Hervé Galliffet).

Notes: *Mascagnia arenicola* is found in the Amazon rainforest biome in the states of Amazonas and Rondônia (Figure 5). Not threatened [14].

Specimens examined: **BRAZIL. State of Mato Grosso:** city of Comodoro, BR364 road, 399 km, 13 Km of Vilhena, 11 March 1979, Vieira et al. 878 (MICH). **State of Rondônia:** city of Boa Vista, road to Serra Grande, sandy soil, Sette-Silva et al. 684 (MICH). **State of Amazonas:** city of Maraa, Japurá river, 11 March 1982, Cid and Lima 3494 (MICH).

4. *Mascagnia australis* C.E.Anderson, Brittonia 53: 408. 2001. Type: **ARGENTINA. Department of Primero de Mayo:** Colonia Benítez, Chaco, 14 December 1964, fl., Schulz 14299 (holotype: MICH barcode MICH1244744!; isotypes: CTES?, MO barcodes MO2230150!, MO2391252!). Figure 2.



**Figure 2.** Field photographs of *Mascagnia australis*: (A) detail of the adaxial side of a leaf, (B) detail of a flower in side view, (C) detail of a flower in frontal view, (D) detail of a fruiting branch with winged mericarps (photographs by Climbie Ferreira Hall).

Notes: *Mascagnia australis* is found in the Atlantic rainforest, Cerrado, and Pampa biomes in the States of Mato Grosso do Sul, Paraná, Rio Grande do Sul, and Santa Catarina (Figure 5). Not threatened [14].

Specimens examined: **BRAZIL. State of Mato Grosso do Sul:** city of Bonito, Serra da Bodoquena State Park, Cedro Farm, January 2014, *Arakiki* 68 (HUEFS). **State of Paraná:** city of Londrina, Arthur Thomas Municipal Park, 31 October 1984, *Dias* 13 (FUEL). **State of Rio Grande do Sul:** city of Unistalda, BR287 road, Km 446, 5 January 2011, *Durigon* 473 (ICN). **State of Santa Catarina:** city of São Bento do Sul, Serra Alta, behind Implantec, 21 January 2017, *Schwirkowski* 2194 (FPS).

5. *Mascagnia bierosa* (Moric. ex A.Juss.) W.R.Anderson, Contr. Univ. Michigan Herb. 25: 102, 104. 2007. Type: **BRAZIL. State of Bahia:** *Blanchet* s.n. (holotype: G barcode G00352843!). Figure 3.



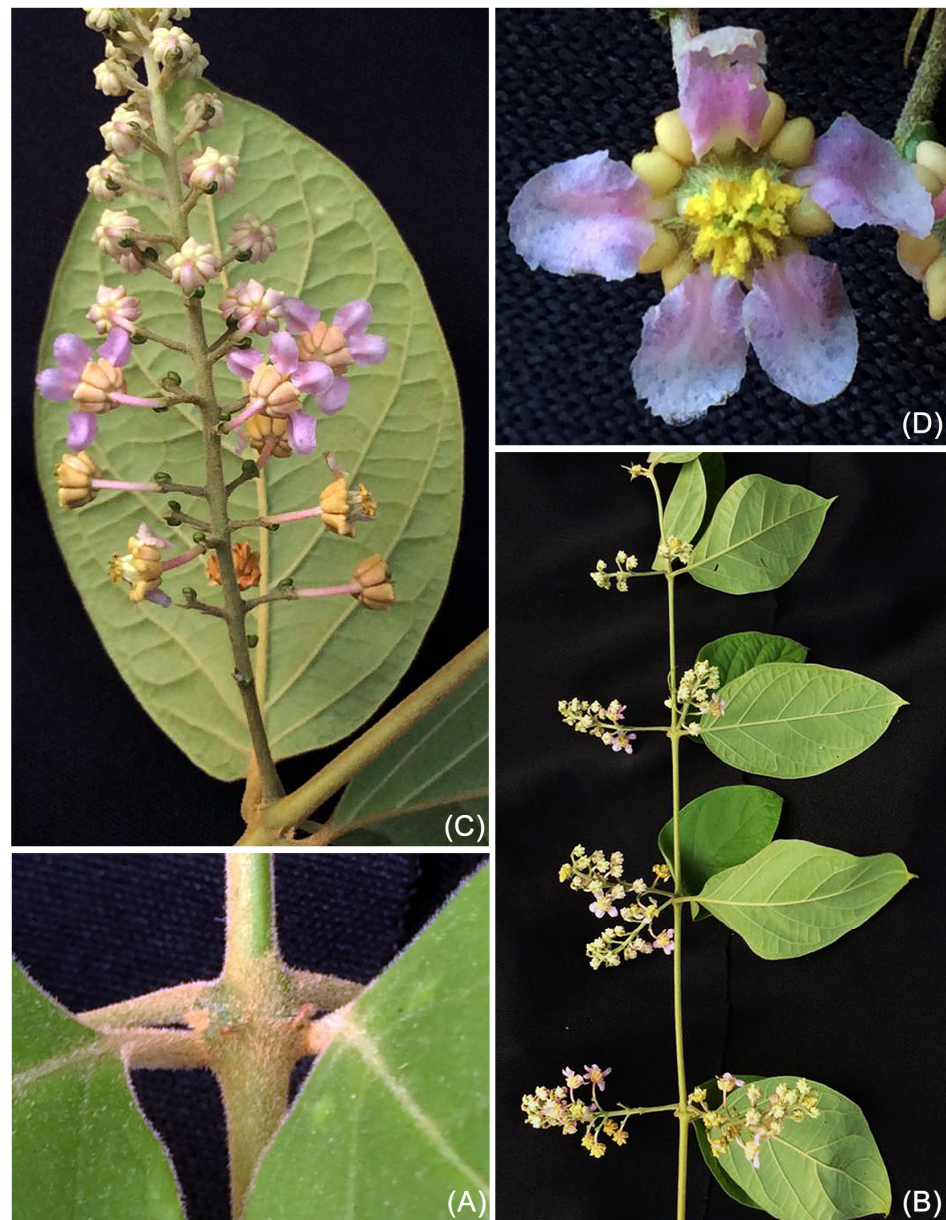
**Figure 3.** Field photographs of *Mascagnia bierosa*: (A) flowering branch with mature winged mericarps, (B) detail of a winged mericarp in frontal view (photographs by Gildasio Oliveira).

Notes: *Mascagnia bierosa* is found in the Atlantic rainforest, Caatinga, and Cerrado biomes in the states of Alagoas, Bahia, Brasília, Ceará, Espírito Santo, Goiás, Minas Gerais, Maranhão, Paraíba, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, São Paulo, Sergipe, and Tocantins (Figure 5). Not threatened [14].

Specimens examined: **BRAZIL. State of Alagoas:** city of Estrela de Alagoas, near BR-316 road, secondary vegetation, 18 January 2001, *Lyra-Lemos 5385* (HUEFS). **State of Bahia:** city of Arataca, RPPN do IESB, Serra do Peito de Moça, Arataca/Una Road, 1 July 2008, *Jardim 5307* (CEPEC). **State of Ceará:** city of Aquiraz, Graiá, sand dunes near Pacoti river, 13 November 2005, *Castro 1633* (EAC). **State of Distrito Federal:** city of Brasília, IBGE Ecological Reserve, near Roncador river, between chacaras 2 and 3, 14 August 1989, *Azevedo and Lopes 278* (MICH). **State of Espírito Santo:** city of Sooretama, Vale Natural Reserve, Aceiro Catelã João Pedro, road margins, 20 September 2012, *Siqueira 567* (SP). **State of Goiás:** city of São Simão, UHE Salto do Rio Verdinho, 25 October 2008, *Guilherme et al. 1388* (UFJ). **State of Maranhão:** city of Timon, outskirts of town, 3 Km W of the Parnaíba river, 28 January 1981, *Carvalho 507* (CEPEC). **State of Minas Gerais:** city of Faria Lemos, Santa Rita farm, July 2002, *Leoni & Silva 5098* (VIES). **State of Paraíba:** city of São José dos Cordeiros, RPPN Fazenda Almas, 5 September 1996, *Barbosa et al. 1532* (JPB). **State of Pernambuco:** city of Triunfo, Mariano Lake, 26 March 1995, *Miranda 2220* (HUEFS). **State of Piauí:** city of Picos, road from Picos to São Félix, 27 January 1982, *Moura 1054* (JPB). **State of Rio Grande do Sul:** city of Cerro Corá, Serra de Santana, 14 April 1971, *Couceiro s.n.* (IPA20025). **State of Sergipe:** city of Poço Verde, Assentamento Santa Maria da Lage, 17 March 2010, *Ferreira 46* (ASE).

6. *Mascagnia conformis* W.R.Anderson, Contr. Univ. Michigan Herb. 25: 104–105, 107. 2007. Type: **BRAZIL. State of Pará:** Santarém, road to Alter do Chão, Capoeira Baixa, sandy soil, 12 December 1978, fr., *Vilhena et al. 251* (holotype: NY barcode NY1043201!; isotypes: MICH barcode MICH1244743!, NY barcode NY1043200!, U barcode U1367646!). Figure 4.

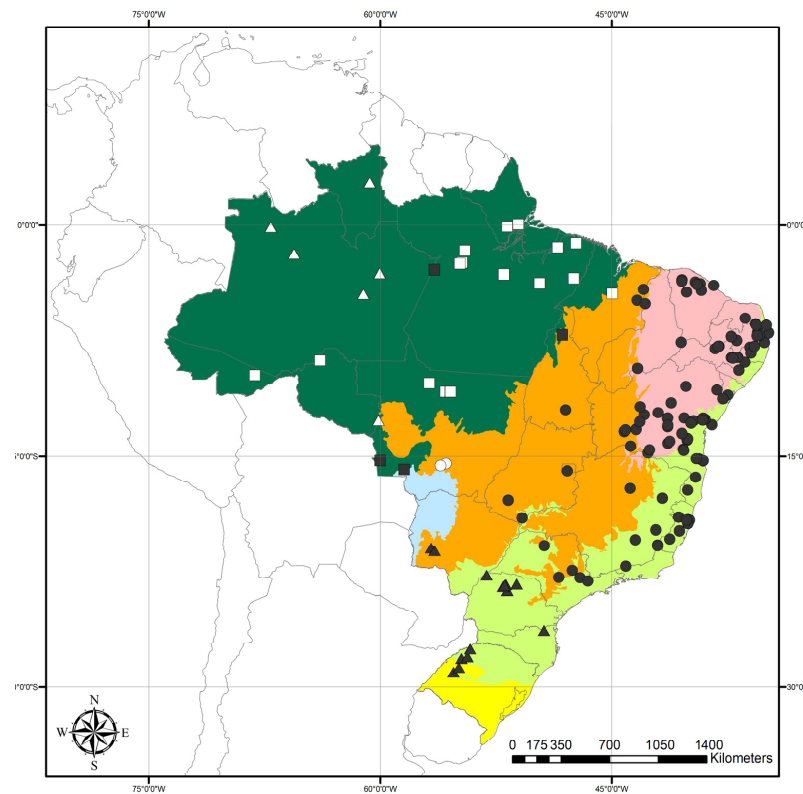
Notes: *Mascagnia conformis* is found in the Amazon rainforest biome in the states of Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, and Rondônia (Figure 5). Not threatened [14].



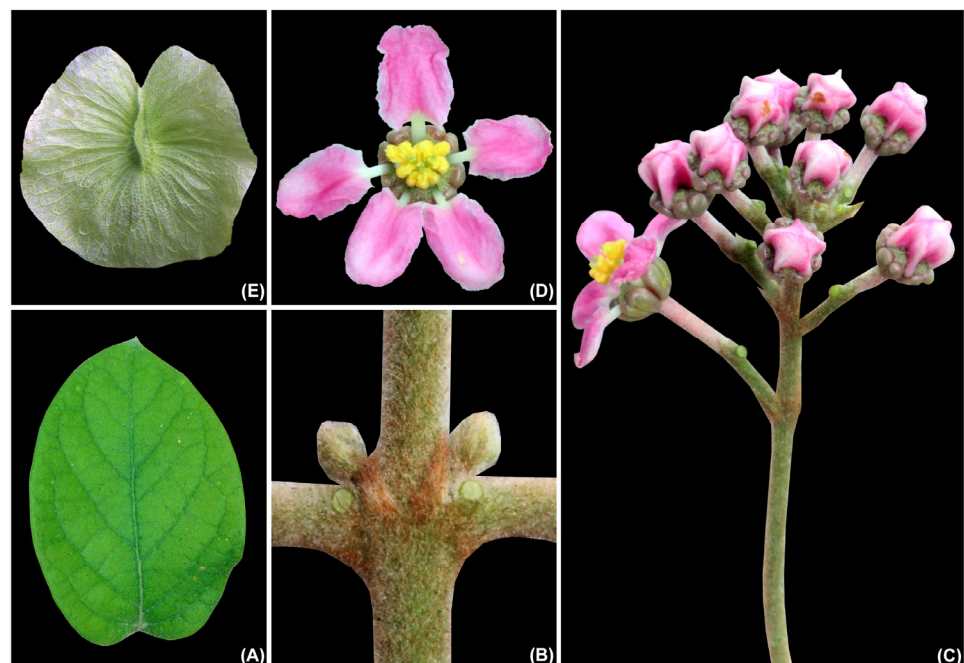
**Figure 4.** Field photographs of *Mascagnia conformis*: (A) details of the stipules, petioles and leaf base, (B) flowering branch, (C) detail of a thyrse, (D) detail of a flower in frontal view (photographs by Luiz Otavio Adao Teixeira).

Specimens examined: **BRAZIL. State of Amapá:** city of Serra do Navio, along road to Porto Terezinha, from junction with main road, 20 November 1954, *Cowan* 38471 (NY). **State of Amazonas:** city of Alta Floresta, road of hydropower of Salto do Apiacas River, 110 km of Alta Floresta, 29 September 1985, *Cid Ferreira* 6279 (MO). **State of Mato Grosso:** city of Colíder, Resgate da FLORA da UHE Colíder, lote D de Supressão, 26 October 2015, *Engels* 3739 (CNMT). **State of Pará:** city of Altamira, Xingu River, acampamento de Aero-Sul a 1 km de Porto, 24 October 1986, *Souza* 468 (INPA).

7. *Mascagnia cordifolia* (A.Juss.) Griseb., Fl. Bras. 12(1): 95. 1858. Type: **Brazil. State of Minas Gerais:** Curimataí, 1816–1821, fl., fr., *Saint-Hilaire catal. B1, N1958* [lectotype designated by Anderson (1993): P barcode P02429202!; isolectotypes: MPU barcode MPU020180!, P barcodes P02429203!, P02429204!] Figure 6.



**Figure 5.** Distribution of species of *Mascagnia* in Brazil: *M. affinis*—dark square, *M. aptera*—white circle, *M. arenicola*—white triangle, *M. australis*—dark triangle, *M. bierosa*—dark circle, *M. conformis*—white square. Amazon rainforest—dark green, Atlantic rainforest—light green, Caatinga dry forests—light red, Cerrado savannas—orange, Pampa grasslands—yellow, and Pantanal wetlands—light blue.



**Figure 6.** Field photographs of *Mascagnia cordifolia*: (A) details of the adaxial side of a leaf, (B) details of the stipules and petioles of leaves, (C) thyse in side view, (D) detail of a flower in frontal view, (E) winged mericarp in frontal view (photographs by Marco Octavio de Oliveira Pellegrini).

Notes: *Mascagnia cordifolia* is found in the Atlantic rainforest, Amazon rainforest, Cerrado, and Pantanal biomes in the states of Bahia, Brasília, Goiás, Maranhão, Mato

Grosso, Mato Grosso do Sul, Minas Gerais, Rio de Janeiro, São Paulo, and Tocantins (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Bahia:** city of Eunápolis, Extremo Sul, surroundings of projeto cedro, 18 January 1997, *Guedes 4200* (ACLB). **State of Distrito Federal:** city of Brasília, Água Limpa farm, near Vargem Bonita, 24 September 1976, Ratter et al. 3659 (MBM). **State of Espírito Santo:** city of Conceição da Barra, Córrego Grande Biological Reserve, Km 4 of perimeter road, 23 January 2012, *Almeida et al. 534* (SP). **State of Goiás:** city of Serranópolis, RPPN Pousada das Araras, 24 September 2005, *Souza 2553* (HJ). **State of Maranhão:** city of Açailândia, 12 July 1992, *Reis 10645* (ESA). **State of Mato Grosso:** city of Cáceres, Fazenda São Domingos, BR 070, frontier of Brazil/Bolivia, 16 September 2010, *Morais & Monteiro 341* (HPAN). **State of Mato Grosso do Sul:** city of Selvíria, Ensino e Pesquisas farm, UNESP, Ilha Solteira campus, 11 September 2014, *Rezende 1566* (HISA). **State of Minas Gerais:** city of São João del-Rei, surroundings of Serra do Lenheiro, road to Fé, 16 October 2018, *Alves 241* (HUFJSJ). **State of São Paulo:** city of Bauru, Bauru Municipal Botanic Garden, trail to Antiga Raia, parcel 93, 20 September 2005, *Weiser 621* (UEC). **State of Tocantins:** city of Formoso do Araguaia, Araguaia watershed, Formoso River, 9 October 2008, *Mendonça et al. 6187* (SP).

8. *Mascagnia cynanchifolia* Griseb., Fl. Bras. 12(1): 95. 1858. Type: **BRAZIL. State of Amazonas:** city of Manaus, near Barra, October 1851, fr., *Spruce 1857* (lectotype designated here: K barcode K000427435!; isolectotypes: BM barcode BM000611537!, G barcodes G00352821! and G00352822!, GH barcode GH00254152!, GOET barcode GOET007639!, K barcode K000427436!, M barcode M0242686!, NY barcode NY00067651!, P barcodes P02429152! and P00689797!, TCD barcode TCD0003927!).

Notes: *Mascagnia cynanchifolia* is found in the Amazon rainforest biome in the states of Amazonas and Mato Grosso (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of Manaus, 1 January 1877, *Jobert 451* (P).

9. *Mascagnia dissimilis* C.V.Morton & Moldenke, Phytologia 1: 19. 1933. Type: **COLOMBIA. Department of Boyacá:** El Umbo region, 130 M-N of Bogota, forest's edge, 3200 ft alt., 21 October 1932, fr., *Lawrance 546* (holotype: NY barcode NY00067652!; isotypes: A barcode A00045141!, F barcode F0062742F!, G barcode G00352826!, MO barcode MO251783!, S accession S-R-9093!).

Notes: *Mascagnia dissimilis* is found in the Amazon rainforest biome in the states of Acre and Rondônia (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Acre:** city of Cruzeiro do Sul, BR-364, km 70, Unidade de Assentamento Santa Luzia, Ramal 3, Gleba 1, 22 October 2001, *Maas 9141* (NY). **State of Amazonas:** city of Vaupés, margins of Papury River, region of Negro River, 17 October 1945, *Fróes 21200* (IAN). **State of Pará:** city of Parauapebas, Serra dos Carajás Biological Reserve, Companhia Vale do Rio Doce, Area 4 of Bahia Igarapé, near reject tanks, 6 January 1992, *Santos 516* (MO). **State of Rondônia:** city of Guajará-Mirim, along the Pacaás Novos River, between the first and second waterfalls, 21 August 1978, *Anderson 12215* (NY).

10. *Mascagnia divaricata* (Kunth) Nied., Nat. Pflanzenfam. 3(4): 55. 1896 [1890]. Type: **VENEZUELA. Department of Sucre:** Cumana, crescit in umbrosis, September, *Bonpland and von Humboldt s.n.* (holotype: P barcode P00679996!; isotypes: B†). Figure 7.

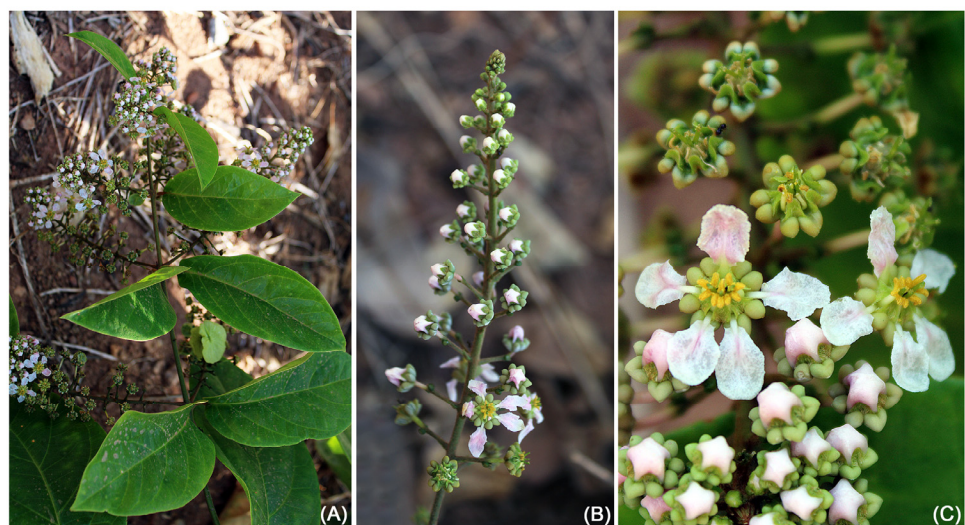


**Figure 7.** Field photographs of *Mascagnia divaricata*: (A) compound thyrses, (B) fruiting branch (photographs by Vinicius Domingues).

Notes: *Mascagnia divaricata* is found in the Atlantic rainforest, Cerrado, Pampas, and Pantanal biomes in the States of Mato Grosso do Sul, Paraná, Rio Grande do Sul, and São Paulo (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Mato Grosso do Sul:** city of Miranda, Cristo Redentor farm, 11 November 2016, *Campelo et al.* 7 (CGMS). **State of Paraná:** city of Fênix, RPPN Porto Velho, Mr Iva Luis de Castro Bittencourt property, 4 December 2014, *Caxambu* 5861 (DVPR). **State of Rio Grande do Sul:** city of Tenente Portela, Turvo River State Park, 17 March 1977, *Hagelund* 11264 (ICN). **State of São Paulo:** city of Amparo, Araribá RPPN Botanic Garden, Duas Cachoeiras farm, 22 October 2017, *Braga* 56 (UEC).

11. *Mascagnia glabrata* W.R.Anderson & C.Davis, Contr. Univ. Michigan Herb. 24: 43–44. 2005. Type: **BRAZIL. State of Rondônia:** Monte Negro, Taboca mining, 10 15S, 63 20W, capoeira, rocky soil, 11 October 1979, fl., fr., *Vieira et al.* 390 (holotype: INPA accession 88715!; isotypes: C barcode C10014233!, MICH barcode MICH1254372!, MO barcode MO-1515430!, NY barcode NY00743710!. Figure 8.



**Figure 8.** Field photographs of *Mascagnia glabrata*: (A) flowering branch, (B) thyrses with floral buds and mature flowers, (C) detail of mature flowers in frontal view (photographs by Diego Ferreira).

Notes: *Mascagnia glabrata* is found in the Amazon rainforest biome in the states of Mato Grosso and Rondônia (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Mato Grosso:** city of Aripuanã, near Humboldt Centre, on road to Juruema River, 9 October 1973, Lleras 18256 (INPA).

12. *Mascagnia lorentensis* C.V.Morton, Proc. Biol. Soc. Washington 45: 49. 1932. Type: **PERU. Department of Loreto:** Mishuyacu, near Iquitos, 100 m alt., forest, February 1930, fl., Klug 907 (holotype: US barcode US00108451!; isotype: NY barcode NY00067660!).

Notes: *Mascagnia lorentensis* is found in the Amazon rainforest biome in the state of Amazonas (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of Tefé, Paranaguá, 22 May 1933, Krukoff 4528 (NY).

13. *Mascagnia lugoi* W.R.Anderson, Contr. Univ. Michigan Herb. 21: 74–76. 1997. Type: **ECUADOR. Department of Napo:** Tierra Colorada, ca. 3 km N of Coca (Puerto Francisco de Orellana), 22 January 1973, fl., fr., Lugo 2920 (holotype: GB barcode GB0159593!; isotype: MICH barcode MICH1102241!).

Notes: *Mascagnia lugoi* is found in the Amazon rainforest biome in the state of Acre (Figure 10). Not threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of Envira, near mouth of Envira River (tributary of Tarauaca River), basin of Juruá River, 3 June 1933, Krukoff 4639 (NY).

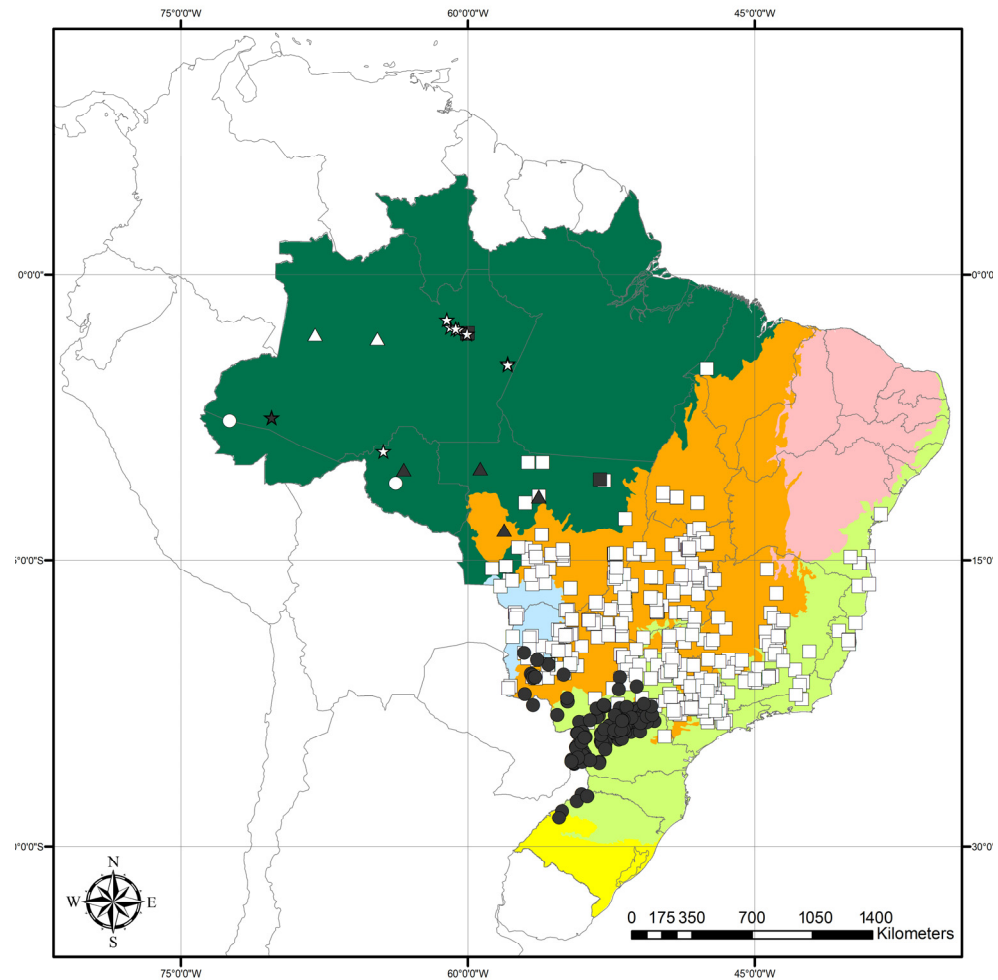
14. *Mascagnia riparia* C.E.Anderson, Brittonia 53(3): 410. 2001. Type: **BRAZIL. State of Rondônia:** Jaci Paraná, 4 km above Jaci Paraná on Jaci Paraná River, terra firme flood forest, 28 Jun. 1968, fl., fr., Prance et al. 5289 (holotype: NY barcode NY01043508!; isotypes: INPA accession 22050!, K barcode K001227539!, MICH barcode MICH1244742!). Figure 9.



**Figure 9.** Field photographs of *Mascagnia riparia*: (A) fruiting branch, (B) corymb with mature winged mericarps (photographs by Enrique Salazar).

Notes: *Mascagnia riparia* is found in the Amazon rainforest biome in the states of Amazonas and Rondônia (Figure 10). threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of Manaus, km 10 of BR17 road, 1 August 1961, Rodrigues & Chagas 3082 (SP).



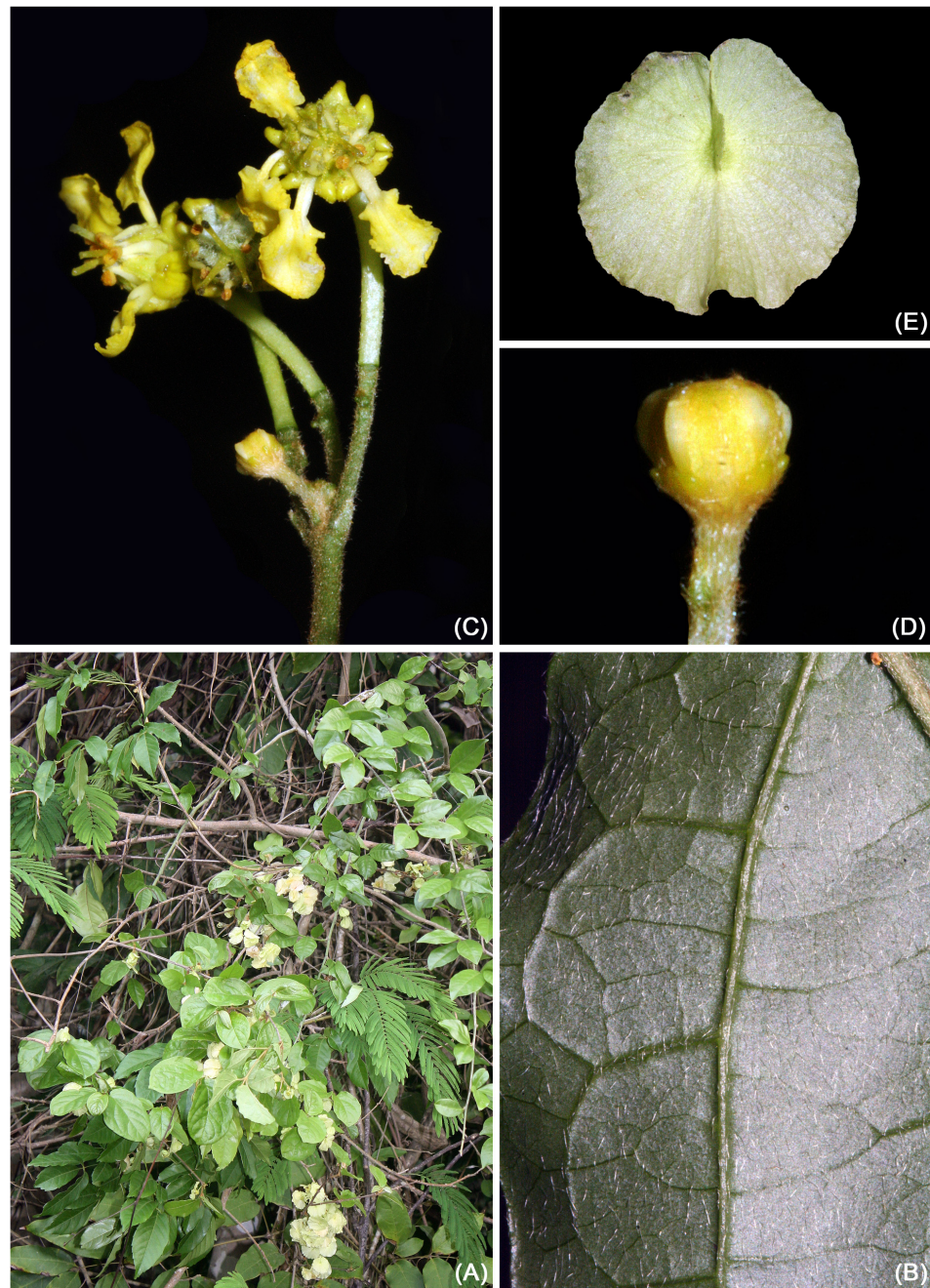
**Figure 10.** Distribution of species of *Mascagnia* in Brazil: *M. cordifolia*—white square, *M. cynanchifolia*—dark square, *M. dissimilis*—white circle, *M. divaricata*—dark circle, *M. glabrata*—dark triangle, *M. lorentensis*—white triangle, *M. lugoi*—dark star, and *M. riparia*—white star. Amazon rainforest—dark green, Atlantic rainforest—light green, Caatinga dry forests—light red, Cerrado savannas—orange, Pampa grasslands—yellow, and Pantanal wetlands—light blue.

15. *Mascagnia schunkei* W.R.Anderson, Mem. New York Bot. Gard. 32: 222–224. 1981. Type: **PERU. Department of Huánuco:** Tingo Maria, east of Tingo Maria, 700 m alt., 24 October 1962. fl., fr., J. Schunke Vigo 6195 (holotype: F barcode F0092884F!; isotypes: LA?, US barcode US00108464!).

Notes: *Mascagnia schunkei* is found in the Amazon rainforest biome in the states of Acre, Amazonas, Amapá, Mato Grosso, Pará, and Rondônia (Figure 15). Not threatened [14].

Specimens examined: **BRAZIL. State of Amapá:** city of Mazagão, 23 December 1984, Rabelo 3070 (F). **State of Amazonas:** city of Labrea, Serra near Namorado Novo, watershed between Coruqueté and Madeira rivers at Abuná, 5 August 1971, Prance 14710 (INPA). **State of Mato Grosso:** city of Nova Ubiratã, Ronuro River Ecological Station, north boundary, monitoring trail II, 2 July 2022, Córdova et al. 2824 (CNMT). **State of Pará:** city of Monte Alegre, Km 42 on road to Monte Alegre to Alequer, PA-25, 5 November 1987, Ferreira 9446 (INPA).

16. *Mascagnia sepium* (A.Juss.) Griseb., Fl. Bras. 12(1): 96. 1858. Type: **BRAZIL. Rio de Janeiro:** 1816–1821, fr., Saint-Hilaire Catal. C2 2° Partie no. 32 (lectotypes designated by Anderson 2007: P barcode P02429164!; isolectotypes: MPU barcode MPU020187!, P barcodes P02429165!, P02429166!, P02429167!, P02429168!, P02429169!). Figure 11.



**Figure 11.** Field photographs of *Mascagnia sepium*: (A) fruiting branch, (B) detail of the abaxial side of a leaf showing the indumentum, (C) corymb, (D) floral bud in side view, (E) winged mericarp in frontal view (photographs by Marco Octavio de Oliveira Pellegrini).

Notes: *Mascagnia sepium* is found in the Atlantic rainforest biome in the states of Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo (Figure 15). Not threatened [14].

Specimens examined: **BRAZIL. State of Espírito Santo:** city of Serra, APA Mestre Álvaro, 4 November 2012, Barros & Iglesias 127 (VIES). **State of Minas Gerais:** city of Lima Duarte, Parque Estadual da Serra do Ibitipoca, mata da portaria, 4 November 2012, Forzza *et al.* 3644 (SP). **State of Rio de Janeiro:** city of Sapucaia, Pilatos farm, 22 September 2000, Pereira 40/35 (RFA). **State of São Paulo:** city of São Paulo, São Paulo University campus, 7 February 2011, Figueiredo 201 (SPF).

17. *Mascagnia strigulosa* (Rusby) Nied., Pflanzenr. 141(Heft 91): 124. 1928. Type: **BO-LIVIA. Department of La Paz:** Charopampa, 23 September 1901, fr., Williams 799

(lectotype designated by Anderson 2007: NY barcode NY00071323!; islectotypes: BM barcode BM000611542!, K barcode K000427464!, MO barcodes MO1432410!, MO101837551!, MO101837552!, NY barcode NY00071324!, US barcode US00108498!). Figure 12.



**Figure 12.** Field photographs of *Mascagnia strigulosa*: (A) fruting branch, (B) corymb with winged mericarps (photographs by Martin Acosta).

Notes: *Mascagnia strigulosa* is found in the Amazon rainforest biome in the states of Amazonas and Pará (Figure 15). Not threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of Marã, Canamaris Native Americans colony, Japurá River, affluent of Solimões River, 31 October 1982, *Cid Ferreira* 3445 (NY). **State of Pará:** city of Rurópolis, 16 September 1931, *Krukoff* 1149 (NY).

18. *Mascagnia tenuifolia* Nied., Arbeiten Bot. Inst. Königl. Lyceums Hosianum Braunschweig 3: 10. 1908. Type: **PERU. Department of Loreto:** San Martín, near Tarapoto, 1855–1856, fl., fr., *Spruce* 4958 (lectotype designated by Anderson 2007: NY barcode NY00067678!; islectotypes: BR barcode BR0000008696397!, G barcode G00352766!, GH barcode GH00254153!, GOET barcode GOET007647!, K barcodes K000202365!, K000202366!, MG barcode MG019499!, MO barcodes MO 102875380!, MO 102875381!, MO 102875382!, MO 102875383!, MO 100659090!, NY barcode NY00067677!, TCD barcode TCD0003923!).

Notes: *Mascagnia tenuifolia* is found in the Amazon rainforest in the states of Amazonas and Mato Grosso (Figure 15). Not threatened [14].

Specimens examined: **BRAZIL. State of Amazonas:** city of São Paulo de Olivença, Solimões River, Bairro de Odório, 17 August 1973, *Lleras et al.* 17384 (NY).

19. *Mascagnia tucuruensis* C.E.Anderson, Brittonia 53(3): 413. 2001. Type: **BRAZIL. State of Pará:** Tucuruí, roadside outside airport, 10 February 1990, fl., *W.R. Anderson* 13749 (holotype: MICH barcode MICH1254371!). Figure 13.

Notes: *Mascagnia tucuruensis* is found in the Amazon rainforest biome in the states of Amazonas and Pará (Figure 15). Threatened [14].

Specimens examined: **BRAZIL. State of Pará:** city of Água Azul do Norte, Itacáunas River, affluent of Tocantins River, Serra Buritirama (B5), manganese mining area, July 1970, *Pires & Belem* 12535 (IAN).

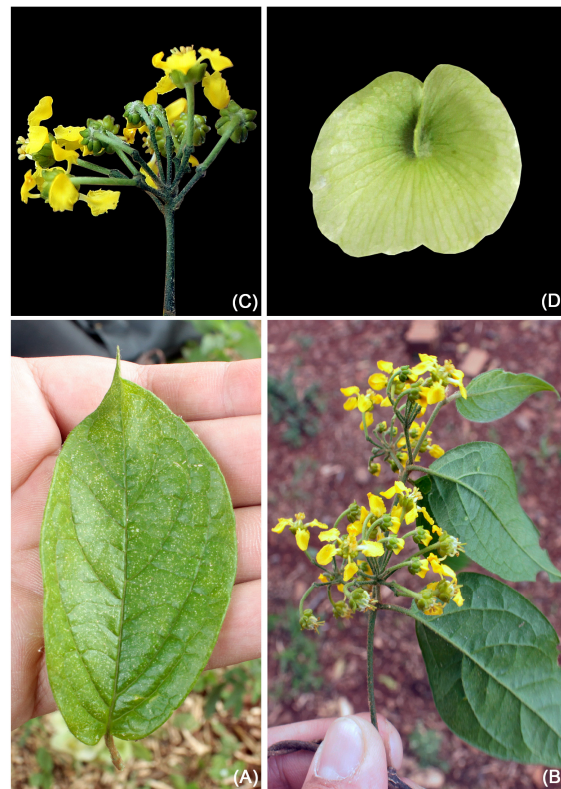


**Figure 13.** Field photographs of *Mascagnia tucuruensis*: (A) vegetative branches and leaves, (B) detail of the inflorescence showing floral buds and flowers in anthesis, (C) detail of the winged mericarps (photographs by Ricardo Ribeiro).

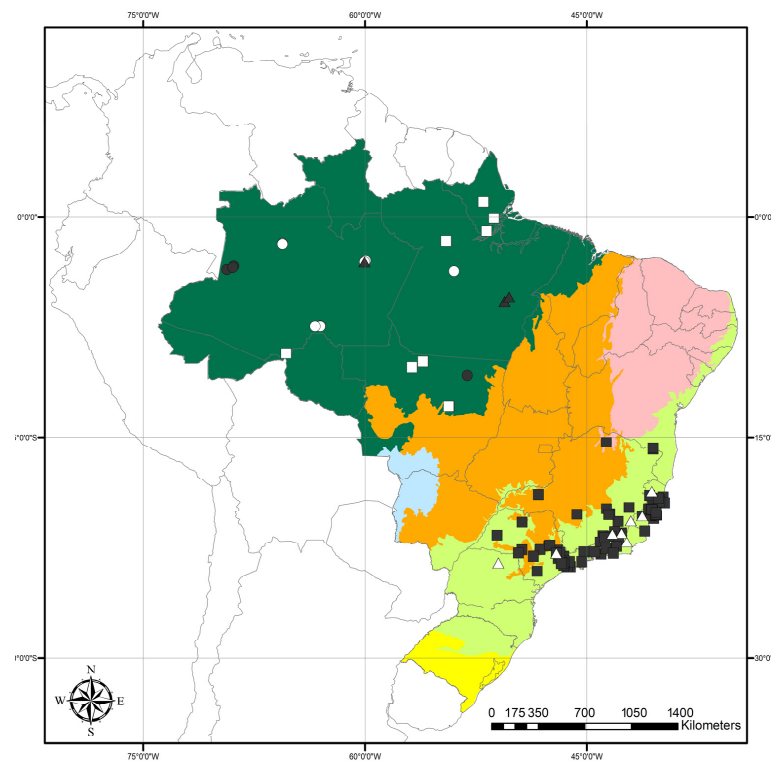
20. *Mascagnia velutina* C.E.Anderson, Brittonia 53(3): 414. 2001. Type: **BRAZIL. State of Minas Gerais:** Carangola, São Martinho farm, 500 m alt., 6 October 1992, fl., fr. *Leoni* 1970 (holotype: MICH barcode MICH1244741!; isotypes: RB barcodes RB01189783!, RB01326315!). Figure 14

Notes: *Mascagnia velutina* is found in the Atlantic rainforest biome in the states of Espírito Santo, Paraná, Rio de Janeiro, and São Paulo (Figure 15). Threatened [14].

Specimens examined: **BRAZIL. State of Espírito Santo:** city of Vila Pavão, Barra da Rapadura, Mr. Wagner's farm, 16 February 2014, *Forzza et al.* 7834 (VIES). **State of Minas Gerais:** city of Coronel Pacheco, Estação Experimental do Café, 9 October 1940, *Heringer* 365 (VIES). **State of São Paulo:** city of Campinas, Jardim Chapadão, 18 September 1936, *Santoro* 793 (US).



**Figure 14.** Field photographs of *Mascagnia velutina*: (A) details of the adaxial side of a leaf, (B) corymb bearing flower buds and mature flowers, (C) detail of a corymb, (D) detail of a winged mericarp in frontal view (photographs by R.F.Almeida).



**Figure 15.** Distribution of species of *Mascagnia* in Brazil: *M. schunkei*—white square, *M. sepium*—dark square, *M. strigulosa*—white circle, *M. tenuifolia*—dark circle, *M. tucuruensis*—dark triangle, *M. velutina*—white triangle. Amazon rainforest—dark green, Atlantic rainforest—light green, Caatinga dry forests—light red, Cerrado savannas—orange, Pampa grasslands—yellow, and Pantanal wetlands—light blue.

#### 4. Discussion

*Mascagnia* in the traditional sense of Niedenzu [17], and later authors [1], was a highly polyphyletic assemblage based solely on the lateral-winged mericarps [5]. After the proposition of several new genera to render *Mascagnia* monophyletic [1], the small Caribbean genus *Triopteris* was found to be nested within *Mascagnia* s.s. [5]. Since the name *Triopteris* is older than *Mascagnia*, a proposal was submitted for the conservation of *Mascagnia* against *Triopteris* [18]. Currently, *Triopteris* is regarded as a synonym of *Mascagnia*, rendering this genus, once and for all, monophyletic [2]. Species of *Mascagnia* are woody lianas to scandent shrubs, with interpetiolar stipules and glands on the abaxial surface of the leaf blade [2]. The flowers, each borne on a pedicel subtended by a well-developed peduncle, are arranged in thyrses or corymbs (1st order inflorescences) [2]. Petal color varies from yellow, pink, white, to various shades of blue or lilac (the latter are otherwise rare in the family) [2]. In most species, the winged mericarp has a veiny, membranous, elliptical or orbicular (occasionally triangular) lateral wing and sometimes a dorsal crest or winglet [2].

Most species of *Mascagnia* inhabit Brazilian rainforests, such as the Amazon and the Atlantic rainforests, with a few species also found in drier environments, including neotropical savannas (cerrado) and dry forests. This seems to be a typical pattern in the genus, but only a complete taxonomic monograph for the entire genus would corroborate the patterns found in this study for Brazil. Of the 20 currently accepted species of *Mascagnia* in Brazil, four are under some kind of threat [14]: the Amazonian *Mascagnia riparia* and *M. tucuruensis*, the Cerrado species *M. aptera*, and the Atlantic Forest species *M. velutina*. However, all of them were generally assessed based on big data analysis for the extinction risk predictions for the world's flowering plants [14], and proper conservation assessments following IUCN guidelines should be carried out to corroborate these preliminary threatened assessments.

This study finally addresses the morphological characterization of *Mascagnia* in Brazil, providing an identification key to aid in proper identification and distribution maps showing biome distribution for all 20 currently accepted species in this genus. This is the first step towards the completion of a taxonomic monograph for *Mascagnia* in Brazil, but also for the entire genus in the Neotropics.

**Author Contributions:** Conceptualisation, R.F.d.A. and M.O.d.O.P.; methodology, R.F.d.A. and M.O.d.O.P.; software, R.F.d.A.; validation, R.F.d.A. and M.O.d.O.P.; formal analysis, R.F.d.A.; investigation, R.F.d.A. and M.O.d.O.P.; resources, R.F.d.A.; data curation, M.O.d.O.P.; writing—original draft preparation, R.F.d.A.; writing—review and editing, R.F.d.A. and M.O.d.O.P.; visualisation, R.F.d.A. and M.O.d.O.P.; supervision, R.F.d.A. and M.O.d.O.P.; project administration, R.F.d.A.; funding acquisition, R.F.d.A. All authors have read and agreed to the published version of the manuscript.

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