



Flora of Ceará: *Dalbergia* (Leguminosae)

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Key words:

- Caatinga
- diversity
- Fabaceae
- semiárido

Palavras-chave:

- Caatinga
- diversidade
- Fabaceae
- semiárido

Abstract

This study aimed to conduct a floristic and taxonomic inventory of *Dalbergia* species occurring in the state of Ceará to enhance our understanding of their diversity, morphological and taxonomic aspects as well as geographical distribution. This research is part of the project “Ceará Flora Project: Knowing to Conserve” and was based on the analysis of morphological features of herbarium specimens, as well as a review of specialized literature. In Ceará, *Dalbergia* is represented by six species: *Dalbergia cearensis*, *D. decipularis*, *D. ecastaphyllum*, *D. frutescens*, *D. miscolobium*, and *D. nigra*. These species were recorded across various phytophysiognomies but occur preferentially in drier environments, such as the savanna, steppic savanna, and seasonal semideciduous forest, as well as in coastal dune vegetation. *Dalbergia cearensis* is endemic to Brazil and widespread throughout the state. All *Dalbergia* species were also collected in conservation units. However, *D. nigra*, classified as vulnerable (VU) under the IUCN criteria, was recorded specifically in the Chapada da Ibiapaba conservation unit. Similarly, *Dalbergia decipularis* was collected exclusively in this region, highlighting the importance of these areas for species conservation. This survey presents an identification key, morphological descriptions, comments on geographical distribution, ecology, and phenology, as well as maps and illustrations of the species.

Resumo

Este estudo teve como objetivo realizar um inventário florístico e taxonômico das espécies de *Dalbergia* ocorrentes no estado do Ceará, com o propósito de ampliar o conhecimento sobre sua diversidade, aspectos morfológicos e taxonômicos assim como distribuição geográfica. Este trabalho faz parte do projeto “Flora do Ceará: Conhecer para Conservar”. A pesquisa foi baseada na análise de caracteres morfológicos de amostras de herbário e na revisão de bibliografia especializada. No Ceará, *Dalbergia* é representada por seis espécies: *Dalbergia cearensis*, *D. decipularis*, *D. ecastaphyllum*, *D. frutescens*, *D. miscolobium* and *D. nigra*. Essas espécies foram registradas em diferentes fitofisionomias, mas ocorrem preferencialmente em ambientes mais secos, como a savana, savana estépica e floresta sazonal semidecídua, além da vegetação de dunas costeiras. *Dalbergia cearensis*, endêmica do Brasil, está amplamente distribuída pelo estado. Todas as espécies de *Dalbergia* também foram coletadas em unidades de conservação. No entanto, *D. nigra*, classificada como vulnerável (VU) segundo os critérios da IUCN, foi registrada especificamente na unidade de conservação da Chapada da Ibiapaba. Da mesma forma, *Dalbergia decipularis* foi coletada apenas nessa região, destacando a importância dessas áreas para a conservação das espécies. São apresentados uma chave de identificação, descrições morfológicas, comentários sobre distribuição geográfica, ecologia e fenologia, além de mapas e ilustrações das espécies.

Original Papers

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Introduction

The monophyletic genus *Dalbergia* L.f. comprises approximately 280 species presenting a pantropical distribution, with centers of diversity in Africa, Central and South America, Asia, and Madagascar (Klitgaard & Lavin 2005; Vatanparast *et al.* 2013; POWO 2025; LDP 2025). The genus has 39 species recorded in Brazil, out of which 21 are endemic, occurring throughout the Brazilian phytogeographic domains. However, the greatest species richness is found in the Amazon, *Cerrado*, and Atlantic Forest (Filardi *et al.* 2025). Members of *Dalbergia* include trees, climbing shrubs, and lianas with imparipinnate leaves, rarely unifoliolate; inflorescences in racemes, panicles, or cymes; papilionaceous flowers with a campanulate calyx; gynoeceum with a stipitate ovary; and samaroid fruits with a central seed chamber (Carvalho 1997; Filardi *et al.* 2025).

The taxonomic delimitation of many *Dalbergia* species is relatively complex due to expressive vegetative morphological variation (Carvalho 1997; Filardi *et al.* 2025). This complexity is also illustrated in the Legume Data Portal and Plants of the World Online, which mentions 659 names for the genus, out of which 287 are accepted species names, while 372 are synonyms (LDP 2025; POWO 2025). Hence, *Dalbergia* urgently requires further taxonomic studies to facilitate the species delimitation and support the development of effective conservation strategies. Many *Dalbergia* species produce high-quality timber known as rosewood, or *jacarandás* (*D. cearensis* and *D. nigra*), which is highly valued for construction, fine furniture, and musical instruments, among other uses (Record 1942; Klitgaard & Lavin 2005). Beyond their economic importance, *Dalbergia* species are also widely utilized in traditional medicine and have been the focus of numerous phytochemical studies (Saha *et al.* 2013; Lucas *et al.* 2020; Sun *et al.* 2021; Naik *et al.* 2024). Currently, according to the IUCN Red List (IUCN 2025), *Dalbergia* includes 20 species classified as critically endangered, 55 as endangered, and 56 as vulnerable.

In Brazil, a taxonomic study on *Dalbergia* was carried out in the scope of a synopsis for the country (Carvalho 1997). However, floristic studies on the genus are still incipient, having only been carried out in the states of Bahia and São Paulo (Lewis 1987; Carvalho & Meireles 2016). In Ceará, *Dalbergia* species have only been mentioned in floristic lists (Silva *et al.* 2012; Loiola *et al.* 2020; Silveira *et al.* 2020).

This study is part of the “Ceará Flora Project: Knowing to Conserve” and aims to carry out a floristic-taxonomic inventory of *Dalbergia* species to better understanding the diversity and geographical distribution of its representatives.

Material and Methods

This study was based on the comparative analysis of vegetative and reproductive features from the virtual herbaria and online databases Reflora and speciesLink, as well as physical collections (EAC, RB, and SJRP) and photographs of *Dalbergia* specimens provided by HUEFS, HVASF, MBM, NY, P and US herbaria (acronyms according to Thiers, continuously updated). The identifications were supported by specialized bibliographies (Carvalho 1997; Carvalho & Meireles 2016; Filardi *et al.* 2025) and confirmed using images of type collections available on REFLORA (2025), JSTOR (2025), and speciesLink (CRIA 2025). The authors of the species follow the International Plant Names Index (IPNI 2025).

The morphological features were described based on Harris & Harris (2001). When the samples collected in Ceará were insufficient for the description or illustration of flowers and/or fruits, additional materials from other states or information from protologues were used to complement the descriptions. The species illustrations were created digitally using the Sketchbook app. Information on habit, habitat, phenology, and popular names was obtained from the labels of the analyzed specimens.

The distribution maps were drawn up in QGIS version 3.28, based mainly on the records with original and municipality geographical coordinates. Vegetation types for the state of Ceará were adapted from the classification of Figueiredo (1997) and the Technical Manual of Brazilian Vegetation (IBGE 2012): Coastal *Cerrado* and Coastal Vegetation Complex (comprising Pioneer Psammophilous Vegetation, Forest behind Dunes, and Lowland Semideciduous Seasonal Forest), Crystalline *Caatinga*, Crystalline Dry Forest, Crystalline Humid Forest, Inland *Cerrado*, Mangrove, Sedimentary *Caatinga*, Sedimentary Dry Forest, Sedimentary Humid Forest, Vegetation under Fluvial and/or Lacustrine influence (Riparian Forest).

Results and Discussion

Dalbergia in Ceará is represented by six species: *Dalbergia cearensis* Ducke, *D. decipularis* Rizzini & A. Mattos, *D. ecastaphyllum* (L.) Taub., *D. frutescens* (Vell.) Britton, *D. miscolobium* Benth., and *D. nigra* (Vell.) Allemão ex Benth.

Among the studied species, *Dalbergia ecastaphyllum* and *D. frutescens* have a wide distribution in South America and, therefore, are the most widely distributed species in Ceará, along with *D. cearensis*. In contrast, *D. decipularis*, *D. miscolobium*, and *D. nigra* are endemic to Brazil and exhibit a more restricted distribution within the state.

Of the six *Dalbergia* species recorded in Ceará, one is considered threatened according to conservation assessments. *Dalbergia nigra* is classified as Vulnerable (VU), indicating a high risk of extinction in the wild, while *Dalbergia cearensis* is categorized as Near Threatened (NT), meaning it is close to qualifying for a threatened status in the near future. The remaining species, *D. decipularis* and *D. miscolobium*, are listed as Least Concern (LC), and *D. ecastaphyllum* and *D. frutescens* have not been evaluated (NE) (Filardi *et al.* 2025; IUCN 2025).

The vegetation type with the highest number of *Dalbergia* species in Ceará is the Sedimentary Humid Forest, where *D. cearensis*, *D. decipularis*, *D. frutescens*, *D. miscolobium*, and *D. nigra* have been recorded. Regarding conservation areas, at least four species occur within protected units: *D. frutescens* and *D. miscolobium* are found in the Serra da Meruoca and Floresta Nacional do Araripe, respectively; *D. decipularis* and *D. nigra* are recorded in the Chapada da Ibiapaba, which includes the Parque Nacional de Ubajara. These occurrences highlight the importance of these areas for the conservation of *Dalbergia* species in Ceará.

The treatment applied does not consider the variety *D. frutescens* var. *tomentosa* once, according to Carvalho & Meireles (2016) and Filardi *et al.* (2025), with the type and color of indumentum (*D. frutescens* var. *tomentosa* - ferrugineum-tomentose × *D. frutescens* var. *frutescens* - sparsely pilose to pilose) as the diagnostic element to separate the two varieties. This feature appeared not consistent

in the specimens from Ceará, as well as in some parts of EAC34845 and SJRP36200 materials, in which both types of indumenta occur. We suggest that a more detailed morphological study should be carried out to understand the morphological limits of these taxa.

Taxonomic treatment

Dalbergia L.f. Suppl. Pl. 52, 53. 1781. nom. cons.

Trees, erect to scandent shrubs, or lianas. Leaves alternate, imparipinnate, with 5–22 leaflets, rarely 1-foliolate; stipules generally deciduous; stipels absent; leaflets alternate, with brochidodromous venation. Inflorescence racemose or paniculate; bracts usually deciduous, rarely persistent. Flowers papilionaceous, bilaterally symmetrical, generally numerous, and often fragrant; bracteoles deciduous or persistent; calyx campanulate, 5-lobed, vexillary lobes generally broader than the others, partially united, carinal lobes narrower and longer; corolla white, cream, purple, or violet, standard obovate, orbicular, or panduriform, usually emarginate at the apex, clawed; wings generally auriculate at the base; keel petals slightly shorter than the wings, usually auriculate at the base, connate along the carinal side; stamens 9 or 10, monadelphous or diadelphous, anthers small, erect, basifixed, with short apical dehiscence (poricidal), rarely with longitudinal slits; ovary stipitate, style curved, stigma terminal. Fruit samaroid, chartaceous, or coriaceous, with the seed-bearing nucleus thickened. Seeds reniform.

Key to species of *Dalbergia* (Leguminosae) from Ceará

1. Unifoliolate leaves.....3. *Dalbergia ecastaphyllum*
- 1'. Pinnate leaves.....2
2. Mature leaflets pilose or pubescent in abaxial surface 3
- 2'. Mature leaflets glabrous or subglabrous in both faces 4
3. Trees, leaflets abaxial surface pilose, vexillum obovate 2. *Dalbergia decipularis*
- 3'. Scandent shrubs or lianas, leaflets abaxial surface pubescent, vexillum panduriform.....4. *Dalbergia frutescens*
4. Leaflets 5–7.....1. *Dalbergia cearensis*
- 4'. Leaflets 11–22.....5
5. Petiole and rachis tomentose, base of the leaflets rounded, corolla white 6. *Dalbergia nigra*
- 5'. Petiole and rachis glabrous, base of the leaflets obtuse or cuneate, corolla purple ..5. *Dalbergia miscolobium*

1. *Dalbergia cearensis* Ducke, Arch. Jard. Bot. Rio de Janeiro 4: 73. 1925. Figs. 1a; 2a-f

Trees or small trees 5–20 m tall. Branches cylindrical, grayish, subglabrous, with rounded and white lenticels. Leaves with deciduous stipules; pulvinus cylindrical, glabrous to

subglabrous, 0.3–0.6 × 0.1–0.2 cm; petiole 1–3 cm long, glabrous to subglabrous; rachis 7–15 cm long, glabrous to subglabrous. Leaflets pinnate, 5–7, 3–6.5 × 2–5 cm; ovate to elliptic, alternate to subopposite, margins entire, concolor, glabrous to subglabrous in both faces; apex obtuse and

retuse; base rounded to subcordate. Panicle, axillar, or terminal; 2.8–5.7 cm long, lax, pilose. Flowers 7.8–10 mm long, pedicellate; bracteoles 0.5–0.6 mm long, elliptical to oval, pubescent, deciduous. Calyx 2.5–4 mm long, vexillary lobes connate for almost their entire length, rounded; keel lobes acute to acuminate; ciliate in the lobe margins. Corolla light-yellow. Vexillum 5.4–5.6 mm long, orbicular, apex retuse, base attenuate, glabrous. Alae 4.5–8 mm long, obovate, apex rounded, base attenuate, glabrous. Keel 4–6 mm long, obovate, broader than wings, connate at the apex, apex rounded, base auriculate, glabrous. Androecium monadelphous 9 or 10 stamens, 2–3 mm long; filaments 3.5 mm long; anthers 0.2 mm long. Gynoecium 5.5 mm long; stipe 1.5 mm long, glabrous; ovary 3×0.97 mm, eglandular, sparsely ciliate in the margins; style 1 mm long, glabrous. Samara, $3-4 \times 1$ cm, oblong to elliptical; apex mucronate to cuneate; base acute to cuneate, long-stipitate; stipe 3–5 mm long, glabrous; seed chamber reticulate, glabrous. Seed 1.

Examined material: Acaraú, fazenda Floresta, X.1967, fl., F.J.A. Matos (RB146517, SJRP36195). Aiuaíba, Gameleira de Baixo, 12.IV.1991, M.A. Figueiredo et al. 129 (EAC). Brejo Santo, reservatório Cana Brava, $07^{\circ}35'23''\text{S}$, $38^{\circ}51'42''\text{W}$, 28.VIII.2013, D.G. Oliveira 1034 (HVASF). Crateús, serra das Almas, 3.III.2003, E. Nunes 24 (EAC). Crateús, serra das Almas, 29.IV.2005, J.R. Lima 41 (EAC35729). Crato, terris altis siccis, 27.VI.1946, fr., A. Ducke (US1903175). Fortaleza, road from Fortaleza to Crato, BR-116, 38 km S of Barro, km 499, 13.II.1985, fr., A.I. Gentry et al. 50077 (RB). Graça, sítio Mariano, 2.I.2014; fl., A.S.F. Castro 2775 (SJRP), sítio Santa Clara, $03^{\circ}57'47''\text{S}$, $40^{\circ}49'11''\text{W}$, 1.XI.2017, fl., F.F. Araújo 85 (EAC). Granja, Parazinho, 27.VI.1984, A. Fernandes & F.J.A. Matos (EAC12715). Morada Nova, sítio Santo Antônio de Boa Água, 27.V.2019, fr., J. Rabelo 4680 (SJRP). Moraújo, congl. 31, sub.2, ár. 7, $03^{\circ}25'12''\text{S}$, $40^{\circ}40'48''\text{W}$, 21.I.2014, fl., W. Batista 164 (RB). Novo Oriente, Estrondo, planalto do Ibiapaba, 4.V.1991, fr., F.S. Araújo 440 (EAC). Pacoti, Serra Verde, $04^{\circ}15'48''\text{S}$, $38^{\circ}54'20''\text{W}$, 15.XI.2007, J.R. Lima 412 (RB). Quixadá, fazenda Logradouro, Juatama, 18.IV.2012, fr., A.S.F. Castro 2633 (SJRP36197). Quixeramobim, congl.214, sub.1, ár. 11, $05^{\circ}13'21''\text{S}$, $39^{\circ}03'36''\text{W}$, 7.III.2014, fr., J.M.D. Silveira 61 (RB791461). Reriutaba, Juré, 6.II.2018, fl., A.S.F. Castro

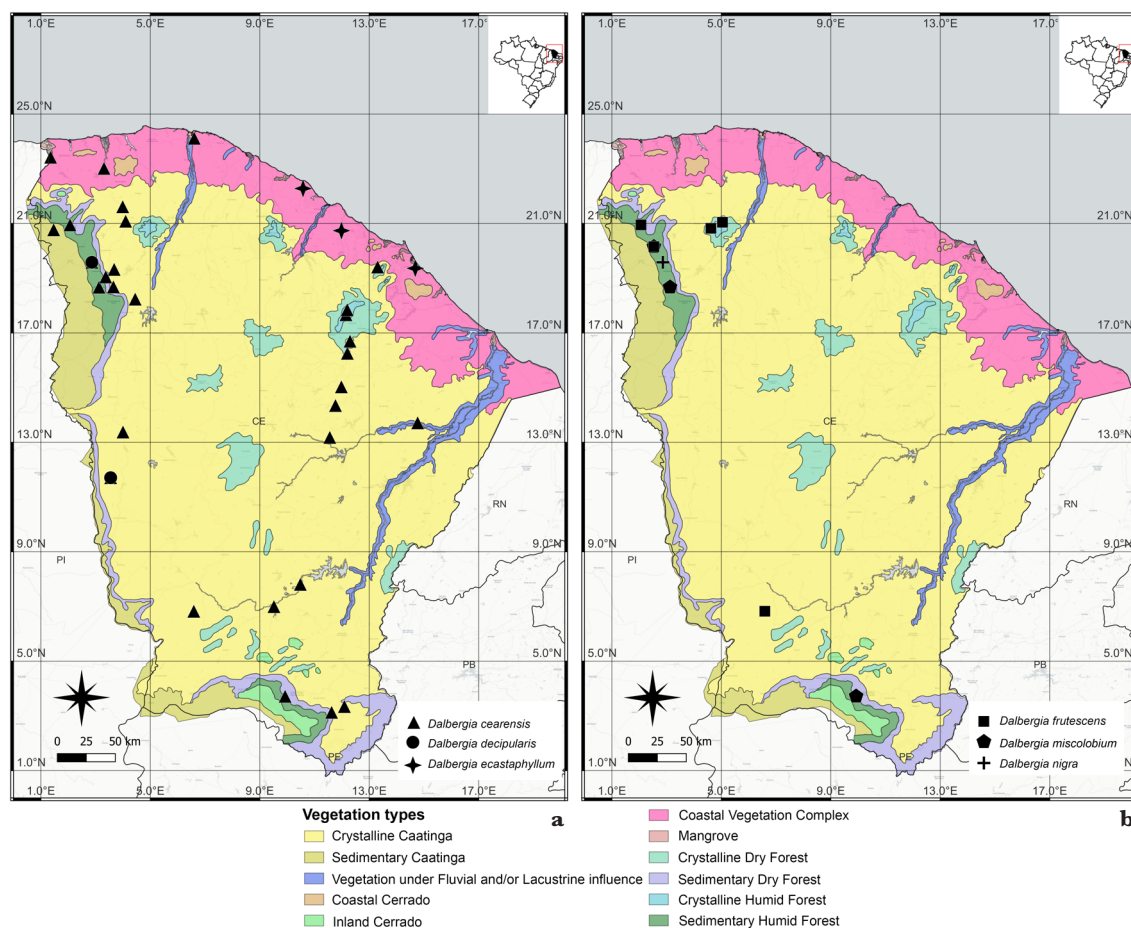


Figure 1 – a-b. Geographic distribution of *Dalbergia* in Ceará state.

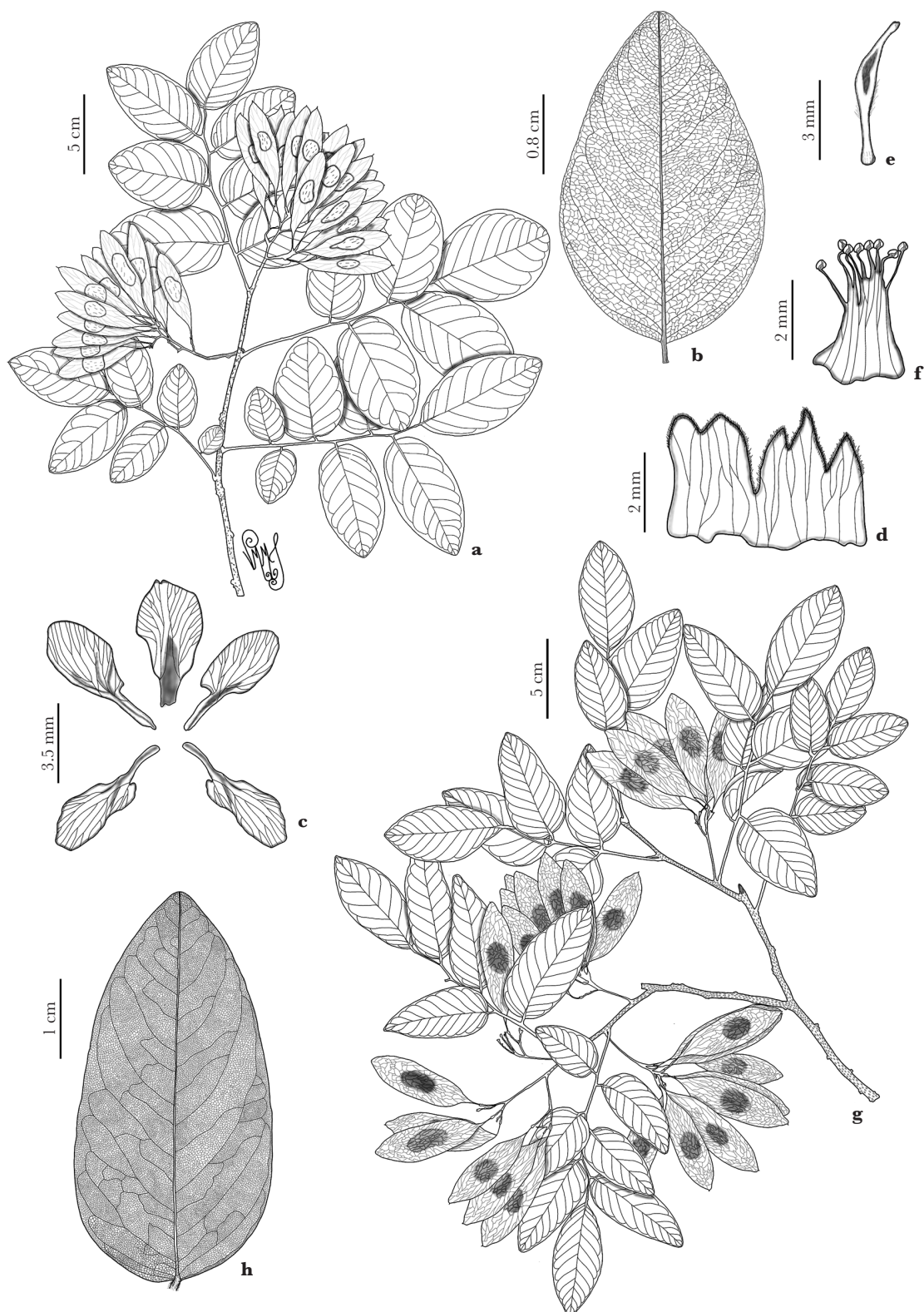


Figure 2 – a-f. *Dalbergia cearensis* – a. fruiting branch; b. leaflet; c. petals; d. calyx; e. gynoecium; f. androecium. g-h. *Dalbergia decipularis* – g. fruiting branch; h. leaflet. (a-b. E. Nunes 24 [EAC]; c-f. F.J.A. Matos [SJRP36195]; g-h. A.M. Carvalho et al. 2393 [MBM]).

3009 (SJRP36190). Tianguá, BR-222, sentido São João da Fronteira, 03°51'35"S, 41°08'52"W, 740 m, 9.II.2007, fr., D. Cardoso 1773 (HUEFS116607). Ubajara, Jaburuna Sul, planalto Ibiapaba, 24.IX.1994, fl., F.S. Araújo 1002 (EAC22508). Viçosa do Ceará, 03°36'00"S, 41°13'12"W, 20.I.2014, fl., A.E.S. Ferreira 150 (RB791523).

Dalbergia cearensis is recognized by its leaves with 5 to 7 leaflets, petiole, rachis, and mature leaflets glabrous or subglabrous, as well as a calyx ciliate only on the margins of the vexillary and keel lobes. This species is endemic to Brazil, occurring primarily in dense arboreal *caatinga* (Carvalho 1997; Filardi *et al.* 2025). In Ceará, it has been widely recorded across the state, mainly in *Caatinga* areas but also in Restinga, in the municipalities of Acaraú, Brejo Santo, Cratêus, Fortaleza, Graça, Granja, Morada Nova, Moraújo, Novo Oriente, Pacoti, Quixadá, Quixeramobim, Reriutaba, and Viçosa do Ceará. The species was collected with flowers from October to February and with fruit from February to June. The vernacular names of this species are *pau-violeta*, *violeta*, *violeta-rabo-de-macaco*, and *violete*.

This species is categorized as Near Threatened (NT), indicating that while it is not currently at high risk of extinction, it is close to qualifying for a threatened category in the near future. It is widespread in Brazil (EOO = 739,734,924 km², AOO = 532,00 km²), occurring in multiple vegetation types and in protected areas. However, habitat loss and selective logging, particularly due to its valuable wood, may contribute to its potential decline (Fernandes & Amorim 2020).

2. *Dalbergia decipularis* Rizzini & A. Mattos, Bras. Florestal 4(13): 24-25. 1973. Figs. 1a; 2g-h

Tree 5–10 m tall. Branches cylindrical, grayish, glabrous, with rounded and white lenticels. Leaves with deciduous stipules; pulvinus cylindrical, pubescent, 0.3–0.4 × 0.1–0.2 cm; petiole 1.5–2 cm long, pilose to pubescent; rachis 5–6 cm long, pubescent. Leaflets pinnate, 5–7, 1.5–5 × 0.5–3; ovate to elliptic, alternate; margins entire; discolor; adaxial surface glabrous, abaxial surface pilose; apex acute and mucronate, rarely obtuse; base rounded. Panicle, axillary, 2–4.5 cm long, congested, pubescent. Flowers 3.25–5 mm long, sessile; bracteoles 1 mm long, elliptical, pubescent, deciduous. Calyx 2–3 mm long, vexillary lobes connate for almost their entire length, rounded; keel lobes acute to acuminate, the median lobe is the longest, acuminate; pubescent only in the lobes. Corolla white. Vexillum 3–4 mm long, obovate, apex emarginate, base truncate, glabrous. Alae 3 mm long, elliptical, apex rounded, base attenuate, glabrous. Keel 3 mm long, elliptical, apex rounded, base auriculate, glabrous. Androecium monadelphous 9(10) stamens, 2–2.5 mm long;

filaments 1.5 mm long; anthers 0.2 mm long. Gynoecium 2.5 mm long; stipe 0.9 mm long, glabrous; ovary 1 × 0.3 mm, eglandular, glabrous; style 0.7 mm long, glabrous. Samara 4–6 × 1–1.8 cm, oblong to elliptical; apex cuneate to mucronate; base acute to cuneate; long-stipitate; stipe 5–7 mm long, glabrous; seed chamber reticulate, glabrous to subglabrous. Seed 1.

Examined material: Novo Oriente, Estrondo, planalto Ibiapaba, 3.VIII.1990, fr., F.S. Araújo 255 (EAC). Novo Oriente, Estrondo, planalto Ibiapaba, 4.V.1991, fr., F.S. Araújo 439 (EAC). Ubajara, Jaburuna do Sul, planalto Ibiapaba, 28.VIII.1992, fr., F.S. Araújo (SJRP36199). Ubajara, Jaburuna do Sul, planalto Ibiapaba, 23.IX.1994, fl., F.S. Araújo (SJRP36193). Ubajara, Jaburuna do Sul, planalto Ibiapaba, 2.XII.1994, fr., F.S. Araújo 1030 (SJRP). Ubajara, Jaburuna do Sul, planalto Ibiapaba, 21.X.1994, fl., F.S. Araújo 1015 (SJRP). Ubajara, Jaburuna do Sul, planalto Ibiapaba, 27.I.1996, fl., F.S. Araújo (EAC23611).

Additional examined material: BRAZIL. BAHIA: Jacobina, 20 km na estrada Jacobina-Capim Grosso. Fazenda Pau-d'alho, 2.IV.1986, fr., A.M. Carvalho *et al.* 2393 (MBM).

Dalbergia decipularis is characterized by congested panicles and slightly smaller flowers (3.25–5 mm in length) compared to other *Dalbergia* species occurring in Ceará, which typically have flowers measuring around 4–10 mm in length. Like *D. frutescens*, *D. decipularis* exhibits pronounced morphological variation, but presenting arboreal habit and the obovate shape of vexillum.

Carvalho (1997) performed a taxonomic treatment describing that *Dalbergia decipularis* occurs in the state of Bahia, whereas Rizzini & Mattos-Filho (1973) registered the species in Minas Gerais as well. Currently, according to the Flora and Funga of Brazil (Filardi *et al.* 2025), the species is recorded in states of Bahia, Ceará, and the Distrito Federal. In Ceará, the species was recorded in the municipalities of Novo Oriente and Ubajara, in Semideciduous Seasonal Forests (Dry Forest) and Steppic Savannas (*Caatinga* and/or Carrasco). Further collections and field observations are needed to better understand the morphology of this species, as well as its precise geographical distribution. The species was collected with flowers from September to January and with fruit from May to December. The vernacular names of this species are *violeta*, *violeta-rabo-de-macaco*, and *violete*.

Classified as Least Concern (LC) by CNCFlora, this species does not currently face significant threats that would place it in a higher-risk category. It is relatively widespread in Brazil (EOO = 608,572 km²; AOO = 148.00 km²), occurring in multiple vegetation types and protected areas. There is no evidence of significant population decline due to wood use. However, local populations may still be affected by habitat degradation (Fernandes & Moraes 2020).

3. *Dalbergia ecastaphyllum* (L.) Taub. in Engler & Prantl., Nat. Pflanzenfam. 3(3): 335. 1894.

Figs. 1a; 3a-j

Scandent or semi-prostrate shrubs. Branches cylindrical, grayish, pilose, with rounded and white lenticels. Leaves with stipules 1×0.2 cm, lanceolate, pilose; pulvinus cylindrical, white-pilose, 0.4×0.1 cm; petiole 0.4–0.5 cm long, white-pilose. Leaflets unifoliolate, 6–12 $\times$ 3.4–5.5 cm; ovate to elliptic; alternate; margins entire, concolorous, white-pilose to subglabrous in both faces; apex acuminate; base rounded. Raceme or panicle, axillar, with peduncle 1.9–2.7 cm long, congested, ferruginous-tomentose. Flowers 7–8 mm long; bracteoles 0.8–0.9 mm long, subulate, tomentose, persistent. Calyx 3.5 mm long, vexillary lobes connate for one-third of their length, pilose; keel median lobe 1 mm longer, pilose. Corolla grayish-white. Vexillum 6–7 mm long, orbicular, apex slightly emarginate, base rounded, glabrous. Alae ~6.9 mm long, obovate, base rounded, apex rounded, glabrous. Keel ~5.9 mm long, obovate, connate at the apex, base auriculate, glabrous. Androecium diadelphous 5+5 or occasionally 5+4 stamens, 5 mm long; filaments 4.8 mm long; anthers 0.2 mm long. Gynoecium 5.5 mm long; stipe 2 mm long, pilose; ovary long-stipitate, 0.5×0.4 mm, eglandular, pilose; style 2.7 mm long, sparsely pilose. Samara 2.5–3 $\times$ 1.8–2 cm, orbicular, apex rounded, base attenuate, short-stipitate; stipe 4 mm long, pilose; seed chamber with slightly reticulate venation, pilose. Seed 1.

Examined material: Aquiraz, praia de Aquiraz, 15.II.1966, fl., A. Fernandes (EAC 2235); praia de Aquiraz, 29.XI.1977, fr., A. Fernandes (EAC 3776); 15.X.1967, fl. and fr., F.J.A. Matos (EAC 5459); Barco Preto, 26.VII.1986, fl. and fr., A. Fernandes et al. (EAC 14538, HUEFS 141701); mangue, 18.XII.1982, fl., A. Fernandes (EAC 11720); praia do Presídio, iguapé, 31.XII.1999, fl., A. Fernandes (EAC 28802, HUEFS 141688); prainha, 29.XI.1966, fr., A. Fernandes (EAC 2256). Pacém, mangue do Rio Guaribas, zona 24, São Gonçalo do Amarante, 5.IV.2008, fl., M.F. Moro & E. Tameirão-Neto 347 (EAC 42571). Trairi, Praia de Flecheiras, 28.I.1996, fl., A.S.F. Castro (EAC 23963).

Dalbergia ecastaphyllum is a notably unifoliolate species, different from all others in Ceará. Among Brazilian species, *D. amazonica* (Radlk.) Ducke, *D. monophylla* Black, and *D. negrensis* (Radlk.) Ducke also is a unifoliolate species (Carvalho 1997). The indumentum distinguishes *D. ecastaphyllum* from *D. negrensis* (adaxial leaflets surface glabrous versus pilose). Regarding *D. amazonica* and *D. monophylla*, the calyx teeth provide a key distinction: in *D. ecastaphyllum*, the upper two teeth are almost free or fused for less than half of their length, while in the other two species, the teeth are unequal in shape and size (Carvalho 1997).

This species is widely distributed across tropical America, being associated with river estuaries, stream banks, and mangroves but is also found along seashores. In coastal environments,

its semi-prostrate, multi-stemmed growth habit plays a vital role in stabilizing sand (Carvalho 1997). In Ceará, the species was recorded in three municipalities, Aquiraz, Pacém, and Trairi on coastal dune vegetation, locally known as *restinga*. The species was collected with flowers from October to July and with fruit from July to November. The vernacular name of this species is *bugi*.

4. *Dalbergia frutescens* (Vell.) Britton, Bull. Torrey Bot. Club 16: 324. 1889. Figs. 2a; 3k-r

Scandent shrubs or lianas. Branches cylindrical, grayish, pilose to pubescent, with rounded and white lenticels. Leaves with deciduous stipules; pulvinus cylindrical, pubescent to tomentose, 0.3×0.1 – 0.2 cm; petiole 1–1.5 cm long, pilose to ferruginous-tomentose; rachis 4–8 cm long, pilose to ferruginous-tomentose. Leaflets pinnate, 5–9, 2–5 $\times$ 1–3.5 cm, ovate to elliptic, alternate, margins entire, discolor, adaxial surface glabrous, abaxial surface pubescent; apex acute, attenuate or obtuse, base rounded or obtuse. Panicle axillary, 2.5–6.5 cm long, lax, pilose to ferruginous-tomentose. Flowers 4–5 mm long; bracteoles 0.6–0.7 mm long, oval, pilose, deciduous. Calyx 2.7 mm long, vexillary lobes connate up to half their length, keel lobes deltoid, the median lobe longer; pilose. Corolla white, cream, or yellow. Vexillum 4 mm long, panduriform, apex emarginate, base truncate, glabrous. Alae 3.8 mm long, oblong, apex rounded, base auriculate, glabrous. Keel 3.6 mm long, obovate, broader than the alae, connate at the apex, apex rounded, base auriculate, glabrous. Androecium monadelphous (9)10 stamens, 4 mm long; filaments 3.7 mm long; anthers 0.3 mm long. Gynoecium 3.5 mm long; stipe 1 mm long, subglabrous; ovary 2×0.4 mm, eglandular, subglabrous; style 0.7 mm long, glabrous. Samara 4–4.5 $\times$ 1–1.5 cm, oblong to elliptical; apex mucronate to obtuse; base acute to attenuate; long-stipitate; stipe 5 mm long, glabrous; seed chamber reticulate, glabrous. Seed 1.

Examined material: Aiuba, estação ecológica de Aiuba, 15.X.2004, fl., E. Nunes (EAC 38297). Alcântaras, sítio Fidalgo, serra da Meruoca, 20.XI.1989, fl., A. Fernandes (EAC 16500). Meruoca, serra da Meruoca. 12.XII.2002, fl., A. Fernandes (EAC 32225); serra da Meruoca, próximo a Alcântara, 8.VII.1993, fr., A. Fernandes (EAC 20361); serra da Meruoca, próximo a Alcântaras, 30.XI.1990, fl., A. Fernandes & E. Nunes (SJRP 36207), serra da Meruoca, Santo Antônio, 15.IX.1977, fl., A. Fernandes (EAC 3774); serra da Meruoca, Anil, 29.XI.1990, fl., A. Fernandes (SJRP 36204). Tianguá, 22 km de Tianguá, próximo ao açude Jaburu, 11.XII.2001, fl., A.S.F. Castro (EAC 31305). Ubajara, sítio Jaburu, 4.III.2005, fr., E. Nunes (EAC 34845). Viçosa do Ceará, chapada do Ibiapaba, 5.I.1987, fr., A. Fernandes & M.A. Figueiredo (SJRP 36200).

Additional examined material: BRAZIL. BAHIA: Ribeirão do Largo, ca. 23 km na estrada, Itambé/Encruzilhada, 15°19'39"S, 40°45'5"W, 14.VIII.2001, fr., A.M. Carvalho et al. 6913 (MBM).

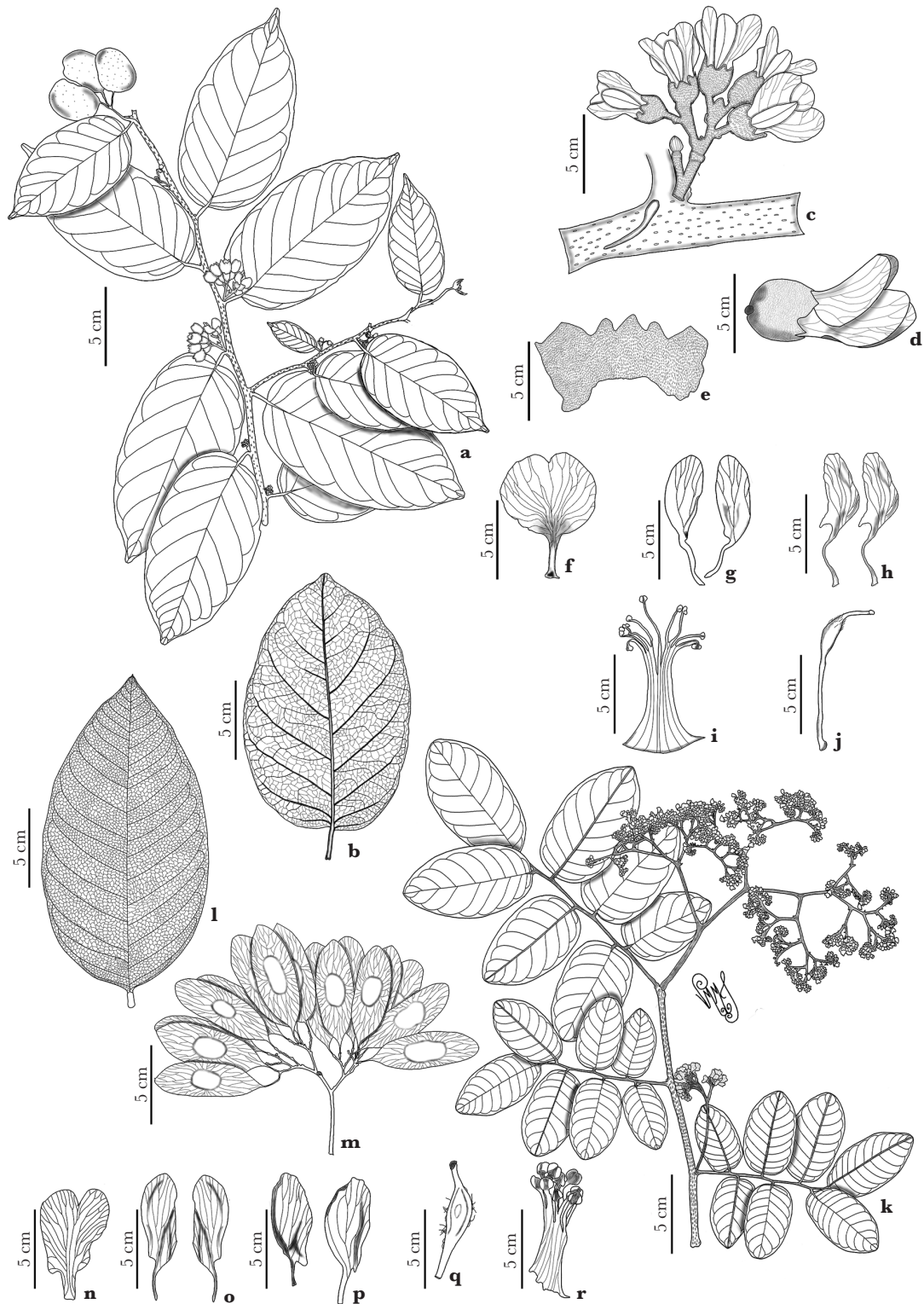


Figure 3 – a-j. *Dalbergia ecastaphyllum* – a. flowering and fruiting branch; b. leaflet; c. inflorescence; d. flower; e. calyx; f. vexillum; g. allae; h. keel; i. androecium; j. gynoecium. k-r. *Dalbergia frutescens* – k. flowering branch; l. leaflet; m. fruiting branch; n. vexillum; o. allae; p. keel; q. gynoecium; r. androecium. (a-b. A. Fernandes *et al.* [EAC14538]; c. V.P. Mata; d,j. A.S.F. Castro [EAC 23963]; k. A. Fernandes [EAC32225]; l. A. Fernandes [EAC20361]; m. A.M. Carvalho *et al.* 6913 [MBM]; n-r. A. Fernandes [EAC32225]).

Dalbergia frutescens exhibits significant variability in vegetative morphology, growth habit, and habitat preference. The species can adopt a habit ranging from a scandent shrub to a liana depending on environmental conditions. In Ceará, it can be distinguished from others by its growth form and the presence of pilose to tomentose petioles and rachises, a densely pilose calyx, and a pandurate-shaped vexillum.

This species is widely distributed across South America. In Ceará, *Dalbergia frutescens* is commonly associated with open areas, particularly in capoeira (secondary vegetation) and carrasco (dense shrubland) within the *Caatinga* biome. It has been recorded in the municipalities of Aiuaba, Alcântaras, Tianguá, Ubajara, and Viçosa do Ceará. The species flourishes from September to December and bears fruit from January to July. Its vernacular names are *cipó-de-macaco* and *violete-de-anel*.

5. *Dalbergia miscolobium* Benth., J. Linn. Soc. 4, Suppl. 35. 1860. Figs. 2a; 4a-d

Tree 3–12 m tall. Branches cylindrical, grayish, subglabrous to pilose, with rounded and white lenticels. Leaves with deciduous stipules; pulvinus cylindrical, glabrous, 0.3–0.4 × 0.1–0.2 cm; petiole 1.5–1.7 cm long, glabrous; rachis 7–9 cm long, glabrous. Leaflets pinnate, 13–15; 1–2.5 × 0.5–1 cm; ovate, oblong, elliptic or obovate; alternate to subopposite; margins entire, concolorous, glabrous to subglabrous (mature), sparsely pilose (young) in both faces; apex truncate or retuse to rounded, slightly emarginate; base obtuse or cuneate. Panicle, axillar, 3.5–7 cm long, lax, tomentose. Flowers 5–10 mm long; bracteoles 2–4 mm long, elliptical to oval, pubescent, persistent or deciduous. Calyx 5 mm long, vexillary lobes connate for almost their entire length, rounded; keel lobes acute to acuminate, deltoid; the median lobe is the longest, acuminate; sparsely pilose. Corolla purple. Vexillum 7.5–9 mm long, large-elliptic, apex emarginate, base truncate, glabrous. Alae 5–7 mm long, falcate to elliptic, apex rounded, base auriculate, glabrous. Keel 5–7 mm long, falcate to elliptic, connate along the lower margins, apex rounded, base auriculate, glabrous. Androecium diadelphous 9+1 stamens, 3–5 mm long; filaments 2–5 mm long; anthers 0.3 mm long. Gynoecium 4.5 mm long; stipe 0.5–1 mm long, glabrous; ovary long-stipitate, 3 × 0.5 mm, with glands on the margins, style 1–1.5 mm long, glabrous. Samara 4–5.5 × 1–1.5 cm, oblong to oblong-elliptic, apex obtuse to mucronate, base acute, long-stipitate; stipe 8–9 mm long, glabrous; seed chamber with diffuse venation, glabrous. Seed 1(2).

Examined material: Crato, 8.VIII.2019, fl., S.F. Oliveira 22 (EAC, RB, HUEFS). Chapada do Araripe, 29.VII.1993, fr., A. Fernandes & F.J.A. Matos (SJRP 36203). Nordeste

plot Araripe-01, Floresta Nacional do Araripe, trilha do Belmonte, 07°16'32"S, 39°27'15"W, 23.III.2019, P.W. Moonlight et al. 1693 (HUEFS). Faveira, São Benedito, 27.V.1981, A. Fernandes & P. Martins (EAC 10396). Serra do Araripe, 26.II.1958, fr., T.N. Guedes 524 (RB, US). Tianguá, Estrada Tianguá-Piauí, 1.IX.1992, fr., E. Nunes & B.S. Cavada (EAC, HUEFS).

Additional examined material: BRAZIL. MINAS GERAIS: Diamantina, ca. 7 km of Diamantina, km 299, 2.II.1972, fl., W.R. Anderson et al. 35166 (NY); ca. 50 km N.E. of Francisco Sá, road to Salinas, 13.II.1969, fr., H.S. Irwin et al. 23261 (NY).

Dalbergia miscolobium has flowers with a purple corolla, ovary presenting glands, and diadelphous stamens (9+1). This species is widespread across Bolivia and Brazil and is associated with open *cerrados*, or “campos limpos”, and rocky fields vegetation (Carvalho 1997). In Ceará, the species was recorded in Serra do Araripe in the municipalities of Crato, Faveira, and Tianguá. The species was collected with flowers in August and with fruit from February to September. The vernacular name of this species is *violete*.

Classified as Least Concern (LC), *D. miscolobium* has a wide extent of occurrence (EOO = 4,162,951,594 km², AOO: 1,568,00 km²) and is recorded in more than ten locations subject to threats. Several occurrences have been documented in fully protected conservation units. There is no evidence of population decline that would warrant the application of other risk criteria. However, further research on population trends and numbers is needed to expand current knowledge and ensure its long-term conservation. (Amorim & Bicalho 2020).

6. *Dalbergia nigra* (Vell.) Allemão ex Benth., J. Linn. Soc. 4 (Suppl.): 36. 1860. Figs. 2a; 4e-l

Tree medium size. Branches cylindrical, grayish, white-pilose to pubescent, with rounded and white lenticels. Leaves with deciduous stipules; pulvinus cylindrical, tomentose, 0.3 × 0.1 cm; petiole 0.6 cm long, yellow-tomentose; rachis 4–6 cm long, yellow-tomentose. Leaflets pinnate, (10)11–16(22); 0.7–1.2 × 0.3–0.6 cm; oblong; alternate to subopposite; margins entire, concolorous, densely pilose (young) and subglabrous at maturity in both faces; apex truncate or retuse to rounded, slightly emarginate; base rounded. Panicle, axillar, 4–5 cm long, lax, tomentose. Flowers 8–10 mm long; bracteoles 1 mm long, oval, pilose, deciduous. Calyx 5 mm long; vexillary lobes connate, obtuse; keel lobes acute to acuminate; pubescent only in the lobes. Corolla white. Vexillum 7 mm long, oblong-obovate, apex slightly emarginate, base truncate, glabrous. Alae 6.5 mm long, oblong-obovate, apex rounded, base auriculate, glabrous. Keel 5.5 mm long, obovate, connate at the apex, apex rounded, base auriculate, glabrous.

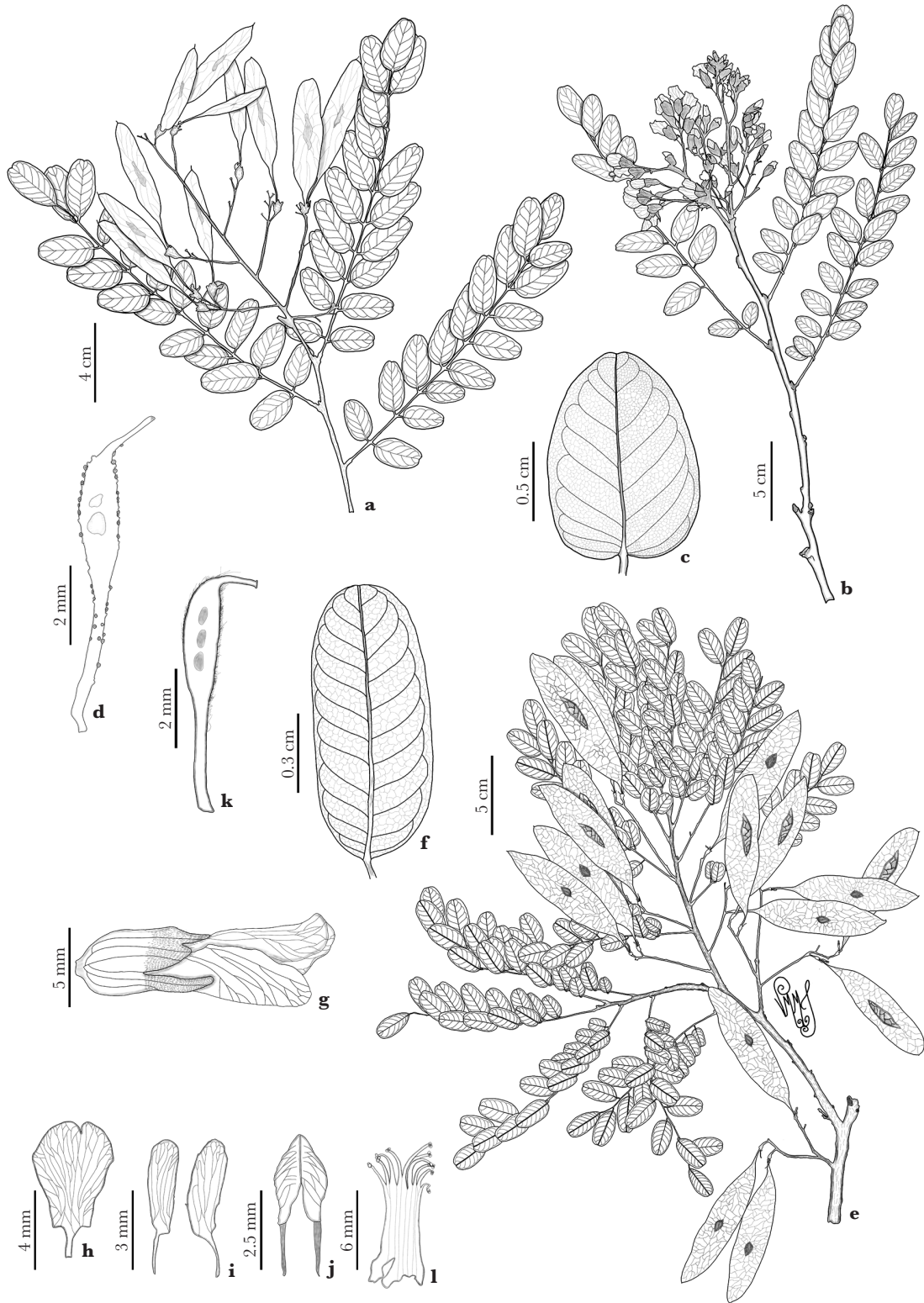


Figure 4 – a-d. *Dalbergia miscolobium* – a. fruiting branch; b. flowering branch; c. leaflet; d. gynoecium. e-l. *Dalbergia nigra* – e. fruiting branch; f. leaflet; g. flower; h. vexillum; i. allae; j. keel; k. gynoecium; l. androecium. (a. H.S. Irwin 23261 [NY]; b-c. W.R. Anderson 35166 [NY]; d. S.F. Oliveira 22 [EAC]. e-f. T.S. Nunes & J.G.C. Sobrinho 1143 [P]; g-l. J.R. Mattos & M. Nadruz 500 [RB]).

Androecium monadelphous 10 stamens, 6–7 mm long; filaments 2–3 mm long; anthers 0.5–0.6 mm long. Gynoecium 7–8 mm long; stipe 4.1–4.3 mm long, glabrous; ovary long-stipitate, 3.1–3.3 × 1–1.2 mm, eglandular, ciliate in the margins, style 1.2–1.4 mm long, glabrous. Samara 4.7–7 × 1–1.4 cm, oblong to oblong-elliptic, apex mucronate to obtuse, base attenuate, long-stipitate; stipe 3–6 mm long, subglabrous; seed chamber with diffuse reticulate venation, glabrous. Seed 1(2).

Examined material: UBAJARA, chapada da Ibiapaba, 28.XII.1979, fr., A. Fernandes (EAC 7899).

Additional examined material: BRAZIL. BAHIA: Feira de Santana, campus da UEFS, entre o 1° e 2° módulo, ao lado do auditório I, 12°12'S, 38°58'W, 17.VI.2004, fr., T.S. Nunes & J.G.C. Sobrinho 1143 (P). RIO DE JANEIRO: Rio de Janeiro, Jardim Botânico do Rio de Janeiro, Canteiro 13°, 1.XII.2016, fl., J.R. Mattos & M. Nadruz 500 (RB).

Dalbergia nigra is vegetatively similar to *D. miscolobium*. Both species can be distinguished by the leaflet's base, being rounded in *D. nigra*, it is and obtuse or cuneate in *D. miscolobium*. Leaflet shape is also an important trait, being oblong in *D. nigra* and vary between elliptical, oblong, and oval in *D. miscolobium*.

In Ceará, the species was recorded in only one municipality, Ubajara, within the Chapada da Ibiapaba, in a sedimentary humid forest. The probable phenological period for the species to flower is from August to December, with fruiting occurring from February to July, as observed in São Paulo state (Carvalho & Meireles 2016).

Dalbergia nigra is endemic to Brazil and classified as vulnerable (VU) according to the IUCN Red List criteria provided by CNCFlora (A2cd; B2ab[i, ii, iii, v]). Although the entire genus *Dalbergia* is listed under CITES, *D. nigra* was the first species to be discussed and included in Appendix I during CoP8 (CITES 1992), due to its extensive use for over 300 years to produce high-quality furniture, such as cabinets and pianos (CITES 1992). Habitat deforestation and overexploitation of its highly valued wood have made *D. nigra* extremely rare in the wild (Carvalho 1997).

In Ceará, there are very few records of the species, making this report particularly significant, as previous studies documented its occurrence from southern Bahia to northern São Paulo. Further collection efforts are needed to locate new populations of the species within the state.

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Data availability statement

In accordance with Open Science communication practices, the authors inform that there is no data sharing of this manuscript.

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