



## Original Paper

# Flora of Ceará, Brazil: Lythraceae

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### Abstract

This study aimed to carry out a floristic-taxonomic survey of the Lythraceae representatives, as part of the project “Flora do Ceará: knowing to conserve”. The data were obtained via the morphological analysis of samples collected in the field, and collections in herbaria as well as in specialized bibliographies. In the state of Ceará, Lythraceae is represented by 15 species belonging to four genera: *Ammannia* (2); *Cuphea* (9), *Lafoensia* (3) and *Pleurophora* (1). The species were recorded in different phytophysiognomies, but they occur preferentially in the Steppic Savanna (Caatinga and/or Carrasco), in the Dense Ombrophilous Forest (Wet Forest) and in the Vegetation Complex of the Coastal Zone (Dunes and Lowland Semideciduous Forests). The taxon with the highest number of records was *Cuphea campestris*, which occurs in 26 municipalities. Eight species were recorded in ten conservation units in Ceará. Four species are endemic to the northeastern region: *Cuphea campestris*, *C. laricoides*, *C. loefgrenii* and *Lafoensia glyptocarpa*. *Lafoensia glyptocarpa* and *L. pacari* are new records for Ceará. The identification key, morphological descriptions, comments on distribution, ecology, phenology, uses, maps, and species illustrations are presented.

**Key words:** *Cuphea*, diversity, Myrtales, Northeast of Brazil, taxonomy.

### Resumo

O estudo objetivou realizar o levantamento florístico-taxonômico dos representantes da família Lythraceae, como parte do projeto “Flora do Ceará: conhecer para conservar”. Os dados foram obtidos através da análise de caracteres morfológicos de amostras obtidas em campo, coleções de herbários e bibliografias especializadas. No território cearense, Lythraceae está representada por 15 espécies pertencentes a quatro gêneros: *Ammannia* (2); *Cuphea* (9), *Lafoensia* (3) e *Pleurophora* (1). As espécies foram registradas em diferentes fitofisionomias, mas ocorrem preferencialmente na Savana Estépica (Caatinga e/ou Carrasco), na Floresta Ombrófila Densa (Mata Úmida) e no Complexo Vegetacional da Zona Litorânea (Dunas e Mata de Tabuleiro). O táxon com o maior número de registros foi *Cuphea campestris*, ocorrendo em 26 municípios. Nove espécies foram registradas em dez unidades de conservação do Ceará. Quatro espécies são endêmicas da região Nordeste: *Cuphea campestris*, *C. laricoides*, *C. loefgrenii* e *Lafoensia glyptocarpa*. *Lafoensia glyptocarpa* e *L. pacari* são novas ocorrências para o Ceará. Chave de identificação, descrições morfológicas, comentários sobre distribuição, ecologia, fenologia e usos, mapas, e ilustrações das espécies são apresentados.

**Palavras-chave:** *Cuphea*, diversidade, Myrtales, Nordeste do Brasil, taxonomia.

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## Introduction

Lythraceae (order Myrtales) comprises 28 genera and 600 species with distribution on all continents except Antarctica, with the largest concentration of genera in Tropical America and Africa (Graham *et al.* 2005; Cavalcanti *et al.* 2016). The family is predominantly woody and traditionally recognized by opposite entire leaves, a persistent perigynous, campanulate to tubular floral tube (caducous in *Lafoensia*) with crinkled petals, two whorls of stamens and, capsular fruit (Graham *et al.* 2005; Cavalcanti *et al.* 2016).

Based on the molecular and morphological evidence, Lythraceae is classed as a monophyletic taxon (Stevens 2017 onwards; Graham *et al.* 2005, 2006). Among the genera, *Cuphea* L. stands out for presenting a high number of species (ca. 250) and has been the focus of various taxonomic revisions (Duré & Molero 2000; Barber *et al.* 2010; Graham 2019; Facco 2019; Facco *et al.* 2022; Facco & Cavalcanti 2023).

The representatives of Lythraceae have different uses, such as in popular medicine. *Lafoensia pacari* A.St.-Hil. is a plant with great ethnopharmacological importance (Firmo *et al.* 2016), and is used in the treatment of inflammations, gastritis, ulcers, and cancer (Cabral & Pasa 2009). Some studies of this species have also proved its antibacterial (Firmo *et al.* 2014), antifungal (Silva Júnior *et al.* 2009), anti-inflammatory and analgesic (Nascimento *et al.* 2011) and antioxidant potential (Firmo *et al.* 2015). The wood of *Lafoensia pacari* is used in civil construction, both in external and internal works (Carvalho 2003). *Cuphea carthagenensis* (Jacq.) J.F.Macbr. is indicated as a diaphortic, a diuretic, and a laxative (Otenio *et al.* 2020), as well as for the control of arterial hypertension and prevention of arteriosclerosis (Lusa & Bona 2011). *Lafoensia glyptocarpa* Koehne, popularly known in the region as mirindiba-rosa, is ornamental (Souza & Lorenzi 2019).

In Brazil there are 14 genera and 241 species of Lythraceae, of which 178 are endemics (Flora e Funga do Brasil 2023, continuously updated). The Brazilian Lythraceae were treated or cited in the state floras of Santa Catarina (Lourteig 1969), Goiás e Tocantins (Cavalcanti *et al.* 2001), São Paulo (Cavalcanti & Graham 2002), Acre (Daly & Silveira 2008), Alagoas (Lyra-Lemos *et al.* 2010), Distrito Federal (Cavalcanti & Graham 2011), Pernambuco (Lima 2020) and Rio Grande do Sul (Facco *et al.* 2022). They were also cited in several

local floras such as Serra do Cipó/Minas Gerais (Cavalcanti 1990); Serra de Grão-Mogol/Minas Gerais (Cavalcanti 2004); Reserva Biológica de Guaribas/Paraíba (Nunes & Lima 2017); Reserva Ducke/Amazonas (Martins *et al.* 1999); Mirandiba/Pernambuco (Cavalcanti 2009); Serra dos Carajás/Pará (Cavalcanti *et al.* 2016) and Usina São José, Igarassu/Pernambuco (Lima *et al.* 2020).

Lythraceae is a relevant component of the flora of Ceará, however its representatives are cited only in some floristic surveys (Loiola *et al.* 2015, 2020; Araújo *et al.* 2020; Silveira *et al.* 2020a,b). Inserted in the project “Flora do Ceará: knowing to conserve”, the present study aims to carry out a floristic-taxonomic survey and understand the distribution of representatives of the Lythraceae family.

## Material and Methods

Initially, consultations were carried out via the Flora e Funga do Brasil 2023 (continuously updated), REFLORA (2022) and *speciesLink* (CRIA 2022) sites to obtain a preliminary list of species occurring in Ceará. Then, analyses were made of samples obtained in the field, collections deposited in the EAC, HCDAL and HUVA herbaria and the online collections of the ALCB, CEN, ESA, HUEFS, HURB, HVASF, IAN, IPA, JPB, MAC, MBM, NY and US herbaria (acronyms according to Thiers [continuously updated] and HST [not indexed]).

Species identification was carried out via comparative analyses of specimens, photos of type collections and consultation of specialized bibliographies (Cavalcanti 2002; Cavalcanti & Graham 2002; Graham 2007; Graham & Graham 2014; Brauner 2017). Author names were based on IPNI (2022) and morphological terminology followed Harris & Harris (2001). Taxon descriptions were based on samples collected in Ceará. However, additional material from other northeastern states was included to complement the descriptions of some taxa when the samples were incomplete in relation to their floral or fruit characteristics.

For each genus and their respective taxa, a specific terminology and pattern of description were adopted. The illustrative boards were prepared on the Canva online platform with photos of specimens taken in the field and of specimens in the EAC herbarium.

Species distribution maps were prepared using the QGIS program (version 2.18.28, Las Palmas). For samples with no information on

geographic coordinates, the coordinates of the municipality obtained with the “geoLoc” tool (CRIA 2022) were included.

Vegetation types for the state of Ceará were adapted from the classification of Figueiredo (1997) and the Technical Manual of Brazilian Vegetation (IBGE 2012): Vegetation Complex of the Coastal Zone (comprising Pioneer Psammophilous Vegetation, Forest behind Dunes, and Lowland Semideciduous Forests), Neotropical Savanna (Cerrado), Semideciduous Seasonal Forest (Dry Forest), Steppic Savanna (Caatinga and/or Carrasco), Dense Ombrophilous Forest (Wet Forest), Forest Savanna (Cerradão), and Vegetation under Fluvial and/or Lacustrine Influence (Riparian Forest). Information concerning the vegetation type, popular names, and flowering and fruiting periods were obtained from the exsiccate labels.

## Results and Discussion

For the state of Ceará, 15 species belonging to four genera were recorded: *Ammannia auriculata* Willd., *A. latifolia* L., *Cuphea antisyphilitica* Kunth, *C. campestris* Mart. ex Koehne, *C. carthagenensis* (Jacq.) J.F. Macbr., *C. circaeoides* Sw ex Sims, *C. impatientifolia* A. St.-Hil., *C. laricoides* Koehne, *C. loefgrenii* Bacig., *C. micrantha* Kunth, *C. racemosa* (L.f.) Spreng., *Lafoensia glyptocarpa* Koehne, *L. pacari* A. St.-Hil., *L. vandelliana* Cham. & Schldl. and *Pleurophora anomala* (A. St.-Hil.) Koehne.

*Lafoensia glyptocarpa* e *L. pacari* are new records for Ceará. Four species are endemic to the northeastern region: *Cuphea campestris*, *C. laricoides*, *C. loefgrenii* and *L. glyptocarpa*. The taxa with the highest number of records were *C. campestris* and *P. anomala*, which occurred in 26 and 18 municipalities, respectively. The species were recorded in different phytophysiognomies, but they preferentially occur in the Steppic Savanna (Caatinga and/or Carrasco), in the

Dense Ombrophilous Forest and in the Vegetation Complex of the Coastal Zone (Dunes and Lowland Semideciduous Forests).

Nine species were recorded in the following conservation units: Environmental Protection Area (EPA) Lagamar do Cauípe (*A. latifolia*), EPA Cachoeira da Missão Velha (*A. latifolia*), Ecological Station (ES) of Aiuaba (*C. campestris*, *C. circaeoides*, *C. impatientifolia*, *P. anomala*), ES Pecém (*C. micrantha*, *L. vandelliana*), Araripe-Apodi National Forest (*L. pacari*), State Botanical Park of Ceará (*A. latifolia* and *C. campestris*), Ubajara National Park (Ubajara NP) (*C. impatientifolia*), Private Natural Heritage Reserve (PNHR) Fazenda Não Me Deixes (*C. campestris*, *C. impatientifolia*, *P. anomala*), PNHR Francy Nunes (*C. campestris*, *C. impatientifolia*, *L. pacari*), PNHR Serra das Almas (*C. campestris*, *C. impatientifolia*, *C. laricoides*, *C. loefgrenii*).

## Taxonomic treatment

**Lythraceae** J.St.-Hil., Expos. Fam. Nat. 2: 175, nom. cons. (1805).

Herbs terrestrial, annual or perennial, subshrubs, shrubs, treelets or trees, glabrous, or with trichomes unicellular, eglandular or glandular. Leaves simple, opposite or verticillate, petiolate, subsessile or sessile, margin entire, plane, subrevolute or revolute; venation brochidodromous, rare hypodromous. Inflorescences cymose or racemose. Flowers monoclinal, often showy, actinomorphic or zygomorphic, dichlamydia; dialysepalous calyx, valve prefloration; corolla dialipetal, imbricate prefloration; stamens exerted or included, double the number of petals, anthers rimose; style filiform, stigma capitate, papillose; ovary superior, sessile or stipitate, 2–4-locular, bi-pluriovulate, axial placentation, rare parietal. Fruit capsule, uniloculicidal or with irregular division. Seeds 2-numerous, winged or not.

## Identification key of the species of Lythraceae occurring in Ceará

1. Pores visible at the apex of the leaves.
  2. Leaves elliptic to large elliptic, membranaceous, acumen elongated (3–6 mm long); racemes multiflorous; seeds orbicular ..... 3.1. *Lafoensia glyptocarpa*
  - 2'. Leaves narrow oblong, oblong or obovate, carthaceous to subcoriaceous, acumen short (1–3 mm long); racemes pauci-multiflorous; seeds oblong to rectangular.
    3. Pedicel subquadrangular, slightly winged; ovary globose, smooth ..... 3.2. *Lafoensia pacari*
    - 3'. Pedicel flattened, not winged; ovary obconical to subglobose, irregularly sulcate in the equatorial zone ..... 3.3. *Lafoensia vandelliana*
- 1'. Pores absent at the apex of leaves.

4. Inflorescence in cyme or dichasium; flowers actinomorphic.
  5. Dichasium with peduncles 8–24 mm long; flowers with pedicels 4–5 mm long; fructiferous pedicel 4–8 mm long ..... 1.1. *Ammannia auriculata*
  - 5'. Cymes with peduncles 0.5–2 mm long or sessile; flowers sessile; fructiferous pedicel sessile ..... 1.2. *Ammannia latifolia*
- 4'. Inflorescence in racemes or cyme; flowers zygomorphic.
  6. Anthers basifixed; ovary stipitate, surrounded by nectaries ..... 4.1. *Pleurophora anomala*
  - 6'. Anthers dorsifixed; ovary sessile, with unilateral nectariferous gland fixed at the base.
    7. Petiolate leaves; petioles 0.4–3 cm long.
      8. Pedicels patent and persistent, forming an angle of 90° in relation to the branch; ovules 5 ..... 2.4. *Cuphea circaoides*
      - 8'. Pedicels non-patent and non-persistent; ovules 3 or numerous.
        9. Bracteoles elliptic; spur obtuse, slightly deflexed; nectariferous gland horizontal; ovules 3 ..... 2.5. *Cuphea impatientifolia*
        - 9'. Bracteoles absent; spur truncate; nectariferous gland erect; ovules numerous ..... 2.9. *Cuphea racemosa*
    - 7'. Leaves subsessile to sessile.
      10. Leaves verticillate; brachyblasts lateral; venation hyphodromous ..... 2.6. *Cuphea laricoides*
      - 10'. Leaves opposite; brachyblasts absent; venation brochidodromous.
        11. Floral tube 20–23 mm long; petals orange to red; ovules 9 ..... 2.7. *Cuphea loefgrenii*
        - 11'. Floral tube 4–8 mm long; petals white, rose, light pink, pink, lilac or purple; ovules 3–6.
          12. Petals 2 pink to purple and 4 white to light pink; ovary gibbous unilaterally at apex ..... 2.2. *Cuphea campestris*
          - 12'. Petals lilac, rose or purple; ovary not gibbous.
            13. Nectariferous gland horizontal; seeds 5–6, margin acute ..... 2.3. *Cuphea carthagenensis*
            - 13'. Nectariferous gland deflexed; seeds 3, margin obtuse.
              14. Capsule cylindrical ..... 2.1. *Cuphea antisiphilitica*
              - 14'. Capsule pyriform ..... 2.8. *Cuphea micrantha*

### 1. *Ammannia* L., Sp. Pl.: 119. 1753.

Annual herbs, terrestrial; branches erect, glabrous, branched or not in the upper portion. Leaves opposite, blades narrow elliptic, linear to lanceolate or oblong, membranaceous, glabrous; venation brochidodromous. Inflorescence in cymes or dichasium, 1–15 flowers, axillary, peduncles long filiform, short or sessile; bracteoles present. Flowers actinomorphic, pedicellate or sessile; floral tube campanulate to urculate; calyx lobes triangular, alternate, with small and thick appendages; petals 1–4 or absent, obovate, pink to lilac; stamens 4–8, exerted or included, anthers dorsifixed; ovary ellipsoid, 4-carpelar, 2–4-locular, styles exerted or included, stigma papillose. Capsule subglobose, pedicellate or sessile. Seeds numerous, semi elliptic.

The genus comprises approximately 80–100 species, which are distributed mainly in Africa and Asia, and seven species occur in America in temperate to tropical regions (Graham & Graham 2014). In Brazil, four species that are not endemic to the country are recorded (Graham *et al.* 2022). In Ceará, the genus *Ammannia* is represented by two species.

**1.1. *Ammannia auriculata*** Willd., Hort. Berol. 1:7, pl. 7. 1803. Figs. 1; 2a-c

Herbs 15–50 cm tall.; much branched in the upper portion. Leaves 2–4.5 × 0.3–0.5 cm, narrow elliptic, linear to lanceolate, base auriculate to cordate, apex acuminate to acute. Dichasium 1–15 flowers, peduncles 8–24 mm long, filiform; bracteoles ca. 1 mm long; pedicel 4–5 mm long.

Floral tube 2–3 × 1–1.2 mm, campanulate to urculate; petals 4; stamens exsert; ovary ca. 0.6 long; style ca. 2 mm long, exsert. Capsule 2 × 2–2.2 mm; fructiferous pedicel 4–8 mm long.

**Examined Material:** Cariri cearense, 25.III.1936, fl., *P. Luetzelburg* (EAC 36207). Fortaleza, Rio Maranguapinho, 24.VIII.1935, fl., *F.E. Drouet* 2348 (NY, US). Independência, 05°23'73"S, 40°19'54"W, 12.V.2011, fl., *H.H.S. Gonzalez et al.* 19 (EAC). Massapê, 13.VII.2008, fl., *E.B. Souza* 1611 (HUEFS, HUVA).

**Additional material:** BRAZIL. PERNAMBUCO: Recife, Campus da UFRPE, 16.X.2013, fl. and fr., *H.C. Gomes & A.M. Miranda* 5 (EAC, HST).

*Ammannia auriculata* is a well-defined species and easy to recognize by having dichasium with long peduncles (8–24 mm long), stamens and styles exserted, and a fructiferous pedicel that has a length of 4–8 mm. This set of characteristics distinguishes this species of *A. latifolia*, which has cymes with short peduncles (0.5–2 mm long), stamens and styles included and capsule sessile.

Species with a wide distribution in tropical and subtropical areas of the planet (Xu & Deng 2017). In Brazil, it occurs in the northeastern region in the states of Bahia, Ceará and Pernambuco and

in the central-western region, in the states of Mato Grosso and Mato Grosso do Sul (Graham *et al.* 2022). In Ceará, the species has records in three municipalities, and occurs in Steppic Savanna and in the Vegetation Complex of the Coastal Zone (Lowland Semideciduous Forest).

The species was collected with flower in March, May and July.

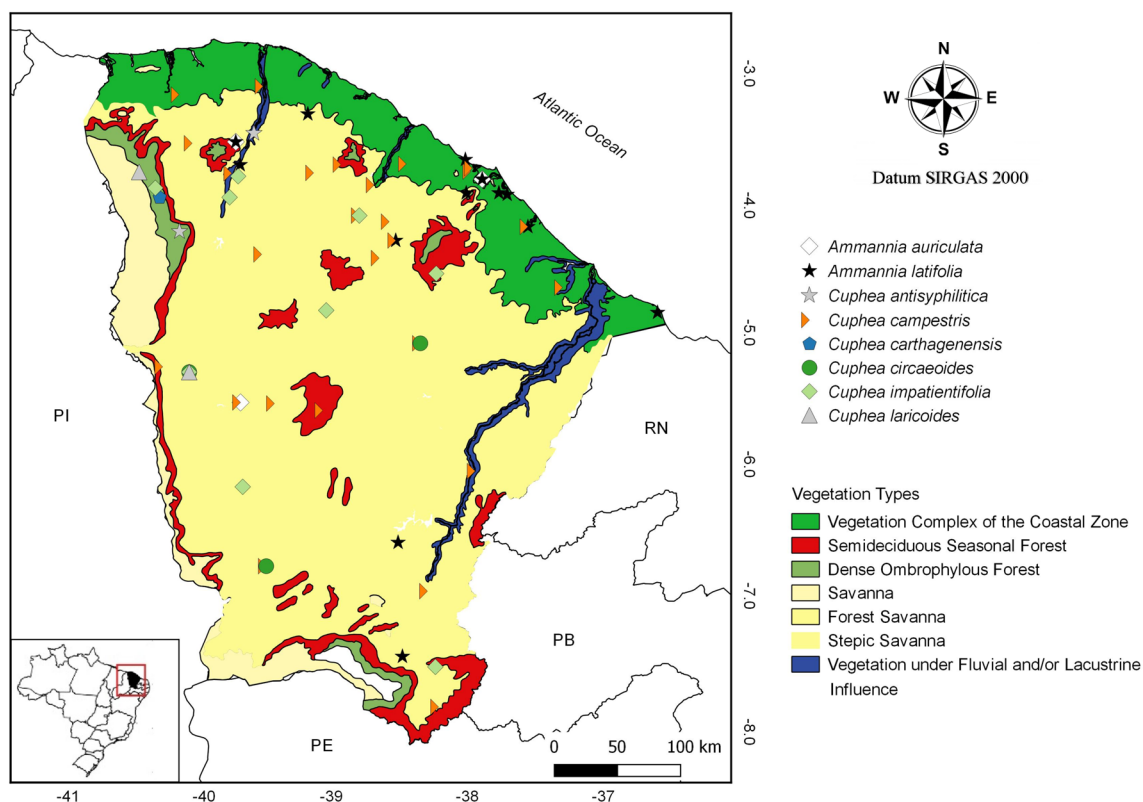
The species popular name is *Tronco vermelho orelhudo*.

**1.2. *Ammannia latifolia* L., Sp. Pl. 1: 119-120. 1753.**

Figs. 1; 2d-f

Herbs 20–60 cm tall.; unbranched or sparsely branched. Leaves 3–11 × 0.3–1.5 cm, linear-lanceolate to oblong, base auricular, apex obtuse to subacute. Cymes 1–10 flowers at the top, peduncles 0.5–2 mm long or sessile; bracteoles ca. 2 mm long; flowers sessile. Floral tube 2.5–3 × 2 mm, urculate; petals absent or 1–4; stamens included; ovary ca. 0.5 mm long; 2–3 mm style 0.8–1 mm long, included. Capsule 3–5 × 3–5 mm; fructiferous pedicel sessile.

**Examined material:** Amontada, distrito de Salgado, 03°19'22"S, 39°49'29"W, 7.IX.2013, fl. and fr., *M.I.B.*



**Figure 1** – Geographic distribution of Lythraceae species in the state of Ceará.



**Figure 2** – a-c. *Ammannia auriculata* – a. branches with pedicellate flowers and fruits; b. pedicellate fruit; c. pedicellate flower. d-f. *A. latifolia* – d. branches with sessile fruits; e. sessile fruit; f. sessile flower. g-i. *Cuphea antisiphilitica* – g. hirsute branch; h. leaf, details abaxial side; i. floral tube. j-m. *C. campestris* – j. branch with flower; k. pubescent branch; l. leaf, details adaxial side; m. unilaterally gibbous ovary. [a-c. H.C. Gomes 5 & A.M. Miranda (EAC, HST); d-f. M.I.B. Loiola et al. 2087 (EAC); L.Q. Matias et al. 575 (EAC); g-i. A. Fernandes & P. Martins (EAC 9783); j-m. R.R. Miranda et al. 134 (EAC).

*Loiola et al. 2087* (EAC). Aquiraz, várzea do Rio Pacoti, 24.VIII.2001, fr., *A.S.F. Castro 1034* (EAC). Caridade, 21.VI.2008, fr., *D.J.L. Sousa et al. 20* (EAC, HCDAL). Cascavel, 12.V.2000, fr., *R. Amado & L.Q. Matias* (EAC 30710). Caucaia, Parque Estadual Botânico do Ceará, 27.V.1998, fl. and fr., *E.B. Souza* (EAC 24541); Área de Proteção Ambiental Lagamar do Cauípe, 03°38'85"S, 38°40'90"W, 7.VII.2009, fr., *D.J.L. Sousa et al. 83* (EAC). Eusébio, várzea do Rio Poti, 20.VI.2004, fr., *A.S.F. Castro 1480* (EAC). Fortaleza, Lagoa de Maraponga, 03°47'28"S, 38°34'15"W, 11.VII.2018, fr., *V.S. Sampaio & G.F. Mendes 494* (EAC). Icapuí, Morro Pintado, 04°45'01"S, 37°17'95"W, 12.X.2011, fr., *H.H.S. Gonzalez et al. 37* (EAC). Iguatu, Lagoa do Báu, 6.IX.2009, 06°23'72"S, 29°09'92"W, fl. and fr., *L.Q. Matias et al. 575* (EAC). Maranguape, Milagres, riacho dos Porcos, 6.VI.2012, fr., *V.M. Cotarelli 1815* (HVASF). Massapê, 13.VII.2008, fr., *E.B. Souza 1612* (HUEFS). Missão Velha, Área de Proteção Ambiental Cachoeira de Missão Velha, 07°13'23"S, 39°08'40"W, 9.VI.2015, fr., *A.C. Albuquerque et al. 5* (EAC). Sobral, estrada das Marrecas, 03°41'17"S, 40°18'40"W, 27.VI.2017, fr., *E.B. Souza & F.F. Araújo 4686* (EAC).

*Ammannia latifolia* is a notably distinct species, characterized as a herb with sparse branches, flowers sessile, stamens and style included, and capsule sessile; these being the main characteristics that differentiate it from *A. auriculata*, which is unbranched or sparsely branched, flowers pedicellate (peduncles 0.5–2 mm long) or sessile, stamens and style exserted and a fructiferous pedicel of 4–8 mm long.

*Ammannia latifolia* has a wide distribution on the American continent, from the United States to Chile (GBIF 2022). In Brazil, it occurs only in the northeastern region, in the states of Bahia, Ceará, Paraíba and Pernambuco (Graham *et al.* 2022). In Ceará, it is registered in 13 municipalities and in three conservation units: EPA Lagamar do Cauípe, EPA Cachoeira de Missão Velha and the State Botanical Park of Ceará. The species occurs in the Vegetation Complex of the Coastal Zone (Lowland Semideciduous Forest), Vegetation with Fluvial and/or Lake Influence, Dense Ombrophilous Forest and Steppic Savanna.

The species was collected with flowers in May and September and with fruits between May and October.

## 2. *Cuphea* P.Browne, Civ. Nat. Hist. Jamaica: 216. 1756.

Herbs, subshrubs or shrubs, annuals or perennials; with trichomes long glandular and/or short curved or erect, strigose, indumentum hirsute, hirtellous or pubescent; brachyblasts present or

absent. Leaves sessile, subsessile or petiolate, opposite or verticillate, venation brochidodromous, rarely hyphodromous. Inflorescence in frondose to bracteose racemes. Flowers zygomorphic, 6-merous, bracteolate or bracteole absent; floral tube, persistent in fruiting; spur acute, obtuse to truncate, slightly to strongly deflexed, horizontal; sepals triangular; petals subequal, pink, lilac, purple, orange or white, deciduous or persistent in the fruit; stamens 11, included or exserted, anthers dorsifixed; ovary superior, sessile, elliptic, pubescent or glabrous, style glabrous or villous, ovules 3-numerous; nectariferous gland unilateral, dorsal, fixed at the base of ovary. Capsule, uniloculicidal cylindrical, fusiform, pyriform or tubular. Seeds 3-numerous, margin acute or obtuse, rarely winged.

This is the largest genus of the family and has approximately 240–250 species that are distributed across the American continent in tropical and temperate climates (Graham & Graham 2014). In Brazil, there are 107 species, of which 71 are endemic (Cavalcanti *et al.* 2022a). In Ceará, *Cuphea* is represented by nine taxa.

### 2.1. *Cuphea antisyphilitica* Kunth, Nov. Gen. Sp., 6: 202-203, 1824. Figs. 1; 2g-i

Herbs to subshrubs erect to decumbente, 40–60 cm tall; branches hirsute, glandular and eglandular trichomes; brachyblasts absent. Leaves opposite, sessile to subsessile; petiole 0.1–0.3 mm long. Blade 5–12 × 3–7, narrow oval, oval or oblong, base obtuse to cordate, apex acute, margin plane to subrevolute, carthaceous to coriaceous, strigose, appressed eglandular trichomes; venation brochidodromous. Racemes frondose to frondose-bracteose; bracteoles oval; pedicel 1–1.8 mm long, interpetiolar, not patent, not persistent. Flowers 6–9 mm long. Floral tube 4–7 × 1–1.5 mm, hirsute on outer surface, greenish with greenish to purplish glandular trichomes; spur obtuse, deflexed; petals obovate, purple, deciduous in the fruit; stamens included; ovary glabrous, style villous, ovules 3; nectariferous gland deflexed. Capsule ca. 5 × 1.5 mm, cylindrical. Seeds 3, obovate, margin obtuse.

**Examined material:** Aquiraz, Caponga da Bernarda, Ferreira, 12.VII.2001, fl., *A.S.F. Castro 999* (EAC). Guaraciaba do Norte, 27.II.1981, fl., *A. Fernandes & P. Martins* (EAC 9783). Santana do Acaraú, 6.III.1972, fl., *W.R. Anderson et al. 36722* (US).

**Additional material:** BRAZIL. MARANHÃO: Carolina, Parque Nacional Chapada das Mesas, 07°04'25"S, 47°05'45"W, 20.X.2015, fl. and fr., *A.C. Sevilha et al. 5500* (CEN).

*Cuphea antisyphilitica* shares its hirsute branches and villous style with *C. racemosa*; however, it differs by having sessile to subsessile leaves (*vs.* petiolate, petiole 0.4–1.5 cm long.), obtuse and deflexed spur (*vs.* truncate and short), deflexed nectariferous gland (*vs.* erect) and 3 ovules (*vs.* numerous).

*Cuphea antisyphilitica* occurs in Bolivia, Brazil, Colombia, Guyana, Paraguay, and Venezuela (Facco & Cavalcanti 2023). In Brazil, it is distributed in the central-western, northeastern, northern, and southeastern regions. In the northeastern region, the species has been recorded in the states of Bahia, Ceará, Maranhão, Piauí and Sergipe (Cavalcanti *et al.* 2022a). In Ceará, it has records in only two municipalities in the Vegetation Complex of the Coastal Zone (Lowland Semideciduous Forest) and Steppic Savanna.

The species was collected with flowers in February and March.

## 2.2. *Cuphea campestris* Mart. ex Koehne, *Fl. bras.* 13(2): 265. 1877. Figs. 1; 2j-m

Subshrubs erect, 25–50 cm tall; branches pubescent, eglandular trichomes present, rarely glandular; brachyblasts absent. Leaves opposite, sessile to subsessile; petiole ca. 5 mm long. Blade 1.6–4 × 0.3–0.8 cm, narrow elliptic to narrow lanceolate, base acute to cuneate, apex acute, margin entire, plane, carthaceous, indumentum strigose on both surfaces; brochidodromous venation. Racemes frondose-bracteose; bracteoles elliptic; pedicel ca. 1 mm long, interpetiolar, not patent, not persistent. Flowers 8–14 mm long. Floral tube 5–8 × 2–2.5 mm, strigose on outer surface, greenish to reddish with appressed eglandular trichomes, rare greenish to reddish glandular trichomes; spurn obtuse, strongly deflexed; petals obovate, 2 pink to purple and 4 white to light pink, deciduous on the fruit; stamens exerted; ovary pilose, gibbous unilaterally at apex, style glabrous, ovules 3–6; deflexed nectariferous gland. Capsule 5–7 × 1.8–3 mm, fusiform to pyriform. Seeds 4–5, elliptic, acute margin, with small wing.

**Examined material:** Aiuaba, Estação Ecológica de Aiuaba, 28.IV.1981, fl., *P. Martins* (EAC 10165). Aracati, Fazenda Recordações Aroeiras, 04°34'15"S, 37°59'35"W, V.2013, fl., *M.I.B. Loliola* (EAC 57864). Brejo Santo, 07°35'09"S, 38°53'04"W, 11.IV.2013, fl., *N.M. Almeida & D.P. Souza 521* (HURB). Canindé, 18.III.2002, fl., *V.C. Souza et al. 28691* (ESA). Caridade, 21.VI.2008, fl., *D.J.L. Sousa et al. 9* (EAC). Cascavel, distrito de Cristais, 26.IV.2006, fl., *A. Alves-Araújo & M. Oliveira 160* (IAN). Caucaia, Parque Estadual Botânico do Ceará,

25.III.1998, fl. and fr., *E. Nunes & F.S. Cavalcanti* (EAC 26263). Coreau, Ubauna, 28.III.1994, fl., *M.A. Figueiredo & F.S. Araújo* (EAC 21361). Crateús, Reserva Particular do Patrimônio Natural Serra das Almas, 05°08'25"S, 40°52'06"W, 3.III.2017, fl., *F.J. Chamorro 232* (EAC). General Sampaio, Reserva Particular do Patrimônio Natural Francy Nunes, 31.V.2008, fl., *M.F. Moro et al. 417* (EAC). Granja, 03°11'01"S, 40°45'01"W, 21.V.2015, fl., *E.B. Souza et al. 3483* (EAC). Independência, 05°19'22"S, 40°26'75"W, 12.V.2011, fl. and fr., *H.H.S. Nascimento 17* (EAC). Irauçuba, IV.2007, fl., *C.D.S. Pessoa 38* (EAC). Itapajé, margem da BR-222, 4.IV.1996, fl. and fr., *A.S.F. Castro* (EAC 24026). Jaguaribe, 12.IV.2011, fl., *A.M. Miranda & K. Manso 6308* (EAC, HST). Lavras da Mangabeira, 6.VI.1985, fl., *A. Fernandes et al.* (EAC 13244). Marco, 16.IV.2006, fl., *A.S.F. Castro 1731* (EAC). Paramoti, 31.III.2000, fl. and fr., *E.B. Souza et al. 495* (EAC). Pedra Branca, 27.IV.1981, fl., *P. Martins* (EAC 10124). Pentecoste, Fazenda Experimental Vale do Curu, 03°50'00"S, 39°20'54"W, fl., *R.R. Miranda et al. 134* (EAC). Quixadá, Reserva Particular do Patrimônio Natural Fazenda Não Me Deixes, 4.VIII.2000, fl., *R.C. Costa* (EAC 32042). Santa Quitéria, 15.V.2016, fl., *I.S.A. Cardins 188* (IPA). São Gonçalo do Amarante, Croatá, 03°40'55"S, 39°07'00"W, 14.IV.2022, fl., *M.I.B. Loliola et al. 2871* (EAC). Sobral, Embrapa, 03°44'55"S, 40°22'19"W, 21.III.2016, fl., *R.R. Miranda et al. 121* (EAC). Tauá, bacia do riacho Carrapateira, 05°24'15"S, 40°03'53"W, 20.IV.2014, fl., *A.C. Gomes 43* (EAC).

*Cuphea campestris* is distinct from other *Cuphea* species that occur in Ceará due to it having narrow elliptic to narrow lanceolate leaves, and its exclusive characters are flowers with petals of different colors, two pink to purple and four white to light pink, and a unilaterally gibbous ovary at the apex.

This is an endemic species of northeastern Brazil, and occurs in Alagoas, Bahia, Ceará, Paraíba, Pernambuco and Rio Grande do Norte (Cavalcanti *et al.* 2022a). This taxon has the highest number of records in Ceará (26 municipalities) and occurs in five conservation units: ES Aiuaba, State Botanical Park of Ceará, PNHR Fazenda Não Me Deixes, PNHR Francy Nunes and PNHR Serra das Almas. The species occurs in Vegetation with Fluvial and/or Lake Influence, Semideciduous Seasonal Forest and Steppic Savanna.

The species was collected with flowers between March and August and with fruits in March, April and May.

## 2.3. *Cuphea carthagenensis* (Jacq.) J.F. Macbr., *Nat. Hist., Bot. Ser.* 8: 124. 1930. Figs. 1; 3a-c

Herbs to subshrub erect, ca. 25 cm tall; branches pubescent, eglandular and glandular



trichomes; brachyblasts absent. Leaves opposite, subsessile to petiolate; petiole ca. 4 mm long. Blade 1.3–4.8 × 0.7–1.8 cm, elliptic, base acute, apex acute, margin plane, membranaceous to carthaceous, pubescent with glandular trichomes concentrated on the veins; venation brochiodromous. Racemes frondose; bracteoles elliptic; pedicel 2–4 mm long, interpetiolate, not patent, not persistent. Flowers 6–7 mm long. Floral tube 4–6 × 0.8–1 mm, pubescent on outer side, greenish with sparse glandular trichomes and eglandular trichomes, greenish to vinaceous; spur obtuse to acute, slightly deflexed; petals obovate, lilac, deciduous on fruit; stamens included; ovary glabrous, style glabrous, ovules 5–6; nectariferous gland horizontal. Capsule 8–10 × 1–1.8 mm, fusiform. Seeds 5–6, obovate, margin acute, with small wing.

**Examined material:** Baturité, morro dos Jesuitas, 26.XII.1997, fl., *A.S.F. Castro* (EAC 26003). Guaramiranga, Sítio Sinimbu, 17.XII.2002, fl., *A. Silveira & R. Oliveira 449* (EAC). Ibiapina, encosta Serra de Ibiapaba, 9.IX.2001, fl. and fr., *A.S.F. Castro 1062* (EAC).

**Additional examined material:** BRAZIL. PARAÍBA: Sertãozinho, Sítio Canafístula, 06°44'06"S, 35°27'30"W, 6.IV.2018, fl., *J.M.P. Cordeiro 1269* (CEN, JPB).

*Cuphea carthagenensis* is a well-defined species and has the peculiar characteristics of elliptic leaves, small flowers (6–7 mm long) with an obtuse to acute spur, capsule fusiform and seeds with an acute margin with a small wing.

*Cuphea carthagenensis* occurs in the Americas, from the northern United States to southern Brazil (GBIF 2022). The species has been recorded in all Brazilian regions and, in the northeastern region, it occurs in Alagoas, Bahia, Ceará, Pernambuco, and Sergipe (Cavalcanti *et al.* 2022a). In Ceará, there are only two records in Ombrophilous Dense Forest.

The species was collected with flowers and fruits in September.

The species popular name is *Sete-sangrias*.

**2.4. *Cuphea circaeoides* Sm. ex Sims, J., Bot., Mag., 48: pl. 2201. 1820.** Figs. 1; 3d-f

Subshrub erect, 16–28 cm tall; branches hirtellous, glandular and eglandular trichomes; brachyblasts absent. Leaves opposite; petiole 1–1.8 cm long. Blade 2.9–6 × 1–2 cm, elliptic to large elliptic, base asymmetric or obtuse, apex acute, margin plane, membranaceous, eglandular trichomes appressed, glandular trichomes rare; venation brochiodromous. Racemes bracteose; bracteoles elliptic; pedicel 3–5 mm long,

interpetiolate to axillary, patent, persistent, forming a 90° angle to the branch. Flowers 6–7 mm long. Floral tube 6–9 × 2–3 mm, hirsute on outer side, greenish to purplish with glandular trichomes; spur obtuse, unconscious; petals narrow-obovate, lilac, deciduous on fruit; stamens included; ovary glabrous, style glabrous, ovules 5; nectariferous gland erect. Capsule 5–6 × 2–3 mm, fusiform to pyriform. Seeds 4, large-elliptic, margin acute.

**Examined material:** Aiuaba, Estação Ecológica de Aiuaba, 28.IV.1981, fl. and fr., *P. Martins* (EAC 10162). Gameleira de Cima, 9.IV.1997, fl. and fr., *L.W. Lima-Verde 577* (EAC).

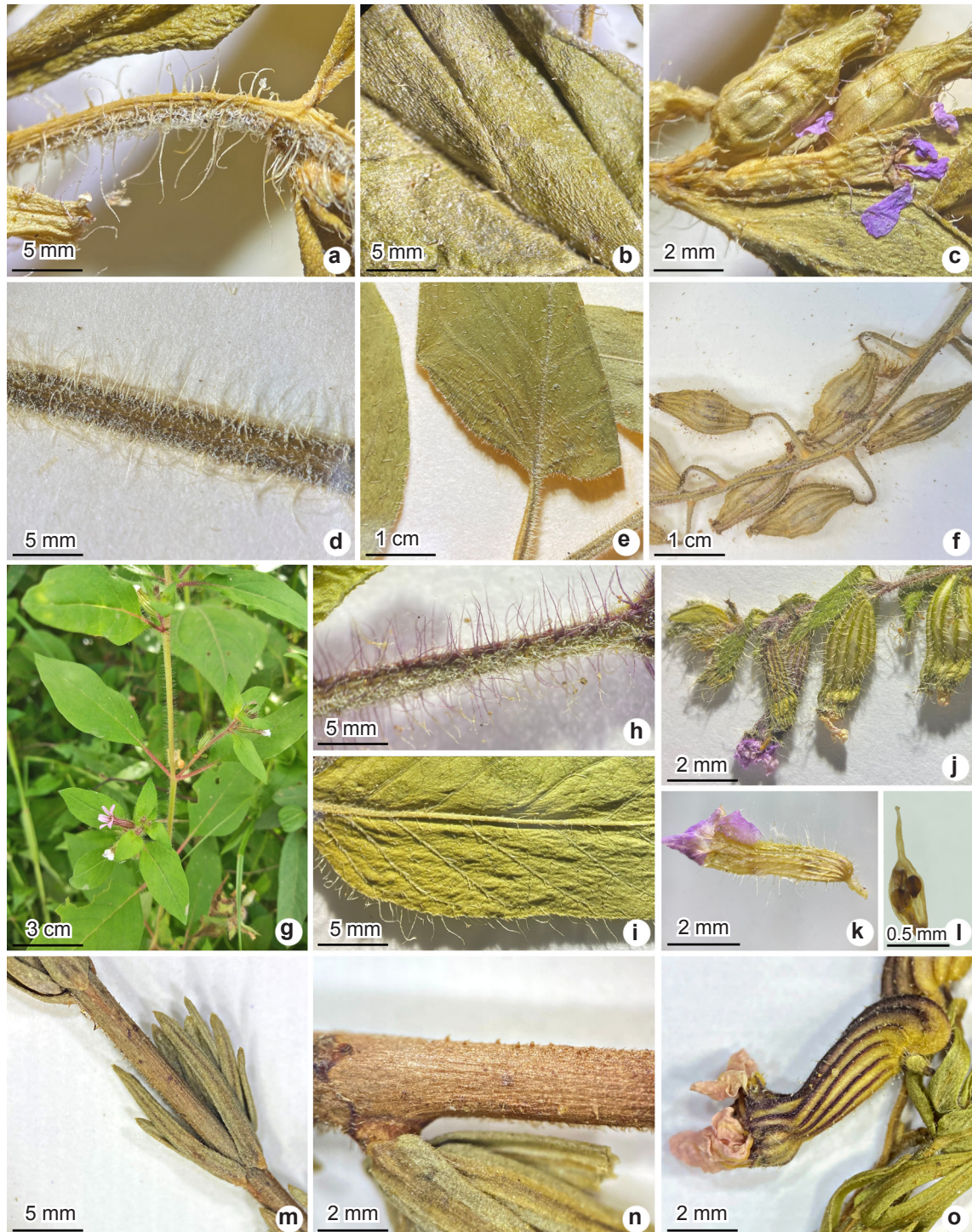
*Cuphea circaeoides* resembles *C. impatientifolia* in that both have petiolate leaves and an obtuse spur, but *C. circaeoides* has flowers with pedicels 3–4 mm, persistent, patent, forming a 90° angle to the branch (*vs.* pedicels 0.5–2 mm). This is also the main character for identification of the taxon in herborized collections.

This species is endemic to Brazil, with occurrence in the semiarid region, and records only in the north of Minas Gerais (southeastern region) and, in the Northeastern region, it has been confirmed to occur in Alagoas, Bahia, Ceará, Paraíba, Pernambuco, and Sergipe (Cavalcanti *et al.* 2022a). In Ceará, the species was recorded in Steppic Savanna in three municipalities. It is recorded only in the conservation unit ES Aiuaba.

The species was collected with flowers and fruits in April.

**2.5. *Cuphea impatientifolia* A.St.-Hil., Fl. Bras. Merid., 3: 113. 1833.** Figs. 1; 3g-l

Herbs erect, 28–42 cm tall; branches hirsute, glandular and eglandular trichomes; brachyblasts absent. Leaves opposite; petiole ca. 0.8–3 cm long. Blade 2.7–8 × 0.8–4 cm, elliptic to oval, base attenuate, apex obtuse to acute, margin plane, membranaceous, pubescent with sparse eglandular trichomes; venation brochiodromous. Racemes bracteose, sometimes in zig-zag; bracteoles elliptic; pedicel 0.5–2 mm long, axillary, not patent, not persistent. Flowers 7–10 mm long. Floral tube 7–8 × 2–2.5 mm, pubescent on outer side, greenish with greenish to purplish glandular trichomes; spur obtuse, slightly deflexed; petals narrowly ovate, lilac, persistent in fruit; stamens included; ovary glabrous, style glabrous, ovules 3; nectariferous gland horizontal. Capsule ca. 7 × 3 mm, fusiform to pyriform. Seeds 3, large elliptic, margin acute.



**Figure 3** – a-c. *Cuphea carthagenensis* – a. pubescent branch; b. leaf, details adaxial side; c. floral tube. d-f. *C. circaeoides* – d. hirtellous branch; e. petiolate leaf; f. fruit with patent pedicels, forming angle of 90°. g-l. *C. impatientifolia* – g. habit; h. hirsute branch; i. leaf, details abaxial side; j. branch with flowers; k. floral tube; l. ovary. m-o. *C. laricoides* – m. branch with brachyblasts; n. pubescent branch; o. floral tube. [a-c. A.S.F. Castro 1062 (EAC); d-f. P. Martins (EAC 10162); L.W. Lima-Verde 577 (EAC); g-l. R.R. Miranda & F.M. Gomes 202 (EAC); E.B. Souza et al. 4570 (EAC); m-o. D. Teixeira 26 (EAC); L.W. Lima-Verde 1045 (EAC)].

**Selected examined material:** Aiuaba, Estação Ecológica de Aiuaba, 23.V.2013, fl. and fr., *M.I.B. Loiola & F.R.S. Tabosa 1995* (EAC). Aracati, Aroeira, Fazenda Recordações, 04°34'06"S, 37°59'16"W, 28.V.2022, fl., *L.M. de Sousa & M.I.B. Loiola 89* (EAC). Baturité, 30.V.1994, fl. and fr., *L.W. Lima-Verde* (EAC 21662). Camocim, Lago Seco, 02°52'47"S, 40°52'27"W, 16.III.2018, fl., *E.B. Souza et al. 5106* (EAC). Capistrano, Fazenda Arçanga, 30.V.1994, fl., *L.W. Lima-Verde* (EAC 21662). Caririaçu, 1.III.1980, fl., *P. Martins* (EAC 8194). Crateús, Reserva Particular do Patrimônio Natural Serra das Almas, 26.II.2002, fl., *F.S. Araújo & J.R. Lima 1332* (EAC). General Sampaio, Reserva Particular do Patrimônio Natural Francly Nunes, 20.V.2008, fl. and fr., *M.F. Moro et al. 402* (EAC). Groairas, Lagoa do Peixe, 03°55'18"S, 40°23'14"W, 7.IV.2017, fl. and fr., *E.B. Souza et al. 4570* (EAC). Itapipoca, estrada para o açude Ipu-Mazagão, 03°33'14"S, 39°28'52"W, 14.IV.2022, fl., *M.I.B. Loiola et al. 2875* (EAC). Madalena, 04°44'05"S, 39°41'32"W, 10.VI.2018, fl. and fr., *E.D. Lozano et al. 4164* (MBM). Meruoca, Santa Rita, trilha para a Pedra do Urubu, 03°37'55"S, 40°27'14"W, 13.V.2016, fl., *E.B. Souza et al. 4022* (EAC). Milagres, Fazenda Nazaré, 07°17'52"S, 38°54'26"W, 21.IV.2011, fl. and fr., *C.G. Silva 49* (HURB). Quixadá, Reserva Particular do Patrimônio Natural Fazenda Não Me Deixes, 29.III.2001, fl., *R.C. Costa* (EAC 32038). Sobral, Embrapa, 03°46'12"S, 40°19'34"W, 26.IV.2016, fl. and fr., *R.R. Miranda & F.M. Gomes 202* (EAC). Tauá, bacia do riacho Carrapateira, 05°24'18"S, 40°03'59"W, 20.IV.2014, fl., *R.C. Gomes 62* (EAC). Ubajara, Planalto da Ibiapaba, Parque Nacional de Ubajara, 24.II.1999, fl., *A. Fernandes et al.* (EAC 27912).

*Cuphea impatientifolia* is distinct from other species occurring in Ceará due to its hirsute branches with purple trichomes, petiolate leaves (petioles 0.5–2.5 cm long), elliptic to oval, floral tube with obtuse spur and ovary with three ovules.

*Cuphea impatientifolia* is endemic to Brazil, with distribution only in the semiarid region, with records in the north of Minas Gerais (southeastern) and in all states of the northeastern region, in the phytogeographic domains of Caatinga and Atlantic Forest (Cavalcanti *et al.* 2022a). In Ceará, the species was recorded in 11 municipalities in vegetation of Semideciduous Seasonal Forest and Steppic Savanna. It has confirmed occurrence in five conservation units: ES Aiuaba, PNHR Serra das Almas, PNHR Francly Nunes, PNHR Fazenda Não Me Deixes and Ubajara NP.

The species was collected with flowers between February and June and with fruits between April and June.

**2.6. *Cuphea laricooides* Koehne, *Fl. bras.*, 13(2): 338. 1877.** Figs. 1; 3m-o

Subshrub decumbent, rare erect, 30–40 cm tall; branches pubescent, eglandular trichomes, rare glandular trichomes; lateral brachyblasts, starting from leaf axils. Leaves verticillate, usually 3, sessile. Blade 3–7.5 × 1–1.5 mm, linear to narrow oval, base truncate to obtuse, apex acute, margin subrevolute to revolute, coriaceous, strigose on both faces, with appressed eglandular trichomes; venation hypodromous. Racemes frondose; bracteoles oval; pedicel ca. 2 mm long, interpeciolar, not patent, not persistent. Flowers 8–9 mm long. Flower tube 6–8 × 2–3 mm, pubescent on outer side, greenish to purplish with whitish eglandular trichomes; spur obtuse, strongly deflexed; petals narrow ovate to obovate, pinkish to white, deciduous in fruit; stamens exerted; ovary glabrous, style glabrous, ovules 3–4; nectariferous gland deflexed. Capsule 5–6 × 2–3 mm, tubular. Seeds 2–3, large-obovate, margin obtuse.

**Examined material:** Crateús, Reserva Particular do Patrimônio Natural Serra das Almas, 26.II.2002, fl., *F.S. Araújo & L.C. Girão 1324* (EAC); Serra das Almas, 05°08'47"S, 40°55'33"W, 20.III.2014, fl. and fr., *D. Teixeira 26* (EAC). Tianguá, 23.VIII.2004, *L.W. Lima-Verde et al. 3020* (EAC).

As diagnostic features, *Cuphea laricooides* has verticillate leaves with a revolute margin and floral tube with a strongly deflexed spur. It is the only species among those recorded in Ceará that presents hypodromous venation.

This species is endemic to the northeastern region of Brazil, and occurs in the states of Bahia, Ceará, Maranhão, and Piauí (Facco & Cavalcanti 2023). In Ceará, so far, it has been found in only two municipalities in Ombrophilous Dense Forest and Steppic Savanna and in the conservation unit PNHR Serra das Almas.

The species was collected with flower in February and March and with fruit in March.

**2.7. *Cuphea loefgrenii* Bacig., *Contr. Gray Herb.* 95: 24. 1931.** Figs. 4; 5a-d

Subshrubs to shrubs erect, ca. 90 cm tall; branches hirtellous, glandular and eglandular trichomes appressed; brachyblasts absent. Leaves opposite; petiole 1–2 mm long. Blade 1.2–3.5 × 0.5–2 cm, oval, base attenuate to acute, apex acute, margin plane, carthaceous, pubescent, appressed eglandular trichomes and sparse glandular; venation brochidromous. Racemes frondose-bracteose; bracteoles elliptic; pedicel 2–4 mm long, axillary,

not patent, not persistent. Flowers 22–25 mm long. Floral tube 20–23 × 4–5 mm, greenish to orange, hirsute on outer side, with greenish to vinaceous glandular trichomes; spur obtuse, horizontal; petals obovate, orange to red, persistent in fruit; stamens exserted; ovary glabrous, style glabrous, ovules 9; nectariferous gland deflexed. Capsule 1.5–2 × 0.3–0.4, tubular. Seeds 8–9, obovate, margin acute. **Examined material:** Crateús, Reserva Particular do Patrimônio Natural Serra das Almas, 05°08'49''S, 40°54'96''W, 14.I.2017, fl., *H.M. Meneses* 83 (EAC). Graça, 11.VI.2007, fl., *M.M.P. Boto* 19 (HUEFS). Granja, 03°21'32''S, 40°44'35''W, 23.II.2016, fl., *E.B. Souza et al.* 3816 (EAC, HUVA). Guaraciaba do Norte, Chapada da Ibiapina, 22.III.2000, fl., *A. Fernandes* (EAC 29064). Ipueiras, 22.VII.2009, fl. and fr., *A.S.F. Castro* 2195 (EAC). Tianguá, 2.III.2013, *M.L. Guedes et al.* 20409 (ALCB). Ubajara, cachoeira do Boi Morto, 23.II.1996, fl., *M.A. Figueiredo* (EAC 23617). Viçosa do Ceará, encosta da Serra das Flores, 13.XII.1985, fl. and fr., *A. Fernandes et al.* (EAC 13985).

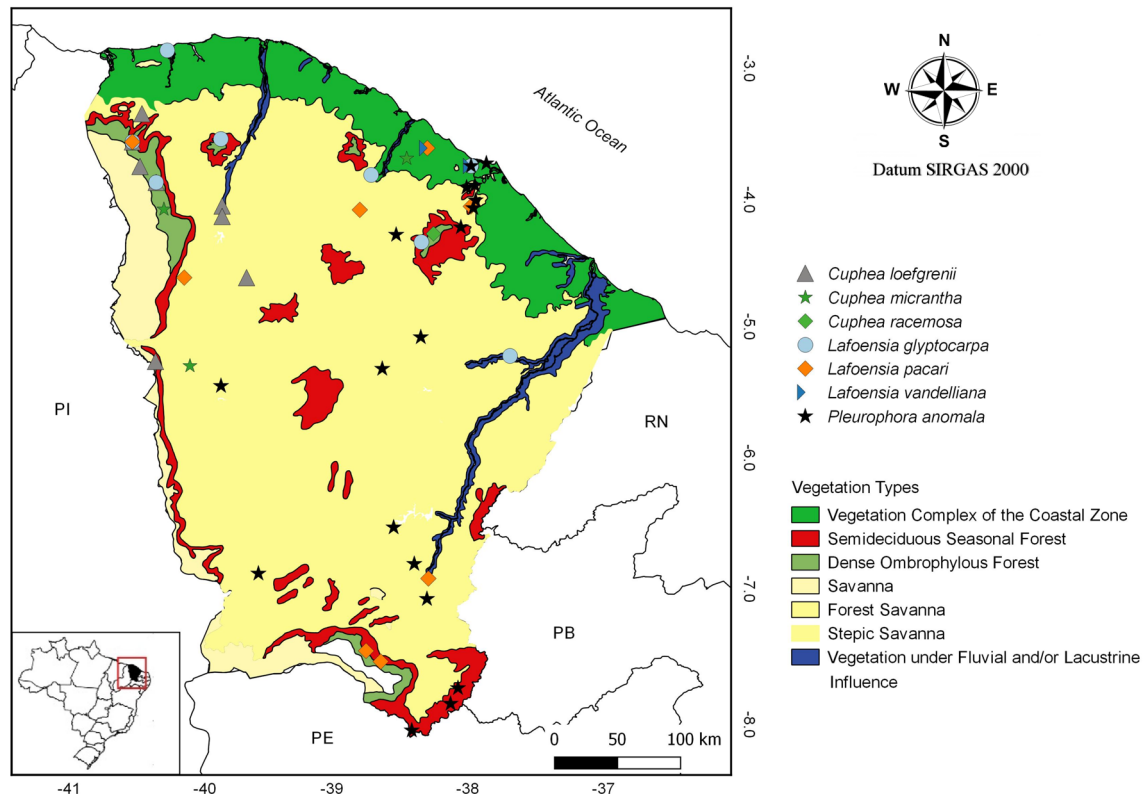
Among the species that occur in Ceará, *Cuphea loefgrenii* is the only species that has hirtellous branches, large flowers (20–25 mm long), floral tube 20–23 mm long and orange to red petals.

*Cuphea loefgrenii* is endemic to northeastern Brazil, and occurs only in the states of Ceará and Piauí, in the phytogeographic domain Caatinga (Cavalcanti *et al.* 2022a). In the Ceará, it has been recorded in eight municipalities in vegetation of Dense Ombrophilous Forest, Savanna and Steppic Savanna. It is recorded only in the conservation unit PNHR Serra das Almas.

The species was collected with flowers in January, February, March, June, July and December and with fruits in July and December.

**2.8. *Cuphea micrantha* Kunth, Nov. Gen. Sp. 6: 196. 1823.** Figs. 4; 5e-k

Subshrub erect, 17–40 cm tall; branches hirsute to pubescent, eglandular trichomes with curved apex and white to vinaceous glandular trichomes; brachyblasts absent. Leaves opposite, sessile to subsessile. Blade 1.8–4.5 × 0.5–1.4, oval to elliptic, base cuneate, apex acute, margin plane, membranaceous, strigose; venation brochidodromous. Racemes bracteose to frondose-bracteose; bracteoles elliptic; pedicel 0.8–1 mm long, not patent, not persistent. Flowers 6–7 mm



**Figure 4** – Geographic distribution of Lythraceae species in the state of Ceará.



**Figure 5** – a-d. *Cuphea loefgrenii* – a. hirtellous branch; b. leaf, details adaxial side; c. floral tube; d. floral tube details. e-k. *C. micrantha* – e. habit; f. branch with flowers; g. detail of fruit dehiscence; h. floral tube; i. fruit. j. ovary; k. ovules. l-n. *C. racemosa* – l. hirsute branch; m. leaf, details abaxial side; n. floral tube. [a-d. *E.B. Souza et al. 3816* (EAC); *D. Teixeira 28* (EAC); e-k. *M.V.C.C. da Silva 1 & L.M. Sousa* (EAC); *M.I.B. Loiola et al. 2872*; l-n. *L.W. Lima-Verde* (EAC 22406)].

long. Floral tube 5–6 × 1–1.2 mm, pubescent on outer side, greenish to violet with greenish to violet glandular trichomes; spur acute, horizontal; petals narrow elliptic to narrow ovate, pink to lilac, deciduous on fruit; stamens included; ovary glabrous, style glabrous, ovules 3; nectariferous gland deflexed. Capsule 5–6 × 2–3 mm, pyriform. Seeds 3, elliptic to obovate, margin obtuse.

**Examined material:** Aiuaba, lagoa da Boiada, 26.II.1996, fl., *L.W. Lima-Verde 496* (EAC). Caridade, 8.III.2002, fl. and fr., *A. Fernandes* (EAC 31392). Crateús, Reserva Particular do Patrimônio Natural Serra das Almas, 05°08'46"S, 40°55'32"W, 19.III.2014, fl., *D. Teixeira 18* (EAC). Fortaleza, UFC Campus do Pici, 03°44'43"S, 38°34'29"W, 26.IV.2022, fl. and fr., *M.V.C.C. da Silva & L.M. Sousa 1* (EAC). Granja, Papagaios, 03°11'15"S, 40°44'40"W, 15.III.2017, fl., *E.B. Souza 4477* (EAC, HUVA). Irauçuba, Fazenda Cacimba Salgada, 10.V.2000, fl. and fr., *A.M.S. Bitencourt 09* (EAC). Itapipoca, estrada para o açude Ipu-Mazagão, 03°33'14"S, 39°28'52"W, 14.V.2022, fl., *M.I.B. Loiola et al. 2874* (EAC). São Benedito, Fazenda Penha, 22.III.2000, fl. and fr., *E.B. Souza et al. 409* (EAC). São Gonçalo do Amarante, Croatá, 03°40'55"S, 39°07'00"W, 14.IV.2022, fl. and fr., *M.I.B. Loiola et al. 2872* (EAC); Estação Ecológica do Pecém, 3.V.2000, fl., *H. Magalhães 232* (EAC). Ubajara, Escritório do ICMBIO, 03°50'31"S, 40°56'36"W, 26.IV.2021, fl., *M.I.B. Loiola et al. 1524* (EAC).

*Cuphea micrantha* is a well-defined species and is characterized by hirsute to pubescent branches, sessile to subsessile leaves, floral tube with an acute and horizontal spur and a capsule with three elliptic to obovate seeds, obtuse margins.

This species has a wide distribution, and is recorded in Mexico, Central America, the Caribbean, Colombia, Venezuela, Guyana, Bolivia, Paraguay, and Brazil (Facco & Cavalcanti 2023). It occurs in almost all Brazilian regions, except in the south, in the phytogeographic domains Amazonia, Caatinga, Cerrado, and Atlantic Forest (Cavalcanti *et al.* 2022a). It is a plant that is often found in disturbed sites, such as roadsides and pastures (Facco 2019). In northeastern Brazil, it has confirmed occurrence in Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte and Sergipe (Cavalcanti *et al.* 2022a). In Ceará, the species has been recorded in nine municipalities in different vegetation types such as Vegetational Complex of the Coastal Zone (Dune and Lowland Semideciduous Forest), Savanna, Seasonal Semideciduous Forest, Steppic Savanna, and Dense Ombrophilous Forest. It occurs in PNHR Serra das Almas and ES Pecém.

The species was collected with flowers in March, April and May and with fruits in March and April.

**2.9. *Cuphea racemosa* (L.f.) Spreng., Syst. Veg. 2: 455. 1825.** Figs. 4; 5l-n

Subshrub prostrate or decumbent, 40–50 cm tall; branches hirsute, glandular and eglandular trichomes abundant; brachyblasts absent. Leaves opposite; petiole 0.4–1.5 cm long. Blade 1.5–4 × 0.9–2.5 cm, oval, base acute to attenuate, apex acute to obtuse, margin plane, pubescent with sparse eglandular trichomes on both faces, glandular trichomes sparse on margin; venation brochidodromous. Racemes bracteose; bracteoles absent; pedicel 4–9 mm long, interpeciolar, not patent, not persistent. Flowers 6–7 mm long. Floral tube 5–6 × 1–2 mm, greenish to pinkish, pubescent on outer side, greenish to purplish eglandular trichomes; spur truncate; petals obovate, subequal, lilac, deciduous on fruit; stamens included; ovary glabrous, style villous, ovules numerous; nectariferous gland erect. Capsule ca. 5 × 2 mm, cylindrical. Seeds numerous, elliptic, margin obtuse.

**Examined material:** Pacoti, Sítio Olho D'Água dos Tangarás, 10.VIII.1995, fl., *L.W. Lima-Verde* (EAC 22406).

**Additional material:** BRAZIL. PERNAMBUCO: Jaqueira, Serra do Urubu, 8.IX.2010, fl. and fr., *Chagas-Mota 8359* (MAC).

*Cuphea racemosa* is a remarkable species that is characterized by having oval and petiolate leaves (petioles 0.4–1.5 cm long), absence of bracteoles, floral tube with a short and truncate spur (5–6 × 1–2 mm) and an ovary with numerous ovules.

*Cuphea racemosa* occurs in Mexico, Panama, Venezuela, Colombia, Ecuador, Peru, Bolivia, Brazil, Paraguay, Uruguay, and Argentina (GBIF 2022). The species is widely distributed in the Brazilian regions, except for the northern region. In the northeastern region, it has been recorded in Alagoas, Bahia, Ceará, Pernambuco, and Sergipe (Cavalcanti *et al.* 2022a). In Ceará, the species is recorded in only one municipality, and occurs in Ombrophilous Dense Forest.

The species was collected with flowers in August.

**3. *Lafloensia* Vand., Fl. Lusit. Brasil.: 33. 1788.**

Trees to shrubs glabrous. Leaves petiolate, opposite, membranaceous, chartaceous or subcoriaceous, apex with prominent pore; venation brochidodromous, intramarginal veins evident. Inflorescence in racemes; bracts foliaceous; bracteoles deciduous at floral anthesis; pedicel

slightly winged or not. Flowers actinomorphic; floral tube campanulate, coriaceous, greenish to vinaceous/reddish; lobes 9–12, membranaceous, triangular, acute, alternating with appendages between sepals; petals 10–12, inserted on inner margin of tube, alternating with lobes, obovate to oblong, irregularly wavy or crenate, white; stamens 11–26, inserted at base of floral tube, long and exserted. Ovary 2–4-locular, stipitate, straight or sulcate; placentation basal; stigma capitate, papillose. Capsule with loculicidal dehiscence, coriaceous. Seeds numerous, flattened and widely winged.

*Lafoensia* occurs from southern Mexico to southern Brazil (Graham & Graham 2014). Seven species occur in the Brazilian territory, three of which are endemic: *Lafoensia glyptocarpa* Koehne, *Lafoensia nummularifolia* A.St.-Hil. and *Lafoensia replicata* Pohl (Cavalcanti 2022). In Ceará, the genus is represented by three taxa.

### 3.1. *Lafoensia glyptocarpa* Koehne, *Fl. bras.* (Martius) 13(2): 353. 1877. Figs. 4; 6a-c

Shrubs, treelets or trees, 1.5–5 m tall; stem straight to slightly crooked, bark verrucose or striate, reddish brown to grayish; branches cylindrical. Petiole 0.5–1 cm long, slender. Leaves 2–8.2 × 1.4–4 cm, elliptic to large elliptic, base acute to obtuse, apex acute, acumen elongate, 3–6 × 1–3 mm, membranaceous. Racemes multiflorous, 2–22 flowers per raceme; pedicel 1.8–2.8 cm long, flattened, slightly winged. Floral tube 1.5–2 × 1.2–1.9 cm; 10–11 lobes; petals 12; stamens 20; ovary globose, sulcate. Capsule 3–5 × 1.7–2.5 cm, pyriform, fruit broader at base, tapered in upper half, verrucose; fructiferous pedicel ca. 2 cm long. Seeds orbicular.

**Examined material:** Camocim, Boqueirão dos Dourados, 8.I.2012, fl., *A.S.F. Castro 2591* (EAC). Caucaia, 8.VII.2007, fl. and fr., *A.S.F. Castro 1951* (EAC). Pentecoste, Fazenda Experimental Vale do Curu, 03°48'25"S, 39°21'81"W, 16.VI.2015, fl. and fr., *C.C. Oliveira 31* (EAC). Meruoca, Serra da Meruoca, 16.IX.1989, fl., *A. Fernandes et al.* (EAC 16040). Morada Nova, Fazenda Bom Jesus, 1.VI.1994, fl., *M.A.P. Silva & E.L. de Paula-Zarate* (EAC 23694). Mulungu, Sítio Jardim, 04°17'07"S, 39°00'38"W, 20.IX.2004, fl. and fr., *V. Gomes et al. 2009-13* (EAC). Ubajara, Chapada da Ibiapaba, 1.VIII.1980, fl. and fr., *A. Fernandes & P. Bezerra* (EAC 8890). Viçosa do Ceará, Cocalzinho, 12.II.1977, fl., *A. Fernandes & Matos* (EAC 3097).

*Lafoensia glyptocarpa* differs from the other species of the genus by having leaves that are membranaceous, elliptic to large elliptic with

acumen elongated (3–6 × 1–3 mm), racemes multiflorous, ovary sulcate, and seeds orbicular.

This is a species that is endemic to northeastern Brazil, and occurs in the states of Bahia, Ceará, Pernambuco, and Piauí in the phytogeographic domain Cerrado (Cavalcanti 2022). In Ceará, it was recorded in eight municipalities with occurrence in the Vegetation Complex of the Coastal Zone (Lowland Semideciduous Forest), Steppic Savanna, and Vegetation with River and/or Lake Influence. This species is cited for the first time for the state of Ceará.

The species was collected with flowers from January to September and fruits from July to September.

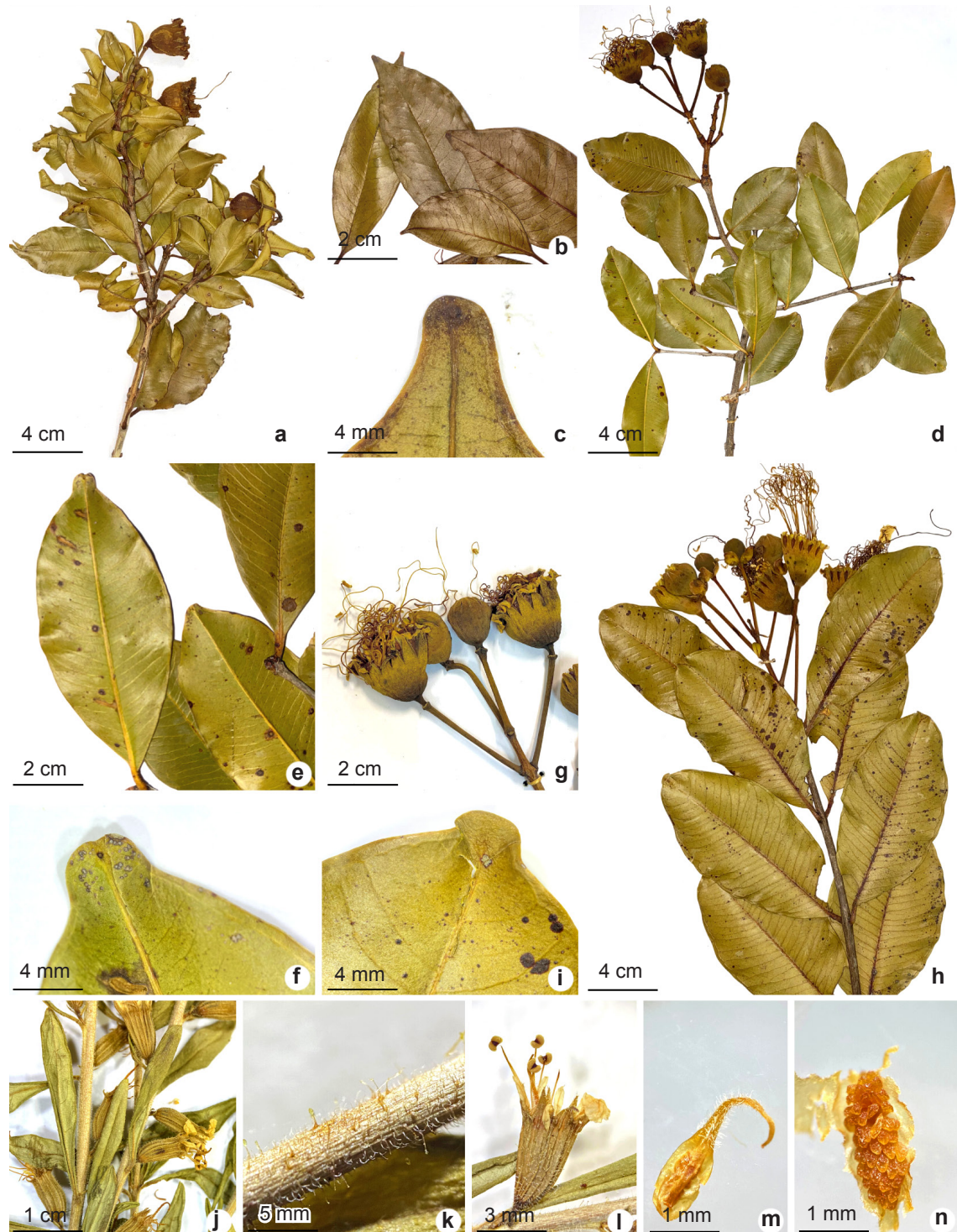
The individuals are used in recovery of degraded areas, landscaping, wood used in construction and shipbuilding (Carvalho 2014). And the species popular name is *Mirindiba*, *mirindiba-rosa*, *pau-mocó*, *rajada*, *rajadinha*.

### 3.2. *Lafoensia pacari* A.St.-Hil., *Fl. Bras. Mer.* 3:159. 1833. Figs. 4; 6d-g

Shrubs, treelets or trees, 1.6–15 m tall; stem crooked, bark coriaceous, reddish brown to grayish; branches cylindrical to subquadrangular. Petiole ca. 0.4–1 cm long, thickened. Leaves 2.5–7 × 1.8–5 cm, narrow oblong, oblong or obovate, base obtuse, apex obtuse to retuse, acumen short 1–3 × 3–3.2 cm, chartaceous to subcoriaceous. Racemes pauciflorous, 2–22 flowers per raceme; pedicel 2.5–3 cm long, subquadrangular, slightly winged. Floral tube ca. 2 × 1.5 cm, 10–12 lobes; petals 10–12; stamens 20–24; ovary globose, smooth. Capsule ca. 3.5 × 2 cm, ovoid to globose. Seeds oblong to rectangular.

**Examined material:** Barbalha, Chapada do Araripe, 17.VII.2002, fl., *I.R. Costa* (EAC 34758). Crato, Chapada do Araripe, Floresta Nacional do Araripe-Apodi, 30.VII.1997, fl., *A.S.F. Castro* (EAC 25293). General Sampaio, Reversa Particular do Patrimônio Natural Francy Nunes, 31.V.2008, fl., *M.F. Moro et al. 438* (EAC). Guaiúba, 04°01'39"S, 38°39'18"W, 1.IX.2014, fr., *D. Pocwardowski 206* (EAC). Ipueriras, Serra da Ibiapaba, 31.VII.2016, fl. and fr., *A.S.F. Castro 2963* (EAC). Lavras da Mangabeira, Sítio Patos, 06°42'44"S, 38°57'37"W, 3.VII.2013, fr., *A.P. Oliveira et al. 2742* (HURB). São Gonçalo do Amarante, Fazenda Pau d'Óleo, 03°38'31"S, 39°06'10"W, 21.VI.2015, fl. and fr., *J.L. Vera Santos 6* (EAC). Viçosa do Ceará, 2.V.2003, fl., *A. Fernandes* (EAC 32514).

*Lafoensia pacari* is a well-defined taxon and, a peculiar feature, it has oblong leaves with short



**Figure 6** – a-c. *Lafoensia glyptocarpa* – a. branch; b. leaf, details abaxial side; c. elongate acumen. d-g. *L. pacari* – d. branch; e. leaf, details abaxial side; f. short acumen; g. buds and flowers. h-i. *L. vandelliana* – h. branch; i. short acumen. j-n. *Pleurophora anomala* – j. branch with flowers; k. pubescent branch; l. floral tube; m. ovary; n. ovules. [a-c. A.S.F. Castro 1951 (EAC); S.T. Rabelo et al. 170 (EAC); d-g. A.S.F. Castro 2963 (EAC); h-i. R.G. Ferreira (EAC 49903); j-n. M.I.B. Loliola (EAC 57856); M.A. Figueiredo 601 (EAC)].



acumen (1–3 × 3–3.2 mm), subquadrangular, slightly winged pedicel, and smooth ovary.

*Lafoensia pacari* is registered in Suriname, Brazil, Bolivia, and Paraguay (GBIF 2022). In Brazil, it has been recorded in all regions of country that have the phytogeographic domain Cerrado (Cavalcanti 2022). In the northeastern region, it only occurs in the states of Bahia, Ceará, and Maranhão (Cavalcanti 2022). In Ceará, it has been recorded in nine municipalities in Neotropical Savanna, Steppic Savanna, and Forested Savanna vegetation. It occurs in the conservation units: Araripe-Apodi National Forest and PNHFR Francy Nunes. This species is cited for the first time for the state of Ceará.

The species was collected with flowers between April and July and fruits between April and September.

The wood is used in civil construction (Carvalho 2003), and the popular names are *mirindiba*, *dedaleira*, *romã braba*, *candeia-de-caju*, *romã*.

**3.3. *Lafoensia vandelliana*** Cham. & Schldl, *Linnaea* 2: 346. 1827. Figs. 4; 6h-i

Shrubs or trees, 2–25 m tall; stem straight; bark rugged, reddish brown to grayish; branches cylindrical. Petiole 3–12 mm long, slender. Leaves 6–8.5 × 3–4.7 cm, elliptic, oblong or obovate, base cuneate or rounded, apex acute, obtuse, rectus or rounded, acumen short ca. 2 × 3 mm, chartaceous to subcoriaceous. Racemes pauciflorous, 10–20 flowers per raceme; pedicel 3–3.5 cm long, flattened, not winged. Floral tube ca. 2 × 1.5 cm; 9–11 lobes; petals 12; stamens 11–26; ovary obconic to subglobose, irregularly sulcate at equatorial zone. Capsule 3.4–5 × 1.8–2.4 cm, subglobose to turbinate, irregularly depressed in upper equatorial half. Seeds rectangular.

**Examined material:** Caucaia, margem do Rio Cauípe, 4.X.2001, fr., *A.S.F. Castro 1084* (EAC). São Gonçalo do Amarante, ESEC do Pecém, 10.VIII.2011, fl., *R.G. Ferreira* (EAC 49903).

*Lafoensia vandelliana* distinguishes itself from other species occurring in Ceará mainly by the generally obovate leaves with short acumen (ca. 2 × 3 mm), flattened and not winged pedicel, ovary irregularly sulcate in the equatorial zone, and subglobose to turbinate capsule, irregularly depressed in the upper equatorial half.

*Lafoensia vandelliana* occur in Suriname, Venezuela, Ecuador, Peru, Bolivia, Paraguay, and Brazil (GBIF 2022). Brazil, it has been recorded in all regions of the country though, in the

northeast, only in the states of Ceará and Maranhão (Cavalcanti 2022). In Ceará, it has been recorded in two municipalities in the Coastal Zon Vegetation Complex (Lowland Semideciduous Forests) and in Vegetation under Fluvial and/or Lacustrine Influence.

The species was collected with buds and Flowers in August and with fruits in October.

**4. *Pleurophora*** D.Don, *Edinburgh New Philos. J.* 12: 112. 1831.

The genus comprises seven species distributed in Argentina, Bolivia, Brazil, and Chile (Graham & Graham 2014). In Brazil, three species occur, two of which are endemic: *Pleurophora anomala* and *Pleurophora pulchra* (Cavalcanti *et al.* 2022b). In Ceará, the genus is represented by one species.

**4.1. *Pleurophora anomala*** (A. St.-Hil.) Koehne, *Mart. Fl. bras.* 13(2): 307. 1877. Figs. 4; 6j-n

Subshrubs erect, 50–100 cm tall, perennial, branched; branches pubescent, eglandular trichomes with curved apex, long, greenish glandular trichomes. Leaves opposite, sessile or subsessile; petiole ca. 1 mm long. Blade 10–25 × 2–5 mm, narrow lanceolate to narrow elliptic, base acute or attenuate, apex cuneate or obtuse, margin plane to subrevolute, membranaceous, pubescent on both sides; venation brochidodromous. Inflorescence in cyme. Flowers zygomorphic, monoclinal, 6-merous, axillary, bracteoles ca. 1 mm long, narrow elliptic or linear; pedicel 0.8–1.5 mm long. Floral tube 4–5 × 3.5–4 mm, pubescent, trichomes erect, greenish; petals subequal, 4 ca. 1 × 0.5 mm, elliptic, 2 ca. 1.3 × 1 mm, oval or obovate, caducous at fruiting, lilac to cream; stamens 6, exserted, filaments glabrescent, anthers dorsifixed, reniform; ovary 2-locular, ovoid, stipitate, surrounded by nectary, glabrous, ovules numerous; style ca. 8 mm, exserted, pubescent. Capsule 4–5 × 3–3.5 mm, cylindrical, dehiscence with irregular division. Seeds numerous, concave-convex, not winged.

**Examined material:** Aiuaba, Estação Ecológica de Aiuaba, 06°40'35"S, 40°11'04"W, 29.V.1996, fl., *M.A. Figueiredo 601* (EAC). Brejo Santo, base da Serra Canabrava, 12.I.2010, fl., *A.P. Fontana 6313* (HVASF). Caridade, 17.III.2002, fl., *V.C. Souza et al. 28687* (ESA). Caucaia, Conceição, 27.VI.2004, fl., *A.S.F. Castro 1484* (EAC). Cedro, 31.V.1933, fl., *Luetzelburg 26488* (IPA). Fortaleza, 3.VI.1956, fl., *J.F. Mattos* (IAN 106036). Guaiúba, Hotel Fazenda Vale do Juá, 20.VI.2001, fl., *A. Fernandes & E. Nunes* (EAC 30810). Iguatu, 06°20'35"S, 39°11'98"W, 16.V.2010, fl., *L.R.O. Normando et al.*

278 (EAC). Independência, 05°19'20"S, 40°26'51"W, 12.V.2011, fl., *H.H.S. Gonzalez et al.* 17 (EAC). Lavras da Mangabeira, Sítio Passagem da Pedra, 8.VII.2013, fl., *A.C.P. Oliveira 2767* (HVASF). Maracanaú, 22.III.2001, fl. and fr., *F.S. Cavalcanti 836* (EAC). Maranguape, 8.V.1997, fl., *A.S.F. Castro* (EAC 24916). Mauriti, margem do açude Quixabinha, 07°50'26"S, 38°74'73"W, 4.VI.2014, fl., *V.M. Cotarelli 1756* (HVASF). Pacatuba, 1.I.1887, fl., *F. Allemão* (P05092859). Penaforte, Sítio Baixio do Couro, 07°48'29"S, 39°04'48"W, 18.VIII.2009, fl., *A.P.B. Santos et al.* 7 (CEN, HVASF, HURB). Quixadá, Reserva Particular do Patrimônio Natural Fazenda Não Me Deixes, 29.III.2001, fl., *L.W. Lima-Verde & R.C. Costa* (EAC 32039). Quixeramobim, Fazenda Pedra Redonda, 27.VIII.1992, fl., *E.B. Souza* (EAC 20127). Redenção, Sítio Menino Jesus de Praga, 04°10'42"S, 38°42'96"W, IV.2013, fl. and fr., *M.I.B. Loiola* (EAC 57856).

*Pleurophora anomala* can be easily recognized by the sessile to subsessile, narrow lanceolate to narrow elliptic leaves, flowers with exserted stamens and styles, stipitate ovary, surrounded by nectaries and numerous ovules.

*Pleurophora anomala* is endemic to Brazil, and is distributed in the Caatinga phytogeographical domain in all states of the northeastern region (except for Maranhão), the north of Minas Gerais, and the southeastern region (Cavalcanti 2022). In Ceará, the species has a wide distribution, with occurrence registered in 18 municipalities in vegetation of Steppic Savanna, in the Vegetational Complex of the Coastal Zone (Lowland Semideciduous Forest), Dense Ombrophilous Forest and Semideciduous Seasonal Forest. It has been recorded in two conservation units: ES Aiuaba and PNHR Fazenda Não Me Deixes.

The species was collected with flowers from January to August and with fruits in March and April.

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### Data availability statement

In accordance with Open Science communication practices, the authors inform that all data are available within the manuscript.

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## Errata

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