

# A TAXONOMIC SYNOPSIS OF ACANTHACEAE JUSS. NATIVE TO PARAÍBA STATE, BRAZIL

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**Abstract.** We present here a taxonomic synopsis of the native representatives of the family Acanthaceae in Paraíba State, north-eastern Brazil. Fertile material was collected during monthly excursions between November 2014 and November 2015. We also analyzed specimens deposited in the Lauro Pires Xavier (JPB) and the Jayme Coelho de Moraes (EAN) herbaria, as well as consulted the REFLORA—Virtual Herbarium of the Flora and Fungi from Brazil and the *Species Link* databank. Taxonomic identifications were based on morphological analyses and consulting the literature. A total of 24 species belonging to 10 native genera were encountered, 11 species being reported for the first time for Paraíba State in this work. The most representative genera were *Ruellia* L. (8 spp.), *Justicia* L. (6 spp.), *Harpochilus* Nees (2 spp.), and *Hygrophila* R. Br. (2 spp.); the other genera were represented each by a single species. A key to the species, illustrations, and data concerning their geographic distributions, flowering, and fruiting are included. Additionally, a lectotype is designated for *Beloperone thunbergioides* and a neotype for *Hygrophila costata* and *Justicia imbricata*.

**Keywords:** Asterids, Brazilian northeast, Eudicotyledons, Lamiales, taxonomy

Acanthaceae Juss. comprise approximately 240 genera and 3,250 species with predominately tropical distribution, although with representatives in temperate regions (Wasshausen and Wood, 2004). Engler and Diels (1936) placed Acanthaceae in the order Tubiflorae, while Cronquist (1981) later positioned it in the order Scrophulariales; according to the APG IV (2016) these taxa are all currently positioned in Lamiales.

Scotland and Vollesen (2000) divided Acanthaceae into three subfamilies: Nelsonioideae, Thunbergioideae, and Acanthoideae, with the latter composed of two tribes—Acantheae and Ruellieae; Ruellieae, in turn, is composed of the subtribes Andrographiinae, Barleriinae, Justiciinae, and Ruelliinae. McDade et al. (2000) subdivided the subfamily Acanthoideae into four tribes: Acantheae, Barleriaceae, Justiceae, and Ruellieae; the latter comprises the genus *Ruellia* L., contained within the subtribe Ruelliinae, which comprises approximately 400 species (Tripp, 2007).

Brazil is one of the principal centers of diversity of the family Acanthaceae (Souza and Lorenzi, 2012), with species distributed in the Atlantic Forest (45%), Cerrado (25%), and Amazon region (15%); the remaining taxa (15%) are found in the other regions of that country (Kameyama, 1990). Forty genera are known to occur in all of the phytogeographical domains of Brazil, with four them being endemic; eight

species distributed among five genera are known to Paraíba State (BFG, 2015).

The principal work dealing with the Brazilian species of Acanthaceae was published by Nees Von Esenbeck (1847) in *Flora Brasiliensis* (with 343 species, many of them new to science at the time, distributed among 57 genera, and 31 illustrations). However, no key to the species identification was provided in this monograph.

The only studies addressing the taxonomy of the family Acanthaceae in northeastern Brazil were published by Silva et al. (2010) and Côrtes and Rapini (2013), the former focusing on the states of Alagoas and Sergipe, and the latter on Bahia State. There have been no specific studies published concerning Paraíba State, although representatives of that family have been mentioned in phytosociological studies and floristic lists, for example, Lourenço and Barbosa (2003), Agra et al. (2004), Barbosa et al. (2004, 2011), and Lima and Barbosa (2014).

We present here a taxonomic synopsis of native representatives of the family Acanthaceae in Paraíba State, northeastern Brazil, including a key to the identification of the species, illustrations, geographical data, other information relative to enlarging our knowledge of the Brazilian phanerogamic flora, and, principally, the taxonomy and distribution of the Acanthaceae in Paraíba.

## MATERIALS AND METHODS

### Study Area

Paraíba State (06°02'12"–08°19'18"S x 34°45'54"–38°45'45"W) is located in northeastern Brazil, bordering Rio Grande do Norte State to the north, Pernambuco State

to the south, the Atlantic Ocean at Ponta do Seixas to the east, and Ceará State to the west. The state comprises 223 municipalities and has a total area of 56,469 km<sup>2</sup> (one of the smallest states in Brazil). Paraíba can be divided into

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four Mesorregions: Mata, Agreste, Borborema, and Sertão (Anuário Estatístico da Paraíba, 2015). Fig. 1.

The landscape of Paraíba State includes coastal plains, high plains, mountains, and valleys; its vegetation is quite varied, ranging from Atlantic Forest to herbaceous Caatinga (thorny deciduous dryland vegetation). While rather dry overall, the state possesses many perennial and intermittent rivers including the Paraíba, Piancó, Piranhas, Taperoá, Mamanguape, Curimataú, Gramame, and Peixe rivers. The regional climate is warm tropical humid along the coast and hot tropical dry (semiarid) in the interior (Portal Brasil, 2015).

#### Field and Laboratory Procedures

Fertile plant specimens (with flowers and/or fruits) were harvested during monthly excursions undertaken between November 2014 and November 2015. The collections were incorporated into the ACAM herbarium, *Campus I*, of the State University of Paraíba (UEPB). We also analyzed specimens deposited in the Lauro Pires-Xavier (JPB) and the Jayme Coelho de Moraes (EAN) herbarium on *Campi I* and *II* of the Federal University of Paraíba (UFPB), and viewed specimens online using the REFLORA—Virtual

Herbarium of the Flora and Fungi from Brazil and the *Species Link* databank.

The morphological studies were principally based on specimens collected in Paraíba State during the present study, complemented by the analyses of exsiccates deposited in the above-mentioned herbarium and, when necessary, consulting the nomenclatural types and original descriptions.

Taxonomic identifications were based on morphological analyses supported by the specialized literature: Ezcurra (1993), Kameyama (1995), Braz et al. (2002), Wasshausen and Wood (2004), Vilar (2009) and Braz and Azevedo (2016). A key was subsequently prepared for identifying the species. Also presented here is a list of the materials examined; commentaries concerning taxonomic affinities based on morphological characteristics (both vegetative and reproductive); and data concerning geographical distributions, flowering, and fruiting; as well as illustrations of the diagnostic characteristics of the native species recorded for the state. The descriptions of the morphological structures are based on the terminology used by Hickey (1973), Radford et al. (1974), Rizzini (1977), Payne (1978), Radford et al. (1974), and Harris and Harris (2001).

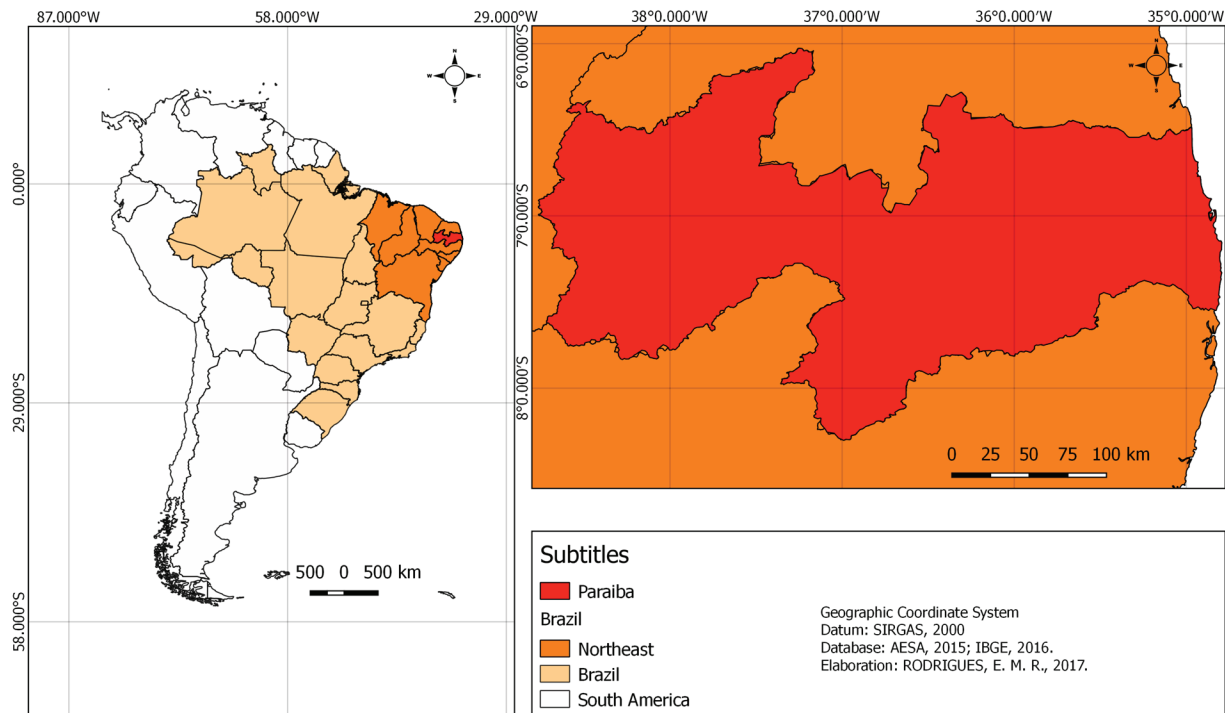


FIGURE 1. Location of the study area, Paraíba State, northeastern Brazil (prepared by: E.M. Rodrigues).

#### RESULTS AND DISCUSSION

Twenty-four species belonging to 10 genera of Acanthaceae were recorded for Paraíba State, including *Ruellia* L. (eight spp.), *Justicia* L. (six spp.), *Harpochilus* (two spp.), and *Hygrophila* R. Br. (two spp.); the other genera (*Avicennia* L., *Aphelandra* R. Br., *Dicliptera* Juss., *Elytraria* Michx., *Lepidagathis* Willd., and *Nelsonia*) were each represented by a single species. Eleven species were

recorded for the first time in the study area: *Avicennia germinans* (L.) L., *Aphelandra nuda* Nees, *Hygrophila costata* Nees and T. Nees, *Justicia asclepiadea* (Nees) Wash. & C. Ezcurra, *J. comata* (L.) Lam., *J. thunbergioides* (Lindau) Leonard, *Lepidagathis alopecuroidea* (Vahl) R.Br. ex Griseb., *Nelsonia canescens* (Lam.) Spreng., *R. inundata* Kunth, *R. ochroleuca* Mart. ex Nees, and *R. simplex* Wright.

Acanthaceae Juss., Gen. Pl.: 102-103. 1789.

Type species: *Acanthus mollis* L., Sp. Pl. 2: 639, as 939. 1753. TYPE: Habitat in Italiae, Siciliae humentibus, duris [Lectotype designated by Brummitt (BM [not seen])].

*Herbs*, less frequently vines or shrubs, rarely trees (*Avicennia*), with simple leaves, generally opposite, rarely alternate or spiraled (Nelsonioideae), decussate, without stipules, with cystoliths. Inflorescences in dichasia, spiciform, glomerules, panicles, racemes and thyrsoids, or with solitary flowers; generally 1 bract and 2 bracteoles per flower, foliaceous or petaloid, bracteoles sometimes partially covering the corolla tube. Flowers generally showy, bisexual, zygomorphic, with two whorls; sepals generally 5, free or fused, calyx sometimes very reduced; sepals and petals connate, with corolla varying from 5-lobate, bilabiate, or more rarely unilabiate, lobes imbricate or convolute. Stamens 2 or 4, didynamous, sometimes with staminodes, epipetalous, anthers rimose or poricidal (*Mendoncia*); annular nectariferous disk at base of ovary, ovary superior, 2-locular, rarely 1-locular, generally 2–10 ovules per

locule, overlapping, in a single line, rarely in two lines, or 2 collateral ovules, placentation axillary, rarely pseudo-parietal, style filiform, stigma generally 2-lobed. Capsule loculicide, almost always explosively dehiscent, with each seed held within a hook-shaped lignified projection derived from the funicle (retinacule) (absent in *Thunbergia*), rarely a drupe (*Mendoncia*), uniseminate indehiscent and fleshy (*Avicennia*); seeds 2–10, generally flat, orbicular (Durkee, 1986; Braz et al., 2002; Kameyama, 2006; Judd et al., 2009).

Acanthaceae comprises approximately 3,250 species within approximately 240 genera, distributed predominantly in the tropics, with few representatives in temperate regions (Cronquist, 1981; Scotland and Vollesen, 2000), with the greatest concentrations of species in southeastern Asia, Malaysia, India, Madagascar, tropical Africa, Central America, Mexico, the Andes, and Brazil (Daniel, 1999). According to the “Flora do Brasil 2020,” the family is represented by 39 genera and 445 species in Brazil associated with all of the regions and phytogeographical domains of that country.

#### IDENTIFICATION KEY TO THE SPECIES OF ACANTHACEAE NATIVE TO PARAÍBA STATE

- |  |                                    |
|--|------------------------------------|
| 1a. Plants arboreal . . . . .  | <i>Avicennia germinans</i>         |
| 1b. Plants herbaceous, subshrubs to shrubs . . . . .   | 2                                  |
| 2a. Corolla clearly bilabiate . . . . .  | 3                                  |
| 2b. Corolla inconspicuously bilabiate . . . . .  | 15                                 |
| 3a. Herbs; corolla 5-lobate . . . . .  | 4                                  |
| 3b. Shrubs to subshrubs; corolla 2-lobate . . . . .  | 9                                  |
| 4a. Inflorescences spiciform or falciform; stamens 4; ovary oblong . . . . .   | 5                                  |
| 4b. Inflorescences spiciform, secundiflorous or not; stamens 2; ovary ellipsoidal to cylindrical . . . . .             | 7                                  |
| 5a. Inflorescences spiciform, not secundiflorous; stamens enclosed; corolla bluish purple or white to violet . . . . . | 6                                  |
| 5b. Inflorescences falciform, secundiflorous; stamens exerted; corolla red . . . . .                                   | <i>Aphelandra nuda</i>             |
| 6a. Bracteoles linear-oblancheolate; 4-seeded . . . . .  | <i>Lepidagathis alopecurioidea</i> |
| 6b. Bracteole elliptic; 8- to 16-seeded . . . . .  | <i>Nelsonia canescens</i>          |
| 7a. Bracts foliaceous, ovate; stigma rhomboidal; ovary ellipsoidal . . . . .   | <i>Elytraria imbricata</i>         |
| 7b. Bracts never foliaceous, triangular; stigma bilobed; ovary cylindrical . . . . .                                   | 8                                  |
| 8a. Herbs erect; branches subquadrangular; corolla purplish white; capsule fusiform . . . . .                          | <i>Justicia comata</i>             |
| 8b. Herbs prostrate; branches tetrangular; corolla purple to lily-colored; capsule ellipsoidal . . . . .               | <i>Justicia laevilinguis</i>       |
| 9a. Branches cylindrical; flowers with 4 bracts; corolla resupinate . . . . .  | <i>Dicliptera mucronifolia</i>     |
| 9b. Branches subquadrangular; flowers with 2 bracts; corolla not resupinate . . . . .                                  | 10                                 |
| 10a. Inflorescences axillary or terminal; ovary piriform; capsule clavate . . . . .                                    | 11                                 |
| 10b. Inflorescences spiciform; ovary cylindrical; capsule of other shape . . . . .                                     | 12                                 |
| 11a. Leaf blade oblong to elliptic or ovate to obovate; inflorescences in axillary thyrsus; corolla greenish . . . . . | <i>Harpochilus neesianus</i>       |
| 11b. Leaf blades ovate, velvety; inflorescences in terminal spikes; corolla pale yellow . . . . .                      | <i>Harpochilus paraibanus</i>      |
| 12a. Bracts elliptic to lanceolate; capsule ovate to oblong . . . . .  | 13                                 |
| 12b. Bracts ovate to elliptic or triangulate; capsule ellipsoidal . . . . .  | 14                                 |
| 13a. Corolla lilac with white stripes . . . . .  | <i>Justicia asclepiadea</i>        |
| 13b. Corolla red . . . . .   | <i>Justicia aequilabris</i>        |
| 14a. Corolla white-purple; unequal and overlapping thecae . . . . .  | <i>Justicia glaziovii</i>          |
| 14b. Corolla pink; oblique and mutic theca . . . . .   | <i>Justicia thunbergioides</i>     |
| 15a. Plants subshrubs to shrubs . . . . .  | 16                                 |
| 15b. Plants herbaceous . . . . .   | 18                                 |
| 16a. Branches cylindrical; stamens exerted; capsule clavate; seeds 4 . . . . .   | <i>Ruellia asperula</i>            |
| 16b. Branches tetrangular; stamens enclosed; capsule ellipsoidal; seeds 8–10 . . . . .                                 | 17                                 |
| 17a. Inflorescences in terminal panicles; corolla tubular, pink; ovary elliptic; stigma filiform . . . . .             | <i>Ruellia cearensis</i>           |
| 17b. Inflorescences racemose; corolla hypocrateriform to infundibuliform; ovary oblong; stigma bilobed . . . . .       | <i>Ruellia ochroleuca</i>          |
| 18a. Bracteoles absent; flowers solitary; capsule oblong . . . . .   | 19                                 |
| 18b. Bracteoles present; flowers united in thyrsus, multiple dichasia or panicles; capsules of other shape . . . . .   | 20                                 |

## IDENTIFICATION KEY TO THE SPECIES OF ACANTHACEAE NATIVE TO PARAÍBA STATE CONT.

19a. Leaf blade with star-shaped trichomes on adaxial face; seeds 3	.....	<i>Ruellia bahiensis</i>
19b. Leaf blade with simple trichomes on adaxial face; seeds 6	.....	<i>Ruellia geminiflora</i>
20a. Bracteoles elliptic; pedicel 0.9–15 cm long; corolla pink; capsule clavate	.....	<i>Ruellia inundata</i>
20b. Bracteoles lanceolate; flowers sessile; corolla blue to lily-colored; capsule ellipsoidal	.....	21
21a. Corolla blue; ovary ellipsoidal; seeds 12–20, orbicular	.....	<i>Ruellia simplex</i>
21b. Corolla lily-colored; ovary oblong; seeds 4–10, suborbicular to oval	.....	22
22a. Herb decumbent; petiole 3–4 mm long; capsule ellipsoidal 2.8 cm long	.....	<i>Hygrophila costata</i>
22b. Herb erect; petiole 0.5–2.9 cm long; capsule ellipsoidal 0.9–1.2 cm long	.....	23
23a. Stamens exserted; ovary oblong; capsule mucronate	.....	<i>Ruellia paniculata</i>
23b. Stamens enclosed; ovary cylindrical; capsule without mucron	.....	<i>Hygrophila paraibana</i>

**1. *Avicennia germinans* (L.) L., Sp. Pl., ed. 3, 2: 891. 1764.**  
Fig. 2A; 3A–E.

Basionym: *Bontia germinans* L., Syst. Nat. (ed. 10) 2: 1122. 1759. TYPE: JAMAICA. Without any other locality, 1753, *P. Browne* 263. [Lectotype: designated by Stearn, Kew Bull. 13: 35 (1958).]

**Distribution and phenology:** distributed along the coasts of Africa, Asia, Australia, and Brazil (Tropicos, 2018). In Brazil, this taxon occurs from the states of Amapá to Santa Catarina (Flora do Brasil 2020, under construction). Recorded here for the first time in the study area. Encountered with flowers in January and April and fruits in January, March, and May. Associated with the Littoral Mesorregion, in mangrove swamp areas.

**Additional selected material examined:** BRAZIL. **Paraíba:** João Pessoa, Mangabeira, 05 January 1990, (fr), *O.T. Moura* 592 (JPB); *Ibid*, Jacarapé, 20 March 1984, (fr), *O.T. Moura* 181 (JPB); *Ibid*, Mangue do Jacarapé, 17 April 1990, (fl), *O.T. Moura* 418 (JPB); Rio Tinto, Sema IV, 19 May 1988, (fl, fr), *L.P. Felix s.n.* (EAN 8243); Santa Rita, Ilha Stuart, 28 January 1994, (fl, fr), *L.P. Felix and O.T. Moura* 6426 (EAN).

*Avicennia germinans* can be easily recognized as it is the only arboreal species of the genus, the only one found in mangrove swamps, and the only representative of the genus with a white corolla and coriaceous petals.

**2. *Aphelandra nuda* Nees, Fl. Bras. 9: 89. 1847. TYPE:** Brazil. Crecit Pernambuco, nec non in Serra dos Orgãos, prov. Sebastianopolitanae, *G. Gardner* 1111. (Holotype: G[00236214]).

**Distribution and phenology:** distributed in Brazil and Peru (Tropicos, 2018). In Brazil has only previously been reported from Pernambuco State (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits in May, August, September, and October. Associated with the Littoral Mesorregion.

**Additional selected material examined:** BRAZIL. **Paraíba:** Cabedelo, Mata do Amém, 15 October 1999, (fl), *A.F. Pontes* 230 (JPB); *Ibidem*, Mata do Amém, 24 September 1999, (fl, fr), *A.F. Pontes* 164 (JPB); Conde, APA de Tambaba, 22 August 2008, (fl), *P.C. Gadelha-Neto* 2418, *I.B. Lima and J.R. Lima* (JPB); João Pessoa, 15 August 1994, (fr), *O.T. Moura* 38 (JPB); *Ibid*, Mata Ciliar do Rio Cabedelo, Mangabeira, 12 May 2011, (fl), *L.A. Pereira* 254 and *E.C.O. Chagas* (JPB).

*Aphelandra nuda* is characterized by an intense red corolla with only 4 stamens, and by its terminal inflorescences with sessile flowers.

**3. *Dicliptera mucronifolia* Nees, Fl. Bras. 9: 161. 1847. TYPE:** BRAZIL. Crecit in prov. Piauiensi, *E. Gardner* 2462. (Holotype: G, not seen; Isotype: K000529513; Photo F[26553]). Fig. 2B.

**Distribution and phenology:** in Brazil, this taxon is found within the semiarid regions of the states of Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, and Minas Gerais, reaching São Paulo, Espírito Santo, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits between January and November in the Agreste, Borborema, Sertão, and Littoral Mesorregions.

**Additional specimens examined:** BRAZIL. **Paraíba:** Araruna, Parque Estadual Pedra da Boca, 27 September 2002, (fl), *Rita Lima et al.* 1654 (JPB); Areia, Mata do Pau-Ferro, 05 November 2010, (fl, fr), *L.L. Barreto* 67 (EAN); Cabedelo, Ilha do Stuart, Estuário do Rio Paraíba do Norte, 27 October 1993, (fr), *O.T. Moura* 1119 (JPB); *Ibid*, Mata do Amém, 01 October 1999, (fr), *A.F. Pontes and M. Costa-Santos* 186 (JPB); Caldas Brandão, 16 May 1985, (fr), *M.F. Agra and L.M. Batista* 597 (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 09 August 2015, (fl, fr), *F.C.P. Costa et al.* 102 (ACAM); Gurjão, 28 July 2007, (fl), *M.C. Pessoa* 166, *J.R. Lima and I.B. Lima* (JPB); João Pessoa, Bica, 03 January 1987, (fl), *L.P. Felix and J.V. Dorneles* 1252 (EAN); *Ibid*, Buraquinho, 29 August 1947, (fl, fr), *L.P. Xavier* (JPB 1498); *Ibid*, Mata do Buraquinho, 28 November 1969, (fl, fr), *L.P. Xavier* (JPB 2727); Maturéia, Pico do Jabre, 10 June 2004, (fl, fr), *L.P. Felix et al.* 10469 (EAN); *Ibid*, Pico do Jabre, 29 July 2014, (fl), *J.M.P. Cordeiro and E.M. Almeida* 320 (EAN); Salgadinho, Serra de São Bento, 08 August 2008, (fl), *R.A. Pontes* 408 (JPB); São Gonçalo, Fazenda Lamarão, 08 April 1995, (fr), *P.C. Gadelha-Neto and H.M. Moreira* 235 (JPB); São Mamede, 11–13 July 2007, (fl), *M.F. Agra, D.A. Barbosa and N. Porto* 6941 (JPB); Sousa, Vale dos Dinossauros, 06 August 2004, fl., *P.C. Gadelha-Neto* 1219 (JPB); Taperoá, 2003, (fr), *C.F.C. Ramalho s.n.* (EAN 11446); *Ibid*, 2003, (fr), *C.F.C. Ramalho* 806 (EAN); Vieirópolis, Serra da Arara, 02 September 2008, (fl, fr), *P.C. Gadelha-Neto* 2442 (JPB).

*Dicliptera mucronifolia* is characterized by its pink to lily-colored corolla, bilabiate, with only 2 stamens, and by its inflorescences in fascicles with greenish white mucronate bracts.

**4. *Elytraria imbricata*** (Vahl) Pers., Syn. Plant. 1: 23. 1805. Fig. 2C.

Basionym: *Justicia imbricata* Vahl, Ecl. Amer. 1: 1. 1797.

TYPE: MEXICO. *Sessé & Mociño 5131* (Neotype, here designated: MA [604997]).

**Distribution and phenology:** distributed in the United States, Mexico, Venezuela, Peru, Guatemala, Honduras, Nicaragua, Costa Rica, El Salvador, Panama, Columbia, the Caribbean, Belize, Bolivia, Argentina, Vietnam, the Philippines, and Brazil (Tropicos, 2018). In Brazil, it can be found in all of the states and phytogeographical domains (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers in August and December and with fruits in August and October, in the Agreste and Sertão Mesorregions.

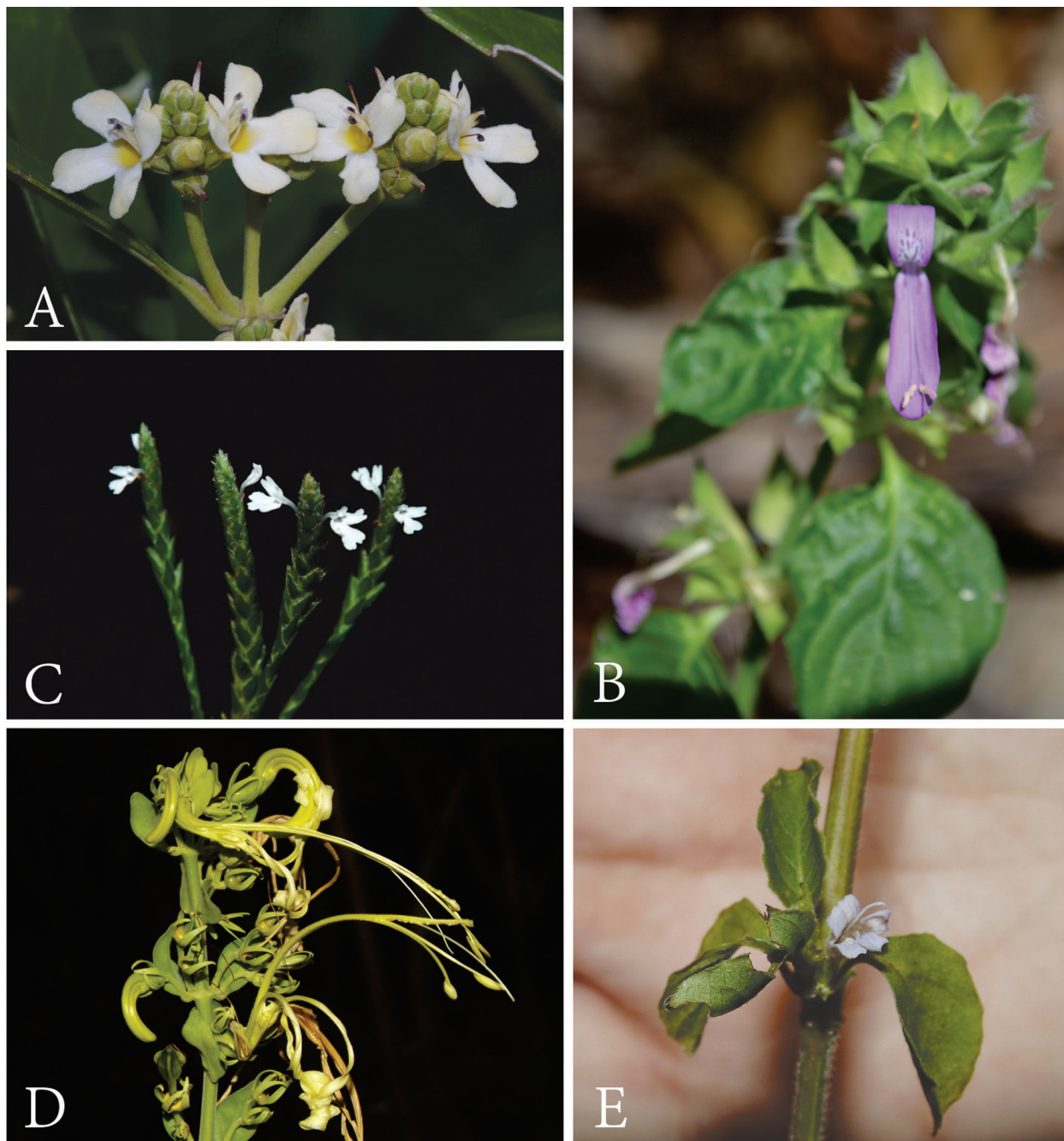


FIGURE 2. **A**, *Avicennia germinans* (L.) L.; **B**, *Dicliptera mucronifolia* Nees; **C**, *Elytraria imbricata* (Vahl) Pers.; **D**, *Harpochilus neesianus* Nees; **E**, *Hygrophila costata* Nees. Photographs: A, H. Galliffet; B, A. N. T. Bandeira; C–E, F. K. S. Monteiro.

**Additional selected material examined:** BRAZIL. **Paraíba:** Alhandra, 08 October 1993, (fr), *O.T. Moura 1105* (JPB); Araruna, Parque Estadual Pedra da Boca, 08 December 2003, (fl, fr), *M.C. Pessoa 74 and J.R. Lima* (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa, A.N.T. Bandeira and F.M. Sobreira 102* (ACAM).

The prototype does not mention type material, and as there is no record of an original material, according to Article 9.13 of the ICN (International Code of Nomenclature) a neotype should be selected to represent this species. For this reason, we chose the material collected by Sessé & Mociño in MA as the neotype for *Justicia imbricata*, as this material is considered to be in consonance with the protologue.

*Elytraria imbricata* is principally recognized by its spiciform and imbricate inflorescences, with white and bilabiate flowers, as well as by its herbaceous habit.

**5. Harpochilus neesianus** Mart. ex Nees, Fl. Bras. 9: 146, t. 24. 1847. TYPE: BRAZIL, in paludosis ad Ihabira, prov. Bahiensis, *J.S. Blanchet 2884* (Holotype: P[00719947]). Fig. 2D; 3F–L.

**Distribution and phenology:** in Brazil, it is distributed in the states of Bahia, Pernambuco, and Paraíba, in the Caatinga domain (Flora do Brasil 2020, under construction). Was encountered in the study area with flowers and fruits between May and September, and recorded in the Agreste, Borborema, and Sertão Mesorregions.

**Additional selected material examined:** BRAZIL. **Paraíba:** Pocinhos, 05 August 2005, (fl, fr), *C.M.L. Neves and F.X. Oliveira s.n.* (EAN 18936); *Ibid.*, Parque das Pedras, 15 May 2003, (fr), *A. Almeida, L.P. Felix and S. Pitrez 390* (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl, fr), *J.M.P. Cordeiro, L.P. Felix and E.M. Almeida 297* (EAN); São João do Tigre, APA das Onças, Serra do Paulo, 17 May 2008, (fl), *M.C. Pessoa 380 and J.R. Lima* (JPB); *Ibid.*, Serra do Jatobá, 22 February 2002, (fl), *M.R. Barbosa 2225, M.F. Agra and J.R. Lima* (JPB); *Ibid.*, Serra do Jatobá, 8–11 March 2002, (fr), *M.F. Agra et al. 5711* (JPB); Remígio, 20 September 1959, (fl), *J.C. Moraes s.n.* (EAN 2242).

*Harpochilus neesianus* can be recognized principally by its showy chiropterophilous flowers with yellowish corollas (Vogel et al., 2004), with curved buds and exerted stamens; its fruits are also showy. This species is a common element on rocky outcrops.

**6. Harpochilus paraibanus** F.K.S. Monteiro, J.I.M. Melo & E.M.P. Fernando, Phytotaxa 358(3): 291. 2018. TYPE: BRAZIL. **Paraíba,** Passagem, Serra do Aba, 17 April 2016, *E.M.P. Fernando 392* (Holotype: [ACAM 1897]; Isotypes: ACAM, CSTR, RB).

**Distribution and phenology:** this species was recently described by Monteiro et al. (2018) and is distributed only in Paraíba State, northeastern Brazil. It was encountered with flowers in April and with fruits in June to November.

**Additional specimens examined:** BRAZIL. **Paraíba:** Mãe D'Água, 13 April 2017, *E.M.P. Fernando 560* (CSTR);

Passagem, Serra do Aba, 28 July 2014, *E.M.P. Fernando 138* (CSTR); *Ibidem*, 28 November 2015, *E.M.P. Fernando 469* (CSTR); *Ibidem*, 15 June 2016, *F.K.S. Monteiro et al. 35* (ACAM, IPA); *Ibidem*, 06 April 2017, *F.K.S. Monteiro 38* (ACAM).

*Harpochilus paraibanus* can be recognized by its cylindrical branches, spikes terminal, and flowers with corolla pale yellow.

**7. Hygrophila costata** Nees, Pl. Hort. Bonn. Icon. 2: 7–8, pl. 3. 1824. TYPE: BRAZIL. Bahia, in humilis. *W.J. Burchell 5657* (Neotype, here designated: K [K000534056]). Fig. 2E; 4A–F.

**Distribution and phenology:** this species is distributed throughout Central and South America and in the United States in North America (Tropicos, 2018). In Brazil, it is encountered in the states of Acre, Bahia, Ceará, and the entire central-western, southeastern, and southern region (Flora do Brasil 2020, under construction). It is reported here for the first time in the study area, where it was encountered with flowers and fruits in September, in the Agreste Mesorregion.

**Additional selected material examined:** BRAZIL. **Paraíba:** Campina Grande, Universidade Estadual da Paraíba, Campus I, 15 September 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 20* (ACAM).

*Hygrophila costata* can be recognized by its thyrsoid inflorescences and diminutive flowers, and its location in humid and seasonally flooded sites.

**8. Hygrophila paraibana** Rizzini, Bol. Mus. Nac. Rio de Janeiro new ser. no. 8, 24, tab. 9. 1947. TYPE: BRAZIL. Escola Agrônômica do Nordeste, Areia, Paraíba, 27 October 1944, *J.M. Vasconcellos 305* (Holotype: RB[00533824]). Fig. 5A.

**Distribution and phenology:** this species is endemic to Paraíba State (Flora do Brasil 2020, under construction) and was encountered with flowers in August and September and with fruits from September to November, in the Agreste Mesorregion.

**Additional material examined:** BRAZIL. **Paraíba:** Areia, Rio do Canto, 04 October 2012, (fr), *A.C. Oliveira 14* (EAN); *Ibidem*, 23 September 2010, (fl, fr), *A.C. Araújo s.n.* (EAN 15879); *Ibidem*, Engenho Gameleira, 22 November 2007, (fr), *L.P. Felix 12043* (EAN); João Pessoa, 06 August 1981, (fl), *O.T. Moura s.n.* (JPB 4759).

*Hygrophila paraibana* is characterized by having yellowish bracts and flowers with lily-colored corollas with white and orange spots on the lower lip.

**9. Justicia aequilabris** (Nees) Lindau, Nat.Pflanzenfam. 4(3b): 350. 1895. Fig. 5B.

Basionym: *Orthotactus aequilabris* Nees, Fl. Bras. (Martius) 9: 131, t. 134. 1847. TYPE: BRAZIL, loco no accuratius indicato, *F. Sellow 174* (Holotype: B, destroyed; Isotype: K[000529235]).

**Distribution and phenology:** this species is encountered in Bolivia, Brazil, and Paraguay (Tropicos, 2018). In Brazil, it is distributed throughout the country and is associated with



FIGURE 3. **A–E.** *Avicennia germinans* (L.) L. **A–B,** reproductive branches; **C,** fruits; **D,** opened corolla showing ovary and stamens; **E,** seed. **F–L.** *Harpochilus neesianus* Nees. **F,** flower; **G–H,** opened corolla showing gynoeceum; **I,** detail of the apex of upper lobe corolla and stamens; **J,** reproductive branches; **K,** seed; **L,** fruit. Drawing by Josicleide Fidelis; A–E, based on Holotype; F–L, based on *J.M.P. Cordeiro, L.P. Felix, and E.M. Almeida 29* (EAN).

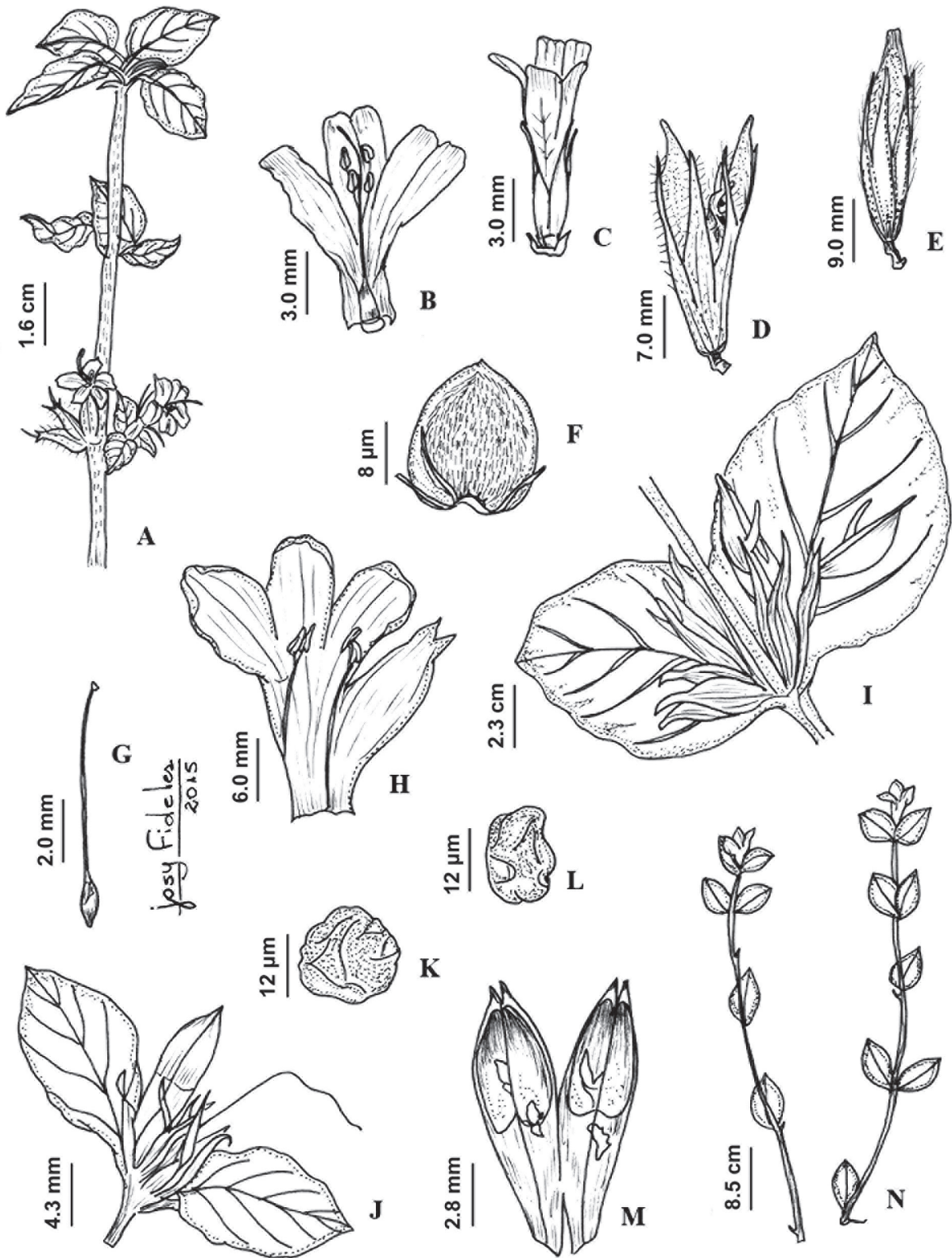


FIGURE 4. **A–F.** *Hygrophila costata* Nees. **A**, habit; **B–C**, detail of the corolla; **D–E**, detail of the fruit; **F**, seed. **G–N.** *Justicia thunbergioides* (Lindau) Leonard. **G**, detail of the gynoecium; **H**, detail of the open corolla; **I–J**, detail of bracts and fruits; **K–L**, seeds; **M**, detail of fruit; **N**, habit. Drawing by Josicleide Fidelis, A–F from F.K.S. Monteiro and A.S. Pinto 20 (ACAM); G–N from F.C.P. Costa et al. 109 (ACAM).



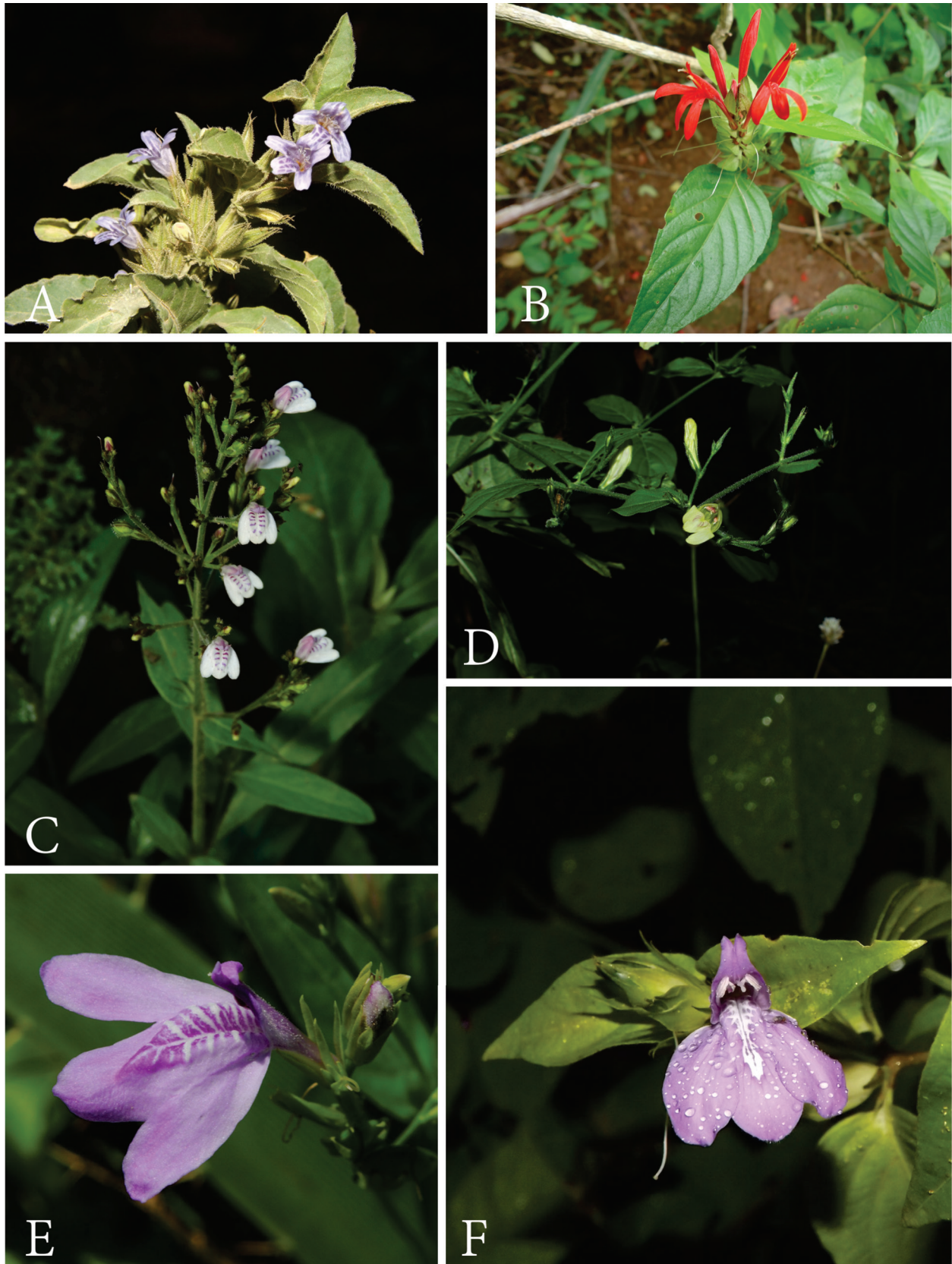


FIGURE 5. **A**, *Hygrophila paraibana* Rizzini; **B**, *Justicia aequilabris* (Nees) Lindau; **C**, *Justicia comata* (L.) Lam.; **D**, *Justicia glaziovii* Lindau; **E**, *Justicia laevilinguis* (Nees) Lindau; **F**, *Justicia thunbergioides* (Lindau) Leonard. Photographs: A and F, F. K. S. Monteiro; B, T. S. Silva; C, H. Galliffet; D, F. C. P. Costa; E, A. González.

all of the phytogeographical domains (Flora do Brasil 2020, under construction). In the study area, it was encountered with flowers in April, May, September, and October in the Agreste, Borborema, and Sertão Mesorregions.

**Specimens examined:** BRAZIL. **Paraíba:** Areia, 16 October 2014, (fl), *L.P. Felix 15135* (EAN); Campina Grande, Distrito de São José da Mata, 07 July 1993, (fl), *L.P. Felix 5841* (EAN); Lagoa Seca, Cachoeira do Pinga, 30 April 2015, (fl), *F.K.S. Monteiro, T.S. Silva and S.M. Pordeus II* (ACAM); Maturéia, Pico do Jabre, 10 June 2004, (fl), *L.P. Felix et al. 465* (EAN); Nova Floresta, 09 June 1993, (fl), *L.P. Felix 5875* (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl), *J.M.P. Cordeiro, L.P. Felix and E.M. Almeida 302* (EAN); São João do Tigre, Serra do Paulo, 23 August 2013, (fl), *L.P. Felix 14304* (EAN).

*Justicia aequilabris* can be easily recognized by its spiciform inflorescences, green bracts that are sometimes purplish at the apex, and by its showy, red, bilabiate corolla.

**10. *Justicia asclepiadea*** (Nees) Wassh. & C. Ezcurra, *Candollea* 52(1): 172. 1997.

Basionym: *Simonisia asclepiadea* Nees, *Fl. Bras.* 9: 144, t. 145. 1847. TYPE: BRAZIL. Mato Grosso, Chapada, *L.Riedel 1063* (Holotype: LE[not seen]; Isotype: GZU[000250365]).

**Distribution and phenology:** it is distributed throughout Bolivia and Brazil, being found in the states of Bahia, Goiás, Mato Grosso, Mato Grosso do Sul, and Piauí, often associated with rupestrian vegetation and gallery forests (Flora do Brasil 2020, under construction; Tropicos, 2018). In the study area it is associated with rocky outcrops; the flowering period is in March.

**Additional selected material examined:** BRAZIL. **Paraíba:** Passagem, Serra do ABA, 06 March 2016, (fl), *E.M.P. Fernando 429* (CSTR).

*Justicia asclepiadea* is easily recognized by inflorescences in secondary laurel spurts, linear bracts, and large purple corollas.

**11. *Justicia comata*** (L.) Lam., *Encycl., Botanique* 1: 632. 1785. Fig. 5C.

Basionym: *Dianthera comata* L., *Syst. Nat.* (ed. 10) 2: 850. 1759. TYPE: JAMAICA. Sloan. *jam.* t. 103 f. 2 [Lectotype: *R. Brown s.n.* (Linn. Herb. 29.2), designated by Graham].

**Distribution and phenology:** widely distributed throughout the tropical Americas, from southern Mexico and Costa Rica to Bolivia, Paraguay, northern Argentina, and northeastern Brazil (Ezcurra, 2002). In Brazil, it is encountered in the states of Acre, Amazonas, Amapá, Pará, Rondônia, Bahia, Rio Grande do Norte, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Paraná, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was found in the study area flowering and fruiting in August.

**Additional selected material examined:** BRAZIL. **Paraíba:** João Pessoa, Jardim Botânico, 11 August 2004, (fl), *R.A. Pontes and N.T. Lima 78* (JPB); *Ibidem*, Mata do Buraquinho, Lago dos Buritis, 01 August 2006, (fl), *R.A. Pontes 370* (JPB).

*Justicia comata* has a grass-like aspect and is characterized by its paniculiform inflorescence with diminutive flowers with purplish white corollas.

**12. *Justicia glaziovii*** Lindau, *Bull. Herb. Boissier* 3: 483. 1895. TYPE: BRAZIL. Rio de Janeiro, Fev. 1882, *A.F.M. Glaziou 13073* (Holotype: B, destroyed; Photo: F8830; Lectotype: designated by Graham (1988); Isolectotype: R[000011240]). Fig. 5D.

**Distribution and phenology:** widely distributed in eastern Bolivia and Northeast Paraguay (Ezcurra, 2002). In Brazil it occurs in the states of Bahia, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, and Rio Grande do Norte (Flora do Brasil 2020, under construction). It is usually found on the edges of forests or Caatingas, also occurring outside the limits of the semiarid regions (Côrtes and Rapini, 2013). It was found in the study area flowering and fruiting in August.

**Additional selected material examined:** BRAZIL. **Paraíba:** Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.K.S. Monteiro et al. 13* (ACAM).

*Justicia glaziovii* is characterized by a white corolla with lilac macules in the lower lobe. A striking characteristic of the species is its oblique anthers and prolongation of the connective.

**13. *Justicia laevilinguis*** (Nees) Lindau, *Bot. Jahrb. Syst.* 19, Beibl., 48: 20. 1894. Fig. 5E.

Basionym: *Rhytiglossa laevilinguis* Nees, *Fl. Bras.* 9(7): 120. 1847. TYPE: BRAZIL. Brasília, *F. Sellow s.n., s.d.* (Holotype: B[100629468]).

**Distribution and phenology:** this species is distributed in Argentina, Bolivia, Brazil, Columbia, French Guiana, Mexico, Paraguay, Suriname, Uruguay, and Venezuela (Tropicos, 2018). In Brazil, it is encountered in the states of Amazonas, Pará, Rondônia, Bahia, Ceará, Minas Gerais, and São Paulo and throughout the central-western and southern regions of that country in the Amazonian, Atlantic Forest, and Pantanal domains (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers in January and with fruits in November and January, in the Littoral Mesorregion.

**Additional selected material examined:** BRAZIL. **Paraíba:** Itapororoca, Lagoa dos Macacos, 22 January 1988, (fl), *L. P. Felix and J.V. Dornelas 1514* (EAN); Sapé, 03 November 1987, (fr), *L.P. Felix and E.C. Silva 1827* (EAN); *Ibidem*, 28 January 1995, (fl, fr), *O.T. Moura 1497* (JPB).

*Justicia laevilinguis* can be easily recognized by having flowers united in secundiflorous spikes, corolla with upper lip bilobate, purple to lily-colored, with white spots in the center.

**14. *Justicia thunbergioides*** (Lindau) Leonard, *Contr. Sci. Los Angeles County Mus.* 32: 10. 1959. Fig. 4G–N; 5F.

Basionym: *Beloperone thunbergioides* Lindau, *Bull. Herb. Boissier*, sér. 2, 5(4): 372–373. 1905. TYPE: BRAZIL. Mato Grosso do Sul, Corumbá, 3–7 April 1903, *G.O.A. Malme 3026* (Holotype: B, destroyed; Photo: F8949) (Lectotype, here designated: S[05-391]).

**Distribution and phenology:** this species has been reported from Bolivia and Brazil (Tropicos, 2018). In Brazil, it is distributed throughout the central-western region and in the states of Alagoas, Bahia, Pernambuco, Minas Gerais, and São Paulo (Flora do Brasil 2020, under construction). It is being reported here for the first time in the study area, where it was encountered with flowers in June and August and fruits in August.

**Additional selected material examined:** BRAZIL. **Paraíba:** Campina Grande, 27 June 2012, (fl), *E.M. Almeida et al.* 570 (EAN); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al.* 109 (ACAM); São João do Tigre, Serra do Paulo, 23 August 2013, (fl), *L.P. Felix 14300* (EAN); *Ibidem*, Serra do Paulo, 03 August 2011, (fr), *S. Nascimento1330* (EAN).

*Justicia thunbergioides* is characterized by having generally solitary flowers, sometimes united into secundiflorous spikes, and by having a pink to lily-colored corolla with white spots on the central lobe.

The specimen located at the Berlin Herbarium (B) was destroyed during World War II, and the material of *Beloperone thunbergioides* deposited at the Stockholm Herbarium (S) is a duplicate of the holotype. For this reason, a lectotype is being proposed for *Beloperone thunbergioides*, Basionym of *J. thunbergioides*.

**15. *Lepidagathis alopecurioidea*** (Vahl) R.Br. ex Griseb., Fl. Brit. W. I. 453. 1864 [1862].

Basionym: *Ruellia alopecuroidea* Vahl, Eclog. Amer. 2: 49. 1798. TYPE: CARIBBEAN. Montserrat, West Indies, *J. Ryan 22196* (Holotype: C, lost; Isotype: GZU[000250101]).

**Distribution and phenology:** occurs in Belize, Brazil, Columbia, the Guyana, northern Mexico, Peru, Trinidad and Tobago, and Venezuela (Tropicos, 2018). In Brazil, it is found in the states of Amazonas, Pará, Goiás, and Mato Grosso (Flora do Brasil 2020, under construction). It is reported here for the first time in the study area, where it was found with flowers in August, October, and December.

**Additional selected material examined:** BRAZIL. **Paraíba:** João Pessoa, Jardim Botânico, 17 October 2003, (fl), *R.A. Pontes, T.M.G. Veloso and P.C. Gadelha-Neto s.n.* (JPB 33301); *Ibidem*, Jardim Botânico, 05 December 2003, (fl), *R.A. Pontes s.n.* (JPB 33304); *Ibid*, Mata do Buraquinho, 30 August 2006, (fl), *R.A. Pontes 381* (JPB).

*Lepidagathis alopecurioidea* can be easily recognized by usually having a well-ramified stem and inflorescences in terminal spikes, with white to violet flowers.

**16. *Nelsonia canescens*** (Lam.) Spreng., Syst. Veg. [Sprengel] 1: 42. 1825 [1824]. Fig. 6A.

Basionym: *Justicia canescens* Lam., Tabl. Encycl. 1(1[1]): 41. 1791. TYPE: SENEGAL. Ex Guinea, 1789, *D. Roussillon 53* (Isotype: P[00435347]).

**Distribution and phenology:** *Nelsonia canescens* occurs in southern Africa, in many parts of the American continent and East and South of Asia (Tropicos, 2018). In Brazil it is found in the states of Acre, Amazonas, Bahia,

Goiás, Maranhão, Minas Gerais, and Pará (Flora do Brasil 2020, under construction). In the study area, the period of flowering and fruiting occurred in April.

**Additional selected material examined:** BRAZIL. **Paraíba:** Bananeiras, Cachoeira do Roncador, 30 April 2015, (fl, fr), *F.K.S. Monteiro et al.* 12 (ACAM).

*Nelsonia canescens* is easily recognized by its inflorescences in dense cylindrical spikes with minute flowers.

**17. *Ruellia asperula*** (Mart. ex Ness) Lindau, Nat. Pflanzenfam. 4(3b): 311. 1895. Fig. 6B.

Basionym: *Stephanophysum asperulum* Mart. & Nees, Fl. Bras. 4: 52. 1847. TYPE: BRAZIL. in silvis prov. Bahiensis ad Villa d Cachoeirá, January 1819, *Martius, C.F.P. von, s.n.* (Holotype: M[0186682]).

**Distribution and phenology:** in Brazil, occurs in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Rio Grande do Norte, Sergipe, and Minas Gerais, in the Caatinga biome (Flora do Brasil 2020, under construction). It was encountered in the study area with flowers and fruits between April and December, in the Agreste, Borborema, Mata Paraibana, and Sertão Mesorregions, where it has been recorded with flowers in April, June, July, August, September, October, and December, and fruiting from August to October and in December.

**Additional selected material examined:** BRAZIL.

**Paraíba:** Araruna, Parque Estadual Pedra da Boca, 18 October 2003, (fl, fr), *M.C. Pessoa 08 and J.R. Lima* (JPB); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al.* 104 (ACAM); Desterro, 10 June 2004, (fl), *L.P. Felix 10414* (EAN); Itapororoca, 28 July 1993, (fl), *L.P. Felix 5961* (EAN); Maturéia, Pico do Jabre, 20–23 December 1997, (fl, fr), *M.F. Agra, R. Pontes and W. Barros 4443* (JPB); Remígio, 10 April 1977, (fl), *P.C. Fevereiro et al.* 318/589 (EAN); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl), *J.M.P. Cordeiro et al.* 294 (EAN); São José dos Cordeiros, RPPN Fazenda Almas, 07 September 2002, (fl, fr), *M.R. Barbosa et al.* 2574 (JPB).

*Ruellia asperula* is principally recognized by having sticky branches and leaves, and red corollas, and by forming large clumps.

**18. *Ruellia bahiensis*** (Nees) Morong, Ann. New York Acad. Sci. 7: 192. 1893.

Basionym: *Dipteracanthus bahiensis* Nees, Fl. Bras. 9: 39. 1847. TYPE: BRAZIL. In aridis argillosis prope Moritiba prov. Bahiensis, s.d., *J.S. Blanchet 466* (Holotype: P[00650155]).

**Distribution and phenology:** this species has been recorded for Argentina and Brazil (Tropicos, 2018). In Brazil, it is found in the states of Alagoas, Bahia, Ceará, Pernambuco, Rio Grande do Norte and Espírito Santo, associated with Caatinga vegetation (Flora do Brasil 2020, under construction). It was encountered in the study area in the Agreste and Borborema Mesorregions, with flowers and fruits in March, April, July, October, and November, and fruits in April, July, October, and November.

**Additional selected material examined:** BRAZIL. **Paraíba:** Areia, Mata do Pau Ferro, 20 March 2015, (fl), *F.K.S. Monteiro et al. 07* (ACAM); *Ibidem*, CCA-UFPA, 21 November 2007, (fl, fr), *M.P. Nicomedes et al. 01* (EAN); *Ibidem*, Mangabinha, 02 Oct 2012, (fl, fr), *L.P. Felix 13984* (EAN); Natuba, 14 April 2015, (fl, fr), *F.K.S. Monteiro et al. 09* (ACAM); Salgadinho, Sítio Morcego, Serra dos Morcegos, 28 July 2014, (fl, fr), *J.M.P. Cordeiro et al. 301* (EAN); São João do Tigre, 01 April 2011, (fl, fr), *L.P. Felix 13651* (EAN).

*Ruellia bahiensis* is similar to *R. geminiflora* in having lily-colored corollas, oblong capsules, and herbaceous habits. *Ruellia bahiensis* differs from the latter by having solitary flowers and star-shaped trichomes on the abaxial face of the leaf blade versus axillary inflorescences and simple trichomes in *R. geminiflora*.

**19. *Ruellia cearensis*** Lindau, Notizbl. Königl. Bot. Gart. Berlin 6: 195. 1914. TYPE: BRAZIL. Ceará. Serra de Maranguape. October 1910, *E. H. Ule 9113* (Isotype: US[01106454]). Fig. 6C.

**Distribution and phenology:** this species is endemic to Brazil, occurring in the states of Alagoas, Bahia, Ceará, Paraíba, and Pernambuco (Flora do Brasil 2020, under construction). In the study area in the Littoral Mesorregion, it was encountered flowering in September.

**Additional specimen examined:** BRAZIL. **Paraíba:** João Pessoa, Bacia Hidrográfica do Rio Timbó, 06 September 2005, (fl), *N.T. Amazonas 46* and *T. Grisi* (JPB).

*Ruellia cearensis* can be easily recognized by its subshrub habit and by its pink, tubular corolla.

**20. *Ruellia geminiflora*** Kunth, Nov. Gen. Sp. 2: 240. 1817. TYPE: COLOMBIA. Ibagué, crescit locis temperatis, siccis prope Santa Ana et Ibagué Novo-Granaensium, s.d., *Humboldt & Bonpland 1801* (Holotype: P[00670076]). Fig. 6D.

**Distribution and phenology:** this species is found in Argentina, Belize, Bolivia, Brazil, the Caribbean, Colombia, Costa Rica, Ecuador, El Salvador, Guiana, French Guiana, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, and Venezuela (Tropicos, 2018). In Brazil, it is distributed throughout the states in the central-western, southeastern, and southern regions of the country and in the states of Amapá, Pará, Tocantins, Bahia, Ceará, Maranhão, and Pernambuco (Flora do Brasil 2020, under construction). In the study area, it was found in the Agreste and Sertão Mesorregions, with flowers in January, March, April, September, and October, and fruits in April, September, and October.

**Additional selected material examined:** BRAZIL. **Paraíba:** Araruna, fl., 13 April 2002, *M.R. Barbosa et al. 2394* (JPB); Areia, 16 August 2014, (fl, fr), *L.P. Felix 15134* (EAN); *Ibidem*, Mata do Pau Ferro, (fl, fr), 23 September 2010, *L.L. Barreto 59* (EAN); 28 July 2011, (fl, fr), *S.A.A. Lima 76* (EAN); Bananeiras, Cachoeira do Roncador, 30 April 2015, (fl, fr), *F.K.S. Monteiro et al. 09* (ACAM); Campina Grande, Universidade Estadual da Paraíba,

11 March 2015, (fl), *F.K.S. Monteiro and A.S. Pinto 03* (ACAM); Lagoa Seca, Fazenda Ipuarana, 06 January 2001, (fl), *C.E. Lourenço 69* (JPB); Taperoá, 2003, (fl, fr), *C.F.C. Ramalho 737/949* (EAN).

*Ruellia geminiflora* is similar to *R. bahiensis* as both produce lily-colored corollas and oblong capsules, and have herbaceous habits. They can be distinguished, however, as *R. bahiensis* has axillary inflorescences and 6 seeds, whereas *R. bahiensis* produces solitary terminal flowers and 3 seeds.

**21. *Ruellia inundata*** Kunth, Nova Gen. & Sp. 2: 239. 1817. TYPE: COLOMBIA. S.loc. Crescit in ripa fluminis Magdalenae prope Mompo et Badillas, s.d., *Humboldt & A. Bonpland 3711* (Holotype: P[00670075]). Fig. 6E; 7A–F.

**Distribution and phenology:** this species occurs in Brazil, Columbia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and Venezuela (Tropicos, 2018). In Brazil, it can be found in the states of Piauí, Bahia and Minas Gerais (Flora do Brasil 2020, under construction). It was recorded here for the first time in the study area associated with the Sertão Mesorregion, producing flowers in April, August and October and fruits in August and October.

**Additional specimens examined:** BRAZIL. **Paraíba:** Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 108* (ACAM); Nazarezinho, 23 April 1982, (fl), *M.A. Sousa et al. 1189* (JPB); Sapé, RPPN Fazenda Pacatuba, (fl, fr), 10 October 2010, *J.L. Viana et al. 28* (JPB).

*Ruellia inundata* is morphologically similar to *R. paniculata*, as both have herbaceous habits and infundibuliform corollas. *Ruellia inundata* differs, however, by having a pink corolla and clavate capsules, whereas *R. paniculata* produces a lily-colored corolla and elliptic capsules.

**22. *Ruellia ochroleuca*** Mart. ex Nees, Fl. Bras. 9: 56, t. 5. 1847. TYPE: BRAZIL. Pernambuco, September 1837, *G. Gardner 900* (Lectotype: designated by Tripp, E. A. & L. A. McDade K[0005342490]). Fig. 6F; 7G–L.

**Distribution and phenology:** occurs in Brazil, Costa Rica, Guatemala, Honduras, and Nicaragua (Tropicos, 2018). In Brazil, it is known from the states of Alagoas, Bahia, and Pernambuco in areas of Caatinga vegetation (Flora do Brasil 2020, under construction). It is reported here for the first time in the Agreste Mesorregion, with flowers in August and September and fruits in August and September.

**Additional selected material examined:** BRAZIL. **Paraíba:** Areia, Mata do Pau Ferro, 09 September 2010, (fl, fr), *L.L. Barreto 56* (EAN); João Pessoa, Mata do Buraquinho, 29 August 1947, (fl), *L.P. Xavier s.n.* (JPB 1515); Lagoa Seca, Sítio Conceição, 20 August 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 15* (ACAM).

*Ruellia ochroleuca* can be easily recognized by its ovate leaf blade, hirsute on the adaxial face, and by its greenish to white ventricose corolla.

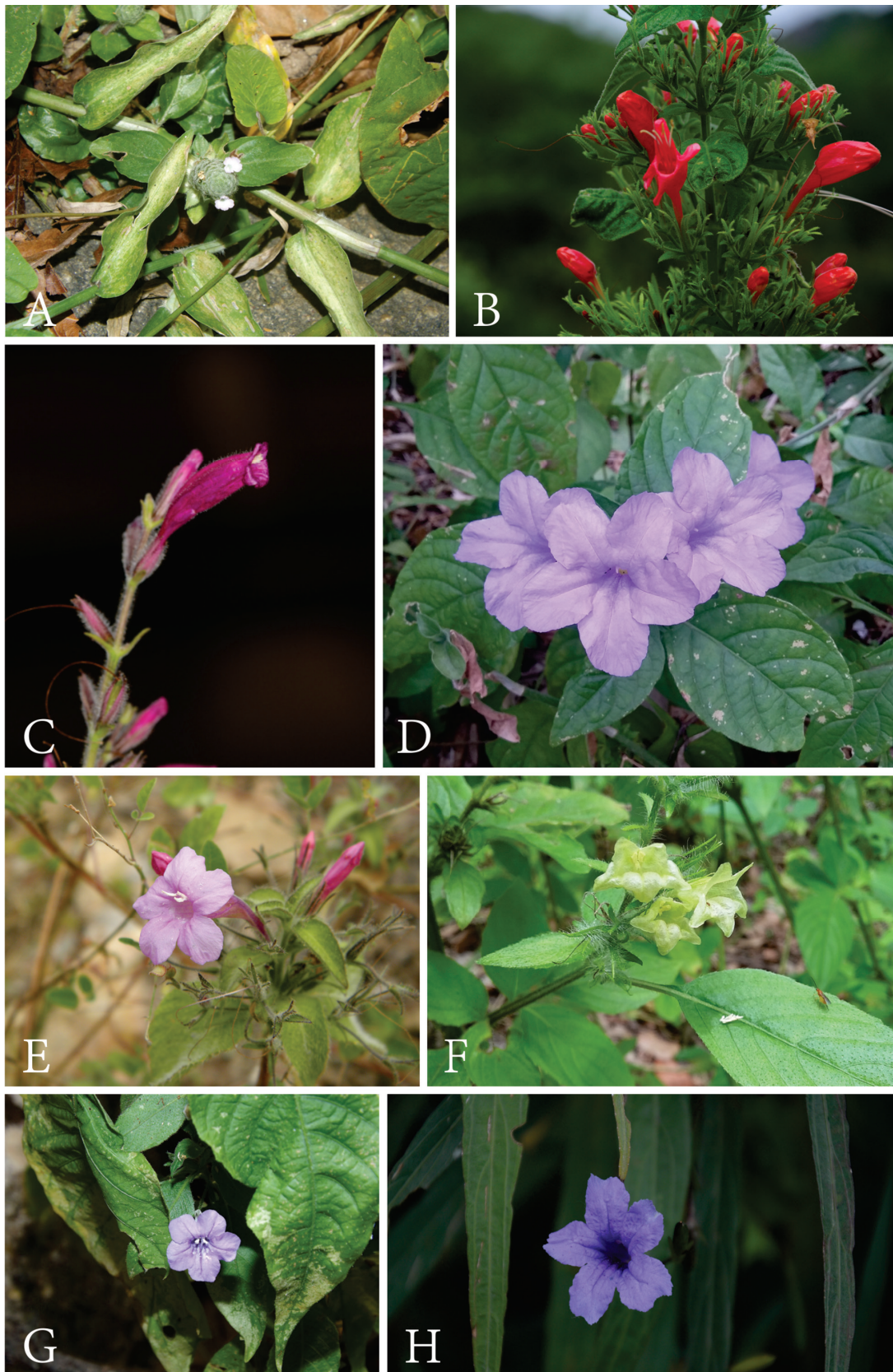


FIGURE 6. **A**, *Nelsonia canescens* (Lam.) Spreng.; **B**, *Ruellia asperula* (Mart. ex Ness) Lindau; **C**, *Ruellia cearensis* Lindau; **D**, *Ruellia geminiflora* Kunth; **E**, *Ruellia inundata* Kunth; **F**, *Ruellia ochroleuca* Mart. ex Nees; **G**, *Ruellia paniculata* L.; **H**, *Ruellia simplex* Wriyth. Photographs: A, D, and F–G, F. K. S. Monteiro; B and H, S. L. Costa; C, A. Popovkin.

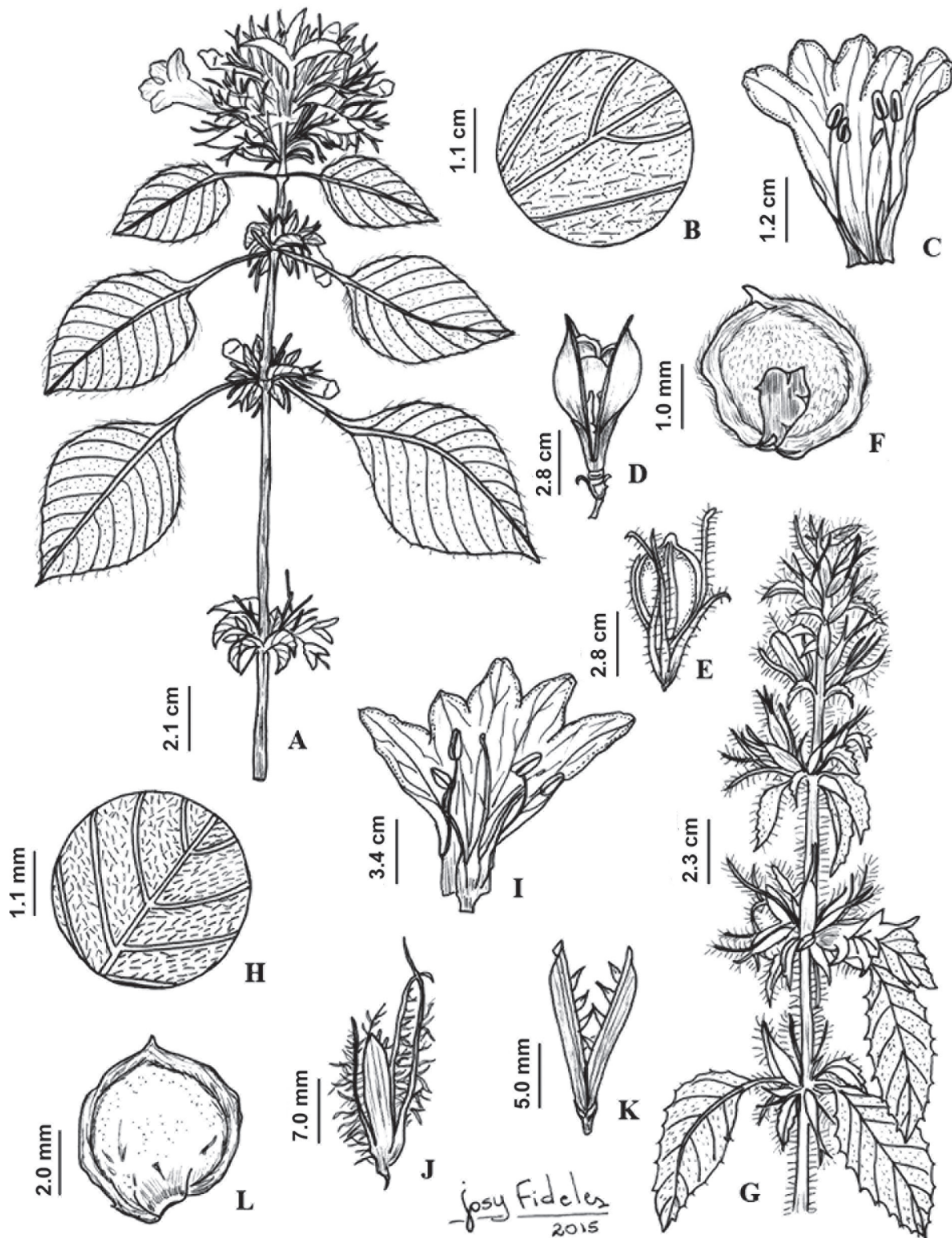


FIGURE 7. A–F. *Ruellia inundata* Kunth. A, habit; B, detail of the adaxial face of the leaf blade; C, corolla open; D–E, fruit; F, seed. G–L. *Ruellia ochroleuca* Mart ex Nees. G, habit; H, detail of the adaxial face of the leaf blade; I, detail of the opened corolla, J–K, fruit; L, seed. Drawing by Josicleide Fidelis; A–F from F.C.P. Costa *et al.* 108 (ACAM); G–L from F.K.S. Monteiro and A.S. Pinto 15 (ACAM).

**23. *Ruellia paniculata* L., Sp. Pl. 2: 635. 1753. TYPE: JAMAICA. *Sloan 59, s.d.* (Holotype: BM[000589553]). Fig. 6G.**

**Distribution and phenology:** occurs in Belize, Bolivia, Brazil, the Caribbean, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and Venezuela (Tropicos, 2018). In Brazil, it has been recorded in the states of Goiás, Minas Gerais and Rio de Janeiro, and throughout the northeastern region of that country, except in Sergipe State (Flora do Brasil 2020, under construction). In the study area, it was encountered in the Agreste, Borborema, and Sertão Mesorregions, with flowers in March, May, August, September, and October, and fruits in March, August, September, and October.

**Additional specimens examined: BRAZIL. Paraíba:** Cabaceiras, 21 October 2007, (fr), *G.A. Costa et al. 13* (JPB); Campina Grande, Universidade Estadual da Paraíba, Campus I, (fl, fr), 11 March 2015, *F.K.S. Monteiro and A.S. Pinto 03* (ACAM); *Ibidem*, (fl, fr), 07 October 2015, *F.K.S. Monteiro and A.S. Pinto 20* (ACAM); Cajazeiras, Parque Ecológico Engenheiro Ávidos, 08 August 2015, (fl, fr), *F.C.P. Costa et al. 101* (ACAM); Junco do Seridó, 14 August 2011, (fl, fr), *E.M. Almeida et al. 1221* (EAN); Maturéia, Pico do Jabre, 17–20 November 1997, (fr), *M.F. Agra and P.C. Silva 5436* (JPB); Mogeiro, 17 September 1941, (fr), *D. Maia s.n.* (JPB 265); Natuba, Estrada entre a cidade de Natuba and Umbuzeiro, 31 September 2010, (fl, fr), *R.A. Pontes 600 and C.E.S. Diniz*

(JPB); Picuí, 01 May 2007, (fl, fr), *P.C. Gadelha-Neto et al. 1711* (JPB).

*Ruellia paniculata* can be easily recognized by its paniculiform inflorescences, lily-colored corolla, and mucronate, ellipsoidal fruits.

**24. *Ruellia simplex* Wright, Anales Acad. Ci. Med. Habana (6) 41: 321. 1870. TYPE: CUBA. En sabanas abajas y frangosas ca. del Hato “El Salado,” jurisdiccion de San Cristóbal y Palacios, 21 December 1860, *C. Wright 3642* (Holotype: GH[00094208]). Fig. 6H.**

**Distribution and phenology:** occurs in Argentina, Brazil, Paraguay, and Uruguay (Tropicos, 2018). In Brazil, it has been reported from the states of Pernambuco, Rio Grande do Norte, Goiás, Mato Grosso, Mato Grosso do Sul, São Paulo, and Rio Grande do Sul (Flora do Brasil 2020, under construction). It was recorded here for the first time in the study area, in anthropogenically impacted sites in the Agreste Mesorregion, flowering and fruiting in February and July.

**Additional selected material examined: BRAZIL. Paraíba:** Campina Grande, anthropic area, 10 July 2015, (fl, fr), *F.K.S. Monteiro and A.S. Pinto 06* (ACAM); Fagundes, anthropic area, 20 February 2015, (fl, fr), *F.K.S. Monteiro et al. 02* (ACAM).

*Ruellia simplex* can be recognized principally by its narrowly lanceolate leaf blade, and flowers with purple to blue corollas.

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