

Taxonomic synopsis and distribution of Turneraceae in Maranhão state, Brazil

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Abstract. The taxonomic treatment of the Turneraceae species from Maranhão state, Brazil is presented. Twenty-one species distributed in two genera were recognized: *Piriqueta*, with seven species, and *Turnera* with 14, of which *P. guianensis*, *T. aurantiaca* and *T. blanchetiana* are new records for the state. *Turnera aurantiaca* is also a new occurrence for the northeastern region of Brazil. In general, the species were frequently found in the cerrado vegetation, being mainly associated with open and anthropized areas. Identification keys, descriptions, photographs, general comments, conservation status and taxa distribution maps for the Maranhão state are presented.

Keywords. Malpighiales, Northeastern Brazil, *Piriqueta*, taxonomy, *Turnera*.

Resumen. Se presenta aquí la sinopsis taxonómica de las especies de Turneraceae del estado de Maranhão, Brasil. Fueron reconocidas 21 especies pertenecientes a 2 géneros: *Piriqueta*, con 7 especies, y *Turnera*, con 14, de las cuales *P. guianensis*, *T. aurantiaca* y *T. blanchetiana* son nuevos registros para el estado, siendo *T. aurantiaca* también un nuevo registro para el conjunto de la región Nordeste de Brasil. En general, estas especies fueron encontradas en vegetación de cerrado, principalmente asociadas a áreas abiertas y antrópicas. Se presentan claves de identificación, descripciones, fotografías, comentarios generales y mapas de distribución de los taxones del estado de Maranhão.

Palabras clave. Malpighiales, Nordeste de Brasil, *Piriqueta*, taxonomía, *Turnera*.

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INTRODUCTION

Turneraceae includes 14 genera and around 230 species (Rocha & al. 2020) which are distributed in tropical and subtropical areas of the Americas, Madagascar eastern Africa and the Mascarene Islands. The African continent has the greatest generic diversity, with nine genera (Arbo 2007; Thulin & al. 2012; Rocha & al. 2019a), while in the Americas, six genera are recorded: *Adenaea* Arbo, *Erblichia* Seem., *Oxossia* L. Rocha, *Pibiria* Maas, *Piriqueta* Aubl. and *Turnera* L. In Brazil has been recorded 165 of *Oxossia*, *Piriqueta* and *Turnera*, of which 117 are endemic (Rocha & al. 2024a).

Turneraceae, along with Malesherbiaceae and Passifloraceae s.s., is classified within Passifloraceae s.l. in the order Malpighiales, following APG IV (2016). However, phylogenies with comprehensive sampling support these three families as independent (Thulin & al. 2012; Tokuyama 2012). This approach aligns with Cronquist (1981) and other traditional classification systems. Therefore, in this study, the classification proposed by Cronquist (1981) is adopted.

There is extensive taxonomic literature on the family Turneraceae in northeastern Brazil, although it remains rather scant for other regions of the country. For this region, the floras of the states of Rio Grande do Norte (Rocha & al. 2012), Sergipe (Arbo 2013), Bahia (Rocha & Rapini 2016), Ceará (Rocha & al. 2018) and Pernambuco (Zelenski & Louzada 2019) were published as well as for the Xingó region, an area that covers the states of Alagoas and Sergipe (Rocha & al. 2017). Among the studies carried out, the broadest and most representative involved the flora of Bahia, which records 64 species (Rocha & Rapini 2016; Rocha & al. 2024a). Despite the intense work that has been carried out in the northeastern region, the ecotonal flora, bordering the Cerrado and the Amazon, still needs investigation.

Most species of this family are common in urbanized areas and forest edges, such as *Turnera subulata* Sm. and *T. melo-chioides* Cambess., while others, such as *T. stipularis* Urb. and *Oxossia pernanbucensis* (Urb.) L.Rocha, are associated with more preserved areas (Zelenski & al. 2016). Both rare and common species are affected by constant threats such as the suppression of native vegetation for pasture and agriculture (see Silva & al. 2023b). In the state of Maranhão, these threats are intensified by the absence of legislation specifically addressing ecotonal areas, which is transforming the state into a mosaic of pastures, overexploited forests, and isolated remnants (Almeida & Vieira 2010).

Here, we provide a taxonomic synopsis of the species of the Turneraceae family found in Maranhão, including identification keys, diagnoses, photographs, distribution maps, and comments on morphology, as well as information on phenology, habitat, and threats.

MATERIAL AND METHODS

Study area

Maranhão is in the northeast of western Brazil and occupies an area of 331,983.293 km² (IBGE 2014). It has different phytogeographies as a result of its geographical position that is a transition between the Amazon domain and the Northeastern of Brazil, i.e., Amazon forest further west, Cerrado (savanna vegetation) in the south-central region, seasonally dry forest in the eastern-central region, dune vegetation, palm forest and transition to Caatinga (dry forest) to the east (IBGE 2014). The climate of Maranhão is classified as Aw (tropical savanna, humid with moderate water deficit), with an average annual temperature between 26 and 27.0 °C and average annual precipitation between 1,400 and 1,800 mm (Köppen 1948). The dry season is, on average, five to six months, from June to November, and the highest concentration of rainfall is in February and March (SUDENE 1986).

Field expeditions and analysis of the collections

The fieldwork was carried out between April 2021 and January 2023 and included areas under the influence of the three predominant phytogeographic domains in the state (Fig. 1). The collected specimens were processed according to the usual taxonomic techniques (Fidalgo & Bononi 1989) and were deposited in the MAR herbarium, with duplicates sent to the SLUI, MG and RB herbaria (acronyms according to Thiers 2024, continuously updated). Morphological analyses also included specimens previously collected in the study area and deposited in the herbaria EAC, HABIT, HEPH, HUEFS, IAN, INPA, IPA, MAR, MG, SLUI, TEPB, UEC, as well as in the non-indexed herbarium HST.

Morphology

For the taxonomic identification, protologues and specialized literature were consulted (Arbo 1995, 1997, 2000, 2005, 2006, 2007, 2008, 2009; Rocha & Rapini, 2016; Rocha & al. 2018) and images of type specimens available online at JSTOR (<https://plants.jstor.org/>) and REFLORA (reflora.jbrj.gov.br/). The morphological terminology follows Radford & al. (1974) and Harris & Harris (2000) and, for the characterization of the indumentum, Gonzalez & Arbo (2004) was used. Data on geographic distribution, habitat and phenology were obtained from field observations, herbarium labels and literature.

For the list of specimens that were examined or selected, only one representative sample (the most recent) was selected for each municipality in the state. However, for those species which are found in only one municipality or fewer than five specimens, all the specimens analyzed are listed. Additional specimens from other Brazilian states were used to complement the description of species lacking flowers and/or fruits, or whenever we deemed it necessary to report morphological variations. Iconography is included only for species lacking images in this work.



Fig. 1. Landscapes of the different collection sites in the state of Maranhão, Brazil.

Distribution analyses

Geographic distribution maps were generated using the QGIS (version 2.18.12) software (QGIS Development Team 2024) and based on the SIRGAS 2000 datum and the coordinates available on the labels from the herbaria. When this information was unavailable, coordinates of the collection sites were obtained using the GeoLoc tool (CRIA 2005).

RESULTS AND DISCUSSION

In the state of Maranhão, Turneraceae is represented by 21 species distributed in two genera: *Piriqueta* with six species, and *Turnera* with 14 species. Nine species (43%) are endemic to Brazil. Among them, *T. carolina* M.J.C.Silva & L.Rocha, recently described and endemic to the Cerrado (savanna vegetation) of Maranhão (Silva & al. 2023a). Three species are recorded for the first time in the state: *Piriqueta guianensis* N.E.Br., *T. aurantiaca* Benth. and *T. blanchetiana* Urb., with *T. aurantiaca* also being a new record for the northeastern region of Brazil.

The greatest richness of Turneraceae species in Maranhão was recorded for the metropolitan region of São Luís, the capital of the state, followed by the Chapada das Mesas National Park and surrounding areas, with nine species each (~43%), and for the Mirador State Park and surrounding areas, with a total of five species (~24%).

Taxonomic treatment

Turneraceae Kunth ex DC., Prodr. 3: 345. 1828. Nom. cons.

Shrubs or herbs. Stipules absent or present, when present, rudimentary or developed. Leaves petiolate or subsessile, alternate, simple, usually both surfaces pilose, venation brochidodromous, margin serrate, serrulate to crenate, rarely entire; with pairs of extrafloral nectaries, basilar or petiolar, opposite or alternate, rarely absent. Inflorescences uniflorous or pluriflorous, in racemes, headlike, spike or spike-like, rarely head, dichasia or cincinni; bracts rarely present, and the flowers are usually at the leaves' axils. Flowers bisexual, actinomorphic, hypogynous, usually heterostylous; peduncle developed (rarely absent), free or adnate to the leaf petiole (epiphyllous flower); bracteoles (prophylls) 2, alternate or opposite, sometimes rudimentary; pedicel absent or present. Calyx gamosepalous, campanulate or tubulose, distal portion 5-laciniate, divided into many narrow and pointed segments, aestivation quincuncial. Corolla dialypetalous, petals 5, alternisepalous, obovate, unguiculate, aestivation contorted, claw adnate to calycine tube, constituting a floral tube. Corona absent or present. Stamens 5, alternipetalous, cylindrical or dorsiventrally flattened filaments, free from each other or basal dorsal portion briefly adnate to the floral tube, margins to the petals claw, forming nectariferous sacs; anthers ovate or sagittate, dorsiventrally flattened, dorsifixed or basifixed, dehiscence longitudinal, introrse. Ovary superior, ovoid, 3-carpellate, gamocarpellary, 1-locular, placentation parietal, ovules anatropous; styles 3, cylindrical, glabrous or pilose, stigmas usually penicillate. Fruit capsule loculicidal, 3-valved, ovoid to globose, exocarp pilose, valves internally glabrous, glossy. Seeds usually reticulate; aril unilateral or enveloping.

Identification key for Turneraceae genera occurring in Maranhão

1. Indumentum with porrect-stellate, stellate and simple tector trichomes, and glandular setiform trichomes with a swollen base; corona present, located at the apex of the petals claw and on the sepals 1. *Piriqueta*
- Indumentum with only simple tector trichomes, sometimes stellate, and glandular micro-capitate, stipitate-capitate and sessile-capitate; corona absent 2. *Turnera*

1. *Piriqueta* Aubl., Hist. Pl. Guiane 1: 298. 1775.

Herbs to shrubs; indumentum with porrect-stellate, stellate and simple tector trichomes and often setiform glandular trichomes with a swollen base. Stipules rudimentary. Leaves herbaceous to chartaceous or subcoriaceous; extrafloral nectaries usually absent. Inflorescences uniflorous or pluriflorous, in axillary cincinni, rarely in a terminal raceme; bracts absent. Flowers with peduncle free from petiole; bracteoles rudimentary or developed, subalternate, located near the articulation of the peduncle with the pedicel; pedicel developed, usually wider and darker than the peduncle. Calyx with ovate to narrowly triangular lobes. Corolla cream, yellow, salmon or pinkish. Corona membranaceous, fimbriate, located at the apex of the petals claw and over the sepals, darkened. Filaments briefly adnate basidorsally to the floral tube. Capsule with exocarp pilose, smooth to granular. Seeds straight or curved; chalaza rounded, obtuse to slightly prominent.

Piriqueta comprises 48 species distributed throughout the Americas (Rocha & al. 2024b), with a predominance in tropical regions, from the southern part of the United States to northern Argentina and Uruguay (Thulin & al. 2012). In Brazil, 40 species are recorded, of which 28 are endemic to the country (i.e., about 70%) (Rocha & al. 2024a, 2024b). They occur predominantly in the Caatinga and Cerrado domains, with their main center of diversity located in the Chapada Diamantina region of Bahia (Arbo & Mazza 2011). For the state of Maranhão, seven species are recorded, occurring mainly in open areas in the Cerrado of the central-south and southern region of the state (Fig. 2a).

Identification key for the Piriqueta species occurring in Maranhão

1. Inflorescences pluriflorous, in axillary cincinni 1.6 *P. sidifolia*
- Inflorescences uniflorous, sometimes gathered on terminal axes 2
2. Flowers homostylous; petals 5–8 mm long 1.7 *P. viscosa*
- Flowers heterostylous; if homostylous (as in *P. cistoides* subsp. *cistoides*), then exocarp smooth; petals > 8 mm long 3
3. Indumentum without setiform glandular trichomes; exocarp smooth 1.2 *P. cistoides*
- Indumentum with setiform glandular trichomes; exocarp granular to tuberculate 4

4. Leaf blade narrow-obovate to almost linear; seeds obpyriform 1.1 *P. breviseminata*
 – Leaf blade variable, but not narrow-obovate; seeds obovoid 5
 5. Leaf margin entire or discreetly serrulate towards the apex 1.5 *P. plicata*
 – Leaf margin serrate-crenate to crenate 6
 6. Exocarp with setiform glandular trichomes with dark-brown base 1.3 *P. duarteana*
 – Exocarp with setiform glandular trichomes with hyaline base 1.4 *P. guianensis*

1.1. *Piriqueta breviseminata* Arbo, Fl. Neotrop. Monogr. 67: 91. 1995. TYPE: Brazil, Bahia, drainage of the rio Corrente, western Bahia, Rio Piau, ca. 225 km SW of Barreiras on road to Posse, Goiás, 12 Apr. 1966, Irwin & al. 14685 (holotype: P 00715425 [photo!]). Figs. 2a, 3a.

Specimens examined.—BRAZIL. **Maranhão**: Mun. Balsas, Agrovila Nova Carli, 08°41'39"S, 46°45'03"W, 04 Jul. 1998, fl. and fr., R.C. Oliveira 1240 (HEPH, HUEFS); *ibid.*, gerais de balsas, 08°39'00"S, 46°43'00"W, 17 Mar. 2000, fl. and fr., R.C. Oliveira 1388 (CEN).

Taxonomic notes.—*Piriqueta breviseminata* can be recognized by the sub-shrub habit, reddish-brown and viscous stem, by the abundance of glandular trichomes on the foliar margin, narrow- obovate to almost linear leaves, petals cream, and short obpyriform seeds (1.8–2.5 mm long). *Piriqueta breviseminata* resembles *P. velutina* L.Rocha & Arbo, endemic to Tocantins, but can be differentiated by its mostly spreading or recurved leaves (vs. leaves oblique or suberect, densely arranged, in *P. velutina*); lower leaf surfaces and margins with glandular setiform trichomes with hyaline bases (vs. glandular setiform trichomes with darkened bulbous bases, mainly in apical leaves); floral peduncles usually longer, 8–12 mm long (vs. floral peduncles shorter, 1.2–4.8 mm long) (Rocha & al. 2024b).

Distribution and habitat.—Endemic to Brazil, occurring in the Cerrado (savanna vegetation) in the states of Bahia, Goiás, Maranhão, Piauí and Tocantins (Rocha & al. 2024a). In Maranhão, it occurs in savanna with sandy and rugged soils of the municipalities of Balsas and Riachão.

Phenology.—Collected with flowers and fruits in March and July.

1.2. *Piriqueta cistoides* (L.) Griseb., Fl. Brit. W.I. 3: 298. 1860. TYPE: Suriname, Solander s.n. (holotype: LINN 384.6 [photo!]). Figs. 2a, 3b–c.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Estreito, margem direita do rio Tocantins, 06°37'S, 47°49'W, 14 Jan. 2008, fl. and fr., G. Pereira-Silva 12620 (IAN); Mun. Pedreiras, galeria do Rio Mearim, 04°56'S, 44°58'W, 27 Jul. 1988, fl. and fr., E. Barroso 58 (SLUI); Mun. São Luís, Parque Estadual do Sítio do Rangedor, 02°29'41"S, 44°16'05"W, 15 May 2024, fl., L.C. Marinho & al. 2153 (MAR).

Taxonomic notes.—*Piriqueta cistoides* can be recognized by its solitary flowers with yellow or orange petals and straight or slightly curved seeds. In addition, it is also easily differentiated from the other species of the genus by the indumentum composed only of tector trichomes and its fruits with a smooth exocarp. Includes two subspecies (Arbo 1995): *P. cistoides* subsp. *cistoides* and *P. cistoides* subsp. *caroliniana* Arbo; both occur in Maranhão. The typical subspecies is distinguished mainly by the flowers homostylous (vs. flowers heterostylous, in *P. cistoides* subsp. *caroliniana*).

Distribution and habitat.—Widely distributed throughout the Americas, ranging from the Southeastern United States to northern Argentina, and represents the species with the widest distribution in the genus (Arbo 1995). In Brazil, it is documented in all states of the North and Northeast (except Paraíba and Rio Grande do Norte), Central-West (except the Federal District), and Southeast (except Espírito Santo), with its presence in the South limited to the state of Paraná (Rocha & al. 2024a). In Maranhão, it predominantly inhabits open vegetation in savannas and coastal vegetation, as well as anthropized areas such as highways and vacant lots.

Phenology.—Collected with flowers and fruits from January to September.

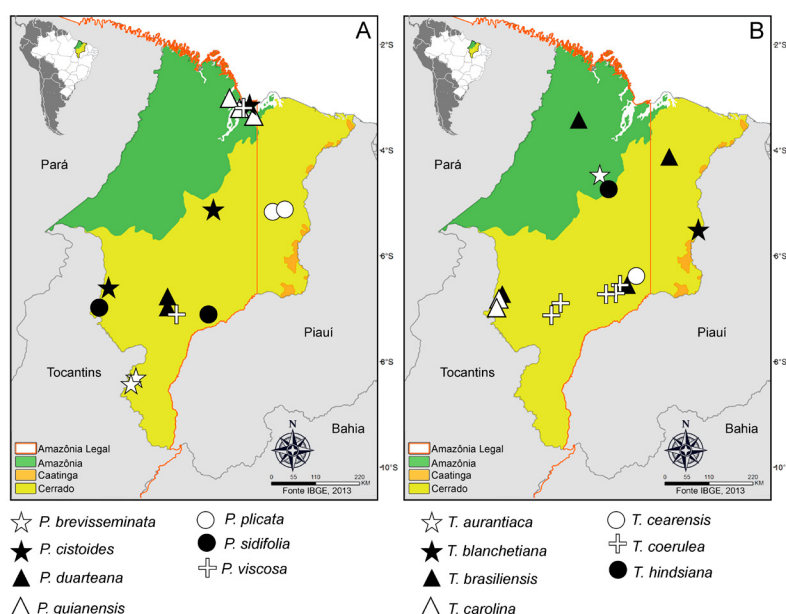


Fig. 2. Geographical distribution maps of Turneraceae species in the state of Maranhão, Brazil. A. Species of *Piriqueta*. B. Some species of *Turnera*.

1.3. *Piriqueta duarteana* (Cambess.) Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 66. 1883. TYPE: Brazil, [Minas Gerais] “In campis prope pagum Contendas [Brasília de Minas] in parte deserta occidentali Provinciae Minas Geraes”, Oct., A.N. Duarte s.n. (holotype: P 012009 [photo!]). Figs. 2a, 3d–f.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Balsas, beira da estrada, 7°10'05"S, 45°56'01"W, 23 Feb. 2022, fl. and fr., M.J.C. Silva 502 (MAR); Mun. Fortaleza dos Nogueiras, Balneário Recanto das Águias, 06°56'49"S, 45°59'02"W, 21 Feb. 2022, fl. and fr., M.J.C. Silva 486 (MAR).

Taxonomic notes.—*Piriqueta duarteana* can be recognized by its exocarp with setiform glandular trichomes with dark-brown base, and the generally short peduncles. *Piriqueta duarteana* includes two varieties (Arbo 1995): *P. duarteana* var. *duarteana* and *P. duarteana* var. *ulei* Urb. Only the typical variety occurs in Maranhão, it is characterized by the viscous indumentum, composed of abundant glandular, simple and porrect-stellate trichomes with central ray about 1 mm long, while *P. duarteana* var. *ulei* has a hispid, ferruginous, viscous indumentum, composed of abundant porrect-stellate trichomes, with central ray 2–6 mm long, as well as short simple hairs and setiform glandular trichomes in smaller quantities. *Piriqueta duarteana* is part of a complex of ten species with similar appearance, with solitary flowers and usually salmon or pink petals (Arbo 1995). Of these, only *P. guianensis* occurs in Maranhão and it is distinguished by the longer peduncles 6–20 mm long (vs. 2–10 mm long in *P. duarteana*) and exocarp with setiform glandular trichomes with hyaline base (vs. dark brown).

Distribution and habitat.—Endemic to Brazil, it is widely distributed in the states of the Northeastern region (except Paraíba) and in the states of Pará, Goiás, Mato Grosso, Minas Gerais and Tocantins (Rocha & al. 2024a). In Maranhão, it inhabits mainly savanna, coastal vegetation and anthropic areas.

Phenology.—Collected with flowers and fruits from February to August.

1.4. *Piriqueta guianensis* N.E.Br., Trans. Linn. Soc. London, Bot. ser. 2, 6: 30. 1901. TYPE: Guyana, Mount Roraima, Ireng Valley, Jul. 1895, J.J. Quelch & F. McConnell 264 (lectotype designated by Arbo (1995: 113): K 000373229 [photo!]). Figs. 2a, 3g–h.

Specimens examined.—BRAZIL. **Maranhão**: Mun. São José de Ribamar, Praia do Caúra, 02°55'S, 44°04'W, 27 Feb. 2016, fl. and fr., A.V.F. Guterres 354 (MAR); Mun. São Luís, dunas da praia de São Marcos, 02°48'S, 44°26'W, 11 Dec. 2015, fl. and fr., A.N.F. Silva 571 (MAR); ibid., Ilha de Tauá Mirim, 02°72'S, 44°38'W, fl. and fr., 6 Jul. 2021, M.J.C. Silva 283 (SLUI).

Taxonomic notes.—*Piriqueta guianensis* can be recognized by its flowers with long peduncles and the salmon to pink corolla and seeds with a punctiform depression on each areole. The species includes two subspecies (Arbo 1995): *P. guianensis* subsp.

guianensis and *P. guianensis* subsp. *elongata* (Urb. & Rolfe) Arbo; only the last one occurs in Maranhão. The typical subspecies has leaves with secondary veins with a divergence angle of 22–45°, hairy styles and seeds 1.5–1.8 mm long, occurring only in Guianas and Northern region of Brazil: Roraima and Tocantins (Arbo 1995; Rocha & Rapini 2016). The subspecies *P. guianensis* subsp. *elongata* is distinguished by its veins with an angle of divergence of 18–30°, styles glabrous to sparsely pilose and larger seeds, 1.9–2.3 mm long, widely distributed in the Northeast Brazil. *Piriqueta guianensis* is similar to *P. duarteana*, it can be differentiated by the peduncle length and the exocarp with setiform glandular trichomes with a hyaline base (see above).

Distribution and habitat.—*Piriqueta guianensis* occurs in Guyana and in the Northern (Roraima and Tocantins) and Northeastern region of Brazil (Arbo 1995; Rocha & al. 2024a). Via this study, it is being reported for the first time for Maranhão, where it occurs in sandy and stony soils of anthropogenic areas and remnants of the Amazon forest of the metropolitan region of São Luís.

Phenology.—Collected with flowers and fruits in February, June and December.

1.5. *Piriqueta plicata* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 65. 1883. TYPE: Brazil. [Bahia] “Habitat in sylvis Catingas ad S. Ant. das Queimadas, Provinciae Bahiensis”, Apr., C.F.P. Martius s.n. (holotype: M 0113098 [photo!]). Figs. 2a, 3i.

Specimens examined.—BRAZIL. **Maranhão**: Mun. Caxias, Fazenda Bandeirantes, 05°00’S, 42°00’W, 31 Jan. 1981, fl. and fr., A. Krapovickas & C. Cristobal 37216 (CTES, MO); Mun. São João do Soter, povoado Candeias, estrada para o santuário do Alto do São Francisco, 04°59’10,0’’S, 43°41’47,2’’W, 9 Dec. 2022, fl. and fr., A.W.C. Ferreira & M.J.C. Silva 1004 (MAR); *ibid.*, estacionamento do santuário, Alto do São Francisco, 04°58’49’’S, 43°41’34’’W, 9 Oct. 2022, fl. and fr., A.W.C. Ferreira & M.J.C. Silva 1008 (SLUI).

Taxonomic notes.—*Piriqueta plicata* can be recognized by its elliptical to linear leaves, with entire margins or serrulate towards the apex, and secondary veins visible only on the abaxial surface. It resembles *P. lourteigiae* Arbo, endemic to the state of Mato Grosso, which differs in the length of the calyx (8–11 mm long vs. 6–8 mm long in *P. plicata*) and the stigmas (1–1.5 mm long vs. 0.3–0.7 mm long) (Arbo 1995).

Distribution and habitat.—Endemic to Brazil, occurring only in the Northeastern region in the states of Bahia, Maranhão and Piauí (Arbo 1995; Rocha & al. 2024a). In Maranhão, small subpopulations were found in the municipalities of Caxias and São João do Soter. It inhabits savanna with sandy soils and anthropized areas such as highways and vacant lots.

Phenology.—Found with flowers and fruits in January, April and December.

1.6. *Piriqueta sidifolia* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 61. 1883. TYPE: Brazil. [Minas Gerais] “In campis ruperrimè crematis prope pagum vulgò Aldea da Boa Vista, in parte occidentali-meridionali provinciae Minas Geraes”, Sep., A. de Saint Hilaire c. 932 (holotype: P 011225 [photo!]). Figs. 2a, 3j.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Carolina, Parque Nacional da Chapada das Mesas, estrada para cachoeira da prata, 07°08’06’’S, 47°26’08’’W, 27 Jan. 2021, fl. and fr., L.C. Marinho & al. 1640 (MAR); Mun. Loreto, fazenda Trabalhosa, entre o rio Balsas e Parnaíba, 07°12’00’’S, 45°07’11.9’’W, 8 Apr. 1962, fl. and fr., G. Eiten & L.T. Eiten s.n. (US 2570297 [photo!]).

Taxonomic notes.—*Piriqueta sidifolia* can be recognized by the leaf blade ovate to narrow-ovate with rounded or cordate base and flowers with yellow or cream petals, with base and streaks dark yellow. *Piriqueta sidifolia* includes two varieties (Arbo 1995): *P. sidifolia* var. *sidifolia* and *P. sidifolia* var. *multiflora* Urb., only the latter occurs in Maranhão. The typical variety exhibits an herbaceous or subshrub habit, leaves with short petioles, 0.5–7 mm long, 2–3(–6)-flowered inflorescences, and is mainly found in the Central-West region of Brazil. *P. sidifolia* var. *multiflora* displays a subshrub to shrub habit, leaves with generally longer petioles, 0.9–2(–3) cm long, and 4–20-flowered inflorescences, and is more prevalent in the Northeast Brazil (Arbo 1995, Rocha & Rapini 2016). *Piriqueta sidifolia* resembles *P. densiflora* Urb., which is distinguished by its narrow-oblong, narrow-elliptical to linear leaf blade, typically rusty or greyish-green even when fresh.

Distribution and habitat.—Endemic to Brazil and widely distributed in the states of the Northeast (except Rio Grande do Norte and Sergipe), Central-West (except Mato Grosso) and in the states of Minas Gerais, Rio Grande do Sul and Tocantins (Rocha & al. 2024a). In Maranhão, it inhabits mainly savannas and open fields with sandy soil.

Phenology.—Found with flowers and fruits in January and April.



Fig. 3. Species of *Piriqueta* in Maranhão: **a**, *P. breviseminata*; **b–c**, *P. cystoides*; **d–f**, *P. duarteana*; **g–h**, *P. guianensis*; **i**, *P. plicata*; **j**, *P. sidifolia*; **k**, *P. viscosa* [L. Rocha: **a**, **k**; M. Silva: **b–f**, **i**, **j**, **m**; K. Pimenta: **h**; L. Marinho: **j**]

1.7. *Piriqueta viscosa* Griseb., Cat. Pl. Cub.: 114. 1866. TYPE: “Cuba occ. [Cuba] “in savanis distr. S. Christobal”, 1863, C. Wright 2608 (holotype: GOET 011242 [photo!]; isotypes: BM 001008401 [photo!], CTES, G 00357416 [photo!], K 000373246 [photo!], MO, NY 00084331 [photo!], P 00506578 [photo!], S 04-579 [photo!], US 00074220 [photo!], W, YU 244599 [photo!]). Figs. 2a, 3k.

Specimens examined selected.—BRAZIL. **Bahia**: Mun. Caetité, 10 km antes de Caetité, estrada saindo de Brejinho das Ametistas, antes do posto de mineração, 27 Apr. 2013, fl. and fr., L. Rocha & P. Gomes 425 (HUEFS). **Maranhão**: Mun. Fortaleza dos Nogueiras, Balneário Recanto das Águias, 06°57'24"S, 46°00'09"W, 21 Feb. 2022, fl. and fr., M.J.C. Silva & A.W.C. Ferreira 489 (SLUI); Mun. São Luís, Parque Estadual do Sítio do Rangedor, 02°29'41"S, 44°16'05"W, 26 Apr. 2024, fl., E.L.S. Pereira & al. 146 (MAR).

Taxonomic notes.—*Piriqueta viscosa* can be recognized by the viscous stems, homostylous flowers with pink to dark pink corolla, and petals with purple base. *Piriqueta viscosa* includes two subspecies (Arbo 1995): *P. viscosa* subsp. *viscosa* and *P. viscosa* subsp. *tovarensis* Urb; only the typical subspecies occur in Maranhão. *Piriqueta viscosa* subsp. *tovarensis* lives only in Costa Rica, Panama, Colombia and Venezuela, differs from the typical subspecies mainly by the yellow or orange corolla (vs. pink in the typical variety).

Distribution and habitat.—Occurs in Mesoamerica, the Antilles, Colombia and Venezuela (Arbo 1995). In Brazil, it is widely distributed in the Northeast, Central-West, Southeast and in the states of Pará and Roraima (Rocha & al. 2024a). In Maranhão, it occurs in rocky outcrops in the savannas of the south-central region of the state.

Phenology.—Found with flowers and fruits in March and April.

2. *Turnera* L., Sp. Pl. 1: 271. 1753.

Herbs to shrubs; indumentum with simple, sometimes stellate tector trichomes, and micro-capitate, stipitate-capitate and sessile-capitate glandular trichomes. Stipules rudimentary or developed, sometimes absent. Leaves herbaceous, chartaceous to almost coriaceous; extrafloral nectaries frequently present, petiolar or basilaminar, usually discoid. Inflorescences uniflorous or pluriflorous, in racemes, dichasia or head; bracts absent or present. Flowers with peduncle free or adnate to the leaf petiole (epiphyllous flower), sometimes absent; bracteoles developed, opposite, located at the apex of the peduncle or the calyx base; pedicel absent, rarely present. Calyx with ovate to narrowly triangular lobes. Corolla yellow, cream, orange, rarely white, lilac or red. Corona absent. Filaments free basidorsally adnate to the floral tube, or the lower part of the filaments adnate at the margins to the petals claw, forming nectariferous sacs. Capsules with exocarp pilose, sometimes glabrous at the base, granular, verrucose or smooth. Seeds straight or curved; chalaza rounded, obtuse or prominent.

Turnera includes 132 species, which are distributed from southeastern United States to Argentina (130 spp.), and Africa, where two species occur (Rocha & al. 2020). In Brazil, 110 species are recorded, 76 of which are endemic to the country (~69%) (Arbo 1997, 2000, 2005, 2008; Rocha & al. 2024a). The species occur in a wide array of environments, mainly cerrado vegetation (savannas), rocky outcrops and caatinga vegetation, with major centers of diversity in the states of Goiás, Bahia and Minas Gerais (Arbo & Mazza 2011). For Maranhão, 14 species were recorded (Figs. 2b, 4), occurring mainly in open areas such as cerrado, coastal vegetation, dunes, white sand soil ecosystems and anthropized areas such as highways and vacant lots.

Identification key for Turnera species occurring in Maranhão

1. Peduncle and pedicel developed..... 2.7 *T. hindsiana*
- Peduncle developed, pedicel absent..... 2
2. Bracteoles lanceolate to obovate, with basal lacinate appendages, exocarp tuberculate 2.1 *T. aurantiaca*
- Bracteoles entire, granular, exocarp granular, verrucose or smooth 3
3. Inflorescences in head or dichasia 4
- Inflorescences uniflorous, solitary, sometimes located at the apical leaves of the branches or in gathered in head-like racemes 6
4. Inflorescences in very brief, head-like dichasia; exocarp tuberculate..... 2.3 *T. brasiliensis*
- Inflorescences in heads; exocarp smooth or granular 5
5. Indumentum with simple tector trichomes; head axillary; obovate or narrow-ovate bracts; exocarp smooth, pilose towards the apex 2.13 *T. stipularis*
- Indumentum with stellate tector trichomes; head terminal; trapezoidal to subcircular bracts; exocarp granular 2.2 *T. blanchetiana*

6. Filaments adnate to the floral tube only at the base, sometimes free 7
 – Filaments with the margins adnate to the claw of the petals, forming nectariferous sacs 10
 7. Flowers homostylous; ovary and exocarp pilose only at apex; seeds lunate 2.7 *T. pumilea*
 – Flowers heterostylous; ovary and exocarp entirely tomentose-hirsute to densely-pilose; seeds obovate 8
 8. Flowers with peduncle free from pedicel 2.9 *T. odorata*
 – Flowers epiphyllous 9
 9. Leaves with dark spots on both sides when dried; sepals and bracts reddish, petals usually bright orange, pilose on the midrib, up to half of the blade 2.4 *T. carolina*
 – Leaves without dark spots when dry; sepals and bracts green, petals usually yellow, glabrous or pilose only at the base 2.8 *T. melochioides*
 10. Seeds with chalaza umbilicate, prominent and concave 11
 – Seeds with chalaza obtuse, not prominent and concave 12
 11. Indumentum with simple tector trichomes only; extrafloral nectaries absent; flowers epiphyllous; corolla yellow-orange or orange 2.11 *T. reginae*
 – Indumentum with simple and stellate tector trichomes; extrafloral nectaries present; flowers with peduncle free from petiole; corolla yellow 2.5 *T. cearensis*
 12. Corolla white to bluish-white 2.6 *T. coerulea*
 – Corolla yellow or cream 13
 13. Corolla entirely yellow 2.12 *T. scabra*
 – Corolla cream or yellow, dark brown base 2.14 *T. subulata*

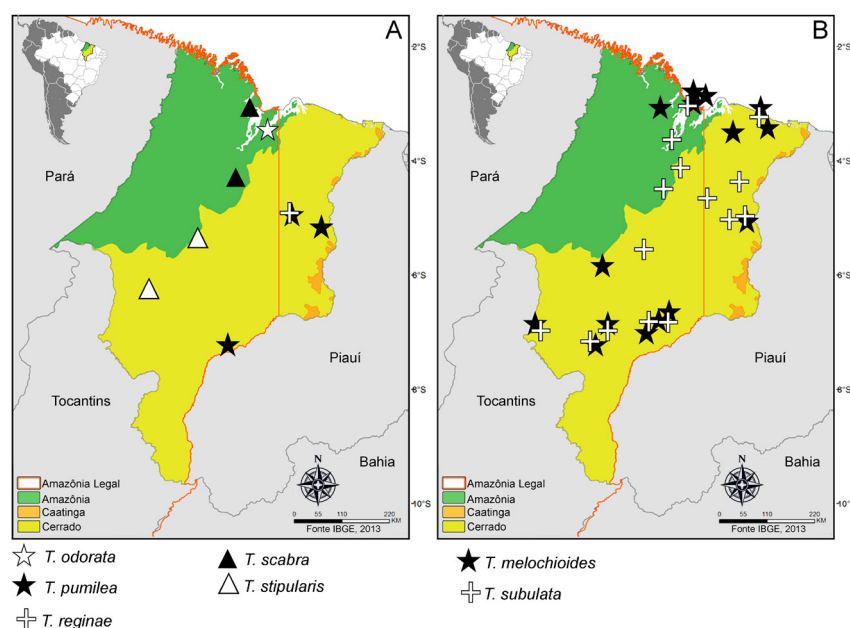


Fig. 4. Geographical distribution maps of *Turnera* species in the state of Maranhão, Brazil.

2.1. *Turnera aurantiaca* Benth., J. Bot. (Hooker) 4: 116. 1842. TYPE: Guyana. “Sandy plains on the Essequibo and Rupunoony”, 1837, R.H. Schomburgk 291 (holotype: K 000373073 [photo!]; isotypes: BM 001008415 [photo!], BR 0000005420810 [photo!], F 0074079F [photo!], 2 FI 004362 [photo!], K 000373076 [photo!], US 00114924 [photo!], W). Fig. 2b.

Iconography.—Rocha (2019b, figs. 63–64: 4).

Specimens examined.—BRAZIL. **Maranhão**: Mun. Lago Verde, Fazenda São Francisco, 04°10’S, 45°09’W, 24 Mar. 1985, fl. and fr., A.B. Anderson & al. 2111 (MG).

Taxonomic notes.—*Turnera aurantiaca* can be recognized mainly by the flowers with developed peduncles and orange

petals. Due to the petals color, *Turnera aurantiaca* resembles *Turnera acuta* Willd. ex Schult., but differs mainly by the larger peduncles, 10–30 mm long (vs. 0.5–13 mm long in *T. acuta*) and glabrous styles (vs. styles pilose) (Arbo 1997).

Distribution and habitat.—Occurs in Guyana, Suriname and in Brazil in the states of Acre, Amazonas and Roraima (Arbo 1997, Rocha & al. 2024a). It is mainly associated with areas of white sand soil ecosystems, riparian or gallery forest, and floodplain forests. Through this study, it is being reported for the first time for Maranhão, where it occurs in secondary forests.

Phenology.—Found with flowers and fruits in the month of March.

2.2. *Turnera blanchetiana* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 130. 1883. TYPE: Brazil. [Bahia] “serra d’Açuruá, sertão do Rio S. Francisco, fl. couleur d’or, bois”, 1838, J.S. Blanchet 2841 (lectotype designated by Arbo (2005:136) P 00715478 [photo!]; isoelectotypes: BM 000611177 [photo!], BR 0000005420506 [photo!], F 0360752 [photo!], FI 004360 [photo!], G 00357405 [photo!], K 000373161 [photo!], NY 00110357 [photo!], P [photo!], SP 003216 [photo!], W [photo!]). Figs. 2b, 5a.

Specimens examined.—BRAZIL. **Maranhão**: Mun. Caxias, beira da MA 216, 05°26’S, 42°58’W, 8 Oct. 2022, fl. and fr., M.J.C. Silva & A.W.C. Ferreira 602 (SLUI).

Taxonomic notes.—*Turnera blanchetiana* can be recognized by its short stellate trichomes, inflorescences in head, and the presence of bracts. Two varieties are recognized for *Turnera blanchetiana*: *T. blanchetiana* var. *blanchetiana* and *T. blanchetiana* var. *subspicata* Urb., only the typical variety occurs in Maranhão. *T. blanchetiana* var. *subspicata* is characterized by inflorescences in spike-like racemes (vs. inflorescence in head in the typical variety).

Turnera blanchetiana resembles *T. cearensis* and *T. bahiensis*, from which it can be differentiated by the inflorescences in head and presence of bracts (vs. uniflorous inflorescences and bracts absent in *T. cearensis*) and stellate tector trichomes (vs. only simple tector trichomes in *T. bahiensis*) (Arbo 2005).

Distribution and habitat.—Occurs in Brazil, Bolivia and Paraguay (Arbo 2005). In Brazil it is found in the Northeast (Bahia, Ceará, Paraíba, Pernambuco, Piauí and Rio Grande do Norte), Central-West (Mato Grosso do Sul and Mato Grosso) and Southeast (Minas Gerais) (Rocha & al. 2024a). In this study, the first report of occurrence of the species for Maranhão is presented. Only two specimens were collected in the Cerrado-Caatinga transition area in the municipality of Caxias, near the border with the state of Piauí.

Phenology.—Found with flowers and fruits in October.

2.3. *Turnera brasiliensis* Willd. ex Schult. Syst. Veg., 6: 678. 1820. TYPE: Brazil. [Pará] Prope Santarém, 1849-1850, R. Spruce 479 (lectotype designated by Arbo (1997:156): P 00715482 [photo!]; isoelectotypes: FI 004359 [photo!], M 0113104 [photo!], P 00715483 [photo!], W [photo!]). Figs. 2b, 5b.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Araganã, BR 316, km 155 da BR 116, 02°09’S, 45°39’W, 8 Dec. 1978, fl. and fr., N.A. Rosa 2890 (INPA [photo!]); Mun. Carolina, foz do ribeirão das lajes com o rio Farinha, 06°55’S, 47°22’W, 06 Apr. 2016, fl. and fr., A.C. Servilha 5643 (CEN); Mun. Chapadinha, 03°74’S, 43°36’W, 28 Nov. 2012, fl. and fr., K. Martins 01 (IAN); Mun. Mirador, Parque Estadual do Mirador, 06°37’S, 44°36’W, 7 Dec. 1998, fl. and fr., G.M. Conceição s.n (EAC 27318).

Taxonomic notes.—*Turnera brasiliensis* can be recognized by the inflorescences in very brief, head-like dichasia, petioles with 2–8 nectaries, large leaves, up to 25 cm long, elliptic-lanceolate or obovate, and fruits with tuberculated exocarp. *Turnera brasiliensis* is similar to *T. glaziovii* Urb., but can be distinguished by the leaves with tomentose adaxial surface (vs. glabrous or subglabrous in *T. glaziovii*) and inflorescences in dichasia (vs. flowers solitary or in short spike).

Distribution and habitat.—It occurs in Guyana, Suriname and in the Northern (Amapá and Pará), Northeastern (only Maranhão) and Central-Western (Goiás, Mato Grosso do Sul, Mato Grosso) regions of Brazil (Arbo 1997; Rocha & al. 2024a). In Maranhão, in areas of Amazonian influence, it occurs in terra-firme forests and moist capoeiras with sandy soil; while, in the savanna, occurs in open fields with stony soil.

Phenology.—Found with flowers and fruits in April, November and December.

2.4. *Turnera carolina* M.J.C. Silva & L. Rocha, Syst. Bot. 48(2): 300. 2023. TYPE: Brazil. Maranhão, Carolina, Morro Redondo, 25 Feb. 2022, M.J.C. Silva & A.W.C. Ferreira 506 (holotype: MG!; isotypes: HUEFS!, MAR!, RB!). Figs. 2b, 5c–d.

Specimens examined.—BRAZIL. **Maranhão**: Mun. Carolina, Morro Redondo, 07°05'50.4"S, 47°26'36.6"W, 25 Feb. 2022, fl. and fr., M.J.C. Silva & A.W.C. Ferreira 506 (HUEFS, MAR, MG, RB); *ibid.*, entrada à esquerda do Balneário Chico de Dodó, 07°05'46"S, 47°26'59"W, 29 Jan. 2012, fl. and fr., R.M. Harley & al. 56618 (HUEFS); *ibid.*, PARNA Chapada das Mesas, cerrado rupestre, trilha para a cachoeira do porão, 06°59'11.9"S, 47°22'10.3"W, 3 Jun. 2022, fl. and fr., M. Salazar-Ferreira & al. 158 (BMA, SLUI).

Taxonomic notes.—*Turnera carolina* can be recognized by the leaves with dark spots on both sides when dried, petals shorter or as long as the calyx, bracts and external face of the calyxes usually reddish, and yellow to orange petals. *Turnera carolina* is similar to *T. vallsii* Arbo, endemic to Goiás, from which it can be differentiated by the calyx length of 7–8 mm long (vs. 4–5.8 mm long *T. vallsii*) and the presence of nectaries on all leaves (vs. present only on the floriferous leaves in *T. vallsii*).

Distribution and habitat.—Endemic to Brazil, occurring in the Chapada das Mesas region, southwest of Maranhão. It occurs in rocky savanna vegetation growing in rocky soils.

Phenology.—Found with flowers and fruits in January, February and June.

2.5. *Turnera cearensis* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 100. 1883. TYPE: Brazil. [Ceará] “prope Brejo grande, a small shrub, fl. yellow”, Feb. 1839, G. Gardner 2405 (holotype: K 000373069 [photo!]). Figs. 2b, 5e.

Specimens examined.—BRAZIL. **Maranhão**: Mun. Mirador, Parque Estadual do Mirador, 06°22'14.9"S, 44°21'47.1"W, 08 May 1998, fl. and fr., G.M. Conceição 235 (EAC).

Additional specimens examined.—BRAZIL. **Ceará**: Mun. Guaraciaba do Norte, 04°10'S, 40°44'W, 15 Jun. 1979, fl. and fr., A. Fernandes s.n. (EAC 6575); Mun. Viçosa do Ceará, Cocalzinho, Chapada da Ibiapaba, 03°33'44" S, 41°05'32" W, 5 Jan. 1987, fl. and fr., A. Fernandes s.n. (EAC 14873).

Taxonomic notes.—*Turnera cearensis* can be recognized by solitary flowers, peduncle free from petiole and yellow petals. *Turnera cearensis* is similar to *T. blanchetiana* but can be distinguished mainly by flowers solitary vs. flowers in head in *T. blanchetiana*.

Distribution and habitat.—Endemic to Brazil, occurring in all states of the Northeastern region and in Minas Gerais (Rocha & al. 2024a). In Maranhão, it occurs in gallery forests and clayey soil of the Cerrado domain of the south-central region of the state.

Phenology.—Found with flowers and fruits in May.

2.6. *Turnera coerulea* DC., Prodr. 3: 346. 1828. TYPE: México. s.l., 1827, J.A. Pavon s.n. (holotype: BM 001024893 [photo!]; isotypes: BM 001024894 [photo!], P 00506577 [photo!]). Figs. 2b, 5f–g.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Balsas, cachoeira três marias, 07°14'18.9"S, 46°14'51"W, 22 Feb. 2022, fl. and fr., M.J.C. Silva 493 (SLUI); Mun. Carolina, Parque Nacional da Chapada das Mesas, sumidouro do rio Farinha, 06°55'54"S, 47°22'53"W, 22 Nov. 2021, fl. and fr., M.J.C. Silva & al. 403 (MAR); Mun. Fortaleza dos Nogueiras, Parque Estadual do Mirador, 06°49'27"S, 45°00'12"W, 18 Oct. 2021, fl. and fr., M.J.C. Silva & al. 326 (MAR); *ibid.*, balneário Recanto das Águias, 06°57'24"S, 46°00'10"W, 21 Feb. 2022, fl. and fr., M.J.C. Silva & al. 487 (MAR); Mun. São Domingos do Azeitão, Parque Estadual do Mirador, 06°42'39"S, 44°44'27"W, 17 Oct. 2021, fl. and fr., M.J.C. Silva & al. 314 (MAR).

Taxonomic notes.—*Turnera coerulea* can be recognized by its flowers with white petals with base yellow with dark blue streaks, as well as serrated leaves usually with wide, irregular teeth. *Turnera coerulea* includes two varieties (Arbo 2005): *T. coerulea* var. *coerulea* and *T. coerulea* var. *surinamensis* (Urb.) Arbo & Fernández, both occur in Maranhão. The typical variety can be recognized by the elliptic, ovate or obovate leaves, with serrated margins and adaxial face with long, curved, antrorse hairs; while *T. coerulea* var. *surinamensis* is distinguished by linear, elliptic or narrow-ovate leaves with serrated margins and a glabrous adaxial face glabrous, except the pilose middle vein.

Distribution and habitat.—*Turnera coerulea* has a disjunct area: Mexico in North America, and Guianas, Brazil and Bolivia in South America (Arbo 2005). In Brazil, it is registered in all states except for the states of the Southern region (Rocha & al. 2024a). In Maranhão, it is a common species in the cerrado vegetation of the southern region of the state, but it also occurs in coastal vegetation and remnants of the Amazon forest in the north of the state.

Phenology.—Found with flowers and fruits all year round.

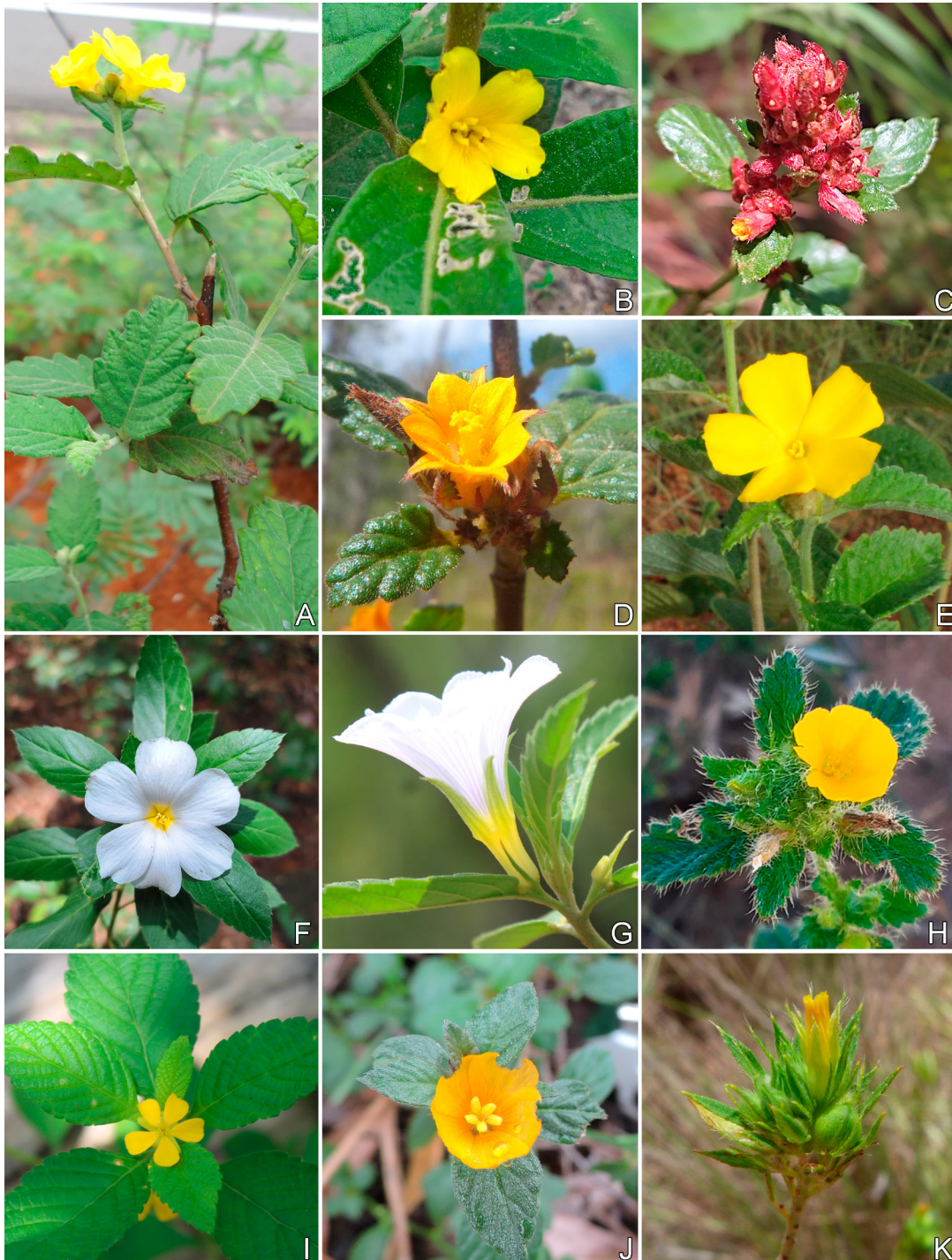


Fig. 5. Species of *Turnera* in Maranhão: **a**, *T. blanchetiana*; **b**, *T. brasiliensis*; **c–d**, *T. carolina*; **e**, *T. cearensis*; **f–g**, *T. coerulea*; **h–k**, *T. melochioides* [L. Rocha: a, b, e; M. Silva: c, f, g, i–k; A. Scatigna: d; A. Fernandes: h].

2.7. *Turnera hindsiana* Benth., Bot. Voy. Sulphur: 101. 1845. TYPE: [Ecuador] “prope Guayaquil”, 1841, R.B. Hinds s.n. (holotype: K 000373206 [photo!]; isotypes: BM 001008417 [photo!], K 000373205 [photo!]). Fig. 2b.

Iconography.—Arbo (1997, figs. 5a–h: 165).

Specimens examined.—BRAZIL. **Bahia**: Mun. Barra, Ibiraba, estrada para Coxos, Lagoa dos Coxos, 10°48'S, 42°50'W, 25 Feb. 1997, fl. and fr., L.P. Queiroz 4851 (HUEFS). **Maranhão**: Mun. Bacabal, fazenda Bacaba, 5 km sul da MA 119, 04°26'S, 44°58'W, 05 Out. 1980, fl., D.C. Daly & al. 511 (holotype of *Turnera hindsiana* subsp. *brachyantha* Arbo: CTES 0001872 [photo!]; isotypes: INPA, MO 2246608 [photo!], NY [photo!], Y).

Taxonomic notes.—*Turnera hindsiana* can be recognized by the peduncle and pedicel developed, ovary glabrous and exocarp tuberculate-crested. Includes two subspecies (Arbo 1997): *T. hindsiana* subsp. *hindsiana* and *T. hindsiana* subsp. *brachyantha*; only the latter occurs in Maranhão. The typical subspecies is restricted to Ecuador and differs mainly by the corolla larger, 6–8.5 mm long (vs. 3–6 mm long in *T. hindsiana* subsp. *brachyantha*).

Distribution and habitat.—The typical subspecies occurs in Ecuador and the *T. hindsiana* subsp. *brachyantha* in Brazil. In Brazil, it has confirmed occurrences only for Bahia, Maranhão and Minas Gerais. In Maranhão, it is known by a single specimen from a disturbed forest edge of the Cerrado domain in the municipality of Bacabal.

Phenology.—Found with flowers and fruits in October and February.

2.8. *Turnera melochioides* Cambess., in Saint Hilaire, Jussieu & Cambessedes, Fl. Bras. Merid. 2: 159 (219). 1883. TYPE: Brazil. [Minas Gerais] “In pascuis prope praedium Olho d’Agoa haud longe à vico Contendas in parte occidentali desertaque provinciae Minas Geraës”, Laroutte s.n. (holotypus P 0715551 [photo!]; isotypes: F, P 00735432 [photo!]). Figs. 4b, 5h–k.

Specimens examined selected.—BRAZIL. **Maranhão**: Mun. Balsas, cachoeira Três Marias, 07°14'18.9"S, 46°14'51"W, 22 Feb. 2022, fl. and fr., M.J.C. Silva 494 (MAR, SLUI); Mun. Carolina, Parque Nacional da Chapada das Mesas, sumidouro do rio Farinha, 06°55'54"S, 47°22'53"W, 22 Nov. 2021, fl. and fr., M.J.C. Silva & al. 391 (MAR); Mun. Fortaleza dos Nogueiras, Parque Estadual do Mirador, 06°49'27"S, 45°00'12"W, 18 Sep. 2021, fl. and fr., M.J.C. Silva & al. 369 (MAR); ibid., Balneário Recanto das Águias, 06°57'24"S, 46°00'10"W, 21 Feb. 2022, fl. and fr., M.J.C. Silva & al. 488 (MAR); Mun. São Domingos do Azeitão, Parque Estadual do Mirador, 06°42'39"S, 44°44'27"W, 17 Sep. 2021, fl. and fr., M.J.C. Silva & al. 368 (MAR); Mun. São Luís, Praia da Guia, 2°53'25"S, 44°34'07" W 10 Aug. 2016, fl and fr., I.F.F. Amorim 364 (MAR).

Taxonomic notes.—*Turnera melochioides* exhibits wide morphological variation, in general can be recognized by the doubly serrate-crenate, sometimes serrated or crenulate leaves, flowers grouped in terminal or axillary racemes, petals small, yellow, sometimes with reddish lines. Includes four varieties (Arbo 2008): *T. melochioides* var. *melochioides*, *T. melochioides* var. *arenaria* Urb., *T. melochioides* var. *latifolia* Urb and *T. melochioides* var. *rugosa* Arbo. The typical variety can be recognized by leaves chartaceous to coriaceous, blade elliptic, broad-elliptic to ovate, dark brown when dry. *Turnera melochioides* var. *arenaria* and *T. melochioides* var. *latifolia* have leaves chartaceous, not dark brown when dry when dried; the first exhibits leaf blade narrow-elliptic to linear, margin almost entire to serrated; while the second has leaf blade ovate to ovate-lanceolate, margin crenate or bicrenate. All occur in Maranhão, except for *T. melochioides* var. *rugosa* Arbo, restricted to the state of Goiás, and can be recognized mainly by the leaves coriaceous and exocarp generally rugose.

Distribution and habitat.—Widely distributed in Bolivia, Brazil (except the Southern region) and Paraguay (Arbo 2008; Rocha & al. 2024a). In Maranhão, it is distributed throughout the state and inhabits various types of environments such as coastal vegetation, savannas, remnants of the Amazon forest and urban areas.

Phenology.—Found with flowers and fruits all year round.

2.9. *Turnera odorata* Rich., Actes Soc. Hist. Nat. Paris, 1: 107. 1792. TYPE: French Guiana. Cayenne, “baume savanne vulgo pro-balneis, in campestribus suburbanis frequent”, L.C. Richard s.n. (holotype P 00715563 [photo!]; isotypes: C, P 00715564 [photo!]). Fig. 4a.

Iconography.—Arbo (2000, figs. 3a–i: 14).

Specimen examined.—BRAZIL. **Maranhão**: Mun. Paço do Lumiar, 02°52'S, 44°15'W, 24 Jan. 1976, fl. and fr., G.M. Barroso & E.F. Guimarães 358 (RB). **Pará**: Mun. Salvaterra, estrada que leva para Salinas, 00°07'S, 48°51'W, 10 Jan. 1982, fl. and fr., C.S. Rosário 184 (IAN); Mun. Vigia, campina do palha, 00°85'S, 48°14'W, Jun. 1952, fl. and fr., R.L. Fróes 28481 (IAN).

Taxonomic notes.—*Turnera odorata* can be recognized by leaves lax or densely pilose, with golden sessile-capitate glandular trichomes, and light-yellow to yellow-orange corolla. *Turnera odorata* is similar to *Turnera aromatica* Arbo, but can be differentiated mainly by the calyx pilose, glabrous or pilose at the base (vs. villous or tomentose in *T. aromatica*), and indumentum with sessile-capitate glandular trichomes, golden (vs. stipitate-capitate glandular trichomes, pale-yellow).

Distribution and habitat.—It occurs in Colombia, Venezuela, Guyana, French Guiana, Suriname and Trinidad and Tobago (Arbo 2000). In Brazil, it is distributed in the North (except Acre), Northeast (only Ceará and Maranhão) and Central-West (except Brasília) (Rocha & al. 2024a). In Maranhão, it is known from a single record, in an anthropogenic area in the municipality of Paço do Lumiar, metropolitan region of São Luís municipality.

Phenology.—The species has been reported with flowers and fruits in January.

2.10. *Turnera pumilea* L., Syst. Nat. ed. 10, 2: 965. 1759. TYPE: Jamaica, s.d., P. Browne s.n. (lectotype designated by Arbo (2008: 256): LINN 384-4 [photo!]). Figs. 4a, 6a–b.

Specimens examined selected.—BRAZIL. **Maranhão:** Mun. Caxias, APA Buriti do Meio, 04°54'48.1"S, 43°06'49"W, 24 Jan. 2013, fl. and fr., N.A. Sampaio 05 (HUEFS); Mun. Loreto, Fazenda Morros, Região da ilha de balsas, 07°22'S, 45°04'W, 24 Mar. 1962, fl. and fr., G. Eiten & L.T. Eiten 3767 (US [photo!]).

Taxonomic notes.—*Turnera pumilea* can be recognized by the floriferous leaves usually congested in apical rosettes, homostylous flowers, capsules hirsute only at the apex, and lunate seeds. This combination of traits represents a unique morphological pattern among the species of *Turnera*. Two varieties are considered for *T. pumilea*: *T. pumilea* var. *pumilea* and *T. pumilea* var. *piauhyensis* Urb. Only the typical variety occurs in Maranhão and can be recognized by the homostylous flowers (vs. heterostylous flowers in *T. pumilea* var. *piauhyensis*).

Distribution and habitat.—Widely distributed from Mexico to northern Argentina (Arbo 2008). In Brazil, occurs in almost all regions (except in the south) (Rocha & al. 2023). In Maranhão, it occurs in several types of environments such as dunes, coastal vegetation, savannas and in remnants of the Amazon forest.

Phenology.—Found with flowers and fruits in all year round.

2.11. *Turnera reginae* Arbo, Bonplandia, 14: 156–158. 2005. TYPE: Brazil. Maranhão, Balsas, projeto Geral de Balsas, lote 16, 08°36'S, 46°43'W, 470 m, 9 Nov. 1996, R.C. Oliveira 392 (holotype: CEN; isotype: CTES). Fig. 4a.

Iconography.—Arbo (2005, figs. 19a–f: 157).

Specimens examined.—BRAZIL. **Maranhão:** Mun. Balsas, projeto Geral de Balsas, Lote 16, 08°36'S, 46°43'W, 470 m, 09 Nov. 1996, fl., R.C. Oliveira 392 (HUEFS); ibid., Condomínio Kissy, 08°36'S, 46°43'W, 470 m, 20 Nov. 1995, fl., M.A. Silva & al. 3255 (EAC).

Taxonomic notes.—*Turnera reginae* can be recognized by the leaves without nectaries, corolla orange and foliaceous bracteoles. The species is similar to *Turnera longiflora* Cambess., not occurring in Maranhão, that can be distinguished by leaves with nectaries and the petals red with yellow base

Distribution and habitat.—It is endemic to Brazil, occurring only in Maranhão, Ceará and Piauí (Rocha & al. 2024a). In Maranhão, it is known only from the municipality of Balsas in the savanna, inhabiting sandy soils.

Phenology.—Found with flowers in November.

2.12. *Turnera scabra* Millsp., Publ. Field Columb. Mus., Bot. Ser. 2(1): 77. 1900. Type: Puerto Rico, on sandy spots in dry fields among the foot hills at Bayamon, 11 Jan. 1899, C.F. Millspaugh 323 (holotype: F 0074076F [photo!]). Figs. 4a, 6c.

Specimen examined selected.—BRAZIL. **Maranhão:** Mun. Alcântara, povoado Centro Alegre, 02°33'02.3"S, 44°37'39"W, 26 Aug. 2022, fl. and fr., M.J.C. Silva 392 (SLUI); Mun. Lago Verde, fazenda São Francisco, 04°00'S, 44°56'W, 26 Sep. 1980, fl. and fr., D.C. Daly 279 (INPA).

Taxonomic notes.—*Turnera subulata* can be recognized by the yellow petals with dark yellow base. *Turnera scabra* is similar to and easily confused with *T. subulata*, from which it can be distinguished by the yellow petals with dark yellow base.

Distribution and habitat.—Widely distributed from Mexico to Colombia, Venezuela and the Guianas (Arbo 2005). In

Brazil, it occurs throughout the northern and northeastern region and in the state of Espírito Santo (Rocha & al. 2024a). In Maranhão, it occurs in several types of environments such as dunes, coastal vegetation, savannas, remnants of the Amazon forest and urban areas.

Phenology.—Found with flowers and fruit all year round.

2.13. *Turnera stipularis* Urb., in Urban I., Jahrb. Königl. Bot. Gart. Berlin, 2: 131. 1883. TYPE: Brazil. [Maranhão] “excursion from the Arraial of Carolina to the aldeia of Pinagees at Boa Esperança and at Boa Vista”, 13 May 1829, W.J. Burchell 9072 (holotype: K 000373160 [photo!]). Figs. 4a, 6d–e.

Specimen examined selected.—BRAZIL. **Maranhão**: Mun. Aldeias Altas, povoado Jatobá, 04°38’S, 43°44’W, 05 Feb. 2022, fl. and fr., F.C. Sousa 51 (MAR); Mun. Barra do Corda, povoado Cachoeirinha, 05°08’S, 45°37’W, 2 Mar. 1983, fl. and fr., G. Schatze & al. 821 (US [photo!]); Mun. Carolina, PARNA Chapada das Mesas, 06°09’S, 46°39’W, 19 Apr. 2018, fl. and fr., R.V.C. Saraiva 276 (HUEFS, SLUI).

Taxonomic notes.—*Turnera stipularis* can be recognized by the glabrous calyx, absence of petiolar nectaries, and the well-developed stipules, 3–6 mm long. and the fruit with smooth exocarp. It is similar to *T. kuhlmanniana* Arbo, endemic to Rondônia, that can be differentiated by the flowers with tomentose calyx, and corolla white and exocarp granular.

Distribution and habitat.—Endemic to Brazil, occurring only in Maranhão and Pará (Rocha & al. 2024a; Silva & al. 2023b). In Maranhão, it is known in a few locations in the Cerrado domain, inhabiting clayey soils on river edges and gallery forests.

Phenology.—Found with flowers and fruits from January to April.

2.14. *Turnera subulata* Sm., Rees, Cycl. 36(2): 441. 1817. TYPE: Colombia, s.d., J.C.B. Mutis s.n. (holotype: LINN 384-3 [photo!]). Figs. 4b, 6f–h.

Specimen examined selected.—BRAZIL. **Maranhão**: Mun. Balsas, cachoeira Três Marias, 07°14’18.9’’S, 46°14’51’’W, 22 Feb. 2022, fl. and fr., M.J.C. Silva & al. 501 (MAR, SLUI); Mun. Carolina, Parque Nacional da Chapada das Mesas, sumidouro do rio Farinha, 06°55’54’’S, 47°22’53’’W, 22 Nov. 2021, fl. and fr., M.J.C. Silva 411 (MAR, SLUI); Mun. Fortaleza dos Nogueiras, Parque Estadual do Mirador, 06°49’27’’S, 45°00’12’’W, 18 Sep. 2021, fl. and fr., M.J.C. Silva & al. 330 (MAR); *ibid.*, balneário Recanto das Águias, 06°57’24’’S, 46°00’10’’W, 21 Feb. 2022, fl. and fr., M.J.C. Silva & al. 490 (SLUI); Mun. São Domingos do Azeitão, Parque Estadual do Mirador, 06°42’39’’S, 44°44’27’’W, 17 Sep. 2021, fl. and fr., M.J.C. Silva & al. 323 (MAR).

Taxonomic notes.—It can be recognized mainly by the epiphyllous flowers, with a peduncle that is adnate to petiole, petals cream or yellow, with dark brown base. It can be confused with *Turnera scabra*, though this is differentiated by the yellow petals with a dark yellow base (vs. cream petals, rarely yellow, with a dark brown base in *T. subulata*).

Distribution and habitat.—The species is widely distributed in the Americas, occurring in Panama, Colombia, Venezuela, French Guiana, Ecuador, northern Bolivia and Brazil. It has also been found in Asia and Africa (Arbo 2005). In Brazil, it occurs in most states, except Acre and Roraima (in the North) and all the states in the South (Rocha & al. 2024a). In Maranhão, it occurs in all environments, especially in urban areas.

Phenology.—It flowers and fruits all year round.



Fig. 6. Species of *Turnera* in Maranhão: **a–b**, *T. pumilea*; **c**, *T. scabra*; **d–e**, *T. stipularis*; **f–h**, *T. subulata* [L. Rocha: a, b; M. Silva: c, g, h; A. Ferreira: d, e; L. Marinho: f].

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REFERENCES

- Almeida A.S. & Vieira I.C.G. 2010. Centro de Endemismo Belém: status da vegetação remanescente e desafios para a conservação da biodiversidade e restauração ecológica. *Revista de Estudos Universitários* 36: 95–111.
- Arbo M.M. 1995. Turneraceae. Parte I. *Piriqueta*. *Flora Neotropica* 67: 1–156.
- Arbo M.M. 1997. Estudios sistemáticos en *Turnera* (Turneraceae). I. Series *Salicifoliae* y *Stenodictyae*. *Bonplandia* 9: 151–208.
- Arbo M.M. 2000. Estudios sistemáticos en *Turnera* (Turneraceae). II. Series *Annulares*, *Capitatae*, *Microphyllae* y *Papilliferae*. *Bonplandia* 10: 1–82.
- Arbo M.M. 2005. Estudios sistemáticos en *Turnera* (Turneraceae). III. Series *Anomala* y *Turnera*. *Bonplandia* 14: 115–318.
- Arbo M.M. 2006. Turneraceae. In Barbosa M.R.V., Sothers C., Mayo S., Gamarra-Rojas C.F.L. & Mesquita, A.C. (eds.), *Checklist das plantas do nordeste Brasileiro: angiospermas e gymnospermas*: 150–151. Ministério da Ciência e Tecnologia, Brasília.
- Arbo M.M. 2007. Turneraceae. In Kubitzki K., Rhower J.B. & Bittrich V. (eds.), *The families and genera of vascular plants* 9: 458–466. Springer, Heidelberg.
- Arbo M.M. 2008. Estudios sistemáticos en *Turnera* (Turneraceae). IV. Series *Leiocarpae*, *Conciliatae* y *Sessilifoliae*. *Bonplandia* 17: 107–334.
- Arbo M.M. 2009. Turneraceae. In Cavalcanti T.B. & Batista M.F. (orgs.), *Flora do Distrito Federal, Brasil* 7: 258–312. Embrapa Recursos Genéticos e Biotecnologia, Brasília.
- Arbo M.M. 2013. Turneraceae. In Prata A.P.N., Amaral M.C.E., Farias M.C.V. & Alves, M.V. (orgs.), *Flora de Sergipe* 1: 533–549. Gráfica e Editora Triunfo, Aracajú.
- Arbo M.M. & Mazza S.M. 2011. The major diversity centre for neotropical Turneraceae. *Systematics and Biodiversity* 9: 203–210.
- CRIA. 2005. Geoloc Tool. Website: <https://splink.cria.org.br/geoloc?criaLANG=pt> [accessed: 13 Jul. 2024].
- Cronquist A. 1981. An integrated system of classification of flowering plants. The New York Botanical Garden. *Columbia University Press*, New York. 1261
- Fidalgo O. & Bononi V.L.R. 1989. *Técnicas de coleta, preservação de material botânico*. Instituto de Botânica, São Paulo.
- González A.M. & Arbo M.M. 2004. Trichome complement of *Turnera* and *Piriqueta* (Turneraceae). *Botanical Journal of the Linnean Society* 144: 85–97.
- Harris J.G. & Harris M.W. 2000. *Plant identification terminology: an illustrated glossary*. Spring Lake Publishing, Utah.
- IBGE – Instituto Brasileiro de Geografia e Estatística. 2014. *Censo Demográfico 2010, Resultados do Universo*. Rio de Janeiro.
- Köppen W. 1948. Climatologia: con un estudio de los climas de la tierra. Fondo de Cultura e Economía, Mexico.
- QGIS Development Team. 2024. *QGIS Geographic Information System. Open Source Geospatial Foundation Project*. Website: <http://qgis.osgeo.org> [accessed: 13 Jul. 2024].
- Radford A.E., Dickison W.C., Massey J.R. & Bell C.R. 1974. *Vascular plant systematics*. Harper & Row Publishers, New York.
- Rocha L., Melo J.I.M. & Camacho R.G.V. 2012. Flora do Rio Grande do Norte, Brasil: Turneraceae Kunth ex DC. *Rodriguésia* 63: 1085–1099.
- Rocha L. & Rapini A.B. 2016. Flora da Bahia: Turneraceae. *Sitientibus série Ciências Biológicas* 15: 1–72.
- Rocha L., Camacho R.G.V., Sales M.F. & Melo J.I.M. 2017. Flora da Região de Xingó, Alagoas e Sergipe (Brasil): Turneraceae. *Rodriguesia* 68: 569–579.
- Rocha L., Nogueira J.W.A., Figueiredo M.F. & Loiola M.I.B. 2018. Flora do Ceará: Turneraceae. *Rodriguésia* 69: 1673–1700.
- Rocha L., Ribeiro P.L., Endress P.K. & Rapini A. 2019a. A brainstorm on the systematics of *Turnera* (Turneraceae, Malpighiales) caused by insights from molecular phylogenetics and morphological evolution. *Molecular Phylogenetics and Evolution* 137: 44–63.
- Rocha L., Cabreira T.N. & Moreira H.J.C. 2019b. *Turneraceae of Brazil*. *Chicago: Field Museum*, 1169: 9. Website: <https://fieldguides.fieldmuseum.org/guides/guide/1169> [accessed: 15 Apr. 2025].
- Rocha L., Ribeiro P.L. & Rapini A. 2020. A lineage-based infrageneric classification of *Turnera* (Turneraceae). *Taxon* 69: 290–306.
- Rocha L., Zelenski A. & Arbo M.M. 2024a. *Turneraceae in Flora e Funga do Brasil*. *Jardim Botânico do Rio de Janeiro*. Website: <https://floradobrasil.jbrj.gov.br/FB240> [accessed: 13 Jul. 2024].
- Rocha L., Arbo M.M., Antar G.M. & Batista F.R.C. 2024b. *Piriqueta velutina* (Turneraceae, Passifloraceae s.l.): a new endangered species from the Brazilian Cerrado. *Kew Bulletin* 79: 251–256.
- Silva M.J.C., Rocha L. & Marinho L.C. 2023a. *Turnera carolina* (Turneraceae, Passifloraceae s.l.): A new species from Maranhão, Northeastern Brazil. *Systematic Botany* 48: 300–306.
- Silva M.J.C., Rocha L. & Marinho L.C. 2023b. A new record of *Turnera stipularis* in Amazonia can lead to a misinterpretation of the status conservation. *Oryx* 57: 286.
- SUDENE. 1986. *Levantamento exploratório - reconhecimento de solos do Estado do Maranhão* vol. 1. Embrapa-SNLCS/SUDENE-DRN: Rio de Janeiro.
- Thiers B. 2024 [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Website: <http://sweetgum.nybg.org/science/ih/> [accessed: 13 Jul. 2024].
- Thulin M., Razafimandimbison S.G., Chafe P., Heidari N., Kool A. & Shore J.S. 2012. Phylogeny of the Turneraceae clade (Passifloraceae s.l.):

Trans-Atlantic disjunctions and two new genera in Africa. *Taxon* 61: 308–323.

Tokuoka T. 2012. Molecular phylogenetic analysis of Passifloraceae sensu lato (Malpighiales) based on plastid and nuclear DNA sequences. *Journal of Plant Research* 125: 489–497.

Zelenski A. & Louzada R. 2019. The genera *Turnera* and *Piriqueta* (Passifloraceae sensu lato) in the state of Pernambuco, Brazil. *Rodriguésia* 70: e04152017.

Zelenski A., Rocha L. & Louzada R. 2016. Rediscovery of *Turnera pernambucensis* (Passifloraceae s.l.) in the northern Atlantic Forest and an update for its description. *Phytotaxa* 286: 177–185.