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The genera *Turnera* and *Piriqueta* (Passifloraceae *sensu lato*) in the state of Pernambuco, Brazil

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Abstract

A taxonomic treatment of the genera *Turnera* and *Piriqueta* in the state of Pernambuco, northeastern Brazil, is presented. Fourteen species of *Turnera* and six species of *Piriqueta* were found in the Atlantic Forest and *Caatinga*, of which nine are endemic to Brazil. *Turnera pernambucensis* is threatened and restricted to the Atlantic Forest of Pernambuco, while *T. joelii* is a new record for the state. The species predominate in steppe savanna and semideciduous seasonal forest, but several of them grow naturally in anthropized areas. Catimbau National Park is the locality with the highest species richness. *Tristylis* is recorded for the first time in *Piriqueta guianensis*. Identification keys, descriptions, illustrations, distribution maps, and comments about habitat, flowering, fruiting, and morphological relationships are provided.

Key words: Caatinga, flora, Malpighiales, taxonomy, Turneraceae.

Resumo

É apresentado um tratamento taxonômico dos gêneros *Turnera* e *Piriqueta* no estado de Pernambuco, nordeste do Brasil. Quatorze espécies de *Turnera* e seis espécies de *Piriqueta* foram encontradas na Floresta Atlântica e Caatinga, das quais nove são endêmicas do Brasil. *Turnera pernambucensis* é ameaçada e restrita à Floresta Atlântica de Pernambuco, enquanto *T. joelii* é um novo registro para o estado. As espécies predominam na savana estépica e floresta estacional semidecidual, mas várias crescem naturalmente em áreas antropizadas. O Parque Nacional do Catimbau é a localidade com a maior riqueza de espécies. *Tristylis* é registrada pela primeira vez em *Piriqueta guianensis*. São fornecidas chaves de identificação, descrições, ilustrações, mapas de distribuição e comentários sobre habitats, floração, frutificação e relações morfológicas.

Palavras-chave: Caatinga, flora, Malpighiales, taxonomia, Turneraceae.

Introduction

Turnera L. and *Piriqueta* Aubl. are the only genera of the former Turneraceae Kunth *ex* DC. (Passifloraceae *sensu lato* according to APG IV 2016) that occur in Brazil. *Turnera* comprises 143 species (Arbo *et al.* 2015) disjunctly distributed in America and Africa, although its greatest diversity is found in tropical South America (Thulin *et al.* 2012). *Piriqueta* is an essentially Neotropical genus with 46 species distributed from the southern United States to northern Argentina and Uruguay (Thulin *et al.* 2012; Cabreira *et al.* 2015). Both genera have centers of diversity in Brazil (Arbo & Mazza 2011), where 120 native species of *Turnera* and 39 of *Piriqueta* occur (Arbo 2015; BFG 2018;

Cabreira *et al.* 2015). The Brazilian Northeast region is particularly rich in terms of diversity, especially the state of Bahia (Rocha & Rapini 2016). In the state of Pernambuco 13 species of *Turnera* and six of *Piriqueta* were recorded in the Lista de Espécies da Flora do Brasil (BFG 2018).

According to the Virtual Herbarium of Plants and Fungi (2015), most specimens of *Turnera* and *Piriqueta* from Pernambuco were collected in only five localities and there are collection gaps in many regions. Moreover, the genera are poorly represented in regional floristic and phytosociological surveys and sometimes the identification does not reach the species level or it needs revision, as in Rodal & Nascimento

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(2002), Gomes *et al.* (2006) and Gomes *et al.* (2011). Taxonomic studies involving the species occurring in Pernambuco are restricted to the Flora of Mirandiba (Agra *et al.* 2009), which includes a few species. The existence of taxonomic complexes in both genera also make species identification difficult.

Considering these points, this study provides a taxonomic treatment of the genera *Turnera* and *Piriqueta* from the state of Pernambuco, including identification keys, morphological descriptions, illustrations, geographical distribution maps, and information about morphological relationships, habitat, timing of flowering, and fruiting. Thus, it is expected to contribute to the recognition of the species in areas of the *Caatinga* and Atlantic Forest of Pernambuco and to expand knowledge about these genera in northeastern Brazil.

Materials and Methods

The state of Pernambuco spans 98,076,109 km² and is located in northeastern Brazil (IBGE 2015). The relief is predominantly flat, including lowlands along the Atlantic Coast and along the São Francisco River in the west (the Sertaneja Depression) separated by upland plateaus in the central (the Borborema Plateau) and northwest (the Chapada of Araripe) portions of the state (Ferreira *et al.* 2014). The dominant climates are Tropical Monsoon (Am *sensu* Köppen's climate) in a narrow band along the coast, Tropical with dry summer (As) just inland from the coast toward the central region of the state and Semi-arid (BSh) throughout the western region, forming strong rainfall gradients east to west, from 2,200 to 400 mm (Alvares *et al.* 2013). The vegetation comprises the Atlantic Forest and *Caatinga* phytogeographical domains, ranging from *restinga*, dense ombrophilous forest, open ombrophilous forest, and semideciduous seasonal forest in the east to steppe savanna in the west (adapted from IBGE 2012).

Fieldwork was conducted monthly from March 2015 to April 2016, including areas with different vegetation types found within conservation units or outside of them. A total of 14 areas were sampled, of which 10 are protected within conservation units. The collected specimens were processed according to the usual techniques in taxonomy (Mori *et al.* 1989) and deposited at UFP herbarium, with duplicates sent to RB and K herbaria (acronyms according to Thiers, continuously updated). The study also included an analysis of the previously collected specimens from

the study area and deposited at ASE, HST (Herbário Sérgio Tavares), HTSA (Herbário do Trópico Semi-Árido), HVASF, INPA, IPA, JPB, MAC, MBM, PEUFR, RB, UB, UEC, UFP, and UFRN herbaria. Altogether 15 species were collected during the fieldwork and 573 vouchers were analysed for taxonomic treatment.

Morphological analyses were conducted under a stereomicroscope from specimens either dried or conserved in 70% ethanol. For taxonomic identification, protocols, revisions (Arbo 1995, 2000, 2005, 2008), and images from type specimens available online were consulted. Morphological terminology follows Radford *et al.* (1974) and Arbo (1995, 2000, 2005, 2008), while Harris & Harris (2001) was used for indument characterization. Descriptions were based on specimens from the state of Pernambuco and supplemented with additional material when available. Data about geographic distribution, habitat and timing of flowering and fruiting were obtained from field observations, herbarium labels and literature. The vegetation types were standardized according to IBGE (2012, adapted) and checked in the Mapa de Vegetação do Brasil (IBGE 2004) when lacking. Distribution maps were generated using the SimpleMapp software (Shorthouse 2017). Illustrations were made from the examined material.

Results and Discussion

The genus *Turnera* is represented in Pernambuco by 14 species and *Piriqueta* by six species. Nine species (45%) are endemic to Brazil, of which *Turnera pernambucensis* Urb. is restricted to Pernambuco and has recently been rediscovered (Zelenski *et al.* 2016). *Turnera joelii* is recorded for the first time in the state.

Species of both genera occur in the Atlantic Forest and *Caatinga* areas. Most species of *Turnera* (12) grow in the *Caatinga*, of which six are found only in this domain, while *T. annularis* Urb. and *T. pernambucensis* are exclusive to the Atlantic Forest; these phytogeographical domains share six species. In relation to *Piriqueta*, all species occur in the *Caatinga*, of which *P. cistoides* (L.) Griseb., *P. duarteana* (A. St.-Hil., A. Juss. & Cambess.) Urb., and *P. sidifolia* (A. St.-Hil., A. Juss. & Cambess.) Urb. are exclusive to that domain.

The species predominate in seasonal vegetation types, such as steppe savanna with 18 species and semideciduous seasonal forest with 10 species, but there are also representatives in

ombrophilous forest (5 spp.) and *restinga* (3 spp.). Thirteen species grow naturally in anthropized areas, of which *T. subulata* Sm., *T. chamaedrifolia* Cambess., and *P. racemosa* (Jacq.) Sweet are the most common. A significant number of species (11) were found on soil islands accumulated on crystalline or sandstone rock outcrops.

The highest species richness was recorded in the Catimbau National Park, a protected area of sedimentary *Caatinga* located in central Pernambuco, where six species of *Turnera* and three of *Piriqueta* occur. Some species, such as *P. sidifolia*, *T. cearensis* Urb., and *T. hermannioides* Cambess. exhibit large populations in this area. *Turnera coerulea* Moç. & Sessé ex DC. was recorded only in one locality within the study area, despite its wide Neotropical distribution. Most species (85%) have populations protected within federal, state, or private conservation units in Pernambuco, except *T. annularis*, *T. blanchetiana*

Urb., and *T. joelii* Arbo. Only *T. pernambucensis* was evaluated in terms of conservation status and categorized as Critically Endangered (Zelenski *et al.* 2016), all other species have not yet been assessed.

The most relevant morphological characters to distinguish species of *Turnera* were the trichomes types, bracteoles shapes, corollas colors, and seeds shapes. For species of *Piriqueta*, the trichomes and inflorescence types were especially useful. Heterostyly with two floral morphs, brevistylous and longistylous, is found in 75% of species, while four species (20%) are tristylous with homostylous, brevistylous and longistylous flowers. Only *P. viscosa* Griseb. is homostylous. Tristyly is described for the first time in a population of *P. guianensis* N.E. Br. found in Catimbau National Park.

Taxonomic treatment

Identification key to the genera *Turnera* and *Piriqueta* in the state of Pernambuco

1. Plants bearing porrect-stellate non-glandular trichomes; bracteoles absent or inconspicuous; flowers with a membranaceous corona inserted at the throat of perianth tube.....*Piriqueta*
- 1'. Plants lacking porrect-stellate non-glandular trichomes; bracteoles conspicuous; flowers without a corona..... *Turnera*

Piriqueta Aubl., Hist. Pl. Guiane 1: 298-300. 1775.

Herbs to shrubs, covered with simple, stellate and porrect-stellate non-glandular trichomes and setiform glandular trichomes (except *P. cistoides* and *P. racemosa*). Leaves alternate, simple, exstipulate, sessile or petiolate, pinnately veined, without nectaries. Flowers solitary or gathered in racemes or cymes, axillary or terminal, actinomorphic, bisexual, homostylous or heterostylous; bracts absent; floral peduncles developed, free; bracteoles absent, inconspicuous or replaced by minute colleters; pedicels developed, articulate on floral peduncle; calyces campanulate, sepals 5, partially

connate and adnate to the petal claws forming perianth tube; corollas apopetalous, contorted, petals 5, unguiculate; coronas membranous, fringed, inserted at the throat on sepals and petals; stamens 5; filaments free, shortly adnate to the perianth tube; anthers dorsifixed; ovaries superior, tricarpellate, unilocular, placentation parietal; styles 3, distinct; stigmas penicillate. Capsules loculicidal, 3-valved, spheroid or ovoid, smooth, granulate, verrucose or tuberculate. Seeds obovoid, straight or curved, reticulate, smooth or papillose; chalazas rounded or concave, not prominent; arils fleshy.

Identification key to the species of *Piriqueta* in the state of Pernambuco

1. Plants bearing setiform glandular trichomes; capsules with granulate, verrucose or tuberculate surface.
 2. Flowers in cincinni.....5. *Piriqueta sidifolia*
 - 2'. Flowers solitary.
 3. Leaves with pauciradiate, porrect-stellate trichomes; corollas 5–9 mm long.....
 -6. *Piriqueta viscosa*

- 3'. Leaves with multiradiate, porrect-stellate trichomes; corollas 10–30 mm long.
4. Capsules with setiform glandular trichomes blackish at the base.....2. *Piriqueta duarteana*
- 4'. Capsules with setiform glandular trichomes hyaline at the base or only with simple trichomes.....3. *Piriqueta guianensis*
- 1'. Plants lacking setiform glandular trichomes; capsules with a smooth surface.
5. Flowers in terminal racemes, sometimes with basal solitary flowers; seeds strongly curved with prominent reticulum nodes..... 4. *Piriqueta racemosa*
- 5'. Flowers solitary, axillary; seeds straight or slightly curved without prominent reticulum nodes...
..... 1. *Piriqueta cistoides*

1. *Piriqueta cistoides* (L.) Griseb., Fl. Brit. W.I. 298. 1864.

Figs. 1a-b; 5a; 6a

Herbs or subshrubs, 35–60 cm tall; branches covered by simple and multiradiate, porrect-stellate trichomes. Leaves papyraceous, discoloured; petioles absent to 3 mm long; blades 7.5–41 × 2–13 mm, narrowly elliptical or lanceolate, bases rounded, cuneate or truncate, margins entire, crenate or serrate, slightly revolute, apices acute, secondary veins 3–7 pairs, adaxial surfaces with sparse or dense stellate and porrect-stellate trichomes throughout blade, abaxial surfaces with dense stellate trichomes on the blade and porrect-stellate trichomes on the veins. Flowers solitary, axillary, heterostylous; floral peduncles 7–10 mm long; bracteoles absent; pedicels 1–4 mm long; calyces 6–8 mm long, tubes 2–3.5 mm long; corollas 8–11.2 mm long, yellowish; coronas yellow; stamens 0.5–0.8 mm long adnate to tube; filaments 3–5 mm long in longistylous flowers, 5.5–9 mm long in brevistylous flowers; anthers 1.4–1.8 mm long; ovaries 1.9–2 mm long; styles 3.5–6 mm long in longistylous flowers, 1–3 mm long in brevistylous flowers; stigmas 0.5–0.6 mm long. Capsules 4–7 × 3.5–5 mm, surfaces smooth, with simple trichomes. Seeds 1.5–2 × 0.9–1.2 mm, straight or slightly curved, reticulate with reticulum nodes not prominent; chalazas rounded.

Selected specimens: margem do Rio São Francisco, na passagem para Santo Antônio da Glória, 09.V.1950, fl. e fr., *D. Andrade-Lima 546* (IPA). Belém de São Francisco, Ilha do Meio, 18.VII.1967, fl. e fr., *E.C. Tenório 315* (IPA, PEUFR). Cabrobó, 16.II.2012, fl. e fr., *V.M. Cotarelli et al. 1324* (HVASF). Petrolina, 5 km norte do Centro de Pesquisa Agropecuária do Trópico Semi-Árido (CPATSA), 11.VIII.1983, fl. e fr., *G. Fotius 3541* (HTSA, IPA); Rio São Francisco, ilha do Rodeadouro, 22.X.2011, fl. e fr., *A.J.S. Santos et al. 52* (HVASF).

Widely distributed in America, from the United States to Argentina (Arbo 1995). It has been recorded in northern, northeastern, central-western and southeastern Brazil and the state of Paraná

(Arbo 1995; BFG 2018). In Pernambuco, it grows in steppe savanna within *Caatinga*, on sandy, clay or rocky soils, between 300–386 m elevation. This species occurs in anthropized areas, but is also found in open areas of natural vegetation, rock outcrops, floodplains and along river margins. *Piriqueta cistoides* is morphologically variable and related to *P. racemosa*, but can be distinguished by its solitary flowers (*vs.* racemes) and straight or slightly curved seeds with reticulum nodes not prominent (*vs.* curved seeds with prominent nodes). Flowering and fruiting in January to October.

2. *Piriqueta duarteana* (A. St.-Hil., A. Juss. & Cambess.) Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 66. 1883.

Figs. 1c-d; 5b-d; 6a

Herbs or shrubs, 0.2–1.5 m tall; branches covered with simple and multiradiate, porrect-stellate trichomes and setiform glandular trichomes. Leaves chartaceous, discoloured; petioles 1.5–11 mm long; blades 9–40 × 8–30 mm, elliptical, ovate or widely ovate, bases rounded, cuneate or attenuate, margins crenate or serrulate, plane or slightly revolute, apices acute or obtuse, secondary veins 4–7 pairs, adaxial surfaces with stellate and porrect-stellate trichomes throughout blade and usually setiform trichomes on the margins, abaxial surfaces with stellate trichomes throughout blade and porrect-stellate, setiform trichomes on the veins. Flowers solitary, axillary, heterostylous; floral peduncles 1–8 mm long; bracteoles absent; pedicels 2–8.5 mm long; calyces 9–16 mm long, tubes 2–3 mm long; corollas 18–23 mm long, pinkish with purple veins and throat; coronas purple; stamens 0.5–1 mm long adnate to tube; filaments 4–4.2 mm long in longistylous flowers, 6–7 mm long in brevistylous flowers; anthers 1.5–2.2 mm long; ovaries ca. 2 mm long; styles 4–5 mm long in longistylous flowers, 2–2.5 mm long in brevistylous flowers; stigmas 0.5–1 mm long. Capsules 3–8 × 4–8 mm, surfaces tuberculate,

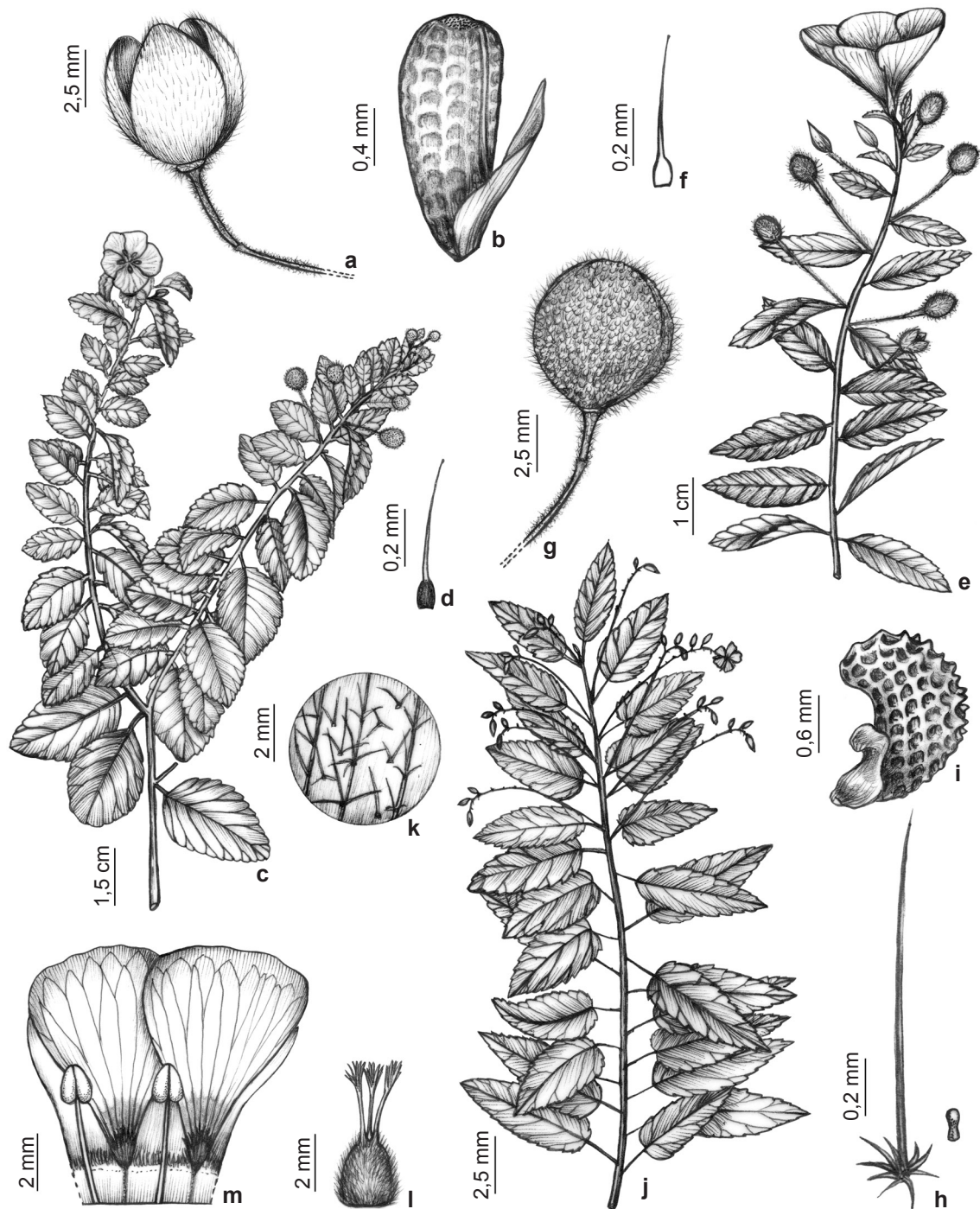


Figure 1 – a-b. *Piriqueta cystoides* – a. open capsule; b. seed, rapheal view. c-d. *Piriqueta duarteana* – c. flowering branch; d. setiform glandular trichome with blackish base. e-g. *Piriqueta guianensis* – e. flowering branch; f. setiform glandular trichome; g. capsule unopened. h-i. *Piriqueta racemosa* – h. microcapitate glandular trichome (right) and porrect-stellate trichome (left); i. seed, side view. j. *Piriqueta sidifolia* – flowering branch. k-m. *Piriqueta viscosa* – k. detail of indument on adaxial surface leaf; l. gynoecium of homostylous flower; m. inner portion of perianth showing corona.

with setiform glandular trichomes of blackish base. Seeds $2.5\text{--}2.9 \times 0.8\text{--}1$ mm, straight or slightly curved, reticulate with reticulum nodes not prominent; chalazas rounded.

Selected specimens: Buíque, Catimbau, 11.VI.1997, fl. e fr., *A.S. Damião et al.* (HST 10104). Petrolândia, margem da BR-316, 29.IV.2015, fl. e fr., *A. Zelenski et al.* 58 (UFP). Petrolina, Fazenda Experimental da UNIVASF, 25.II.2006, fl. e fr., *J.A. Siqueira-Filho et al.* 1552 (HVASF; RB); próximo ao Restaurante Universitário, 18.V.2011, fl. e fr., *F.C. Alencar et al.* 08 (HVASF); próximo à CEMA-Fauna, 17.V.2016, fl. e fr., *A. Zelenski* 188 (UFP).

Endemic to Brazil and widely distributed in the Northeast region plus the states of Pará, Tocantins, Mato Grosso, Goiás, and Minas Gerais (Arbo 1995; BFG 2018). In Pernambuco, it grows in steppe savanna, usually on sandy or clay soils, at 300–395 m elevation. This species has been collected as often in open areas of natural vegetation as in anthropized areas. *Piriqueta duarteana* can be differentiated from *P. guianensis* by its fruits having setiform glandular trichomes with a blackish base (vs. hyaline base). Both species belong to the *Piriqueta duarteana* complex that includes 10 species distributed through the Central and South America, which share a habit similar, glandular trichomes (except *P. venezuelana* Arbo and some specimens of *P. guianensis*), often solitary pinkish flowers, calyx with pilose lobes on the sides of the midrib, granulate or tuberculate capsules, and papillose seeds (except *P. dentata* Arbo) (Arbo 1995). Flowering and fruiting in January to November, but most specimens were collected in April and May.

3. *Piriqueta guianensis* N.E. Br., Trans. Linn. Soc. London, Bot. 6(1): 30. 1901. Figs. 1e-g; 5e; 6b

Herbs or shrubs, 15–60 cm tall; branches covered with simple, stellate and porrect-stellate trichomes and setiform glandular trichomes. Leaves chartaceous, slightly discoloured; petioles 1–6 mm long; blades $12\text{--}38 \times 5\text{--}18$ mm, elliptical, narrowly elliptical, ovate or lanceolate, bases rounded or cuneate, margins crenate or serrulate, plane or slightly revolute, apices acute or obtuse, secondary veins 4–7 pairs, adaxial surfaces with stellate and porrect-stellate trichomes throughout blade and setiform glandular trichomes on the margins, abaxial surfaces with stellate trichomes throughout blade and porrect-stellate trichomes on the veins. Flowers solitary, axillary, heterostylous; floral peduncles 4–20 mm long; bracteoles absent; pedicels 1–7 mm long; calyces 6–14 mm long, tubes

1–3.5 mm long; corollas 10–30 mm long, pinkish with purple veins and throat; coronas purple; stamens 0.5–1 mm long adnate to tube; filaments 3–5 mm long in longistylous flowers, 5–7 mm long in brevistylous flowers; anthers 1.5–2.2 mm long; ovaries 2–3 mm long; styles 4–5 mm long in longistylous flowers, 0.7–2 mm long in brevistylous flowers; stigmas 0.5–1.5 mm long. Capsules 4–7 × 4–7 mm, surfaces tuberculate, with simple and setiform glandular trichomes of hyaline base or only with simple trichomes. Seeds $2\text{--}2.5 \times 0.7\text{--}1$ mm, straight or slightly curved, reticulate with reticulum nodes not prominent; chalazas rounded.

Selected specimens: Buíque, Parque Nacional do Catimbau, Igrejinha, 21.I.2016, fl. e fr., *A. Zelenski et al.* 171 (UFP). Petrolina, Fazenda Experimental da UNIVASF, 03.II.2009, fl. e fr., *M.M. Coelho* 106 (HVASF, IPA); UNIVASF, próximo à caixa d'água, 17.V.2016, fl. e fr., *A. Zelenski* 190 (UFP). Salgueiro, 10.IV.2011, fl. e fr., *M.V. Meiado et al.* 598 (HVASF). Santa Maria da Boa Vista, Ilha de Inhanhuns, 15.IV.2008, fl. e fr., *M. Oliveira* 3401 (UFP). Serrita, acesso à Floresta Nacional (FLONA) de Negreiros, 15.III.2016, fl., *A. Zelenski* 181 (UFP). Triunfo, Pico do Papagaio, 05.VI.2015, fl. e fr., *D.S. Lucena et al.* 690 (UFP).

Disjunctly distributed in Guyana and Brazil, occurring in the Northeast region and state of Roraima (Arbo 1995; BFG 2018). In Pernambuco, the species can be found in semideciduous seasonal forest and steppe savanna, on sandy, clay or rocky soils, at 353–1,200 m elevation. This species is common in open areas of natural vegetation, rock outcrops, near rivers, small lakes or streams, and anthropized areas. *Piriqueta guianensis* belongs to the *P. duarteana* complex and it can be differentiated from *P. duarteana* by its fruits with setiform glandular trichomes of light bases (vs. blackish base). The color of flowers has been variably described on herbaria labels as white, lilac, pink, salmon, yellowish or orange. In Catimbau National Park a population was found with trimorphic flowers, i.e. brevistylous, longistylous and homostylous flowers. Homostylous flowers have also been observed in *D.S. Lucena et al.* 690. Flowering and fruiting in January to November.

4. *Piriqueta racemosa* (Jacq.) Sweet, Hort. Brit. 1: 154. 1826. Figs. 1h-i; 5f; 6b

Herbs or subshrubs, 20–70 cm tall; branches covered with simple and porrect-stellate trichomes and microcapitate glandular trichomes. Leaves papyraceous or chartaceous, discoloured; petioles absent or to 14 mm long; blades $6.5\text{--}65 \times 2\text{--}35$ mm, elliptical or ovate, bases rounded or cuneate,

margins crenate or serrulate, plane, apices acute or obtuse, secondary veins 4–9 pairs, adaxial surfaces with dense stellate and porrect-stellate trichomes throughout blade, abaxial surfaces with dense stellate and porrect-stellate trichomes throughout blade and microcapitate trichomes usually near the margins. Inflorescences in racemes, terminal, sometimes with basal solitary flowers. Flowers homostylous or heterostylous; floral peduncles 6–40 mm long; bracteoles absent; pedicels 2–5.5 mm long; calyces 4.5–8 mm long, tubes 1.5–3 mm long; corollas 5–12 mm long, yellow; coronas yellow; stamens 0.7–1 mm long adnate to tube; filaments 2–3 mm long in longistylous flowers, 4–5 mm long in brevistylous flowers; anthers 1.3–2 mm long; ovaries 1.9–3 mm long; styles 2.7–3 mm long in longistylous flowers, 1–1.5 mm long in brevistylous flowers; stigmas 0.6–1 mm long. Capsules 3.5–9 × 4–8 mm, surfaces smooth, with simple trichomes. Seeds 1.5–2.2 × 0.7–1 mm, strongly curved, reticulate with reticulum nodes prominent; chalazas rounded.

Selected specimens: Arcoverde, km 80 da BR-232, entrada da cidade, 28.VI.2015, fl. e fr., *A. Zelenski et al.* 50 (UFP). Barreiros, margem da rodovia PE-60, 14.VI.2015, fl. e fr., *A. Zelenski* 20 (UFP). Jaqueira, RPPN Frei caneca, Mata do Quengo, 27.VIII.2015, fl. e fr., *A. Zelenski et al.* 106 (UFP). Pesqueira, aldeia Santana, faz. Maravilha, 28.VI.2015, fl. e fr., *A. Zelenski et al.* 45 (UFP). São José da Coroa Grande, Reserva do Una, 14.VI.2015, fl. e fr., *A. Zelenski* 23 (UFP).

Disjunctly distributed in the Caribbean islands, Venezuela, Colombia, Brazil, and Paraguay (Arbo 1995). It occurs in northeastern Brazil and the states of Minas Gerais, Espírito Santo, and Rio de Janeiro (Arbo 1995; BFG 2018). This species inhabits *restinga*, ombrophilous forest, semideciduous seasonal forest, and steppe savanna of Pernambuco, on several soil types, at 16–915 m elevation. It is very common in anthropized areas, but also grows in open areas of preserved vegetation, forest edges, rock outcrops, and along river margins. *Piriqueta racemosa* shares with *P. cistoides* the absence of setiform glandular trichomes, small yellowish flowers (5–12 mm long) and smooth capsules. However, *P. racemosa* is characterized by its racemes sometimes with basal solitary flowers (*vs.* only solitary flowers), and markedly curved seeds with reticulum nodes prominent (*vs.* straight or slightly curved seeds with nodes not prominent). There is variation in the color of flowers according to herbaria labels, which have been reported as orange, yellow or white. Flowering and fruiting throughout the year.

5. *Piriqueta sidifolia* (A. St.-Hil., A. Juss. & Cambess.) Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 61. 1883. Figs. 1j; 5g; 6c

Subshrubs or shrubs, 0.3–2 m tall; branches covered with simple, stellate and porrect-stellate trichomes and setiform glandular trichomes. Leaves chartaceous, discolorous; petioles (5–)10–26 mm long; blades 14–74 × 8–40 mm, elliptical, ovate or lanceolate, bases rounded or cordate, margins crenate, serrulate or serrate, slightly revolute, apices acute or obtuse, secondary veins 5–7 pairs, adaxial surfaces with dense porrect-stellate trichomes throughout blade and setiform glandular trichomes on the margins, abaxial surfaces with dense stellate trichomes throughout blade and porrect-stellate, setiform trichomes on the veins. Inflorescences in cincinni, axillary. Flowers heterostylous; floral peduncles 10–25 mm long; bracteoles 0.5–2 mm long; pedicels 1.5–9 mm long; calyces 8.5–10 mm long, tubes 1.5–3 mm long; corollas 10–16 mm long, yellow; corona yellow; stamens 0.5–1 mm long adnate to tube; filaments 3–3.5 mm long in longistylous flowers, 4–5 mm long in brevistylous flowers; anthers 1.7–3.5 mm long; ovaries 1.2–2 mm long; styles 3.7–4.5 mm long in longistylous flowers, 1–1.5 mm long in brevistylous flowers; stigmas 0.4–0.5 mm long. Capsules 3.5–7 × 4–7.5 mm, surfaces verrucose, with simple and setiform trichomes of hyaline base. Seeds 2.5–3 × 1.2–1.5 mm, straight or slightly curved, reticulate with reticulum nodes not prominent; chalazas concave.

Selected specimens: Buíque, Vale do Catimbau, 11.IV.2010, fl., *J.S. Silva* 77 (IPA); Pedra do Camelo, 19.I.2016, fl. e fr., *A. Zelenski et al.* 157 (UFP); Igrejinha, 21.I.2016, fl. e fr., *A. Zelenski et al.* 175 (UFP). Ibirimir, 22.I.2013, fl., *V.M. Cotarelli et al.* 2357 (HVASF). Inajá, Sítio Mangue, 26.II.2012, fl., *J.E. Fagundes et al.* 78 (HVASF).

Endemic to Brazil and widely distributed in the Northeast region and the states of Tocantins, Goiás, Distrito Federal, Mato Grosso do Sul, Minas Gerais, Rio de Janeiro, and Rio Grande do Sul (Arbo 1995; BFG 2018). It grows in steppe savanna of Pernambuco, on sandy or rocky soils, at 112–917 m elevation. This species was collected in open areas, *carrasco* and rock outcrops. *Piriqueta sidifolia* is easily distinguished from other species in Pernambuco by its elongated petioles (10–26 mm long), leaves usually ovate or lanceolate and cymose inflorescences. Flowering and fruiting in December to September, but most specimens were collected in January.

6. *Piriqueta viscosa* Griseb., Cat. Pl. Cub. 114. 1866. Figs. 1k-m; 5h; 6c

Herbs, 10–60 cm tall; branches covered with simple trichomes and porrect-stellate trichomes usually reduced to a central arm, and setiform glandular trichomes. Leaves papyraceous, concolorous or slight discolorous; petioles 2–9 mm long; blades 15–55 × 4–20 mm, elliptical or narrowly elliptical, bases cuneate or attenuate, margins crenate or serrate, plane, apices acute, secondary veins 6–9 pairs, adaxial and abaxial surfaces with sparse or dense setiform glandular trichomes and pauciradiate, porrect-stellate trichomes with 2–5(–7) arms scattered throughout blade. Flowers solitary, axillary, homostylous; floral peduncles 6–46 mm long; bracteoles absent; pedicels 1.5–5 mm long; calyces 4–8 mm long, tubes 1–2 mm long; corollas 5–9 mm long, pink with purple veins and basal spot; coronas purple; stamens ca. 0.5 mm long adnate to tube; filaments 2–4 mm long; anthers 1–1.4 mm long; ovaries ca. 2 mm long; styles 1.2–3 mm long; stigmas 0.5–1 mm long. Capsules 4–6.5 × 3.5–6.5 mm, surfaces granulate, with simple and setiform trichomes of hyaline base. Seeds 1.8–2 × 0.6–1.8 mm, straight or slight curved, reticulate with reticulum nodes not prominent; chalazas rounded.

Selected specimens: Catende, Pedra do Trevo, 28.II.2008, fl. e fr., *M.S. Leite et al. 648* (RB, UFP). Flores, 16.III.2016, fl., *A. Zelenski 182* (UFP). Petrolina, CPATSA, 19.IV.2004, fl. e fr., *S.A.O. Souza* (HTSA 2435); UNIVASF, 11.III.2009, fl. e fr., *M.M. Coelho et al. 122* (HVASF, IPA). Salgueiro, estrada para Serra de Monte Santo, 19.I.2010, fl. e fr., *D. Araújo et al. 1110* (HVASF). Serrita, Flona Negreiros, 29.I.2013, fl. e fr., *R.A. Silva 2531* (HVASF).

Widely distributed in Central America and tropical South America, from Guatemala and Belize to Bolivia and central Brazil (Arbo 1995). It occurs in ombrophilous forest, semideciduous seasonal forest and steppe savanna of Pernambuco, usually on sandy soils, at 85–515 m elevation. This species

was collected in open areas of natural vegetation, rock outcrops and forest edge. *Piriqueta viscosa* is easily distinguished from the other species by its porrect-stellate trichomes reduced to a single, central arm present in the branches, leaves with pauciradiate, porrect-stellate trichomes (2–5 arms) and small homostylous flowers (5–9 mm long). The flowers were described as white in *M.S. Leite et al. 648* and *D. Araújo et al. 1110*. Flowering and fruiting in January to June, but most specimens were collected in March and April. The common name is *bolinha*.

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

Herbs or shrubs, covered with simple or stellate non-glandular trichomes and often microcapitate, sessile-capitate, stipitate-capitate or clavate glandular trichomes. Leaves alternate, simple, exstipulate or stipulate, sessile or petiolate, pinnately veined, usually with nectaries. Flowers solitary or gathered in racemes or capituliform inflorescences, axillary or terminal, actinomorphic, bisexual, homostylous or heterostylous; bracts absent or developed; floral peduncles developed (except in *T. blanchetiana*), free or adnate to petiole; bracteoles 2, conspicuous, persistent; pedicels absent; calyces campanulate or infundibuliform, sepals 5, partially connate and adnate to the petal claws forming perianth tube; corollas apetalous, contorted, petals 5, unguiculate; coronas absent; stamens 5; filaments free or partially connate, barely adnate to perianth tube at the base or marginally adnate to tube up to the throat, forming nectariferous pockets; anthers dorsifixed; ovaries superior, tricarpeolate, unilocular, placentation parietal; styles 3, distinct; stigmas penicillate. Capsules loculicidal, 3-valved, spheroid, ellipsoid or ovoid, smooth, granulate or verrucose. Seeds obovoid, straight or curved, reticulate or striate-reticulate, smooth or papillose; chalazas rounded, concave or conical, prominent or not; arils fleshy.

Identification key to the species of *Turnera* in the state of Pernambuco

1. Leaves with nectaries.
 2. Stamens free and adnate to the perianth tube only at the base.
 3. Leaves stipulate with entire or serrulate margins..... 17. *Turnera pernambucensis*
 - 3'. Leaves exstipulate with crenate or serrate margins.
 4. Capsules glabrous, except at the apex; seeds strongly reticulate with conical, prominent chalaza..... 18. *Turnera pumilea*
 - 4'. Capsules pubescent; seeds reticulate with rounded, slightly prominent chalaza 16. *Turnera melochioides*

- 2'. Stamens connate and marginally adnate to the perianth tube from the base up to the throat.
5. Flowers with spatulate bracteoles 7. *Turnera annularis*
- 5'. Flowers with linear, lanceolate, narrowly triangular or obovate bracteoles.
6. Flowers in capituliform inflorescences 8. *Turnera blanchetiana*
- 6'. Flowers solitary.
7. Floral peduncles free from the petioles 10. *Turnera cearensis*
- 7'. Floral peduncles adnate to petioles.
8. Branches with simple and stellate trichomes 14. *Turnera hermannioides*
- 8'. Branches with simple trichomes, microcapitate or clavate glandular trichomes.
9. Leaves narrowly elliptical, narrowly oblong or linear, 3.5–7.6 times longer than wide 12. *Turnera coerulea*
- 9'. Leaves widely elliptical, elliptical, obovate or obovate-triangular, 1.2–2.9 times longer than wide.
10. Corollas white or yellowish with dark basal spot and throat 20. *Turnera subulata*
- 10'. Corollas yellow lacking basal spot.
11. Seeds with rounded and not prominent chalaza 19. *Turnera scabra*
- 11'. Seeds with concave and prominent chalaza 15. *Turnera joelii*
- 1'. Leaves without nectaries.
12. Plants bearing simple trichomes and stipitate-capitate glandular trichomes 11. *Turnera chamaedrifolia*
- 12'. Plants bearing simple trichomes and sessile-capitate glandular trichomes.
13. Flowers and capsules with linear bracteoles; corollas yellow 13. *Turnera diffusa*
- 13'. Flowers and capsules with narrowly elliptical or narrowly obovate bracteoles; corollas white or lilac with yellow basal spot 9. *Turnera calyptrocarpa*

7. *Turnera annularis* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 124. 1883. Figs. 2a; 6d

Subshrubs; branches covered with simple trichomes and sessile-capitate glandular trichomes. Leaves papyraceous, concolorous; stipules 1–3.5 mm long; petioles 3–5 mm long; nectaries marginal, 2–3 pairs; blades 25–60 × 12–23 mm, elliptical, bases attenuate, margins crenate or serrate, plane or slightly revolute, apices acute, secondary veins 5–6 pairs, adaxial surfaces with sparse, simple trichomes throughout blade, abaxial surfaces with dense, sessile-capitate glandular trichomes throughout blade and simple trichomes mainly on the veins. Inflorescences in racemes, terminal. Flowers heterostylous; bracts spatulate; floral peduncles 1–1.5 mm long, free; bracteoles spatulate; calyces ca. 5 mm long, tubes 3–3.5 mm long; corollas ca. 8 mm long, white with yellow basal spot; stamens connate, marginally adnate 0.8–1 mm to tube from the base up to the throat; filaments not seen in longistylous flowers, 4.5–6 mm long in brevistylous flowers; anthers 1–1.3 mm

long; ovaries ca. 1.5 mm long; styles not seen in longistylous flowers, ca. 2 mm long in brevistylous flowers; stigmas 0.3–0.8 mm long. Fruits and seeds not seen.

Specimens examined: Nazaré da Mata, 12.IV.1954, fl., J.C. Moraes 1083 (UB-image).

Additional specimens examined: BRAZIL. ALAGOAS: Atalaia, Serra da Naceia, 24.III.1983, fl., G.L. Esteves & M.N.R. Staviski 2148 (MAC).

Endemic to Brazil, occurring in the states of Paraíba, Pernambuco, Bahia, Minas Gerais, and Rio de Janeiro (Arbo 2000; BFG 2018). Here recorded for the first time for the Atlantic Forest of Alagoas. It is a rare species known in Pernambuco from two specimens collected for the last time 62 years ago in semideciduous seasonal forest (Arbo 2000). *Turnera annularis* can be differentiated from all other species by its spatulate bracts and bracteoles and its capitate-sessile glandular trichomes, which are plentiful on the abaxial surface of leaves and bracteoles. Flowering and fruiting in March and April (Arbo 2000).

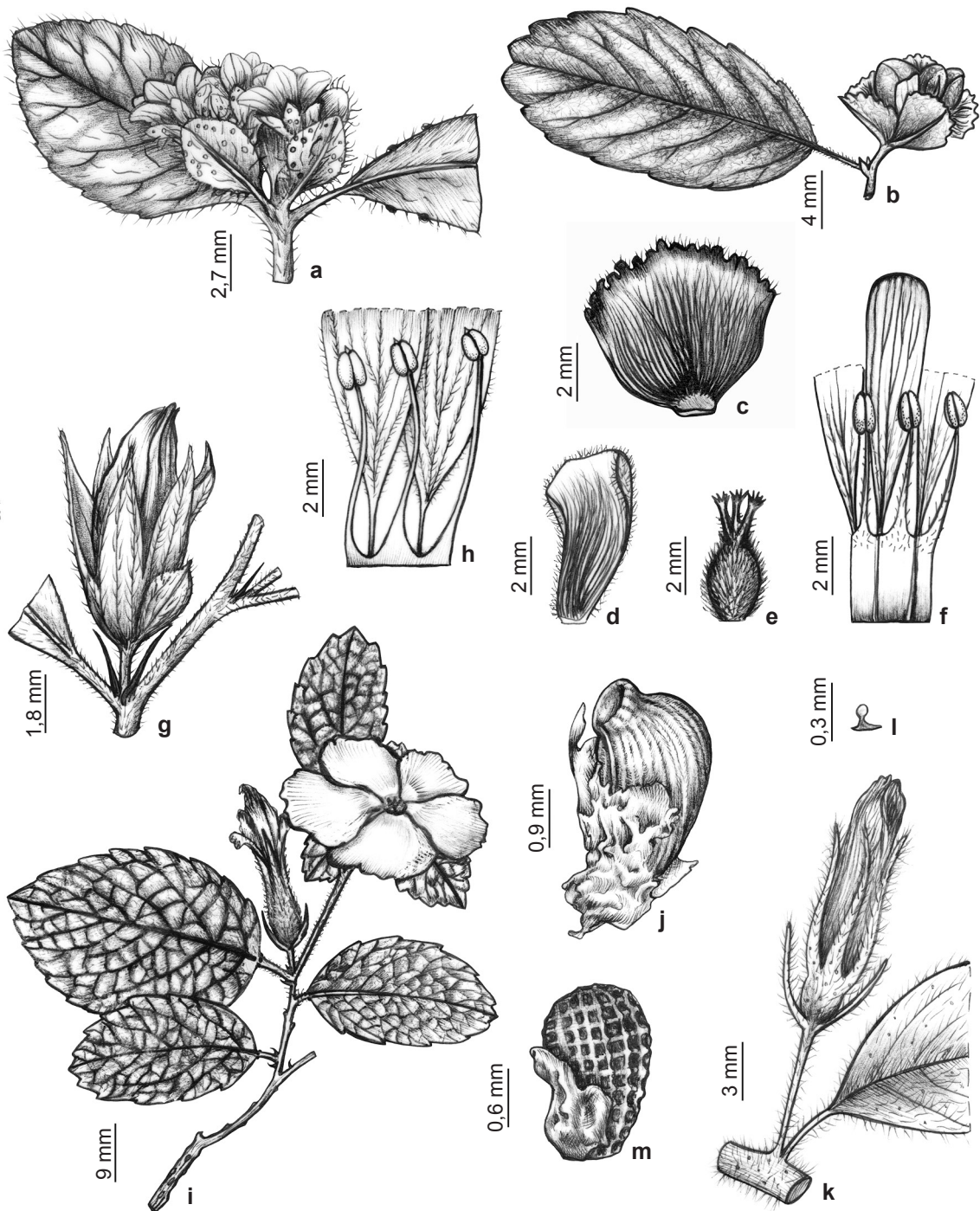


Figure 2 – a. *Turnera annularis* – flowering branch. b-f. *Turnera blanchetiana* – b. branch with flower buds; c. bract, adaxial surface; d. bracteole, adaxial surface; e. gynoecium of brevistylous flower; f. inner portion of perianth with stamens connate and marginally adnate to the petal. g-h. *Turnera calyptrocarpa* – g. branch with spent flower; h. inner portion of perianth with stamens shortly connate at the base. i-j. *Turnera cearensis* – i. flowering branch; j. seed, rapheal view. k-m. *Turnera chamaedrifolia* – k. branch with spent flower; l. stipitate-capitate glandular trichomes; m. seed, side view.

8. *Turnera blanchetiana* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 130. 1883. Figs. 2b-f; 6d

Shrubs, up to 1.5 m tall; branches covered with stellate trichomes. Leaves chartaceous, discolorous; stipules 0.5–1.7 mm long; petioles 4–7 mm long; nectaries acropetiole and marginal, 1–4 pairs; blades 20–37 × 10–23 mm, elliptical or obovate, bases cuneate, margins crenate to serrate, revolute, apices acute or obtuse, secondary veins 4–8 pairs, adaxial and abaxial surfaces with dense, stellate trichomes throughout blade. Inflorescences capituliform, terminal. Flowers heterostylous; bracts widely depressed, obovate or very widely obovate; floral peduncles absent; bracteoles obovate; calyces 8–9 mm long, tubes 4–4.5 mm long; corollas 11–12 mm long, yellow; stamens connate, marginally adnate ca. 3 mm to tube from the base up to the throat; filaments ca. 3 mm long in longistylous flowers, 6–7 mm long in brevistylous flowers; anthers 1–1.5 mm long; ovaries 2–2.7 mm long; styles ca. 4 mm long in longistylous flowers, 1–1.5 mm long in brevistylous flowers; stigmas 0.5–1 mm long. Capsules ca. 5 × 4.5 mm, granulate, tomentose. Seeds not seen.

Specimens examined: Floresta, Faz. FASA, 19.I.1989, fl. e fr., *M.J.N. Rodal & E.M.N. Ferraz 44* (IPA, PEUFR). Petrolina, Lagoinha, 11.III.1982, fl., *V.C. Lima et al. 53* (IPA, PEUFR); 03.VIII.1982, bt., *L. Lima* (IPA 46275, 46297, 46301).

Additional specimens examined: BRAZIL. BAHIA: Petrolina-Remanso, 25.IV.1971, fl., *E.P. Heringer et al. 358* (IPA).

Disjunctly distributed from northeastern Brazil to northern Minas Gerais and central-western Brazil, eastern Bolivia, and northern Paraguay (Arbo 2005). In Pernambuco, it was recorded in *Caatinga* on sandy soils, at 200–400 m elevation. This species inhabits open areas of steppe savanna. *Turnera blanchetiana* is morphologically similar to *T. cearensis*, with which it shares shrub habit, stellate trichomes, leaves often elliptical or ovate with nectaries, yellow flowers with stamens connate and adnate to the tube from the base up to the throat. However, *T. blanchetiana* has bracteate capituliform inflorescences (vs. solitary flowers without bracts) that allow us to differentiate them. Flowering and fruiting in January, March and August.

9. *Turnera calyptrocarpa* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 128. 1883. Figs. 2g-h; 6d

Subshrubs or shrubs, 0.5–2 m tall; branches covered with simple trichomes and sessile-capitate glandular trichomes. Leaves chartaceous,

discolorous; stipules 2–4 mm long; petioles 1–3 mm long; nectaries absent; blades 6–27 × 2.2–13 mm, elliptical, narrowly elliptical or obovate, bases attenuate; margins crenate or serrate, revolute, apices acute or obtuse, secondary veins 3–5 pairs, adaxial surfaces with sparse, simple trichomes, abaxial surfaces with dense, simple and sessile-capitate trichomes. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 1–2.5 mm long, free; bracteoles narrowly elliptical or narrowly obtrullate; calyces 4–6.5 mm long, tubes 1.5–3 mm long; corollas 6–11 mm long, white or lilac with yellow basal spot and throat; stamens connate, adnate 0.1–0.3 mm to tube only at the base; filaments 2.5–4 mm long in longistylous flowers, ca. 7 mm long in brevistylous flowers; anthers 1–1.9 mm long; ovaries 2–3 mm long; styles 3–4.2 mm long in longistylous flowers, 0.5–1 mm long in brevistylous flowers; stigmas 0.3–0.5 mm long. Capsules 3.5–4.5 × 3–5 mm, granulate, tomentose. Seeds 1.9–2.1 × 1 mm, straight, reticulate; chalazas slightly concave, not prominent.

Selected specimens: Arcoverde, Serra das Varas, 10.VI.2010, fl. e fr., *J. Alves 79* (ASE, IPA). Carnaubeira da Penha, 30.VIII.2012, fl., *N.M. Almeida & R.A. Cavalcante 231* (HVASF). Custódia, 15.IV.2009, fl. e fr., *M. Oliveira 3948* (HVASF, IPA). Petrolina, CPATSA, 15.IV.1988, fl. e fr., *J.L.S. Lima 368* (INPA, HTSA); 01.IV.2003, fl., *S.A.O. Souza et al. 2475* (HTSA).

Endemic to northeastern Brazil and the state of Minas Gerais (Arbo 2000; BFG 2018). In Pernambuco, it grows in the Atlantic Forest and *Caatinga*, in semideciduous seasonal forest and steppe savanna, usually on rocky or clay soils, between 526–910 m elevation. This species was collected in forest interiors, open areas and rock outcrops, as well as anthropized areas. *Turnera calyptrocarpa* is characterized by its long stipules (2–4 mm long), white or lilac flowers with yellow base and straight seeds. This species was misidentified as *T. chamaedrifolia* in some herbaria, but it can be distinguished from the latter by its stipulate leaves (vs. exstipulate leaves) covered with simple trichomes and sessile-capitate glandular trichomes (vs. simple trichomes and stipitate-capitate glandular trichomes), and narrowly elliptical or narrowly obtrullate bracteoles (vs. linear bracteoles). In *M. Oliveira 3948* longistylous and brevistylous flowers were found in the same plant. Flowering and fruiting in January to October, but most specimens collected from February to April.

10. *Turnera cearensis* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 100. 1883. Figs. 2i-j; 5i; 7a

Subshrubs or shrubs, 0.5–4 m tall; branches covered with simple and stellate trichomes. Leaves chartaceous, discolorous; stipules 1.3–3.5 mm long; petioles 2–11 mm long; nectaries acropetal and marginal, 1–3 pairs; blades 20–80 × 8–40 mm, ovate, elliptical, narrowly elliptical or narrowly oblong, bases rounded, cuneate or oblique, margins crenate or serrate, slightly revolute, apices acute or obtuse, secondary veins 5–8 pairs, adaxial surfaces with dense stellate trichomes throughout blade and some microcapitate glandular trichomes, abaxial surfaces with dense stellate trichomes throughout blade. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 1.5–6.5 mm long, free; bracteoles linear or lanceolate; calyces 9–18 mm long, tubes 4.5–8 mm long; corollas 13–25 mm long, yellow; stamens connate, marginally adnate 4–6 mm to tube from the base up to the throat; filaments ca. 6 mm long in longistylous flowers, 7–9 mm long in brevistylous flowers; anthers 2–2.5 mm long; ovaries 3.2–5 mm long; styles 4.5–7 mm long in longistylous flowers, 1.8–4 mm long in brevistylous flowers; stigmas 0.5–1 mm long. Capsules 6–10 × 5–7 mm, granulate, sericeous. Seeds 3–3.9 × 1.2–2 mm, curved, striate-reticulate; chalazas concave, prominent.

Selected specimens: Buíque, Parque Nacional (PARNA) do Catimbau, 24.V.2013, fl. e fr., *J.A. Siqueira-Filho et al.* 2907 (HVASF); Serrinha, 21.I.2016, fl., *A. Zelenski et al.* 170 (UFP). Custódia, Serrote da Porteira, 22.XI.2011, fl. e fr., *V.M. Cotarelli et al.* 1133 (HVASF). Salgueiro, Fazenda Miguel, 10.II.2009, fl., *J.G. Carvalho-Sobrinho et al.* 1912 (HVASF, IPA). Tacaratu, 30.I.2009, fr., *J.G. Carvalho-Sobrinho et al.* 1804 (HVASF, IPA).

Endemic to northeastern Brazil and the state of Minas Gerais (Arbo 2005; BFG 2018). In Pernambuco, it grows in semideciduous seasonal forest and steppe savanna, on sandy or rocky soils, at 362–925 m elevation. It occurs mainly in forest interiors, open areas and rock outcrops, but also in anthropized areas. *Turnera cearensis* is morphologically related to *T. blanchetiana*, but can be distinguished mainly by its solitary flowers without bracts (vs. bracteate capituliform inflorescences). Flowering and fruiting in November to June, but most specimens collected from January to June. The common name is *malva*.

11. *Turnera chamaedrifolia* Cambess., *Fl. Bras. Merid.* 2(16): 221. 1829. Figs. 2k-m; 5j; 7b

Herbs or subshrubs, 15–60 cm tall; branches covered with simple trichomes and stipitate-

capitate glandular trichomes. Leaves papyraceous, discolorous; stipules absent; petioles 1.5–12 mm long; nectaries absent; blades 5–42 × 3.5–22.5 mm, elliptical, ovate or trullate, bases attenuate or cuneate, margins crenate or serrate, plane or slightly revolute, apices acute, secondary veins 5–9 pairs, adaxial surfaces with sparse simple and stipitate-capitate trichomes throughout blade, abaxial surfaces with dense stipitate-capitate trichomes throughout blade and simple trichomes mainly on the veins. Flowers solitary, axillary, homostylous or heterostylous; bracts absent; floral peduncles 3–19 mm long, free; bracteoles linear; calyces 6–13 mm long, tubes 2–4 mm long; corollas 8–17 mm long, yellowish with or without vinaceous throat; stamens free, adnate 0.3–1 mm to tube only at the base; filaments 3.8–5 mm long in longistylous flowers, 4–5 mm long in brevistylous flowers; anthers 1.2–3 mm long; ovaries 1.5–3 mm long; styles 3–4.5 mm long in longistylous flowers, 1–2.5 mm long in brevistylous flowers; stigmas 0.8–2 mm long. Capsules 3–8 × 3.5–7 mm, granulate, pilose. Seeds 1.5–2 × 0.8–1.5 mm, straight or slightly curved, reticulate; chalazas rounded, not prominent.

Selected specimens: Águas Belas, distrito de Ribeira do Alto, 30.VI.2015, fl. e fr., *A. Zelenski et al.* 59 (UFP). Arcoverde, sul de Caraibas de Cima, 02.II.2014, fl. e fr., *A.C.P. Oliveira et al.* 3174 (HVASF). Brejo da Madre de Deus, Fazenda Bituri, 16.III.1996, fl. e fr., *A.B. Marcon 151* (PEUFR). Garanhuns, subida do Morro Magano, 08.X.1971, fl. e fr., *D. Andrade-Lima 6533* (IPA). Triunfo, Sítio Santa Rita, 15.VII.2010, fl. e fr., *J.A. Siqueira-Filho et al.* 2381 (HVASF).

Endemic to northeastern Brazil and the states of Minas Gerais and Rio de Janeiro (Arbo 2000; BFG 2018). In Pernambuco, it inhabits semideciduous seasonal forest and steppe savanna, on sandy, clay or rocky soils, at 490–1,200 m elevation. This species is common in forest edges, open areas, rock outcrops, and anthropized areas. *Turnera chamaedrifolia* is characterized by simple trichomes and stipitate-capitate glandular trichomes; the latter is unique among the species of this study and usually is plentiful on branches, abaxial leaf surface and calyx. Flowering and fruiting in January to November, but most specimens were collected from January to June. The common name is *relógio*.

12. *Turnera coerulea* Moç. & Sessé ex DC., *Prodr.* 3: 346. 1828. Figs. 3a-b; 5k; 7b

Herbs or subshrubs, 15–30 cm tall; branches covered with simple trichomes. Leaves



Figure 3 – a-b. *Turnera coerulea* – a. flowering branch; b. leaf abaxial surface. c-e. *Turnera diffusa* – c. flowering branch; d. leaf abaxial surface with sessile-capitate glandular trichomes; e. seed, side view. f-g. *Turnera hermamioides* – f. flowering branch; g. seed, side view. h. *Turnera joelii* – seed, rapheal view. i-l. *Turnera melochioides* – i-j. variation of leaves, abaxial and adaxial surfaces; k. capsule; l. seed, rapheal view.

papyraceous, concolorous; stipules absent; petioles 1.5–6 mm long; nectaries basilaminar, 1 pair; blades 23–44 × 3–12 mm, narrowly oblong, narrowly elliptical or linear, bases cuneate or rounded, margins serrate or serrulate, plane or slightly revolute, apices acute, secondary veins 5–7 pairs, adaxial surfaces with scattered simple trichomes on the midrib, abaxial surfaces with scattered, simple and microcapitate trichomes on the veins. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 1.5–3 mm long, adnate to petioles; bracteoles linear; calyces 15–19.5 mm long, tubes 5–8 mm long; corollas 17–25 mm long, white with blue or purple veins and yellow throat; stamens connate, marginally adnate 4–5 mm to tube from the base up to the throat; filaments 5–6 mm long in longistylous flowers, 8–9 mm long in brevistylous flowers; anthers ca. 3 mm long; ovaries ca. 2 mm long; styles 7.5–8 mm long in longistylous flowers, 3–3.5 mm long in brevistylous flowers; stigmas 1.5–2 mm long. Capsules ca. 3 × 3.5 mm, verrucose, strigose. Seeds 2.8–3 × 1 mm, straight or slightly curved, reticulate; chalazas rounded, not prominent.

Specimens examined: Buíque, Sítio Bom Jesus, 21.X.1996, fl., *G.S. Baracho et al.* 266 (UFP); Vale do Catimbau, VII.2007, fl., *O. Cano et al.* 760 (IPA); margens do Riacho Catimbau, 25.V.2013, fl., *J.A. Siqueira Filho et al.* 2938 (HVASF); Paraíso Selvagem, 20.I.2016, fl., *A. Zelenski et al.* 167 (UFP); 20.I.2016, fl., *A. Zelenski et al.* 168 (UFP).

Additional specimens examined: BRAZIL. SERGIPE: Itaporanga d'Ajuda, Fazenda Trapsa, 21.IX.2013, fl. e fr., *W.W. Thomas et al.* 16207 (UFP).

Disjunctly distributed in Mexico and Brazil, occurring in the North, Northeast, Central-western regions and the state of Minas Gerais (Arbo 2005; BFG 2018). In Pernambuco, it was recorded in open areas of steppe savanna and rock outcrops within *Caatinga*, on sandy and rocky soils, at ca. 800 m elevation. *Turnera coerulea* is the only species in Pernambuco with bluish-white flowers. When dry, this species is often mistaken for *T. subulata*, which it resembles in habit, presence of basilaminar nectaries, peduncle adnate to petiole, large flowers (17–25 mm long) with stamens connate and marginally adnate to the tube up to the throat. However, *T. coerulea* differs by its narrowly elliptical or narrowly oblong leaves (*vs.* elliptical, obovate or obovate leaves) and flowers with yellow throat (*vs.* blackish throat). It was collected with flowers in January, May, July and October.

13. *Turnera diffusa* Willd. *ex* Schult., *Syst. Veg.* 6: 679. 1820. Figs. 3c-e; 5l; 7c

Herbs or shrubs, 0.3–2 m tall; branches covered with simple trichomes and sessile-capitate glandular trichomes. Leaves chartaceous, discolorous; stipules 0.8–1.5 mm long; petioles absent or to 2.5(–5) mm long; nectaries absent; blades 7–26 × 3–10 mm, elliptical, obovate, oblanceolate, narrowly elliptical or narrowly oblong, bases cuneate or attenuate, margins crenate or serrulate, revolute, apices acute or obtuse, secondary veins 5–8 pairs, adaxial surfaces with sparse or dense simple trichomes, abaxial surfaces with dense sessile-capitate trichomes throughout blade and simple trichomes on the veins. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 0.3–1.1 mm long, adnate to petioles; bracteoles linear; calyces 4–7.5 mm long, tubes 2–3.5 mm long; corollas 4–7.5 mm long, yellow; stamens free, adnate 0.4–0.8 mm to tube only at the base; filaments 3.5–4 mm long in longistylous flowers, 4–6 mm long in brevistylous flowers; anthers 0.5–1 mm long; ovaries 0.8–1 mm long; styles 4–6 mm long in longistylous flowers, 1.5–3 mm long in brevistylous flowers; stigmas 0.5–1 mm long. Capsules 2–3 × 1.5–2 mm, verrucose, tomentose. Seeds 1.5–2 × 0.6–1 mm, markedly curved, reticulate; chalazas rounded, not prominent.

Selected specimens: Buíque, PARNA do Catimbau, 03.IV.2000, fl. e fr., *A.P.S. Gomes et al.* 514 (IPA, JPB, MAC); Trilha da Concha, 11.VI.2010, fl. e fr., *J.S. Silva* 75 (IPA); Paraíso Selvagem, 20.I.2016, fl. e fr., *A. Zelenski et al.* 164 (UFP). Ibimirim, entre Povoado Troncado e Salgado, 22.I.2013, fl. e fr., *V.M. Cotarelli et al.* 2344 (HVASF). Inajá, Sítio Peitudo, 26.II.2012, fl. e fr., *J.E. Fagundes & E.G. Araújo* 93 (HVASF).

Disjunctly distributed from the southern United States to Central America and northeastern Brazil to northern Minas Gerais (Arbo 2000; BFG 2018). In Pernambuco, it occurs in vegetation of steppe savanna within *Caatinga*, on sandy or rocky soils, at 433–829 m elevation. It was collected in open areas and rock outcrops, as well as in anthropized areas. *Turnera diffusa* can be easily recognized by its small, revolute, often sessile leaves covered with simple trichomes and sessile-capitate glandular trichomes and its small yellow flowers (4–7.5 mm long). Flowering and fruiting in January to September. The common name is *alecrim-de-caboclo*.

14. *Turnera hermannioides* Cambess., *Fl. Bras. Merid.* 2(16): 218. 1829. Figs. 3f-g; 5m-n; 7d

Herbs or subshrubs, 0.3–1 m tall; branches covered with simple and stellate trichomes. Leaves papyraceous, concolorous; stipules 0.5–1 mm long;

petioles 2–4 mm long; nectaries basilaminar, 1–2 pairs; blades 9–40 × 6–22 mm, elliptical, circular, very widely ovate or very widely obovate, bases cuneate or attenuate, margins serrate, plane or slightly revolute, apices acute, secondary veins 4–7 pairs, adaxial and abaxial surfaces with stellate and microcapitate trichomes throughout blade and simple trichomes on the veins. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 0.5–2.5 mm long, adnate to petioles; bracteoles linear or narrowly triangular; calyces 12–18 mm long, tubes 4–5 mm long; corollas 21–28 mm long, white or yellowish; stamens connate, marginally adnate 2.5–3 mm to tube from the base up to the throat; filaments 5–6 mm long in longistylous flowers, 8–8.5 mm long in brevistylous flowers; anthers 2.2–3.5 mm long; ovaries 1.5–2.2 mm long; styles 5.5–8 mm long in longistylous flowers, 4–5 mm long in brevistylous flowers; stigmas 1–2 mm long. Capsules 3.5–5 × 4–6 mm, verrucose, tomentose. Seeds 2.7–3.3 × 0.9–1 mm, curved, reticulate; chalazas concave, prominent.

Selected specimens: Buíque, PARNA do Catimbau, 04.IX.1999, fl. e fr., *C. Schlindwein et al.* 960 (UFP); trilha da gruta da cachoeira, 01.III.2009, fl. e fr., *J.I.S. Barbosa* 37 (IPA); proximidades do alojamento do PELD, 19.I.2016, fl. e fr., *A. Zelenski et al.* 153 (UFP). Lagoa Grande, Ducos, 27.V.2010, fl. e fr., *T.A. Silva* 3596 (HTSA). Petrolina, estrada da Taperá, 28.IX.2011, fl. e fr., *T.S. Oliveira et al.* 12 (HVASF).

Endemic to Brazil, occurring in the states of Tocantins, Piauí, Pernambuco, Sergipe, Bahia, Goiás, Minas Gerais, and Espírito Santo (Arbo 2005; BFG 2018). In Pernambuco, it grows in steppe savanna within *Caatinga*, on sandy or clay soils, at 235–898 m elevation. This species is common in open and anthropized areas. *Turnera hermannioides* resembles *T. scabra* that also has a habit similar, papyraceous, concolorous leaves with basilaminar nectaries, peduncles adnate to petioles, and yellowish, solitary flowers with stamens connate and adnate to the tube from the base up to the throat. However, *T. hermannioides* can be distinguished from the *T. scabra* by its simple and stellate trichomes (*vs.* only simple trichomes) and seeds with concave, prominent chalaza (*vs.* rounded, not prominent chalaza). In *C. Schlindwein et al.* 960 longistylous and brevistylous flowers were found on the same plant. Flowering and fruiting in January to September, with most specimens collected from March to May. The common name is *chanana*.

15. *Turnera joelii* Arbo, *Bonplandia* 7(1/4): 78–83. 1993. Figs. 3h; 7c

Herbs, 30–60 cm tall; branches covered with simple trichomes and microcapitate and clavate glandular trichomes. Leaves papyraceous, concolorous; stipules absent; petioles 2–5 mm long; nectaries basilaminar, 1 pair; blades 18.5–37 × 5–20 mm, elliptical or obtusate; bases cuneate or attenuate, margins serrate or serrulate, plane, apices acute, secondary veins 4–5 pairs, adaxial surfaces with scattered simple and microcapitate trichomes on the veins and margins, abaxial surfaces with simple trichomes on the veins and microcapitate, clavate glandular trichomes throughout blade. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 1.5–2 mm long, adnate to petioles; bracteoles linear; calyces 13.5–16 mm long, tubes 5–6 mm long; corollas 22–28 mm long, yellow; stamens connate, marginally adnate 2.7–3 mm to tube from the base up to the throat; filaments not seen in longistylous flowers, 10–11 mm long in brevistylous flowers; anthers 2–2.5 mm long; ovaries 1.9–2.5 mm long; styles not seen in longistylous flowers, 4–5 mm long in brevistylous flowers; stigmas 1.2–1.8 mm long. Capsules 5.5–7 × 4–6.5 mm, verrucose, pubescent. Seeds 2.8–3 × 1 mm, curved, reticulate; chalazas concave, prominent.

Specimens examined: Petrolina, CPATSA, 29.IV.2002, fl., *S.A.O. Souza et al.* (HTSA 2188a).

Additional specimens examined: BRAZIL. BAHIA: Olho D'Água, fl. e fr., *G. Fotius* 3983 (HTSA).

Endemic to Brazil, occurring in the northern Bahia (Arbo 2005) and Pernambuco. Only a single specimen is known from steppe savanna in far western Pernambuco, at 376 m elevation. *Turnera joelii* can be confused with *T. subulata* and *T. scabra* which it shares leaves with 1 pair basilaminar nectaries, peduncles adnate to petioles, and solitary flowers with stamens connate and adnate to tube up to the throat, but its totally yellow flowers without a dark spot at the base (*vs.* flowers with a dark spot in *T. subulata*) and umbilicate seeds (i.e. concave, prominent chalazas *vs.* seeds with rounded, not prominent chalazas) allow us to differentiate them. It was collected in flower in April.

16. *Turnera melochioides* Cambess., *Fl. Bras. Merid.* 2(16): 219. 1829. Figs. 3i–l; 5o–p; 8a

Herbs or shrubs, 0.4–1.5 m tall; branches covered with simple trichomes and microcapitate glandular trichomes. Leaves papyraceous or

chartaceous, concolorous or discolorous; stipules absent; petioles 1–4(–6) mm long; nectaries marginal or basilaminar, 1–2 pairs; blades 10–60 × 1.5–20 mm, linear, narrowly elliptical, elliptical or ovate, bases cuneate or attenuate, margins crenate or serrate, plane or slightly revolute, apices acute, secondary veins (4–)5–7 pairs, adaxial surfaces with sparse or dense, simple trichomes throughout blade, abaxial surfaces with dense simple trichomes mainly on the veins and margins and microcapitate trichomes throughout blade. Inflorescences in racemes, axillary or terminal. Flowers heterostylous; bracts absent or ovate; floral peduncles 1–3 mm long, adnate to petiole; bracteoles linear or lanceolate; calyces 5.5–9 mm long, tubes 3–4.5 mm long; corollas 8–13 mm long, yellow; stamens free, adnate 0.3–1 mm to tube only at the base; filaments 3.5–4.2 mm long in longistylous flowers, 7–7.5 mm long in brevistylous flowers; anthers 1–1.9 mm long; ovaries 1–1.5 mm long; styles 4–5.3 mm long in longistylous flowers, 2.2–2.5 mm long in brevistylous flowers; stigmas 1–2 mm long. Capsules 3.5–5.5 × 3–6 mm, smooth, pubescent. Seeds 1.8–2 × 0.6 mm, curved, reticulate; chalazas rounded, slightly prominent.

Selected specimens: Araripina, Chapada do Ararape, 15.V.2016, fl. e fr., *A. Zelenski 184* (UFP). Buique, PARNA do Catimbau, 30.VII.2005, fl. e fr., *R.A. Pick 278* (IPA, UFP). Goiana, Itapirema, 01.V.1936, fr., *P.P. Melo* (IPA 4436). Petrolina, CPATSA, 05.V.1985, fl. e fr., *L. Lima 330* (HTSA). Trindade, BR-316, 26.IV.1983, fl. e fr., *F. Gallindo et al.* (IPA 4257, 42574; PEUFR 7306, 7308).

Widely distributed in Brazil, Bolivia, and Paraguay (Arbo 2008). This species was recorded in ombrophilous forest, semideciduous seasonal forest and steppe savanna in the state of Pernambuco, on sandy and rocky soils, at 805–950 m elevation. It was collected in open areas, *carrasco*, rock outcrops, and anthropized areas. *Turnera melochioides* is morphologically variable mainly with respect to the type habit and width (1.5–20 mm wide), form (linear, narrowly elliptical, elliptical or ovate), consistency (papyraceous or chartaceous) and color (concolorous or discolorous) leaves. It resembles *T. pumilea* that also has small, yellow flowers and smooth fruits, but differs by its pubescent fruits (*vs.* glabrous fruits) and seeds with rounded, slightly prominent chalaza (*vs.* conical, prominent chalaza). Flowering and fruiting in January to October, but most specimens were collected from May to October. The common name is *vassourinha-amarela*.

17. *Turnera pernambucensis* Urb., Jahrb. Königl. Bot. Gart. Berlin 2: 133. 1883. Figs. 4a–d; 5q; 7d

Subshrubs or shrubs, up to 2.5 m tall; branches covered with simple trichomes. Leaves chartaceous, discolorous; stipules 0.5–1 mm long; petioles 1–8 mm long; nectaries marginal, 1–3 pairs; blades 32–136 × 10–42 mm, narrowly elliptical, bases attenuate, margins entire or serrulate, plane or slightly revolute, apices acute, secondary veins 4–6 pairs, adaxial and abaxial surfaces with scattered simple trichomes mainly on the midrib. Inflorescences in racemes, axillary. Flowers heterostylous; bracts elliptical or rhombic; floral peduncles 1–1.5 mm long, adnate to petioles; bracteoles linear; calyces 4.5–5.5 mm long, tubes 2.5–3.2 mm long; corollas 5.5–7.5 mm long, white with yellow basal spot; stamens free, adnate 0.2–1 mm to tube only at the base; filaments 2–2.2 mm long in longistylous flowers, 3.2–5 mm long in brevistylous flowers; anthers 0.7–1 mm long; ovaries ca. 1 mm long; styles 4–5.5 mm long in longistylous flowers, 1.1–2 mm long in brevistylous flowers; stigmas 0.1–0.5 mm long. Capsules 1.5–3 × 2–3.5 mm, punctate, pubescent. Seeds 2–2.5 × 1.3–1.5 mm, slightly curved, striate-reticulate; chalazas concave, prominent.

Selected specimens: Jaqueira, RPPN Frei Caneca, mata nas proximidades do alojamento, 18.VII.2012, fl., *J.L. Costa-Lima et al. 738* (UFP); Mata do Quengo, 27.VIII.2015, fl. e fr., *A. Zelenski et al. 105* (UFP); 27.VIII.2015, fl. e fr., *A. Zelenski et al. 108* (UFP). Lagoa dos Gatos, Serra do Urubu, Mata do Quengo, 18.VIII.2010, fl., *J.L. Viana et al. 68* (UFP); Trilha do Mosquito, 03.XII.2014, fl., *L.S.B. Calazans et al. 470* (RB).

Endemic to the Atlantic Forest of Pernambuco and recently rediscovered (Zelenski *et al.* 2016). This species is currently known from a single semideciduous seasonal forest remnant, growing in the understory at 512–700 m elevation. *Turnera pernambucensis* can be distinguished from other species by its entire to serrulate leaves, rhombic or elliptical bracts and punctate capsules. Flowering and fruiting in May to January.

18. *Turnera pumilea* L., Syst. Nat. 2: 965. 1759.

Figs. 4e–g; 5r; 8a

Herbs, 10–25 cm tall; branches covered with simple trichomes and usually microcapitate glandular trichomes. Leaves papyraceous, discolorous; stipules absent; petioles 2–11 mm long; nectaries marginal or laminar, 1 pair; blades 18–55 × 7–22 mm, elliptical or narrowly elliptical, bases cuneate or attenuate, margins serrate,



Figure 4 – a-d. *Turnera pernambucensis* – a. flowering branch; b. inner portion of perianth, sectioned stamen (left) to show the adnate base; c. gynoecium of longistylous flower; d. seed, side view. e-g. *Turnera pumilea* – e. habit; f. capsule; g. seed, side view. h-i. *Turnera scabra* – h. flowering branch; i. seed, rapheal view. j. *Turnera subulata* – flower.

plane, apices acute, secondary veins 4–10 pairs, adaxial and abaxial surfaces with sparse or dense simple trichomes, usually microcapitate glandular trichomes on the margins of the abaxial surface. Inflorescences in racemes, axillary or terminal. Flowers homostylous or heterostylous; bracts absent; floral peduncles 0.5–1.5 mm long, adnate to petiole; bracteoles linear; calyces 7.2–9.1 mm long, tubes 2–4 mm long; corollas 7.5–13 mm long, yellow with or without brown basal spot; stamens free, adnate ca. 0.5 mm to tube only at the base; filaments ca. 4 mm long in longistylous flowers, not seen in brevistylous flowers; anthers 0.7–1 mm long; ovaries ca. 2 mm long; styles ca. 3 mm long in longistylous flowers, not seen in brevistylous flowers; stigmas 2–3 mm long. Capsules 3–7 × 3–5 mm, smooth, glabrous except at the apex. Seeds 1.8–2 × 0.8–1.5 mm, markedly curved, strongly reticulate; chalazas conical, prominent.

Selected specimens: Floresta, estrada de acesso à Serra do Boi Morto, 16.V.2013, fl. e fr., *V.M. Cotarelli & J. Silva 2544* (HVASF). Ouricuri, margem da BR-316, 21.III.1987, fl. e fr., *J.L.S. Lima 360a* (HTSA). Petrolina, CPATSA, 06.IV.1983, fl. e fr., *G. Fotius 3396* (HTSA); Faz. Experimental da UNIVASF, 08.V.2009, fl. e fr., *M.M. Coelho & D.P. Souza 173* (HVASF). Serrita, Flona Negreiros, margem do Riacho Jibóia, 15.III.2016, fl. e fr., *A. Zelenski 178* (UFP).

Disjunctly distributed from Mexico to northern and northwestern South America, as well as in northeastern, southeastern and central Brazil, Bolivia, Paraguay to northern Argentina (Arbo 2008). In Pernambuco, it inhabits steppe savanna, usually on sandy or rocky soils, at 370–580 m elevation. This species is common in open areas and anthropized areas. *Turnera pumilea* can be easily differentiated from other species by its curved seeds with markedly reticulate seed coat and conical, prominent chalaza (Fig. 4f). It resembles *T. melochioides* that has pubescent capsules (vs. glabrous capsules) and seeds with rounded, slightly prominent chalaza (vs. conical, prominent chalaza). Flowering and fruiting in December to July, but most specimens were collected from March to May.

19. *Turnera scabra* Millsp., Publ. Field Columbian Mus., Bot. Ser. 2(1): 77. 1900. Figs. 4h–i; 5s; 7a

Herbs or subshrubs, 10–50 cm tall; branches covered with simple trichomes. Leaves papyraceous, concolorous; stipules absent or to 0.6 mm long; petioles 3–8 mm long; nectaries basilaminar, 1 pair; blades 16–25 × 10–20 mm, elliptical or widely elliptical, bases cuneate or attenuate, margins crenate or serrate, plane or slightly revolute, apices

acute, secondary veins 5–7 pairs, adaxial and abaxial surfaces with scattered, simple trichomes throughout blade. Flowers solitary, axillary, heterostylous; bracts absent; floral peduncles 1.5–2.5 mm long, adnate to petioles; bracteoles linear; calyces 12–18 mm long, tubes 4–5 mm long; corollas 21–24 mm long, yellowish; stamens connate, marginally adnate 2–3 mm to tube from the base up to the throat; filaments not seen in longistylous flowers, 7–8 mm long in brevistylous flowers; anthers 3–3.3 mm long; ovaries 1–1.7 mm long; styles not seen in longistylous flowers, 2–2.5 mm long in brevistylous flowers; stigmas 1.3–2 mm long. Capsules 3–5 × 3.5–5 mm, granulate or verrucose, pubescent. Seeds 2.8–3 × 1 mm, straight or slightly curved, reticulate; chalazas rounded, not prominent.

Specimens examined: Fernando de Noronha, base do Morro do Francês, 15.X.2003, fl. e fr., *A.M. Miranda 4213* (HST). Ipojuca, Praia de Nossa Senhora do Ó, III.1958, fl. e fr., *A. Sarmiento* (PEUFR 114). Recife, Dois Irmãos, na Universidade Rural de Pernambuco, 24.II.1962, fr., *E. Fromm et al. 1104* (UEC).

Additional specimens examined: BRAZIL. RIO GRANDE DO NORTE: Natal, Praia de Ponta Negra, 23.XI.1996, fl. e fr., *J.A. Siqueira-Filho 414* (UFP).

Widely distributed from southern Mexico to northern and northeastern Brazil (Arbo 2005; BFG 2018). In Pernambuco, it inhabits the Atlantic Forest, in *restinga* and ombrophilous forest, and steppe savanna in *Caatinga*, on sandy or rocky soils, from just above sea level to 600 m elevation. This species was found mainly in anthropized areas. *Turnera scabra* belongs to the *T. ulmifolia* complex that includes 13 species (Arbo 2005). It resembles *T. subulata*, which is also part of the complex, but differs by its flowers without dark spot at the base of the petals (vs. flowers with a blackish spot). This species also can be confused with *T. joelii* and *T. hermannioides* which have umbilicate seeds (vs. seeds rounded, not prominent chalaza); besides, *T. hermannioides* has simple and stellate trichomes (vs. simple trichomes). Flowering and fruiting in February, March and October. The common name is *chanana*.

20. *Turnera subulata* Sm., Cycl. 36(2). 1819.

Figs. 4j; 5t; 8b

Herbs or subshrubs, 20–70 cm tall; branches covered with simple trichomes and microcapitate glandular trichomes. Leaves papyraceous, concolorous or discolorous; stipules 0.4–1 mm long; petioles 2–11 mm long; nectaries basilaminar, 1 pair; blades 15–85 × 10–38 mm, elliptical, obovate or obtrullate, bases cuneate or attenuate, margins

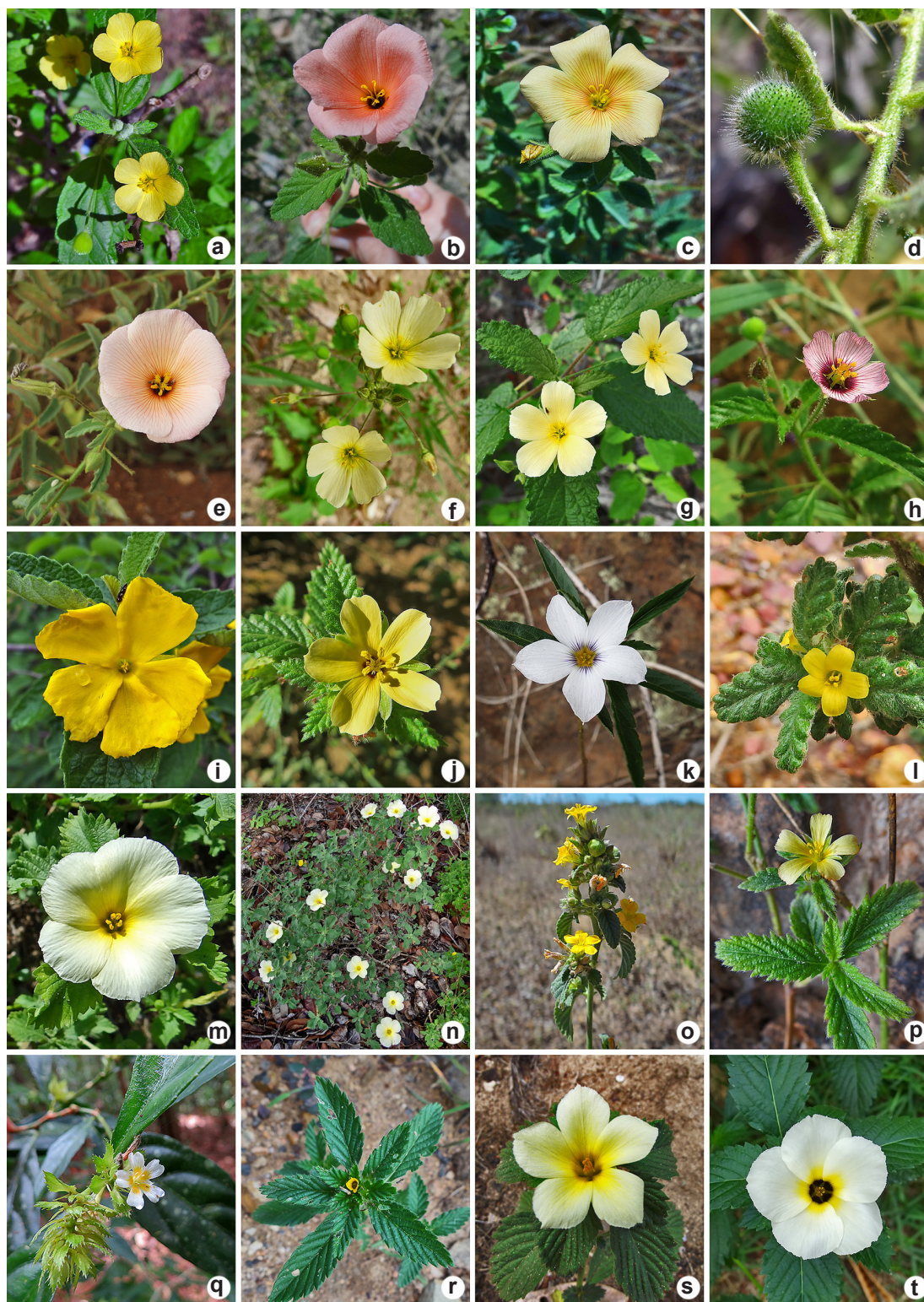


Figure 5 – a-t. *Turnera* and *Piriqueta* in the state of Pernambuco, northeastern Brazil – a. *P. cistoides*; b-d. *P. duarteana*; e. *P. guianensis*; f. *P. racemosa*; g. *P. sidifolia*; h. *P. viscosa*; i. *T. cearensis*; j. *T. chamaedrifolia*; k. *T. coerulea*; l. *T. diffusa*; m-n. *T. hermannioides*; o-p. *T. melochioides*; q. *T. pernambucensis*; r. *T. pumilea*; s. *T. scabra*; t. *T. subulata*. Photos: a-r,t. by A. Zelenski; s. by D. Cavalcanti.

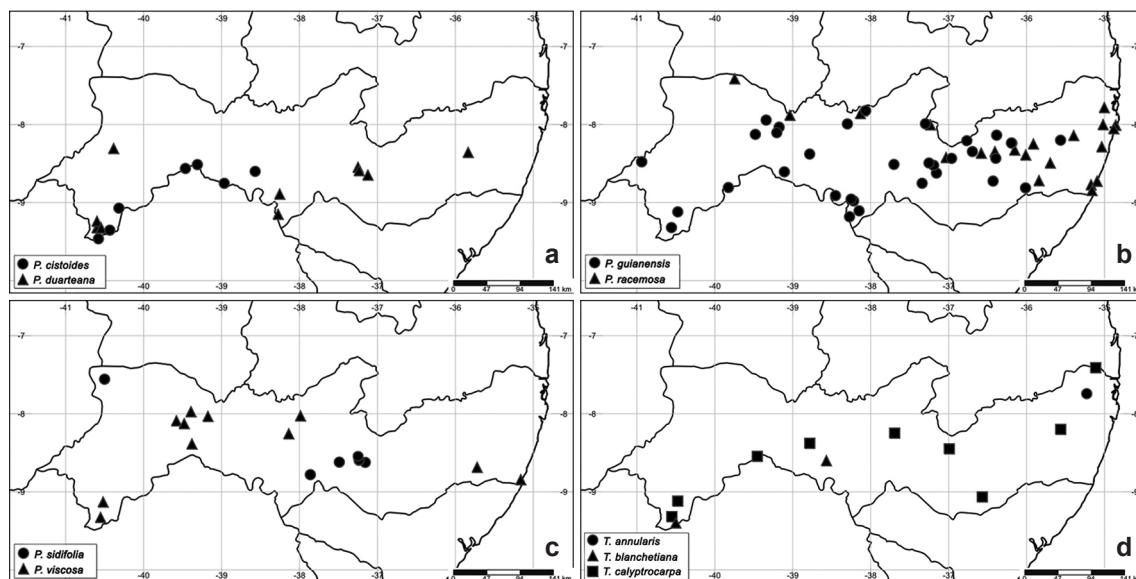


Figure 6 – a. distribution of *Piriqueta cistoides* and *P. Duarteana* in Pernambuco; b. distribution of *Piriqueta guianensis* and *P. racemosa* in Pernambuco; c. distribution of *Piriqueta sidifolia* and *P. viscosa* in Pernambuco; d. distribution of *Turnera annularis*, *T. blanchetiana* and *T. calyptrocarpa* in Pernambuco.

serrate, plane or slightly revolute, apices acute, secondary veins 4–9 pairs, adaxial and abaxial surfaces with dense simple trichomes on the veins and usually scattered microcapitate trichomes throughout blade. Flowers solitary, axillary,

heterostylous; bracts absent; floral peduncles 0.5–6 mm long, adnate to petioles; bracteoles linear; calyces 9.5–19 mm long, tubes 3–5.5 mm long; corollas 18–30 mm long, white, yellowish or yellow with blackish basal spot and throat; stamens connate,

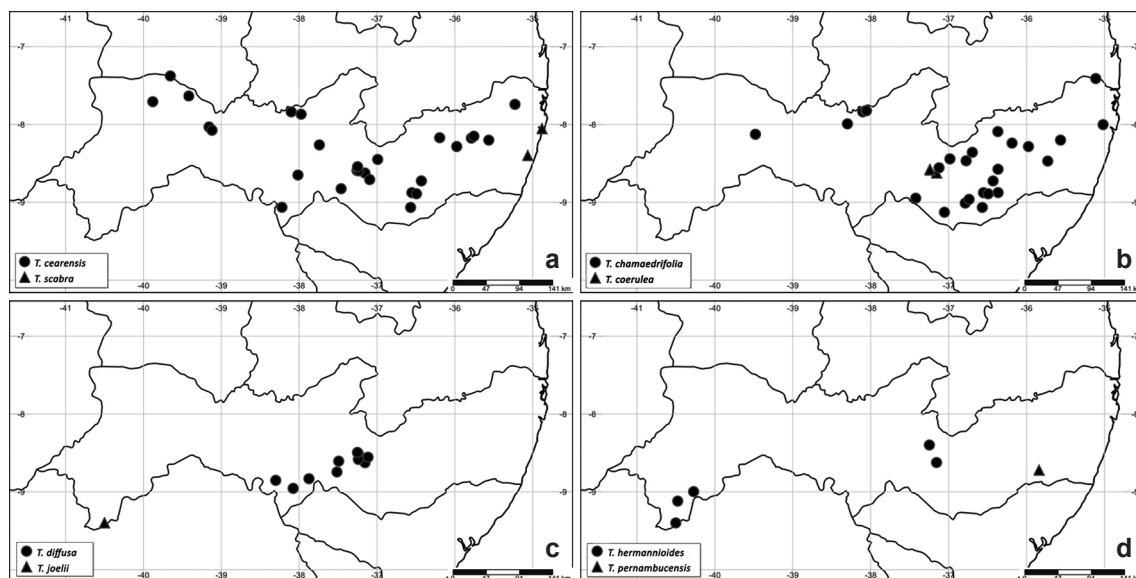


Figure 7 – a. distribution of *Turnera cearensis* and *T. scabra* in Pernambuco; b. distribution of *Turnera chamaedrifolia* and *T. coerulea* in Pernambuco; c. distribution of *Turnera diffusa* and *T. joelii* in Pernambuco; d. distribution of *Turnera hermannioides* and *T. pernambucensis* in Pernambuco.

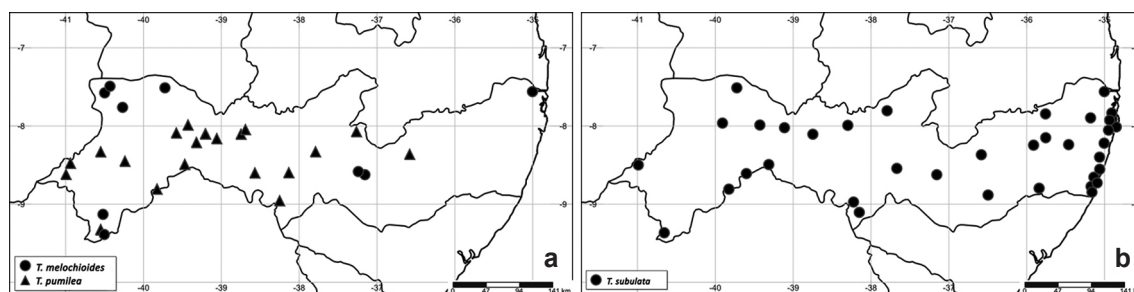


Figure 8 – a. distribution of *Turnera melochioides* and *T. pumilea* in Pernambuco; b. distribution of *Turnera subulata* in Pernambuco.

marginally adnate 2–4 mm to tube from the base up to the throat; filaments 5–6 mm long in longistylous flowers, 8–10 mm long in brevistylous flowers; anthers 3–5 mm long; ovaries 1.5–2.2 mm long; styles 7–10 mm long in longistylous flowers, 3.5–6 mm long in brevistylous flowers; stigmas 1.5–3 mm long. Capsules 2.5–5 × 3–6 mm, verrucose, pubescent. Seeds 2.5–3 × 0.8–1.3 mm, straight or slightly curved, reticulate; chalazas rounded, not prominent.

Selected specimens: Buíque, Vale do Catimbau, 17.VI.2008, fl. e fr., *M.B.C. Silva et al.* 3646 (IPA). Igarassu, Usina São José, Mata de Santa Helena, 28.I.2009, fl. e fr., *E. Pessoa & T. Arruda* 45 (HVASF, MAC, UFP). Petrolina, Fazenda Experimental UNIVASF, 10.XI.2008, fl. e fr., *R.F.S.F. Aquino* 06 (HVASF). São José da Coroa Grande, Reserva do Una, Platô Camurim, 14.VI.2015, fl. e fr., *A. Zelenski* 25 (UFP). Serrita, Flona Negreiros, 15.III.2016, fl. e fr., *A. Zelenski* 179 (UFP).

Widely distributed from Panama to Bolivia and Brazil (Arbo 2005). In Pernambuco, it was recorded in the Atlantic Forest and *Caatinga*, occurring in all vegetation types and soils, from just above sea level to 849 m elevation. This species grows in open areas, being very common in anthropized areas. *Turnera subulata* belongs to the *T. ulmifolia* complex (Arbo 2005). It is morphologically related to *T. scabra*, that also is part of complex, and similar to *T. joelii*, but can be distinguished from them by its flowers with a dark spot from the throat up to the base of the petals (*vs.* flowers without a dark spot) and seeds with rounded, not prominent chalaza (*vs.* concave, prominent chalaza in *T. joelii*). This species is often misidentified as *T. ulmifolia* in herbaria, which is distributed from the southern United States to Central America, including the Caribbean islands (Arbo 2005). Flowering and fruiting throughout the year, but most specimens were collected from December to May. The common name is *arranca-estrepe*, *chanana*, *mentrasto-branco*, *saca-estrepe*.

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