



## Original Paper

# Flora of Ceará, Brazil: Talinaceae

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### Abstract

The aim of this study was to conduct a floristic inventory and update the geographical distribution of Talinaceae species in Ceará state, in the Northeast Region of Brazil. The study was based on a comparative analysis of morphological characters of specimens deposited in the EAC, ESA, HCDAL, HUEFS, HUVA, HVASF, MOSS and RB herbaria, specialized literature, photos of type collections, and field expeditions conducted between March 2015 and April 2022. For the state, *Talinum fruticosum* and *T. paniculatum* have been recorded, which prefer drier vegetations, such as Stepic Savanna (Caatinga and Carrasco) and Semideciduous Seasonal Forest (Mata Seca), but also grow in areas that are more humid. The species occur in eight conservation units in Ceará: Dunas da Lagoinha and Serra de Meruoca Environmental Protection Areas, Aiuaba Ecological Station, Sobral National Forest, Ubajara National Park, Pedra da Andorinha Wildlife Refuge, Serra das Almas and Fazenda Trussú Private Natural Heritage Reserves. An identification key, descriptions, photographs, and comments about the geographical distribution, taxonomic relationships, and phenology are provided for the species.

**Key words:** Caatinga, Flora, Semiarid region, Taxonomy.

### Resumo

Objetivou-se com este estudo realizar o levantamento florístico e atualizar a distribuição geográfica das espécies de Talinaceae no estado do Ceará, Nordeste do Brasil. O estudo foi baseado em comparações de caracteres morfológicos de espécimes depositados nos herbários EAC, ESA, HCDAL, HUEFS, HUVA, HVASF, MOSS e RB, bibliografias especializadas, fotos de coleções-tipos e expedições em campo realizadas no período de março/2015 a abril/2022. Para o estado foram registradas *Talinum fruticosum* e *T. paniculatum*, ocorrendo preferencialmente em ambiente mais secos como Savana Estépica (Caatinga e Carrasco) e Floresta Sazonal Semidecídua (Mata Seca), mas também em áreas mais úmidas. As espécies estão inseridas em oito Unidades de Conservação: Áreas de Proteção Ambiental Dunas de Lagoinha e Serra de Meruoca, Estação Ecológica de Aiuaba, Floresta Nacional de Sobral, Parque Nacional de Ubajara, Reserva de Vida Silvestre Pedra da Andorinha, Reservas Particulares do Patrimônio Natural Serra das Almas e Fazenda Trussú. São apresentados chave de identificação, descrições, comentários sobre as espécies, distribuição geográfica, relações taxonômicas, dados fenológicos e fotografias.

**Palavras-chave:** Caatinga, Flora, Semiárido, Taxonomia.

### Introduction

The family Talinaceae (Caryophyllales) comprises 28 species that belong to three genera: *Amphipetalum* Bacigalupo, with one species recorded for Paraguay and Bolivia; *Talinum* Adans., with 15 species distributed in Africa and the

Americas; and *Talinella* Adans., with 12 species endemic to Madagascar (Nyffeler & Egli 2010). In Brazil, the family is represented only by *Talinum fruticosum* (L.) Juss. and *T. paniculatum* (Jacq.) Gaertn., which both occur in the state of Ceará (Hassemer 2022).

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Its species were traditionally treated in *Portulacaceae s.l.* However, based on molecular studies, the group was split into four families: *Anacamptserotaceae*, *Montiaceae*, *Portulacaceae s.s.*, and *Talinaceae* (Carolin 1993; Hershkovitz & Zimmer 1997; Applequist & Wallace 2001; Egli & Ford-Werntz 2002; Nyffeler 2007; Nyffeler & Egli 2010; APG IV 2016). *Talinaceae* consist of succulent herbs or subshrubs with the following: generally tuberous roots; alternate, entire, glabrous to tomentose leaves; terminal, paniculate inflorescences or inflorescences reduced to one flower per leaf axil; showy, bisexual, actinomorphic flowers with numerous stamens and a superior, unilocular, 3(–5)-carpellate, pluriovulate ovary; and fruit that is a loculicidal capsule (Souza & Lorenzi 2019; Hassemer 2022).

The *Talinaceae* species in Brazil are commonly reported as crop invasives (Mendoza & Wood 2013; Souza & Lorenzi 2019) and unconventional food and medicinal plants (Madeira & Botrel 2018; Menezes 2020). The leaves are rich in protein, calcium, iron, zinc and molybdenum (Manhães *et al.* 2008), and are a source of food that can be consumed raw in salads (Kinupp 2007) or in stews, soups, and omelets (Madeira & Botrel 2018). *Talinum fruticosum* has a laxative property (Agra *et al.* 2008), while *T. paniculatum* is used in home medicine to treat wounds, inflammation, and skin conditions (Tolouei *et al.* 2019).

In Brazil, studies about *Talinaceae* are still incipient. The first reference is a treatment by Rohrbach (1872), in *Flora brasiliensis*, where the author reported two species: *Talinum patens* (Jacq.) Willd. (currently a synonym of *T. paniculatum*) and *T. racemosum* (L.) Rohrb. Subsequently, representatives of the family were cited in some state and local floras, such as Rio de Janeiro (Teixeira 1959), Rio Grande do Sul (Mattos 1984), São Paulo (Rodrigues & Furlan 2002), Bahia (Coelho & Giulietti 2006), Alagoas (Lemos *et al.* 2010), Paraíba (Albuquerque *et al.* 2022), and Mirindiba in Pernambuco (Coelho 2009).

For the state of Ceará, no taxonomic treatment specifically for the family had been published. The species of *Talinaceae* have only been mentioned in general floristic studies conducted in the municipality of Crateús (Araújo *et al.* 2011), Chapada do Araripe (Silva *et al.* 2012; Loiola *et al.* 2015), Ubajara National Park (Silveira *et al.* 2020a), and Maciço de Baturité (Silveira *et al.* 2020b).

Within the scope of the project “Flora of Ceará: conhecer para conservar” (Loiola *et al.* 2020), which purposes to provide data to broaden the knowledge about the flora of Ceará, the aim of this study was to conduct a floristic-taxonomic survey and update the geographical distribution of the species of *Talinaceae* in the state of Ceará. Here, an identification key, descriptions, photographs, and comments on the geographical distribution, taxonomic relationships, and phenology are provided for the species.

## Material and Methods

The floristic-taxonomic survey was based on material from field expeditions carried out from March 2015 to April 2022 and an analysis of collections in the EAC, ESA, HCDAL, HUEFS, HUVA, HVASF, MOSS, and RB (acronyms according to Thiers, continuously updated) herbaria. We photographed, collected, and processed the botanical material following the methods proposed by Mori *et al.* (1989).

Taxonomic identifications were made by consulting specialized literature (Coelho 2009; Machado Filho *et al.* 2012; Mendoza & Wood 2013), conducting comparative analyses of exsiccatae reviewed by specialists, and looking at photos of collections available on the Re flora Virtual Herbarium (REFLORA 2022) and *speciesLink* (CRIA 2022). For the morphological descriptions, we adopted the terminology proposed by Radford (1974) and Gonçalves & Lorenzi (2011), while the nomenclature of taxa was confirmed using the International Plant Names Index - IPNI (2022). The identification key and the descriptions of the genus and species are based on samples collected in Ceará. The photographic plate was made using GIMP 2.10.22 (GIMP 2022) and Adobe Photoshop 22.3.0 (Adobe 2021).

We obtained data about the geographical distribution, vegetation types, popular names, and phenology from labels of the specimens analyzed. The distribution map of the species, which indicates the type of vegetation where they occur, was drawn by delimiting 0.5° longitude × 0.5° latitude grid cells. For specimens with no coordinates, we used the coordinates of the city where they were collected, which were obtained using the “geoLoc” tool (CRIA 2022).

For the vegetation types, we adopted the classification proposed by Figueiredo (1997) and the Brazilian Vegetation Technical Manual

(IBGE 2012), where we identified the following: Semideciduous Seasonal Forest (Dry Forest), Dense Ombrophilous Forest (Humid Forest), Stepic Savanna (Caatinga and Carrasco), Mixed Dicotylus-Palmaceous Forest (Carnaubal), and Vegetation under Fluvial and/or Lacustrine Influence (Ciliar Forest).

## Results and Discussion

For the state of Ceará, two species have been recorded, *Talinum fruticosum* (L.) Juss. and *T. paniculatum* (Jacq.) Gaertn, which are found mainly in the drier areas of Steppic Savannah (Caatinga and Carrasco) and Seasonal Semideciduous Forest (Dry Forest). However, they also occur in humid areas of Dense Ombrophilous Forest and Vegetation under Fluvial and/or

Lacustrine Influence (Ciliar Forest). The species occur at elevations up to 470 m (*T. fruticosum*) and 684 m (*T. paniculatum*) and are generally associated with shady locations and fertile soils.

The occurrence of the species was confirmed for eight conservation units (CU): Dunas da Lagoinha Environmental Protection Area (*Talinum fruticosum*), Serra da Meruoca Environmental Protection Area (*Talinum paniculatum*), Aiuaba Ecological Station (*Talinum fruticosum* and *T. paniculatum*); Sobral National Forest, Ubajara National Park and Pedra da Andorinha Wildlife Refuge (*Talinum fruticosum*); Serra das Almas Private Natural Heritage Reserve (*Talinum fruticosum* and *T. paniculatum*); and Fazenda Trussú Private Natural Heritage Reserve (*Talinum fruticosum*).

## Identification key to the Talinaceae species in Ceará

1. Inflorescence cymose, terminal, peduncle triangular; petals pink; seeds tuberculate..... 1. *Talinum fruticosum*
- 1'. Inflorescence in a terminal panicle, peduncle cylindrical; petals yellow or pink; seeds verrucose..... 2. *Talinum paniculatum*

### Taxonomic treatment

**Talinaceae** (Fenzl) Doweld.

*Talinum* Adans., Fam. Pl. 2: 245, 609. 1763.

Herbs, 20–80 cm tall, succulent, erect, annual, glabrous. Roots thickened. Stem branched, green. Leaves alternate, in basal rosettes, persistent, petiolate; blade elliptic to obovate, apex rounded, acute or truncate, margin entire, base cuneate. Inflorescence a terminal branched cyme or panicle, peduncle cylindrical or triangular. Flowers pedicellate; sepals 2, hyaline with green central vein; petals 5, yellow or pink; stigma trifid; ovary pubescent. Fruits loculicidal capsules, globose or ovoid, dehiscent by 3 longitudinal slits. Seeds reniform, numerous, dark brown to blackish.

*Talinum* comprises approximately 50 species that are mainly distributed in dry tropical and subtropical regions of both hemispheres, with centers of diversity in the Neotropics and South Africa (Mabberley 2008). In Brazil, the family Talinaceae is represented only by the two species treated in this paper: *Talinum fruticosum* and *T. paniculatum*.

**1. *Talinum fruticosum*** (L.) Juss., Gen. Pl. 312. 1789. Figs. 1; 2a-d

Herb, 20–40 cm tall. Leaves persistent; subsessile or petiole 1–2 mm long; blade 46–110 × 20–45 mm, elliptic to obovate, base attenuate, apex rounded or truncate, margin entire; central vein evident on abaxial side. Inflorescence 60–130 mm long, terminal branched cyme, peduncle triangular. Flowers pedicellate; sepals 7–9 mm long, hyaline with a green central vein; petals 10–13 mm long, elliptic, pink; ovary pubescent. Capsules 6–8 mm long, globose, greenish yellow with reddish spots; fruiting pedicel 6–12 mm long. Seeds 1–1.3 mm long, lenticular, reticulate, whitish (when young) to blackish (when mature), shiny.

**Examined material:** Aiuaba, Estação Ecológica de Aiuaba, 5.II.1997, L.W. Lima-Verde & E.O. Barros 421 (EAC). Brejo Santo, Reservatório Porcos, Povoado Atalhos, 9.X.2012, fl., D.G. Oliveira 523 (HVASF). Crateús, RPPN Serra das Almas, III.2017, fl., P.W. Moonlight 716 (HUEFS). Fortaleza, Campus do Pici, ao lado do Depto. de Tecnologia de Alimentos, 03°44'25"S, 38°34'09"W, 18.IV.2022, fl. and fr., M.I.B. Loiola 2878 (EAC). Iguatu, Fazenda Trussú/RPPN Trussú, 16.V.2009, fl., B.G. Lima 450 (MOSS). Jaguaribe, Maciço do Pereiro, 10.IV.2011, fl. and fr., A.M. Miranda & K. Manso 6277

(HVASF). Jati, Reservatório Jati, Sítio Santana, 29.I.2013, fl., *D.G. Oliveira 874* (HVASF). Mauriti, São Miguel, 07°17'41"S, 38°37'30"W, 20.V.2015, fr., *M. Oliveira 6120* (RB). Paraibapa, APA Dunas de Laginha, 16.VII.2004, *Djane* (EAC 34272). Quixadá, 29.III.2001, fr., *R.C. Costa & L.W. Lima-Verde 319* (EAC). Santa Quitéria, 4,7 km SW (em linha reta) da sede da Fazenda Itataia, 25.IV.2012, fl., *J. Paula-Souza et al. 10920* (ESA). Sobral, Fazenda Experimental da UVA, 10.IV.2015, fl. and fr., *E.B. Souza 3304* (HUVA); distrito de Tapera, REVIS Pedra da Andorinha, 1.III.2018, fl. and fr., *E.B. Souza et al. 4946* (EAC, HUVA); distrito de Jaibaras, FLONA de Sobral, 9.VI.2022, fl., *E.B. Souza et al. 6391* (HUVA). Ubajara, PARNA Ubajara, portão Araticum, 24.II.1999, fl., *A. Fernandes* (EAC 27934).

*Talinum fruticosum* has a cymose, terminal inflorescence, with a truncated peduncle, pink-petaled flowers, and tuberculate seeds. These characteristics distinguish it from *T. paniculatum*, which has a terminal, panicle inflorescence, cylindrical peduncle, yellow- or pink-petaled flowers, and verrucous seeds.

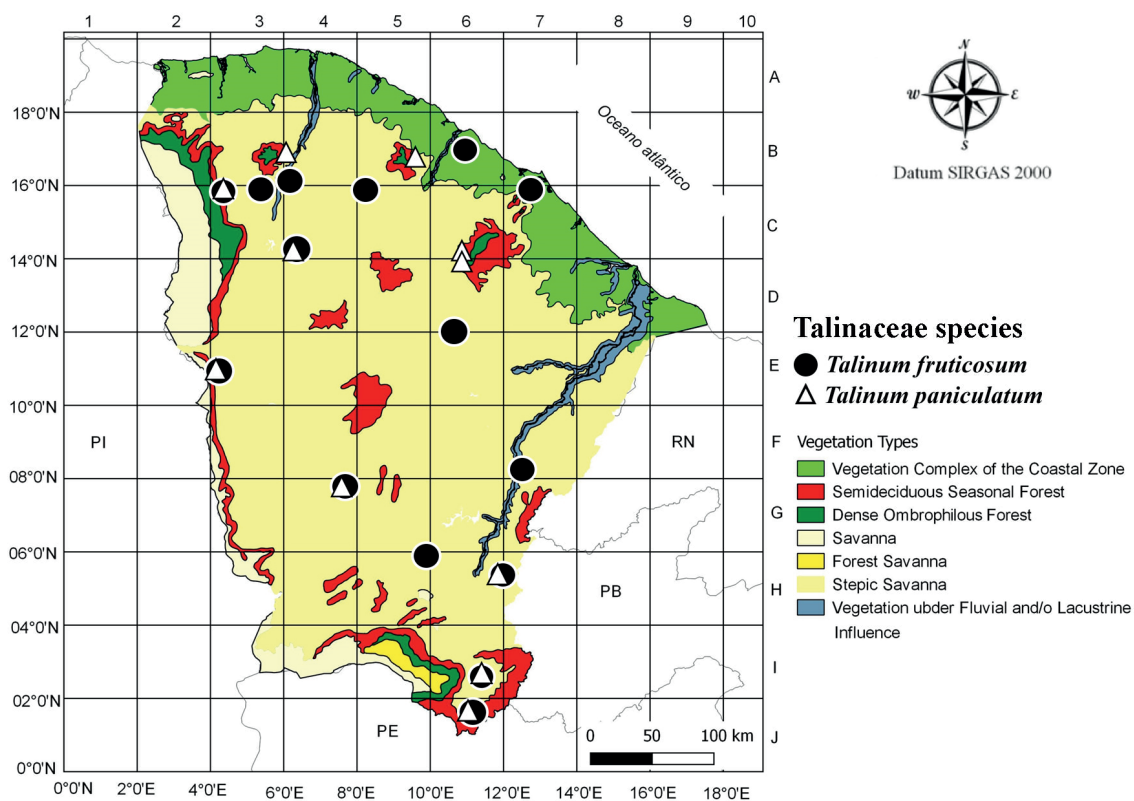
This species is widespread, with an area of occurrence ranging from the United States, through Mexico, Nicaragua and South America, to northern

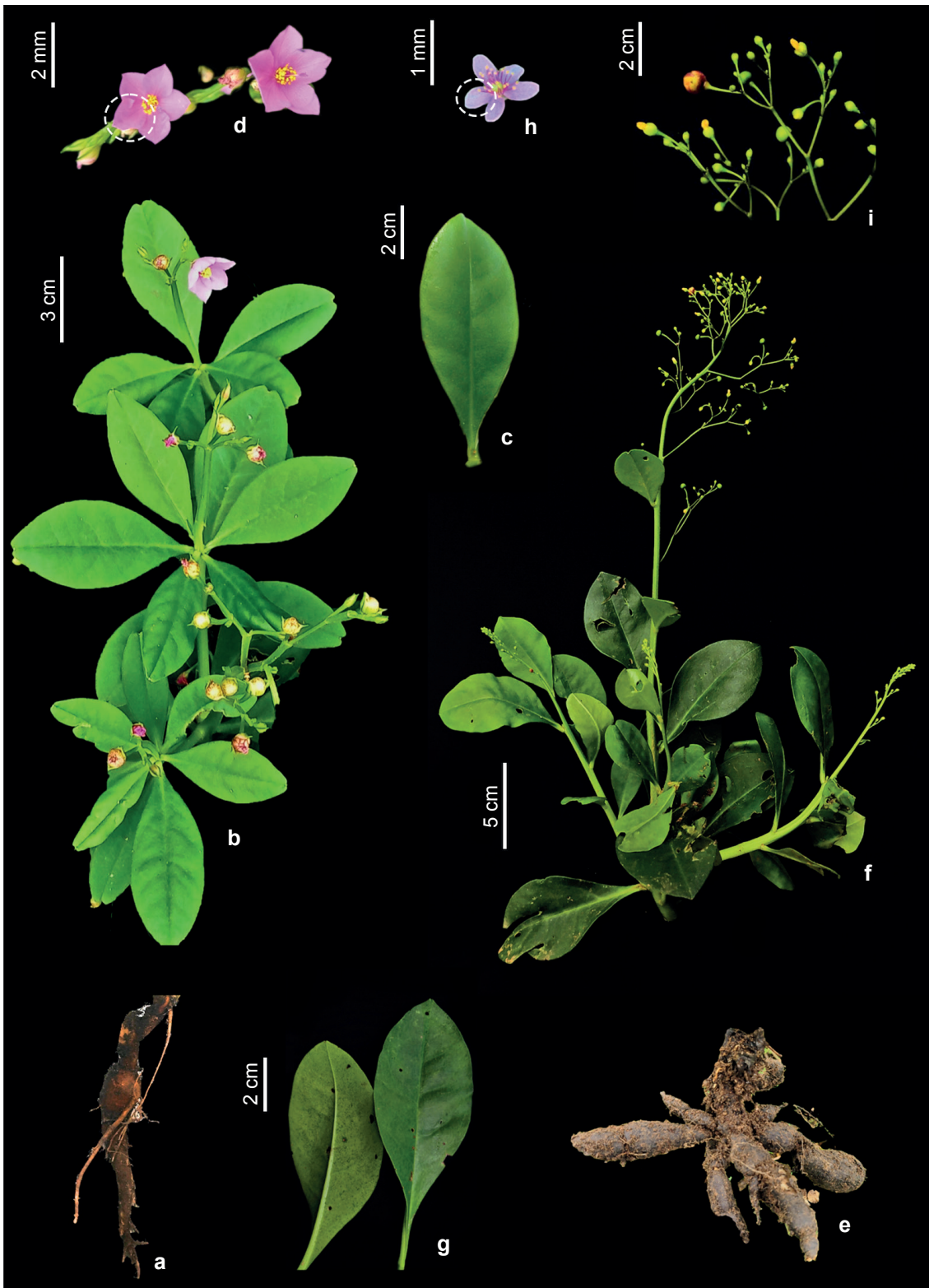
Argentina (Mendoza & Wood 2013). Since it has a wide range, it was categorized by the IUCN (2001) as Least Concern (LC) (Mendoza & Wood 2013). Its occurrence is confirmed for all regions of Brazil, where it inhabits the Amazon, Caatinga, Cerrado, Atlantic Forest, and Pantanal domains (Hassmer 2022). In Ceará, it has been recorded in Stepic Savanna vegetation (Caatinga and Carrasco), Semideciduous Seasonal Forest (Dry Forest) and Vegetation under Fluvial and/or Lacustrine Influence (Ciliar Forest), at elevations up to 470 m. It has been recorded in Dunas da Lagoinha Environmental Protection Area, Aiuaba Ecological Station, Sobral National Forest, Ubajara National Park, Pedra da Andorinha Wildlife Refuge and Serra das Almas and Fazenda Trussú Private Natural Heritage Reserves.

It has been collected with flowers from January to May and in October and with fruits in January, March, and April.

Its leaves are used as human food, in salads, and the species has ornamental potential (Kissmann & Groth 1995).

The popular names are beldroega-graúda, cariru, feijão das dunas, manjongome, manjoãogomes.





**Figure 2** – a-i. Species of Talinaceae in the state of Ceará – a-d. *Talinum fruticosum* – a. roots; b. habit; c. adaxial leaf surface; d. flowers, highlighting the shape of the petal; e-i. *Talinum paniculatum* – e. roots; f. habit; g. leaves; h. flower, highlighting the shape of the petal; i. immature fruits. (photos: a-d. M.I.B. Loiola 2878; e-i. L.H.X. Portela et al. 18).

**2. *Talinum paniculatum*** (Jacq.) Gaertn., Fruct. Sem. Pl. 2: 219. t.128. 1791. Figs. 1; 2e-i

Herb, 30–40 cm tall. Leaves petiolate, persistent; petiole 7–9 mm long; blade 2–13 × 2–5.5 mm, elliptic, base attenuate, apex attenuate, margin entire; central vein evident on the adaxial side. Inflorescence in a terminal panicle, peduncle cylindrical. Flowers pedicellate; sepals 0.4–0.3 mm long, green; petals 0.3–0.4 mm long, elliptic, yellow or pink. Capsules 4–5 mm long, globose, yellow; fruiting pedicel 10–15 mm long. Seeds 1–1.2 mm long, reniform, verrucose, blackish, shiny.

**Examined material:** Aiuaba, Estação Ecológica de Aiuaba, Gameleira de cima, 9.IV.1997, fr., *L.W. Lima-Verde 555* (EAC). Brejo Santo, Reservatório Porcos, 27.IV.2009, fr., *M. Oliveira 4011* (HVASF). Caridade, 12.XI.2009, fr., *A.C. Bezerra 30* (EAC). Caririaçu, Parque da Macaúba, 18.IV.2009, fr., *A.C.B. Santos et al. 4732* (HCDAL). Crateús, RPPN Serra das Almas, 20.III.2003, fr., *L.W. Lima-Verde 354* (EAC). Jati, Sítio Sabueiro, ASV do canal que liga o Reservatório Jati ao Reservatório Atalho, 3.IV.2013, fl., *D.G. Oliveira 977* (HVASF). Maranguape, Coité, 7.III.1996, fl., *A.S.F. Castro 133* (EAC). Mauriti, margem do Riacho São Miguel, 20.V.2015, fl., *M. Oliveira 6120* (HUEFS). Meruoca, APA Serra da Meruoca. Santa Maria, trilha para a Pedra do Urubu-Rei, 13.V.2016, fr., *E.B. de Souza et al. 4015* (EAC, HUVA); Palestina do Norte, na subida da serra, 2.VI.2022, fr., *L.H.X. Portela et al. 18* (HUVA). Mulungu, Sítio Jardim, 12.III.2003, fr., *A.P. Silveira 953* (EAC). Quixeramobim, barragem, 25.VII.1995, fr., *A.S.F. Castro* (EAC 23151). Santa Quitéria, Serra dos Quirino ou dos Pajeú, ca. 8,5 km (em linha reta) de Itatira, 26.IV.2012, fr., *J. Paula-Souza et al. 10997* (ESA). Tururu, comunidade quilombola de Água Preta, 21.III.2015, fr., *J.C.M.S.M. Sobczak 25* (EAC). Ubajara, Cachoeira do Boi Morto, 22.III.1978, fr., *A. Fernandes* (EAC 4213).

*Talinum paniculatum* is easily recognized by its paniculiform inflorescences with a cylindrical peduncle, flowers with yellow to pink petals, and warty seeds.

This species is widely distributed in tropical America, with an area of occurrence that ranges from the United States, through Mexico, the Caribbean region and South America, to northern Argentina (Mendoza & Wood 2013). Since it occurs throughout the Neotropical region, the IUCN (2001) categorized it as Least Concern (LC) (Mendoza & Wood 2013). Its occurrence is confirmed for all of Brazil, and it is present in the Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal, and Pampa domains (Hassemer 2022). In the state of Ceará, it has been recorded in Stepic Savanna (Caatinga and Carrasco), Semideciduous

Seasonal Forest, Dense Ombrophilous Forest (Humid Forest), and Vegetation under Fluvial and/or Lacustrine Influence (Ciliar Forest), at elevations up to 684 m. This species occurs in Serra da Meruoca Environmental Protection Area, Aiuaba Ecological Station, and Serra das Almas Private Natural Heritage Reserve.

It has been collected with flowers from February to May and with fruits in February, April, May, and June.

The leaves can be eaten raw or cooked and the entire aerial part of the plant can be used for animal feed (Kissmann & Groth 1995).

The popular names are beodroega, beldroega, botãozinho-rosa.

## Acknowledgements

We thank the following: the curators, employees, and interns at the EAC, ESA, HCDAL, HUEFS, HUVA, HVASF, and MOSS herbaria, for the help during this study and loaning the collections; and the INCT project - Virtual Herbarium of Brazilian Flora and Fungi (Process 465420/2014-1), for the financial support for the fieldwork. Maria Iracema Bezerra Loiola thanks CNPq, for the researcher scholarship (Proc. N° 308685/2020-2) and FUNCAP (Proc. N° MLC-0191-00147.01.00/22). Elnatan Bezerra de Souza and Luís Henrique Ximenes Portela thank FUNCAP, for the BPI productivity grant (Proc. N° BP4-0172-00170.01.00/20).

## Data availability statement

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

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