



## Original Paper

# Flora of Ceará, Brazil: Portulacaceae s.s.

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### Abstract

This study aimed to carry out a floristic inventory and update the geographical distribution of Portulacaceae species that occur in the state of Ceará, Northeast Region of Brazil. The field expeditions for collection and observation of species were realized between March/2015 and March/2021. Six species of *Portulaca* have been recorded in the state of Ceará, being identified mainly by habit, margin and leaf shape, flower coloration, operculum shape, and seed ornamentation. All species occur in Conservation Units in the state of Ceará: *P. elatior*, *P. halimoides*, *P. mucronata*, *P. oleracea*, *P. pilosa* and *P. umbraticola*. The highest floristic richness was found in the Stepic Savanna, where all species were recorded. *Portulaca halimoides* had the widest distribution in Ceará, with 17 records, occurring in various vegetation types, especially in the Stepic Savanna. *Portulaca mucronata* was registered exclusively in Stepic Savanna, being the species with the lowest number of records. Identification key, descriptions, comments about the species, taxonomic relationships, phenological data and photographs of the species are presented here.

**Key words:** Caatinga, flora, *Portulaca*, semi-arid region, taxonomy.

### Resumo

Este estudo objetivou realizar o levantamento florístico e atualizar a distribuição geográfica das espécies de Portulacaceae ocorrentes no estado do Ceará, Nordeste do Brasil. As expedições de campo para coleta e observações das espécies foram realizadas no período de Março/2015 a Março/2021. Seis espécies de *Portulaca* foram registradas no estado do Ceará, sendo identificadas principalmente pelo hábito, forma e margem das folhas, coloração das flores, forma do opérculo e ornamentação da semente. Todas as espécies ocorrem em Unidades de Conservação no estado: *P. elatior*, *P. halimoides*, *P. mucronata*, *P. oleracea*, *P. pilosa* e *P. umbraticola*. A maior riqueza foi encontrada na Savana Estépica, onde todas as espécies foram registradas. *Portulaca halimoides* apresentou a mais ampla distribuição no Ceará, com 17 registros, ocorrendo em vários tipos de vegetação, especialmente na Savana Estépica. *Portulaca mucronata* foi registrada exclusivamente em Savana Estépica, sendo a espécie com o menor número de registros. Aqui são apresentados chave de identificação, descrições, comentários sobre as relações taxonômicas, dados fenológicos e fotografias das espécies.

**Palavras-chave:** Caatinga, flora, *Portulaca*, região semiárida, taxonomia.

### Introduction

Portulacaceae *sensu stricto* (Cactineae - Caryophyllales) is currently recognized as monotypic, including only *Portulaca* L. The family comprises 110 species with a cosmopolitan

distribution (APG IV 2016; Giulietti & Coelho 2018). The delimitation of Portulacaceae *sensu lato* was the subject of discussions in studies with a taxonomic and phylogenetic approach, the latter resulting in their segregation into four families

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(Anacampserotaceae, Montiaceae, Portulacaceae s.s. and Talinaceae) (Carolin 1993; Hershkovitz & Zimmer 1997; Applequist & Wallace 2001; Eggli & Ford-Werntz 2002; Nyffeler 2007; Nyffeler & Eggli 2010; APG IV 2016).

The group includes erect or prostrate herbs (rare shrubs), often succulent, with simple, alternate leaves; cymose inflorescence, sometimes reduced to a solitary flower; showy flowers, usually androgynous, actinomorphic, monochlamydeous, pedicellate or sessile; stamens commonly numerous; inferior ovary; circumscissile capsule fruit (Coelho 2009a; Coelho & Giuliatti 2010; Souza & Lorenzi 2019).

Some representatives of Portulacaceae stand out economically for having ornamental or medicinal properties, or for being used in human food. The leaves of *Portulaca oleracea* L. are consumed in some regions of Brazil in the form of salad (Kinupp 2007), and both the vegetative and reproductive portions this species have been used in traditional medicine worldwide for centuries, as anti-inflammatory, diuretic, vermifuge, anthelmintic and for digestive problems (Agra *et al.* 2008; Lorenzi & Matos 2008).

In Brazil, Portulacaceae s.s. is represented by 21 species of *Portulaca* of which nine are endemic (*Portulaca diegoi* Mattos, *P. frienseana* Poelln., *P. giuliettiae* T.Vieira & A.A.Coelho, *P. goiasensis* T.Vieira & A.A.Coelho, *P. hatschbachii* D.Legrand, *P. hirsutissima* Cambess., *P. hoehnei* D.Legrand, *P. minensis* D.Legrand and *P. werdermannii* Poelln.) (Santos & Hassemer 2021). Portulacaceae species can occur in different types of vegetation, being common in the Caatinga and rare in the interior of forest formations, such as Ombrophilous and Semi-deciduous Forests. For the Brazilian Northeast Region and the state of Ceará, nine and six species are registered, respectively (Santos & Hassemer 2021).

Studies focusing on Portulacaceae species in Brazilian territory are scarce and, in general, ancient. The first study on the family was carried out by Rohrbach (1872) at *Flora brasiliensis*, which listed eight species. Posteriorly, representatives of Portulacaceae were mentioned in some regional or local studies. The taxa of this family were registered in the states of Rio de Janeiro (Teixeira 1959); Rio Grande do Sul (Mattos 1961); São Paulo (Rodrigues & Furlan 2002); Pará, specifically for Serra dos Carajás (Giulietti & Coelho 2018); Bahia (Coelho & Giulietti 2006), Alagoas (Lemos *et al.* 2010) and also in Pernambuco/Flora of Mirindiba

(Coelho 2009b). Currently, the most complete study of Portulacaceae s.s. for Brazil was conducted by Coelho & Giulietti (2010), where 13 species of *Portulaca* were recognized.

For Ceará, no broader floristic survey or taxonomic treatment of the family has been carried out. The only records found in the literature on Portulacaceae species in Ceará territory were the studies developed by Araújo *et al.* (2011) that registered three species for the RPPN (Private Natural Heritage Reserve) Serra das Almas, in the county of Crateús and that of Loiola *et al.* (2020) who listed five species for that state.

Within the scope of the Project “Flora of Ceará: knowing to conserve”; and with the aim of providing data to expand the knowledge about the flora of Ceará and aid in understanding the circumscription of this family, the present work had as objectives to present the floristic-taxonomic survey and to update the geographic distribution of the species of Portulacaceae s.s. in the state of Ceará. Additionally, identification keys, descriptions, comments about the species, taxonomic relationships, phenological data, and photographic plate of the species are presented here.

## Material and Methods

The floristic-taxonomic survey was based on materials from field expeditions carried out between March/2015 and March/2021 and analysis of collections from the herbaria ASE, EAC, ESA, IPA, MOSS, UFP, UFRN, HCDAL, HUEFS, HUVA, HVASF, and SPF; the acronyms are in accordance with Thiers (continuously updated). In the field, the botanical material was photographed, collected and processed following the techniques proposed by Mori *et al.* (1989).

Identification of species was carried out by the review of the specialized literature (Coelho & Giulietti 2010; Machado Filho *et al.* 2012), comparative analysis of exsiccates reviewed by specialists, and images of type-collections available at the ReFlora - Virtual Herbarium (REFLORA 2021) and *speciesLink* Network (CRIA 2021). For the morphological descriptions, the terminology proposed by Radford (1974) and Gonçalves & Lorenzi (2011) was adopted, and for the confirmation of the names of the taxa the IPNI website (2021) was consulted.

The data related to geographical distribution, type of vegetation, popular names, flowering and fruiting periods were obtained from the labels

of the analyzed exsiccates, specialized articles, and from the Flora do Brasil 2020 (continuously updated) website (<<http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/>>). The map of the geographic distribution of the species with the indication of the occurring type of vegetation was drawn by delimiting squares of 0.5° longitude × 0.5° latitude, according to Rebouças *et al.* (2020). The registration of specimens without indication of coordinates was georeferenced using the coordinates of the county, which were obtained with the tool “geoLoc” (CRIA 2021). The photographic plate was created using the program GIMP 2.10.22 (The Gimp Team 2021).

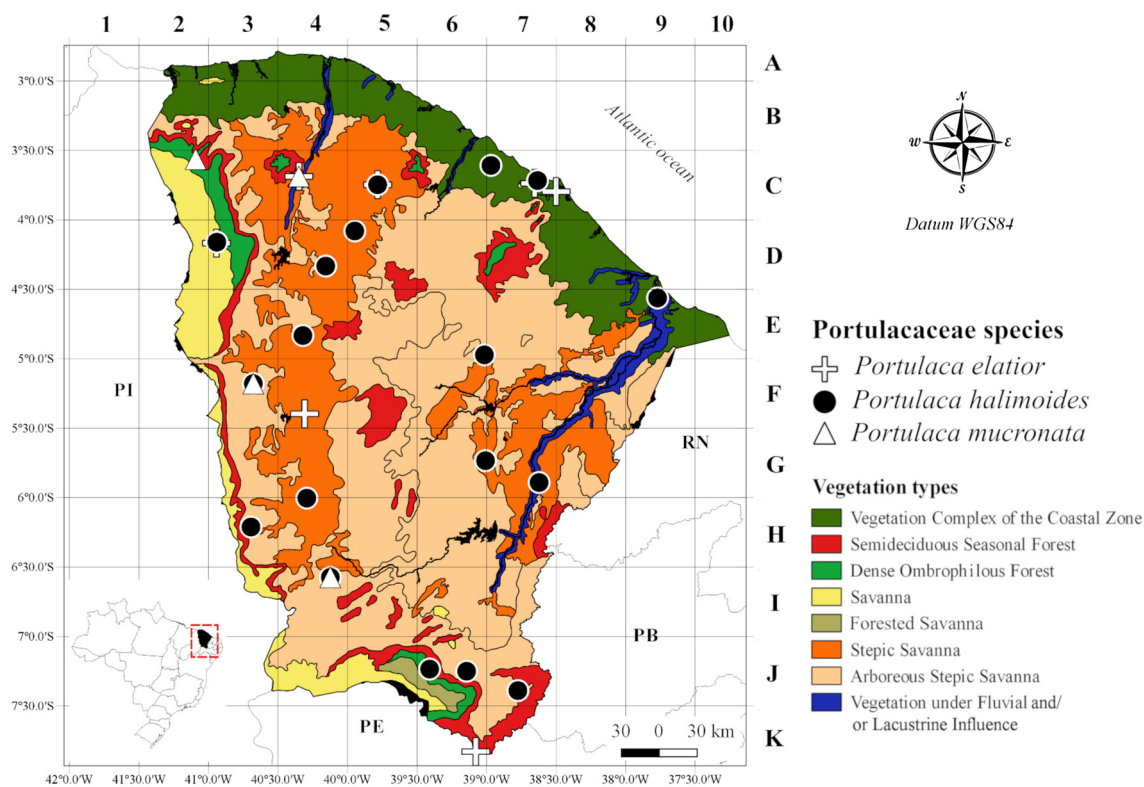
The vegetation types were defined as proposed by Figueiredo (1997) and the Technical Manual of the Brazilian Vegetation (IBGE 2012): Vegetation Complex of the Coastal Zone (comprises the Pioneer Psamphilous Vegetation, Forest behind the Dunes and Lowland Semi-deciduous Forest), Semi-deciduous Seasonal Forest (*Mata Seca*), Dense Ombrophilous Forest (*Mata Úmida*), Savanna (*Cerrado*), Forested Savanna

(*Cerradão*), Stepic Savanna (*Caatinga/Carrasco*), Arboreous Stepic Savanna (*Caatinga Arbórea*) and Vegetation under Fluvial and/or Lacustrine Influence (*Mata Ciliar*).

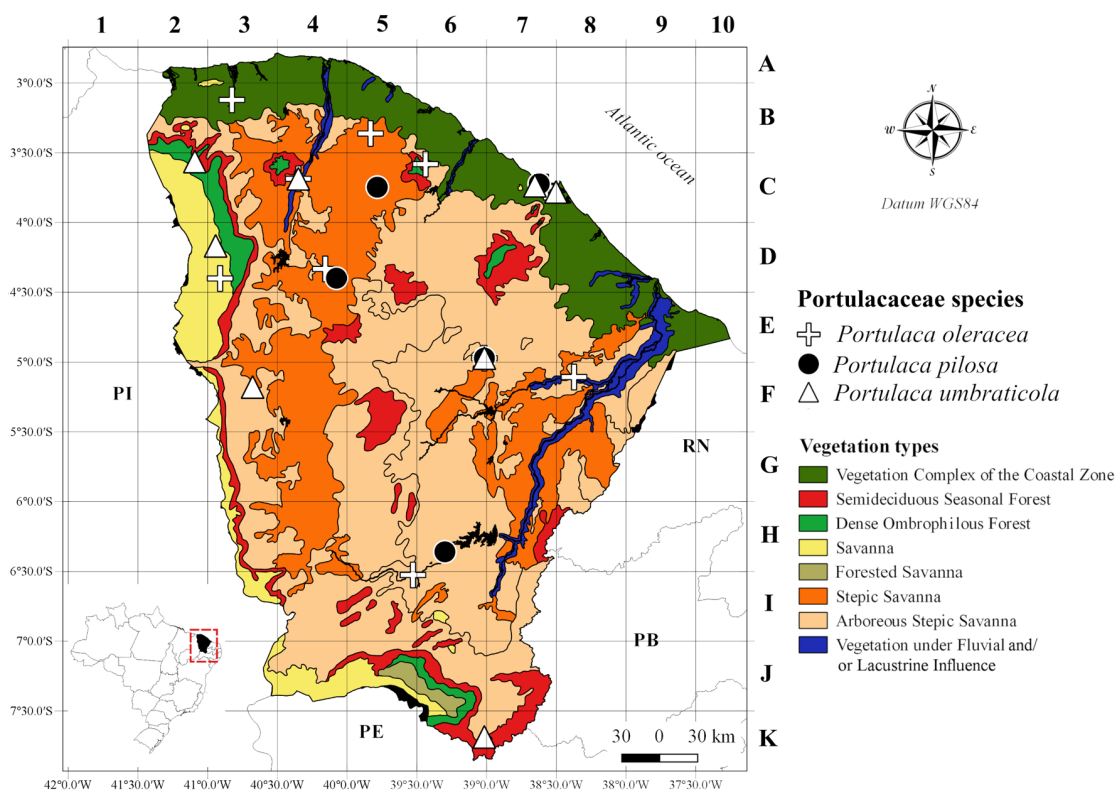
### Results and Discussion

Portulacaceae is represented in the state of Ceará by six species of *Portulaca* (*P. elatior* Mart. ex Rohrb., *P. halimoides* L., *P. mucronata* Link., *P. oleracea* L., *P. pilosa* L., and *P. umbraticola* Kunth.) (Figs. 1; 2), being identified mainly by habit, margin and leaf shape, flower coloration, operculum shape, and seed ornamentation. All species are non-endemic to Brazil (Santos & Hassemer 2021).

The geographic distribution of the taxa is often associated with drier environments, such as Stepic Savanna (*Caatinga/Carrasco*), Savanna and Vegetation Complex of the Coastal Zone (Lowland Semi-deciduous Forest = *Mata de Tabuleiro*). The highest floristic richness was found in the Stepic Savanna, notably in the western portion of the state, where all species were recorded. On the other hand,



**Figure 1** – Geographic distribution of Portulacaceae species in the state of Ceará. (PB = Paraíba; PE = Pernambuco; PI = Piauí; RN = Rio Grande do Norte).



**Figure 2** – Geographic distribution of Portulacaceae species in the state of Ceará. (PB = Paraíba; PE = Pernambuco; PI = Piauí; RN = Rio Grande do Norte).

the more central areas of Ceará state showed few or no records. *Portulaca halimoides* had the widest distribution in Ceará, with confirmed occurrence in 17 counties, occurring in various vegetation types, especially in the Stepic Savanna. *P. mucronata* was registered exclusively in Stepic Savanna, being the species with the lowest number of records, only in four counties (Fig. 1). All species were

registered in Conservation Units in the state of Ceará: Aiuaba Ecological Station/Aiuaba (2 spp.); Cachoeira Missão Velha Environmental Protection Area/Missão Velha (1 sp.); Ceará Botanical Park/Caucaia (3 spp.); Pedra da Andorinha Wildlife Refuge/Sobral (1 sp.); Private Natural Heritage Reserve (RPPN) Serra das Almas/Crateús (2 spp.); RPPN Trussú/Iguatu (2 spp.).

### Identification key to the Portulacaceae species from the state of Ceará

1. Pyxis with alate expansion ..... 6. *Portulaca umbraticola*
- 1'. Pyxis without alate expansion.
  2. Leaves with whitish edge; flowers pedicellate ..... 2. *Portulaca halimoides*
  - 2'. Leaves without whitish edge; flowers sessile.
    3. Flower purple; fruit peduncle 0.5–1 mm long ..... 5. *Portulaca pilosa*
    - 3'. Flower white, yellow or cream; fruit peduncle absent.
      4. Stem prostrate; sepals with crenate dorsal side; opercule conical ..... 4. *Portulaca oleracea*
      - 4'. Stem erect; sepals with concave dorsal side; opercule hemispherical.
        5. Leaves linear-lanceolate, caducous; seeds ornamented ..... 1. *Portulaca elatior*
        - 5'. Leaves oblong-lanceolate or obovate, persistent; seeds unornamented ..... 3. *Portulaca mucronata*

## Taxonomic treatment

**Portulacaceae*****Portulaca* L., Sp. Pl. 1: 445. 1753.**

*Portulaca* species are characterized as herbs, succulent, annual or perennial, with stems cylindrical, sympodial, rare monopodial, prostrate or erect, green to reddish in some species; leaves simple, alternate, usually glabrous, deciduous or persistent, with a flattened or cylindrical limb; inflorescences cymose; flowers actinomorphic, sessile, bisexual, with 2 sepals, 4–5 petals free; stamens usually numerous; ovary inferior or seminiferous and fruit capsule with transversal dehiscence (pyxis); seeds generally small, numerous, reniform, ornamented or not, and lack aryl (Coelho & Giulietti 2010).

The genus has a wide distribution in the Neotropics and in tropical and subtropical regions of Africa (Coelho & Giulietti 2010). In Brazil, *Portulaca* is represented by 21 species, of which nine occur in the Northeast Region (Santos & Hassemer 2021).

**1. *Portulaca elatior* Mart. ex Rohrb., in Mart., *Fl. bras.* 14(2): 302. t. 69. 1872. Figs. 1; 3a; 4a-c**

Herb 15–35 cm; stem erect, green, little branched; trichomes axillary ca. 8 mm long, numerous, lanuginous, whitish, surrounding the entire node. Petiole 1–2 mm long. Leaves glabrous, usually caducous; lamina 10–15 × 1–1.5 mm, linear-lanceolate, base attenuate to rounded, apex acute to acuminate, margin entire, without whitish edge; midrib inconspicuous on the adaxial surface, caducous. Involucral leaves 5–15 × 0.5–1 mm, ca. 6 per inflorescence, linear-lanceolate, base rounded, apex acute, margin entire. Inflorescence 3–7 flowers. Flowers sessile; sepals 4–5 mm long, glabrous, with reddish streaks, concave dorsal side; petals 5–7 mm long, obcordate, apex emarginate, white, yellow or cream; stamens 10–15. Pyxis 4–5 mm long, opercule hemispherical, without alate expansion; fruit peduncle absent. Seeds 0.5–0.8 mm, reniform, 15–25 per fruit, ornamented, blackened, opaque.

**Examined material:** Carnaubal, Planalto da Ibiapaba, 30.IV.2010, fr., *E.M. Marreira et al.* 89 (HUVA). Caucaia, Parque Botânico do Ceará, 29.I.1998, fr., *A. Fernandes et al.* (EAC 26104). Fortaleza, Cidade dos Funcionários, 3.IV.1993, fr., *I.M.B. Sá* 18 (EAC). Independência, Boa Dávila, *I.S.A. Cardins* 128 (IPA). Irauçuba, Fazenda Cacimba, 22.IV.2001, fl. and fr., *G.B. Oliveira* (EAC 31815). Penaforte, Sítio Baixio do Couro, 18.VIII.2009, fr., *A.P.B. Santos* 17 (HVASF).

Sobral, Fazenda Experimental da UVA, 10.IV.2015, fr., *E.B. Souza* 3313 (HUVA).

*Portulaca elatior* resembles *P. mucronata* in that they share an erect stem, with little ramification (a feature not common to the genus), hemispherical opercule and absent fruit peduncle. However, *P. elatior* has linear-lanceolate leaves (vs. oblong-lanceolate) and ornamented seeds (vs. without ornamentation).

*Portulaca elatior* has a wide geographic distribution in the Caribbean and South America, occurring in Cuba, Dominican Republic, Venezuela, Bolivia and Brazil, where it inhabits the phytogeographic domains Caatinga, Cerrado and Atlantic Forest (Santos & Hassemer 2021; TROPICOS 2021). In Ceará, it was registered in seven counties from the coast to the interior, in Savanna, Stepic Savanna (Caatinga) and Vegetation Complex of the Coastal Zone (Lowland Semideciduous Forest). The species was registered at the Ceará Botanical Park.

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

**2. *Portulaca halimoides* L., Sp. Pl. 2:639. 1762.**

Figs. 1; 4d-e

Herb 5–17 cm; stem prostrate, green, densely branched from the base; trichomes axillary 4–10 mm long, very numerous, lanuginous, whitish to brown, surrounding the entire node. Petiole 0.5–1.5 mm long. Leaves glabrous, persistent; lamina 4–12 × 0.8–2 mm, linear to oblong, base attenuate, apex obtuse to rounded, margin entire, with whitish edge; midrib inconspicuous on the adaxial surface, persistent. Involucral leaves 4–8 × 0.5–1 mm, 4–8 per inflorescence, linear to oblong, base attenuate to rounded, apex obtuse, margin entire. Inflorescence 2–6 flowers. Flowers pedicellate; sepals 2–3 mm long, glabrous, dorsal side concave; petals 2–4 mm long, obcordate, apex emarginate, white, yellow or rose; stamens 6–12. Pyxis 0.4–0.8 mm long, opercule conical, without alate expansion; fruit peduncle 1–1.5 mm long. Seeds 0.4–0.5 mm, reniform, 8–15 per fruit, ornamented, greyish, shiny.

**Selected examined material:** Aiuaba, Estação Ecológica de Aiuaba, próximo à Lagoa do Rosio, 22.II.1984, fr., *E. Nunes* (EAC 12361). Aracati, Fazenda Belém, 2.VI.2014, fr., *M.I.B. Loiola et al.* 2243 (EAC). Carnaubal, 30.IV.2010, fr., *E.K.S. Brandão et al.* 18 (EAC). Caucaia, Parque Botânico do Ceará, 24.IV.1988, fl., *M.S. Lopes* 06 (EAC). Crateús, Grajaú, 6.VI.2003, fr., *L.W. Lima-Verde* 52 (EAC). Crato, 26.VIII.1936, fl., *P. Luetzelburg*

23751 (IPA). Irauçuba, 1.I.2007, fr., *C.D.S. Pessoa* 67 (EAC). Jaguaribe, 9.III.1995, fl. and fr., *D. Macedo* 52 (EAC, HUEFS). Mauriti, 2.V.2009, fl., *M.T. Buril* 299 (UFP, HVASF). Missão Velha, margem do Rio Solaman,

APA Cachoeira Missão Velha, 07°13'21"S, 39°08'38"W, 18.VIII.2011, fl. and fr., *E. Melo* 10223 (HUEFS). Parambu, Fazenda Pau Preto, 22.V.1982, fl., *E. Nunes* (EAC 11412, HUEFS 76339). Quixadá, Fazenda Ouro



**Figure 3** – a-i. Portulacaceae of Ceará – a. *Portulaca elatior*; b-c. *P. mucronata*; d-e. *P. oleracea*; f-g. *P. pilosa*; h-i. *P. umbraticola*. Credits: a, c-e. R. T. de Queiroz.

Preto, 12.III.2014, fl., *J. Jardim et al 6548* (UFRN). Santa Quitéria, Minas de Urânio, 26.IV.1979, fr., *A. Fernandes et al.* (EAC 5952). São Gonçalo do Amarante, 13.III.2011, fr., *A.S.F. Castro 2458* (EAC). Sobral, Taperuaba, Unidade de Conservação Refúgio de Vida Silvestre Pedra da Andorinha, 04°03'51"S, 39°59'51"W, 22.V.2016, fl., *E.B. Souza et al. 4072* (HUEFS, HUVA). Solonópole, Açude Sr. Carlos, 27.IV.2017, fl., *F.J. Chamorro 302* (EAC). Tamboril, congl. 189, sub. 4, 04°02'24"S, 41°19'12"W, 24.III.2014, fr., *W. Batista 318* (EAC). Tauá, congl. 274, sub. 3, 7.V.2014, fl., *M. Mayer 63* (EAC).

*Portulaca halimoides* differs from other species occurring in Ceará in that it presents a prostrate stem, densely branched from the base, glabrous leaves, persistent narrow whitish edge on the margin, pedicellate flowers and pyxis with conical opercule. Coelho & Giuliatti (2010) pointed out that pedicellate flowers and fruits with developed peduncles are rare features in the genus.

*Portulaca halimoides* has a confirmed occurrence in the United States, Mexico, Guatemala, Caribbean, Colombia, Venezuela, Ecuador, Peru, and all regions of Brazil (Machado Filho *et al.* 2012; TROPICOS 2021), in the phytogeographic domains Amazon, Atlantic Forest, Caatinga, Cerrado and Pampa (Santos & Hassemmer 2021). In Ceará, it was registered in 17 counties inhabiting the Stepic Savanna (Caatinga/Carrasco), Arboreous Stepic Savanna, Semideciduous Seasonal Forest and Vegetation Complex of the Coastal Zone (in Pioneer Psamophilous Vegetation and Lowland Semideciduous Forest). The species was registered in four Conservation Units in Ceará: Aiuaba Ecological Station, Cachoeira Missão Velha Environmental Protection Area, Ceará Botanical Park and Pedra da Andorinha Wildlife Refuge.

The species was flowering in March, April and May and fruiting from January to June.

### 3. *Portulaca mucronata* Link, Enum. Hort. Berol. 2. 1822.

Fig. 1; 3b-c

Herb 12–26 cm; stem erect, green or reddish, little branched; trichomes axillary 0.4–0.5 mm long, scarce, lanuginous, whitish, surrounding the entire node. Petiole 1–3 mm. Leaves glabrous, persistent; lamina 9–23 × 2–6 mm, oblong-lanceolate or obovate, base attenuate, apex acute, margin entire, papillose, without whitish edge; midrib conspicuous on the adaxial surface, persistent. Involucral leaves 11–20 × 3–6 mm, 7–9 per inflorescence, lanceolate, base attenuate, apex acute, margin entire. Inflorescence 2–5 flowers. Flowers sessile; sepals 6–8 mm long,

glabrous, concave dorsal side; petals 6–9 mm long, obcordate, apex emarginate, yellow; stamens 20–30; ovary inferior. Pyxis 4–7 mm long, opercule hemispherical, without alate expansion; fruit peduncle absent. Seeds 0.6–0.8 mm, reniform, 15–35 per fruit, unornamented, blackened, shiny.

Illustrations of the species are available in Coelho & Giuliatti (2010).

**Selected examined material:** Aiuaba, Estação Ecológica de Aiuaba, Lagoa da Boiada, 26.II.1997, fr., *L.W. Lima-Verde 493* (EAC). Beberibe, córrego da Aroeira, 04°56'49"S, 38°01'01"W, 12.III.2021, fl., *M.I.B. Loiola 2864* (EAC). Crateús, RPPN Serra das Almas, Centro Ecológico, 4.IV.2017, fl., *M. Meneses 166* (EAC). Sobral, Fazenda Experimental da UVA, 10.IV.2015, fr., *E.B. Souza 3315* (HUVA). Viçosa do Ceará, Sítio Engenho Velho, 29.IV.2010, fr., *E.B. Souza et al. 1823* (EAC).

*Portulaca mucronata* has as remarkable features a green to reddish erect stem, yellow flowers and unornamented seeds. Another interesting feature of this species is the sparse pilosity in the leaf axils, a characteristic that is also shared with *P. oleracea* and *P. umbraticola* (Coelho & Giuliatti 2010). However, *P. mucronata* is distinguished from the former by the erect habit and hemispherical opercule (*vs.* prostrate habit and conical opercule) and from the latter by the fruit without alate expansion and the unornamented seeds (*vs.* fruit with alate expansion and ornamented seeds).

*Portulaca mucronata* is widely distributed in South America, occurring in Venezuela, Bolivia, Paraguay, and in all regions of the Brazilian territory, with records in the Amazon, Atlantic Forest, Caatinga and Cerrado domains (Machado Filho *et al.* 2012; Santos & Hassemmer 2021; TROPICOS 2021). In Ceará, it was registered in four counties and exclusively in the Stepic Savanna (Caatinga/Carrasco). This species occurs in two Conservation Units: Aiuaba Ecological Station and RPPN Serra das Almas.

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

### 4. *Portulaca oleracea* L., Sp. Pl.: 445. 1753.

Figs. 2; 3d-e; 4f-g

Herb 20–34 cm; stem prostrate, green or reddish, little branched, glabrous or slightly pilose; trichomes axillary ca. 1 mm long, capitate, scarce, lanuginous, whitish. Petiole 0–3 mm long. Leaves glabrous, persistent; lamina 11–30 × 3–10 mm, oblanceolate to spatulate, base attenuate or rounded, apex retuse, truncate, rounded acute or obtuse, margin entire, without whitish edge;



**Figure 4** – a-j. Portulacaceae of Ceará – a-c. *Portulaca elatior* – a. leaf; b. infructescence with three pyxis; c. ornamented seed; d-e. *P. halimoides* – d. leaf; e. ornamented seed; f-g. *P. oleracea* – f. habit; g. flower with the detail of one crenate dorsal sepal (dashed white circle); h. *P. pilosa* – h. habit; i-j. *P. umbraticola* – i. leaf; j. pyxis with winged expansion (white arrow). [a-c. I.M.B. Sá 18 (EAC); d-e. M.I.B. Loiola et al. 2243 (EAC); f-g. E.B. Souza et al. (EAC 29989); h. L.W. Lima-Verde et al. 596 (EAC); i-j. E.B. Souza et al. 1824].



midrib conspicuous on the adaxial surface, persistent. Involucral leaves 4–6 × 2–3 mm, ca. 4 per inflorescence, oblanceolate to spatulate, base rounded, apex rounded, margin entire. Inflorescence 2–6 flowers. Flowers sessile; sepals 4–6 mm long, glabrous, crenate dorsal side (carina aliform); petals 2–4 mm long, obcordate, yellow or white; stamens 8–15; ovary inferior. Pyxis 4–7 mm long, opercule conical, without alate expansion; fruit peduncle absent. Seeds 0.5–0.8 mm, reniform, 20–30 per fruit, ornamented, blackened, opaque.

**Selected examined material:** Aiuaba, 22.II.2007, fl., *P.G.A. Mendes 52* (HCDAL). Croatá, congl., 105, sub. 1, 04°19'12"S, 41°02'24"W, 29.I.2014, fl., *I. Lucena 128* (EAC). Fortaleza, Horto de Plantas Mediciniais Abreu Matos, UFC, 20.X.2015, fl., *G.F.J. Medeiros* (EAC 58560). Granja, Barragem Lima Brandão, fl., *M.I.B. Loiola et al. 2408* (EAC). Iguatu, RPPN Trussu, 30.III.2008, fl., *B.G. Lima 68* (MOSS). Itapipoca, Baleia, Sítio Bode, 18.II.2016, fl., *B.G. Rodrigues 2* (EAC). Jucás, Rodovia CE 282, próximo à ponte sobre o Rio Jaguaribe, 31.III.2000, fl., *E.B. Souza et al.* (EAC 29989). Morada Nova, Fazenda Lagoa do Meio, 9.III.2009, fl. and fr., *A.S. Silva 64* (ASE). Quixadá, Fazenda Ouro Preto, 12.III.2014, fl., *J. Jardim 6549* (HUEFS). Santa Quitéria, 11,4 km (em linha reta) da sede da Fazenda Itatiaia, 28.IV.2021, fl., *J. Paula-Souza et al. 11081* (ESA, USP). Sobral, Fazenda Experimental da UVA, 10.IV.2015, fl. and fr., *E.B. Souza 3302* (HUVA). Tururu, comunidade quilombola de Conceição dos Caetanos, 30.I.2016, fl., *J.C.M.S.M. Sobczak 136* (EAC).

This species has the exclusive feature sepals with crenate dorsal side (aliform carina). It resembles *P. umbraticola* in leaf shape, which ranges from oblanceolate to spatulate, and sessile flowers. *P. oleracea*, has a prostrate stem (*vs. erect*), conical opercule (*vs. hemispherical*) and absence of membranous alate expansion around the fruit (*vs. presence of membranous alate expansion*).

*Portulaca oleracea* is widely distributed across from the United States of America, Mexico, Belize, El Salvador, Honduras, Guatemala, Nicaragua, Costa Rica, Caribbean, Panama, Venezuela, Colombia, Suriname, French Guiana, Guyana, Brazil, Peru, Ecuador, Chile, Paraguay, Madagascar, Cameroon, Republic of Central Africa, Tanzania, Zambia, India, China and Taiwan (Machado Filho *et al.* 2012; TROPICOS 2021). In Brazilian territory, its occurrence is confirmed in all regions and associated with the Amazon, Atlantic Forest Caatinga, Cerrado, and Pampa domains (Santos & Hassemer 2021). In the state of Ceará, the species is registered in eleven counties in the Stepic Savanna and in the Vegetation Complex

of the Coastal Zone (in Lowland Semideciduous Forest). It occurs at RPPN Trussu.

The species was flowering between January and July, and Fruiting in January, March and April. Popular name: *beldroega, vassourinha*.

##### 5. *Portulaca pilosa* L., Sp. Pl. 2:445. 1753.

Figs. 2; 3f-g; 4h

Herb 15–20 cm; stem prostrate, green, little branched; trichomes axillary ca. 5 mm long, numerous, lanuginous, brown to whitish, surrounding the entire node. Petiole 1–1.5 mm long. Leaves glabrous, persistent; lamina 8–19 × 1–2 mm, oblong to obovate, base attenuate, apex acute, margin entire, without whitish edge; midrib inconspicuous on the adaxial surface, persistent. Involucral leaves 7–15 × 1–2 mm long, 5–10 per inflorescence, linear to lanceolate, base rounded, apex acute, margin entire. Inflorescence 15–29 flowers. Flowers sessile; sepals 5–6 mm long, glabrous, dorsal side concave; petals 4–8 mm long, obcordate, apex emarginate, purple; stamens 15–20. Pyxis 3–4 mm long, opercule conical, without alate expansion; fruit peduncle 0.5–1 mm long. Seeds ca. 0.5 × 0.7 mm, reniform, 10–15 per fruit, ornamented, blackened, opaque.

**Selected examined material:** Aiuaba, Estação Ecológica de Aiuaba, Gameleira de Cima, 9.IV.1997, fr., *L. W. Lima-Verde et al. 596* (EAC). Beberibe, córrego da Aroeira, 04°56'49"S, 38°01'01"W, 12.III.2021, fl., *M.I.B. Loiola 2865* (EAC). Caucaia, Parque Botânico do Ceará, 25.III.1998, fl., *E. Nunes* (EAC 26273). Iguatu, Fazenda Trussu/ RPPN Trussu, 3.V.2008, fl., *B.G. Lima 181* (MOSS). Irauçuba, 1.I.2006, fr., *C.D.S. Pessoa 02* (EAC). Parambú, Fazenda Pau Preto, 22.V.1982, fr., *E.P. Nunes* (EAC 11412). Quixadá, Sítio Santa Luzia, 16.IV.2000, fr., *R.F. Oliveira 45* (EAC).

*Portulaca pilosa* is characterized by conspicuous axillary trichomes (ca. 5 mm long), oblong to obovate leaves and purple flowers. This species is sometimes confused with *P. elatior*, but differs from the latter by its prostrate habit and purple flowers.

*Portulaca pilosa* has a wide geographic distribution in the Americas, occurring from the United States, Mexico, Belize, Honduras, Nicaragua, El Salvador, Costa Rica, Panama, Caribbean, Colombia, Venezuela, French Guiana, Guyana, Ecuador, Peru, Bolivia, Chile, Paraguay, Argentina, and Brazil. Its occurrence has also been confirmed for South Africa, the Philippines, Burma, China, Taiwan, Vietnam, Laos, Myanmar, and Thailand (TROPICOS 2021). The species is widely distributed in Brazil, occurring in the regions

Central-West, North, Northeast, and Southeast, with the exception for the South region, in the Amazon, Atlantic Forest, Caatinga and Pantanal domains (Santos & Hassemer 2021). In Ceará, it is registered in six counties in the Stepic Savanna, in the transitional area of mangrove, and in the Lowland Semideciduous Forest. The species is registered in the Ceará Botanical Park and in the RPPN Trussu.

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

Popular name: *berdoegua*.

**6. *Portulaca umbraticola*** Kunth, in H.B.K., Nov. Gen. Sp. 6: 58.1823. Figs. 2; 3h-i; 4i-j

Herb 13–30 cm; stem erect, green, little branched; trichomes axillary 1.0–2.0 mm long, scarce, lanuginous, whitish, surrounding the entire node. Petiole 1–2 mm long. Leaves glabrous, persistent; lamina 6–35 × 2–10 mm, oblanceolate to spatulate, base attenuate, apex rounded to obtuse, margin entire, without whitish edge; midrib conspicuous on the adaxial surface, persistent. Involucral leaves 12–23 × 3–10 mm, 3 per inflorescence, oblanceolate, base attenuate, apex rounded to obtuse, margin entire. Inflorescence 3–5 flowers. Flowers sessile; sepals 5–7 mm long, glabrous, dorsal side concave; petals 8–13 mm long, obcordate, apex emarginate, white, yellow, orange or rose; stamens 15–25. Pyxis ca. 4 mm long, opercule hemispherical, with alate expansion well developed, sometimes covering the opercule; fruit peduncle ca. 1 mm long. Seeds 0.8–1 mm, reniform, 16–30 per fruit, ornamented, greyish, opaque.

**Selected examined material:** Beberibe, córrego da Aroeira, 04°56'49"S, 38°01'01"W, 12.III.2021, fl. and fr., *M.I.B. Loiola 2863* (EAC). Carnaubal, Planalto da Ibiapaba, 04°10'00"S, 40°55'30"W, 30.IV.2010, fl. and fr., *E.M. Marreira et al. 88* (EAC, HUEFS, UFRN). Caucaia, Praia de Maceió, 1.V.2009, fr., *A.S.F. Castro 2162* (EAC). Crateús, Grajaú, RPPN Serra das Almas, 6.VI.2003, fr., *L.W. Lima-Verde 53* (EAC). Fortaleza, Jardim das Oliveiras, 7.XII.2018, fl., *V.M.B. Farias* (EAC 62125). Jati, Lote 05, margem do Açude Atalho, entrada do açude, 4.VI.2012, fr., *M.V. Cotarelli 1765* (HVASF). Quixadá, Sítio Santa Luzia, 16.III.2000, fr., *R.F. Oliveira 34* (EAC). Sobral, Fazenda Experimental da UVA, 10.IV.2015, fr., *E.B. Souza 3305* (HUVA). Viçosa do Ceará, Sítio Engenho Velho, 29.IV.2014, fr., *E.B. Souza et al. 1824* (EAC, HUEFS, HUVA).

*Portulaca umbraticola* distinctive feature is its membranous alate expansion around the fruit, which sometimes even covers the opercule. It might be mistaken for *P. oleracea*, but the stem form and the

opercule shape easily distinguishes these two taxa. In *P. umbraticola*, the stem is erect (*vs.* prostrate) and the hemispherical opercule (*vs.* conical).

*Portulaca umbraticola* has its geographical distribution throughout the Americas, from the United States, Central America, and Caribbean to Argentina (TROPICOS 2021). In Brazil, this species occurs in all regions and has been registered in the Amazon, Atlantic Forest, Caatinga, Cerrado and Pantanal domains (Santos & Hassemer 2021). In Ceará, the species has records in eight counties, occurring in the Stepic Savanna (Caatinga/ Carrasco) and in the Vegetation Complex of the Coastal Zone (in Pioneer Psamophilous Vegetation), both in sandy and rocky environments. *P. umbraticola* is registered within the RPPN Serra das Almas.

The species was collected with flowers in March, April, and December with fruit between March and June.

## Acknowledgements

We thanks to Rubens Teixeira de Queiroz, for providing some species photos. This research was development to the support of CNPq for productivity scholarship granted (MIBLoiola - Process N° 308685/2020-2); FUNCAP for the financial support (EBSouza - BP4-0172-00170.01.00/20); and the Pernambuco Research Foundation (FACEPE), for the postdoctoral scholarship (RTMRibeiro - BFP-0160-2.03/20).

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Area Editor: Dr. Anderson Alves-Araújo

Received in March 15, 2021. Accepted in May 13, 2021.



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