

**NEW RECORDS IN THE CAATINGA OF PARAÍBA STATE,
NORTHEASTERN BRAZIL: *SPILANTHES URENS* JACQ. (ASTERACEAE,
HELIANTHEAE) AND *BACOPA MONNIERI* (L.) PENNELL
(PLANTAGINACEAE, GRATIOLEAE)**

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Abstract

In this paper we present the first records of *Spilanthes urens* (Asteraceae) and *Bacopa monnieri* (Plantaginaceae) for the state of Paraíba, Northeastern Brazil. Both taxa were collected in the municipality of Cuité, in thorny deciduous woodland (Caatinga). In addition to updating the available data on the Flora of Paraíba, these findings highlight the importance of floristic studies and the need to intensify field collections to improve the sampling of plants in the caatinga of this state. Comments on the taxonomy, morphology, geographical distributions and illustrations of this species are provided. The ornamental potential of both taxa is discussed in light to promote the use of native plants of the caatinga in sustainable landscaping.

Key words: Borborema Plateau, Curimataú region, thorny deciduous woodland

Resumo

Neste trabalho apresentamos os primeiros registros de *Spilanthes urens* (Asteraceae) e *Bacopa monnieri* (Plantaginaceae) para o estado da Paraíba, Nordeste do Brasil. Ambos os táxons foram coletados no município de Cuité, em vegetação de caatinga. Além de atualizar os dados disponíveis sobre a Flora da Paraíba, esses achados destacam a importância dos estudos florísticos e a necessidade de intensificar as coletas de campo para melhorar a amostragem de plantas em áreas de caatinga no Estado. São apresentados comentários sobre a taxonomia, morfologia, distribuição geográfica e ilustrações das espécies. O potencial ornamental dos táxons é discutido a fim de promover o uso de plantas nativas da caatinga no paisagismo sustentável.

Palavras-chave: Planalto da Borborema, região do Curimataú, vegetação caducifolia espinhosa

Introduction

The Caatinga is a biome mainly from northeastern Brazil, characterized as a tropical dry forest and scrub vegetation (Sampaio, 1995; MMA, 2002). It occurs under extreme drought, having a few humid months per year (3-5 months) with low annual rainfall levels

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(500-750 mm per year) and high annual temperature averages 23°-27°C (Sampaio, 1995). This tropical dry forest covers eight states, nearly corresponding to 50% of the Brazil's Northeastern Region (Hueck, 1972; Leal *et al.*, 2003). Despite its great extent and importance as an endemic biome for Brazil, its floristic richness remains understudied. In 2010 the list of flowering plants for this biome encompassed 4.320 species (Forzza *et al.*, 2010) while recently there was a considerable increment in the number of species to 4.657 (BFG, 2015).

The state of Paraíba is essentially landed on the Borborema Plateau (Vasconcelos & Melo, 2015) and the largest portion of its territory belongs to the hot and dry semi-arid domain, with vegetation varying according environmental and geomorphological conditions (Carvalho & Carvalho, 1985). Regarding the knowledge of its flora, in 2010 the list of flowering plants from Paraíba state contained 1.272 species, while the most recent account 1.837 species (BFG, 2015), an increase of 565 species in five years.

Moreira (1988) divided the Paraíba into mesoregions and microregions. In the Agreste mesoregion, an ecologic transitional area between montane forest (caatinga enclaves moist forests) and the deciduous spiny vegetation (Caatinga) (Pereira *et al.*, 2002) is located the Curimataú region, which has an irregular relief, formed by Araruna mountain range, the Valley of Curimataú River and Cuité Plateau. In this region, where the vegetation is dominated by shrubby-arboreous habit, the soil is sandy or stony (Velloso *et al.*, 2002). This region is notable for having a meaningful set of crystalline rocky outcrops that abruptly develop above the surrounding landscape, called inselbergs (Barbosa *et al.*, 2005).

Studies covering taxonomic diversity combined with ecological amplitude are needed to better understand the distribution of angiosperms in caatinga domain. Thus, in order to increase the knowledge of the flora of Paraíba, we herein describe two new occurrences of angiosperms for this state, *Spilanthes urens* Jacq. (Asteraceae) and *Bacopa monnieri* (L.) Pennell (Plantaginaceae).

Materials and Methods

The municipality of Cuité (Figure 1) is located at the central-north portion of the state of Paraíba at the coordinates 06°29'06"S, 36°09'25"W, has a mean altitude of 667 m.a.s.l. (Mascarenhas *et al.*, 2005) and according to Köppen (1948), the climate type is characterized as BSh, hot and semi-arid. The municipality has two distinct seasons, a rainy season from February to June and a pronounced dry season between July and January. The vegetation type in Cuité varies from low and sparse shrub to trees, growing in sandy, rocky or sandy-stony soils (Velloso *et al.*, 2002).

Field work was carried out in a place known as 'Olho D'Água da Bica'. This area, belonging to the Federal University of Campina Grande, has approximately 75 hectares and is located on the south side of the hillside of Cuité Plateau (Sousa *et al.*, 2014), near the urban perimeter and easily accessible. It is an area embedded in a valley with springs of perennial water and exuberant vegetation that contrasts with the dry land of its surroundings during the dry period. For more than 20 years, a part of this area has been used by the population of the municipality of Cuité to perform the staging of the "Passion of Christ". In addition, the local population withdraws species with potential fodder (especially Poaceae) for the feeding of cattle and horses.

Individuals were photographed in field work, collected and identified based on specialized literature. To identify *Spilanthes urens* was used the work of Jansen (1981) and for *Bacopa monnieri*, the works of Souza & Giulietti (1990, 2009). Furthermore, a comparison with exsiccatae of herbarium UFRN and consulting experts was performed to confirm the species' identifications. Specimens were deposited in the herbaria UFRN of

the Federal University of Rio Grande do Norte and JPB of the Federal University of Paraíba (acronym according to Thiers, 2016).

After a literature survey on the species of Asteraceae and Plantaginaceae in Paraíba (e.g., Barbosa *et al.*, 2004; Agra *et al.*, 2004; Lacerda *et al.*, 2005; Barbosa *et al.*, 2007; Tölke *et al.*, 2011; Cordeiro & Félix, 2013; Sales-Rodrigues *et al.*, 2014), and data collected from virtual herbaria (Herbário Virtual da Flora do Brasil, <http://www.floradobrasil.jbrj.gov.br/jabot/herbarioVirtual>, and SpeciesLink, <http://www.splink.org.br>) and revision of the collection deposited in the Herbarium JPB, it was possible to confirm that these species are new occurrences for the Flora of Paraíba.

Results

Spilanthes Jacquin (1760) was described to include *S. insipida* Jacq. and *S. urens* Jacq.. The genus currently consists of six species distributed mainly in sandy soils of South America, West Indies, northern Australia, Malaysia and Central and Western Africa (Jansen, 1981). In Brazil only occurs *Spilanthes nervosa* Chodat and *S. urens* (Magenta & Nakajima, 2015). The genus *Spilanthes* is recognized for having solitary and long pedunculate capitula, cypsela with long ciliate borders and aristate pappus. All species are herbaceous and occur in two distinct habits: erect, characteristic of *S. nervosa*, and the remaining five species have a prostrate decumbent habit (Jansen, 1981). However, to our knowledge, there is no reference in the scientific literature or in any collection integrated to the database SpeciesLink the occurrence of *Spilanthes* for Paraíba state.

Spilanthes urens Jacq., Enum. Syst. Pl. 28. 1760.

Herbs prostrate, rooting at nodes, stems glabrous to sparsely pilose. Leaves sessile, 1.5-7 cm long, narrowly lanceolate to oblanceolate, attenuate and connate at base, apex acute, glabrous to sparsely pilose on both surfaces. Peduncles 5-12 cm long; heads 7.7-10 mm long, ovoid; receptacle 3 to 5 mm long, apex acute to acuminate; phyllaries 7-12, 2-seriate, subequal with the outer slightly longer than the inner; outer series 3-5, herbaceous, ovate to deltate, 3.0-6.5 mm long, rounded to acute at apex, entire to sinuate, usually sparsely to moderately ciliate, surface glabrous to sparsely pilose; inner series 4-7, herbaceous to chataceous, elliptic to obovate, 3.0-5.1 mm long, rounded at apex, irregularly fimbriate toward apex, sparsely to moderately ciliate, surface glabrous to sparsely pilose. Pales rounded and weakly fimbriate at apex, expanded toward apex, 2-4 mm long; corolla white to purplish-white, 2-3 mm long; tube 0.2-0.4 mm long; throat 1.2-2.0 mm long; lobes 0.2-0.6 mm long; anthers 1.2-1.8 mm long, the thecae 0.7-1.1 mm long. Style 1.3-2.1 mm long. Fruit and seed not seen.

Material examined: BRAZIL. PARAÍBA: Cuité, Sítio Olho d'água da Bica, 10-II-2016, V.F. Sousa 135 (UFRN, JPB); same locality, 21-IV-2016, V.F. Sousa 221 (UFRN, JPB).

The second new occurrence belongs to *Bacopa* Aublet (1775) with 50 known species (Souza, 2001; Souza & Giulietti, 2009), of which 27 occurs in Brazil (Souza & Guilherme, 2012; Souza & Hassemer, 2015). In Brazil, so far it has not been registered only for the state of Sergipe (Souza & Hassemer, 2015). The genus is concentrated in the Neotropical region (Souza, 2012), with some species in tropical Africa (Souza, 2001; Souza & Giulietti, 2009). Due to the wide geographical distribution of some species no specific area was defined as the genus diversity center. According to Souza (2001), *Bacopa* is one of the most taxonomically complex among Plantaginaceae genera in Brazil, what in part is associated with their aquatic habitat, which promotes a considerable intraspecific morphological variation. It comprises herbaceous species, often aquatic, bearing showy flowers and usually with ornamental potential (Souza & Guilherme, 2012). For Paraíba, Souza & Hassemer (2015) recorded only *B. aquatica* Aubl. and *B. salzmännii* (Benth.) Wettst. ex Edwall.. There is no reference in the scientific literature or in any collection

integrated to the database SpeciesLink the occurrence of *Bacopa monnieri* (L.) Pennell for Paraíba state.

Bacopa monnieri (L.) Pennell, Proc. Acad. Nat. Sci. Philadelphia 98(2): 94. 1946.

Herbs prostrate, 5-15 cm high, with crawling and erect portions, frequently branched; stems glabrous, cylindrical. Leaves sessile, 0.4-1.2 cm long, opposite, glabrous, obovate, base cuneate, apex rounded, margins entire. Flowers axillary, solitary, one per node; pedicel 1.0-2.2 cm long, erect to suberect in flowering, generally evident in fruiting, glabrous; bractoles 2, opposite, inserted next to the calyx, glabrous, elliptic-lanceolate, apex acute; calyx glabrous; external sepals 0.3-0.5 cm long, ovate, acute apex, rounded base, the internal lanceolate, apex acute, 0.3-0.4 cm long; corolla violet-light, laciniae 0.2-0.4 cm long, suborbicular to ovate. Stamens 4, exserted, glabrous, anthers brownish; ovary ovate, glabrous; stigma capitate to slightly bilobed. Capsule 0.3-0.4 cm long, ovoid, apex acute, glabrous.

Material examined: BRAZIL. PARAÍBA: Cuité, 6°28'27"S, 10-II-2016, V.F. Sousa 134 (UFRN, JPB); same locality, 07-IV-2016, V.F. Sousa 466 (UFRN, JPB).

Discussion and Conclusions

Spilanthes urens (Figure 2A-B) is the most widespread member of the genus, occurring in West Indies, along the Caribbean coast of Colombia, Venezuela, Brazil, Mexico and Costa Rica (Jansen, 1981). In Brazil it is recorded for the states of Amazonas, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná and Rio Grande do Norte, growing in the phytogeographical domains of the Amazon Rainforest and Central Brazilian Savanna (Magenta & Nakajima, 2015). As mentioned above, in the Northeastern Region *S. urens* was registered only for the state of Rio Grande do Norte (Magenta & Nakajima, 2015). This new occurrence in Paraíba state expands its geographic distribution ca. 80 km from the nearest record (municipality of Santo Antônio, Rio Grande do Norte). Santo Antônio municipality is also situated in the transitional area between Caatinga and Atlantic Forest in Rio Grande do Norte. In Cuité, it was found only in small populations with individuals nearly 50 meters distant from each other, but forming dense mats on the sandy-stony soil of open areas.

This species is characterized by prostrate herbaceous habit, branches glabrous to sparsely pilose; leaves sessile; leaf blades 2-8 × 1-1.5 cm, narrowly lanceolate to oblanceolate, 3 main veins arising from the base, attenuate and connate at base, rounded to acute at the apex, both surfaces glabrous and corolla white. According to Jansen (1981) it blooms all year, and in Paraíba it was collected with flowers in February and April.

Due to its rapid growth, resistance to environmental stress and ability to form dense mats, this species can be used as ground cover to protect the soil from erosion process. In addition to its importance ground cover, the white flowers gathered in solitary capitula contrasting with the color of the dark green leaves indicate its potential as an ornamental plant for native gardens. As *Spilanthes urens* is a species that has a blooming period that lasts the whole year, it becomes a constant source of floral resource for native fauna and its usage should be encouraged.

The second new occurrence, *Bacopa monnieri* (Figure 2C-D) was originally described as *Lysimachia monnieri* by Linnaeus (1756). It is a species of pantropical distribution, occurring near the coast of the sea (Souza, 2012; Souza & Giulietti, 1990, 2009). In Brazil, it is registered for the states of Bahia, Ceará, Espírito Santo, Paraná, Pernambuco, Rio Grande do Sul, Rio de Janeiro, Santa Catarina and São Paulo (Souza & Hassemer, 2015). According to Souza & Giulietti (1990), it is a halophilic plant and grows in flooded environments near the sea or in salty temporary ponds. The new record for *B. monnieri* expands the geographic distribution in 221 km from the nearest record (municipality of Olinda, Pernambuco). In this studied area only one small population of *B.*

monnieri was observed growing in sandy clay soil of moist environment, near a water stream.

This species is characterized by the prostrate herbaceous habit, often branched; leaves opposite, sessile to subsessile, obovate, glabrous, apex rounded, and base attenuate; flowers axillary, solitary; sepals external lanceolate and internal sepals linear, corolla whitish, laciniae obovate; stamens 4, exserted and capsule ovoid capsule.

Due to its floral characteristics, several species of *Bacopa* are considered as ornamentals (Souza & Guilherme, 2012). *Bacopa monnieri* (known in English literature as “water hyssop” [Pierce *et al.*, 2009]) is a perennial, creeping herb that roots at the nodes and forms dense mats in wetlands and muddy banks. Additionally, it may grow entirely submerged. This characteristic makes it useful as an ornamental plant for ponds or aquaria. Ecologically, *B. monnieri* is considered a metal hyperaccumulator, sequestering copper and zinc in fairly high concentrations (Owens *et al.*, 1989), as well as demonstrating potential for remediation of mercury (Lenka *et al.*, 1992; Sinha *et al.*, 1996), cadmium and chromium (Rai *et al.*, 1995; Shukla & Rai, 2007), and manganese (Sinha, 1999).

A few studies have been conducted so far in order to describe the flora of Paraíba. However, some recent publications indicate new species (Pontes, 2012) or new occurrences (Pontes & Agra, 2006; Coelho *et al.*, 2008; Tölke *et al.*, 2011; Alves-Araújo & Alves, 2013; Lima & Barbosa, 2014; Costa *et al.*, 2015; Sousa & Versieux, 2016) pointing toward the need to improve the floristic knowledge in the whole state. Considering that the knowledge about biodiversity and its relationships to the environment represent an important subsidy for studies in various areas of science and the need to improve scientific collections of plants of Paraíba, botanical exploration in under collected areas should be a priority.

Regarding the Curimataú region, its floristic diversity is poorly known (Barbosa *et al.*, 2005), which shows the need to intensify botanical studies to enable a greater understanding of the vegetation complex that occurs in this transition area between Caatinga and Atlantic Forest. The intensity of human activities observed there (e.g., agriculture based on slash and burn, the extraction of vegetable products mainly for purposes energy and extensive livestock farming) is replacing the arboreal component for the expansion of herbaceous and shrub strata, decreasing the density and vegetation cover of this region. The disturbed areas are predominant in this region and most of the few remaining areas of native vegetation are not protected. According Barbosa *et al.* (2005), in this region there are only one state reserve, the Parque Estadual da Pedra da Boca (PEPB), located in Araruna, and three small Natural Heritage Private Reserve (RPPNs).

Both taxa have ornamental potential and their sustainable usage in gardening could be promoted. Currently, few native species have been employed in drought tolerant gardens, and *Spilanthes urens* and *Bacopa monnieri* have attributes that make them possible choices of native species. Native plants have an important role in modern garden landscape mainly because of their lower maintenance costs as well as for conserving biological diversity in urban gardens thus providing habitat and resources for the local fauna (Heiden *et al.*, 2006) currently being a desirable practice, with important environmental, aesthetic and cultural benefits (Kabashima *et al.*, 2011).

In the caatinga dry woodland, native species with ornamental potential in this biome have rarely been explored (Versieux *et al.*, 2015; Sousa & Versieux, 2016). However, this biome has a substantial number of native plants that express characteristics for ornamental use. These new record for the state of Paraíba helps to increase the knowledge about the biogeography of these species and to update the data on the Flora of

Paraíba, as well as to increase the number of species with ornamental potential available for landscape designers in this dry biome.

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Bibliographic references

- AGRA, M.F.; BARBOSA, M.R.V. & STEVENS, W.D. 2004. Levantamento florístico preliminar do Pico do Jabre, Paraíba, Brasil. In: PORTO, K.C.; CABRAL, J.J.P. & TABARELLI, M. (Orgs.). *Brejos de altitude em Pernambuco e Paraíba: história natural, ecologia e conservação*. Brasília: Ministério do Meio Ambiente. Série Biodiversidade, p. 123-138.
- ALVES-ARAÚJO, A. & ALVES, M. 2013. Checklist of Sapotaceae in Northeastern Brazil. *Check List* 9(1): 59-62.
- AUBLET, J.B.C.F. 1775. *Histoire des plantes de la Guiane Française: rangées suivant la méthode sexuelle, avec plusieurs mémoires sur différens objets intéressans, relatifs à la culture & au commerce de la Guiane Française, & une notice des plantes de l'Isle-de-France* 1: 1-621. Londres/Paris: P.F. Didot Jeune.
- BARBOSA, M.R.V.; AGRA, M.F.; SAMPAIO, E.V.S.B.; CUNHA, J.P. & ANDRADE, L.A. 2004. Diversidade florística da Mata de Pau Ferro, Areia, Paraíba. In: PORTO, K.C.; CABRAL, J.J.P. & TABARELLI, M. (Orgs.). *Brejos de altitude em Pernambuco e Paraíba: história natural, ecologia e conservação*. Brasília: Ministério do Meio Ambiente. Série Biodiversidade, p.111-122.
- BARBOSA, M.R.V.; ARAÚJO, R.C.F.S. & RODAL, M.J.N. 2005. Estratégias para conservação da biodiversidade e prioridades para a pesquisa científica no bioma Caatinga. In: ARAÚJO, R.C.F.S.; RODAL, M.J.N. & BARBOSA, M.R.V. (Orgs.). *Análise das variações da biodiversidade do bioma Caatinga: suporte a estratégias regionais de conservação*. Brasília: Ministério do Meio Ambiente, p. 415-429.
- BARBOSA, M.R.V.; LIMA, I.B.; LIMA, J.R.; CUNHA, J.P.; AGRA, M.F. & THOMAS, W.W. 2007. Vegetação e flora no Cariri Paraibano. *Oecologia Brasiliensis* 11(3): 313-322.
- BFG, The Brazil Flora Group. 2015. Growing knowledge: an overview of Seed Plant diversity in Brazil. *Rodriguésia* 66(4): 1085-1113.
- CARVALHO, F.A.F. & CARVALHO, M.G.F. 1985. Vegetação. In: GOVERNO DO ESTADO DA PARAÍBA. (Ed.). *Atlas Geográfico do Estado da Paraíba*. João Pessoa, Secretaria da Educação. Grafset: João Pessoa, p. 34-43.
- CHODAT, R.H. 1903. *Bulletin de L'Herbier Boissier*, série 2, Tomo 3: 37-1204.
- COELHO, V.P.M.; AGRA, M.F. & BARACHO, G.S. 2008. Flora da Paraíba, Brasil: *Polygala* L. (Polygalaceae). *Acta Botanica Brasilica* 22(1): 225-239.
- CORDEIRO, J.M.P. & FÉLIX, L.P. 2013. Levantamento fitossociológico em mata de encosta no Agreste Paraibano. *Revista Eletrônica do Curso de Geografia* 21: 13-28.
- COSTA, E.C.S.; LOPES, S.F. & MELO, J.I.M. 2015. Floristic similarity and dispersal syndromes in a rocky outcrop in semi-arid Northeastern Brazil. *Revista de Biologia Tropical* 63(3): 827-843.
- FORZZA, R.C.; BAUMGRATZ, J.F.A.; BICUDO, C.E.M.; CANHOS, A.A.L.; CARVALHO JR., A.A.; COSTA, A.F.; COSTA, D.P.; HOPKINS, M.; LEITMAN, P.M.; LOHMANN, L.G.; MAIA, L.C.; MARTINELLI, G.; MENEZES, M.; MORIM, M.P.; NADRUZ COELHO, M.A.; PEIXOTO, A.L.; PIRANI, J.R.; PRADO, J.; QUEIROZ, L.P.; SOUZA, V.C.; STEHMANN, J.R.; SYLVESTRE, L.; WALTER, B.M.T. & ZAPPI, D. (Eds.). 2010. *Catálogo de plantas e fungos do Brasil*. Volume 1. Andrea Jakobsson Estúdio/Jardim Botânico do Rio de Janeiro, Rio de Janeiro, 871p.
- HEIDEN, G.; BARBIERI, R.L. & STUMPF, E.R.T. 2006. Considerações sobre o uso de plantas ornamentais nativas. *Revista Brasileira de Horticultura Ornamental* 12: 2-7.
- HUECK, K. 1972. *As florestas da América do Sul: ecologia, composição e importância econômica*. São Paulo, Editora da Universidade de Brasília e Editora Polígono S.A, 466p.
- JACQUIN, N.J. 1760. *Enumeratio Systematica Plantarum, quas in insulis Caribaeis* 1-41.

- JANSEN, R.K. 1981. Systematics of *Spilanthes* (Compositae: Heliantheae). *Systematic Botany* 6(3): 231-257.
- KABASHIMA, Y.; ANDRADE, M.L.F.; GANDARA, F.B.; TOMAS, F.L.; POLIZEL, J.L.; VELASCO, G.D.N.; SILVA, L.F.; DOZZO, A.D.P.; MOURA, R.G. & FILHO, D.F.S. 2011. Histórico da composição da vegetação arbórea do parque do Ibirapuera e sua contribuição para a conservação da biodiversidade. *Revista da Sociedade Brasileira de Arborização Urbana* 6(4): 125-144.
- KÖPPEN, W. 1948. *Climatologia*. Editora Fondo de Cultura Económica, México - Buenos Aires, 479p.
- LACERDA, A.V.; NORDI, N.; BARBOSA, F.M. & WATANABE, T. 2005. Levantamento florístico do componente arbustivo-arbóreo da vegetação ciliar na bacia do rio Taperoá, PB, Brasil. *Acta Botanica Brasilica* 19(3): 647-656.
- LEAL, I.R.; TABARELLI, M. & SILVA, J.M.C. 2003. Ecologia e conservação da Caatinga. Recife: Editora Universitária da UFPE, 822p.
- LENKA, M.; PANDA, K.K. & PANDA, B.B. 1992. Monitoring and assessment of mercury pollution in the vicinity of a Chloralkali plant IV. Biocencentration of mercury *in situ* aquatic and terrestrial plants at Ganjam, India. *Archives of Environmental Contamination Toxicology* 22: 195-202.
- LIMA, I.B. & BARBOSA, M.R.V. 2014. Composição florística da RPPN Fazenda Almas, no Cariri Paraibano, Paraíba, Brasil. *Revista Nordestina de Biologia* 23(1): 49-67.
- LINNAEUS, C. 1756. *Centuria II. Plantarum, quam, Consensu Experientiss. Facultat. Med. in Regia Academia Upsaliensi, Praesidi, viro Nobilissimo et Experientissimo*, 1-34.
- MAGENTA, M.A.G. & NAKAJIMA, J.N. 2015. *Spilanthes*. In: Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Available from: <<http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB16305>>. Accessed at: 14 February 2016.
- MASCARENHAS, J.C.; BELTRÃO, B.A.; SOUZA JÚNIOR, L.C.; MORAIS, F.; MENDES, V.A. & MIRANDA J.L.F. (Orgs.). 2005. *Projeto cadastro de fontes de abastecimento por água subterrânea. Diagnóstico do município de Cuité*, Estado da Paraíba. CPRM/PRODEEM, Recife, 23p.
- MMA, Ministério do Meio Ambiente. 2002. *Avaliação e ações prioritárias para a conservação da biodiversidade da Caatinga*. Brasília: Ministério do Meio Ambiente.
- MOREIRA, E.R.F. 1988. *Mesorregiões e Microrregiões da Paraíba, delimitação e caracterização*. GAPLAN: João Pessoa, 74p.
- OWENS, L.P.; HINKLE, C.R. & BEST, G.R. 1989. Low-energy wastewater recycling through wetland ecosystems: Copper and zinc in wetland microcosms. In: SHARITZ, R.R. & GIBBONS, J.W. (Eds.). *Freshwater Wetlands and Wildlife Conference* 8605101, DOE Symposium Series N°61. Oak Ridge: TN USDOE Office of Scientific and Technical Information, p. 1227-1235.
- PEREIRA, I.M.; ANDRADE, L.A.; BARBOSA, M.R.V. & SAMPAIO, E.V.S.B. 2002. Composição florística e análise fitossociológica do componente arbustivo-arbóreo de um remanescente florestal no agreste paraibano. *Acta Botanica Brasilica* 16(3): 357-369.
- PIERCE, S.C.; PEZESHKI, S.R.; MOORE, M.T. & LARSEN, D. 2009. Nutrient response of Water Hyssop to varying degrees of soil saturation. *Journal of Plant Nutrition*, 32: 1687-1701.
- PONTES, R.A.S. & AGRA, M.F. 2006. Flora da Paraíba, Brasil: *Tillandsia* L. (Bromeliaceae). *Rodriguésia* 57: 47-61.
- PONTES, R.A.S. 2012. *Tillandsia paraibensis*, a new species of Bromeliaceae from Northeastern Brazil. *Rodriguésia* 63(3): 551-555.
- RAI, U.N.; SINHA, S.; TRIPATHI, D. & CHANDRA, P. 1995. Wastewater treatability potential of some aquatic macrophytes: Removal of heavy metals. *Ecological Engineering* 5: 5-12.
- SALES-RODRIGUES, J.; CASTELO-BRANCO, B.J. & MELO, J.I.M. 2014. Flora de um inselberg na Mesorregião Agreste do Estado da Paraíba-Brasil. *Polibotânica* 37: 47-61.
- SAMPAIO, E.V.S.B. 1995. Overview of the Brazilian Caatinga. In: BULLOCK, S.H.; MOONEY, H. & MEDINA, E. (Eds.). *Seasonally dry tropical forests*. Cambridge: Cambridge University Press, p. 35-63.
- SHUKLA, O.P. & RAI, U.N. 2007. Preferential accumulation of cadmium and chromium: Toxicity in *Bacopa monnieri* L. under mixed metal treatments. *Bulletin of Environmental Contamination and Toxicology* 78: 252-257.
- SINHA S.; GUPTA, M. & CHANDRA, P. 1996. Bioaccumulation and biochemical effects of mercury in the

plant *Bacopa monnieri* (L). *Environmental Toxicology and Water Quality* 11: 105-112.

SINHA, S. 1999. Accumulation of Cu, Cd, Cr, Mn and Pb from artificially contaminated soil by *Bacopa monnieri*. *Environmental Monitoring and Assessment* 57: 253-264.

SOUSA, J.I.M.; SANTOS, C.A.G.; OLIVEIRA, J.C.D. & FERREIRA, L.L. (2014) O gênero *Croton* L. (Euphorbiaceae) no Horto Florestal Olho D'Água da Bica, Cuité/PB. *ACSA – Agropecuária Científica no Semi-Árido* 10: 1-7.

SOUSA, V.F. & VERSIEUX, L.M. 2016. Notes on the ornamental potential and taxonomy of *Justicia* (Acanthaceae, Justicieae), including a first record for the Paraíba flora, Brazil. *Phytotaxa* 270(3): 203-209.

SOUZA, V.C. 2001. Uma nova espécie de *Bacopa* Aubl. (Scrophulariaceae) da América do Sul. *Acta Botanica Brasílica* 15(1): 57-61.

SOUZA, V.C. 2012. Neotropical Plantaginaceae. In: MILLIKEN, W.; KLITGÅRD, B. & BARACAT, A. (2009 onwards), Neotropikey – Interactive key and information resources for flowering plants of the Neotropics. Available from: <<http://www.kew.org/science/tropamerica/neotropikey/families/Plantaginaceae.htm>>. Accessed at: 28 November 2016.

SOUZA, V.C. & GIULIETTI, A.M. 1990. Scrophulariaceae de Pernambuco. *Boletim de Botânica da Universidade de São Paulo* 12: 185-209.

SOUZA, V.C. & GIULIETTI, A.M. 2009. Levantamento das espécies de Scrophulariaceae sensu lato nativas do Brasil. *Pesquisas, Botânica* 60: 7-288.

SOUZA, L.F. & GUILHERME, F.A.G. 2012. Nova ocorrência para a flora do estado de Goiás: *Bacopa scabra* (Benth.) Descole & Borsini var. *scabra* (Gratiolaceae). *Revista de Biologia Neotropical* 9(2): 1-5.

SOUZA, V.C. & HASSEMER, G. 2015. Plantaginaceae. In: Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. Available from: <<http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB12885>>. Accessed at: 18 December 2016.

THIERS, B. [continuously updated]. Index Herbariorum: a global directory of public herbaria and associated staff. The New York Botanical Garden. Available from: <<http://sciweb.nybg.org/science2/IndexHerbariorum.asp>>. Accessed at: 10 December 2016.

TÖLKE, E.E.A.D.; SILVA, J.B.; PEREIRA, A.R.L. & MELO, J.I.M. 2011. Flora vascular de um inselbergue no Estado da Paraíba, Nordeste do Brasil. *Biotemas* 24(4): 39-48.

VASCONCELOS, G.C.L. & MELO, J.I.M. 2015. Flora of the State of Paraíba, Brazil: Loranthaceae Juss. *Acta Scientiarum, Biological Sciences* 37(2): 239-250.

VELLOSO, A.L.; SAMPAIO, E.V.S.B.; GIULIETTI, A.M.; BARBOSA, M.R.V.; CASTRO, A.A.J.F.; QUEIROZ, L.P.; FERNANDES, A.; OREN, D.C.; CESTARO, L.A.; CARVALHO, A.J.E.; PAREYN, F.G.C.; SILVA, F.B.R.; MIRANDA, E.E.; KEEL, S. & GONDIM, R.S. 2002. *Ecorregiões: propostas para o bioma Caatinga*. APNE. The Nature Conservancy do Brasil, Recife, 76p.

VERSIEUX, L.M.; MORAIS, A.K. & MACÊDO, B.R.M. 2015. O potencial das espécies da caatinga para uso no planejamento e projeto paisagístico. In: BATISTA, M.N.; SCHLEE, M.B.; BARRA, E. & TÂNGARI, V.R. (Eds.). *A vegetação nativa no planejamento e no projeto paisagístico*. Rio de Janeiro: FAU/UFRJ e Rio Books, p. 193-233.

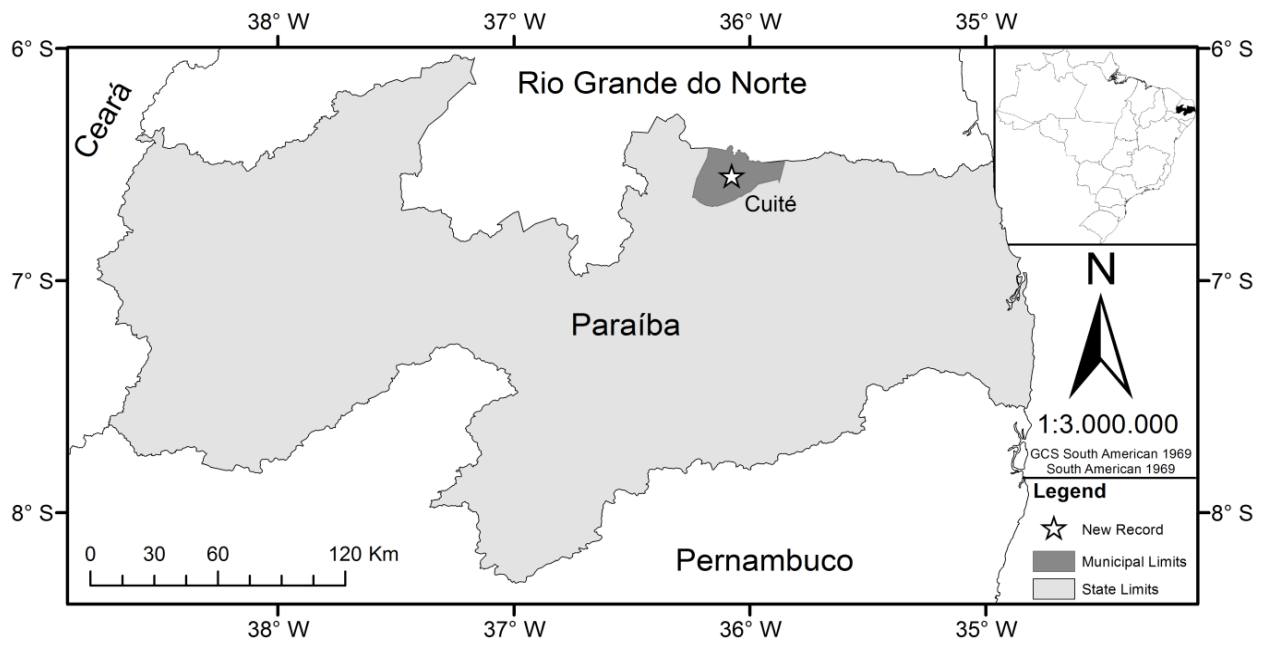


Figure 1: Map of Paraíba state showing the municipality of Cuité (black gray) where *Spilanthes urens* Jacq. and *Bacopa monnieri* (L.) Pennel were collected.

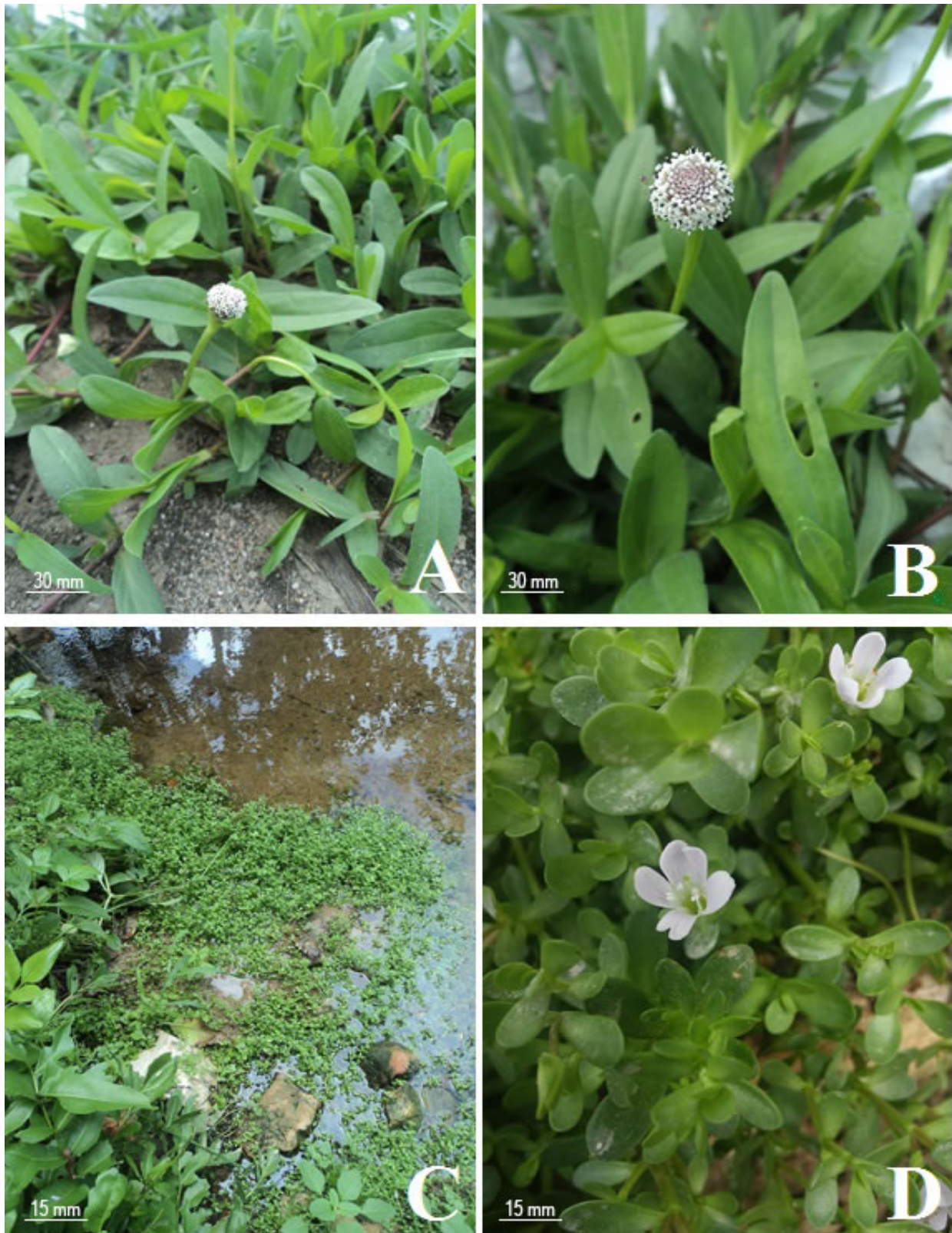


Figure 2: *Spilanthes urens* Jacq. A. Habit. B. Inflorescence details. *Bacopa monnieri* (L.) Pennel. C. Habitat. D. Flower details.