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Flora of the State of Paraíba, Brazil: Loranthaceae Juss.

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ABSTRACT. The family Loranthaceae Juss., characterized by its parasitic habit, is rarely studied in Brazil. Current research provides a taxonomic survey of Loranthaceae in the State of Paraíba, northeastern Brazil, in which ten species belonging to four genera have been recorded: *Passovia* (one species), *Psittacanthus* (two species), *Pusillanthus* (one species) and *Struthanthus* (six species). *Struthanthus concinnus* Mart. was found for the first time in the state of Paraíba. A key to the species identification and taxonomic descriptions is presented, with images, geographic distribution and host data.

Keywords: Brazilian Northeastern region, hemiparasites, Santalales.

Flora do Estado da Paraíba, Brasil: Loranthaceae Juss.

RESUMO. A família Loranthaceae Juss. é caracterizada pelo hábito parasítico e é ainda escassamente estudada no Brasil. Este trabalho realizou o levantamento taxonômico de Loranthaceae no Estado da Paraíba, nordeste do Brasil, onde dez espécies pertencentes a quatro gêneros foram registradas: *Passovia* (1 espécie), *Psittacanthus* (2 espécies), *Pusillanthus* (1 espécie) e *Struthanthus* (6 espécies). *Struthanthus concinnus* Mart. foi registrada pela primeira vez para a flora do Estado da Paraíba. Uma chave para a identificação das espécies e descrições taxonômicas é apresentada, com imagens, dados de distribuição geográfica e de hospedeiros também fornecidos.

Palavras-chave: Nordeste brasileiro, hemiparasitas, Santalales.

Introduction

Featuring more than 4000 parasite species among the angiosperms (NICKRENT et al., 1998), the order Santalales is included in the Loranthaceae group. It is mainly characterised as a hemiparasite with an economic importance associated to the damage it causes to plantations (CAZETTA; GALLETI, 2003). The order Santalales is represented by several species known in Brazil as “ervas-de-passarinho” (mistletoes) and comprises 160 genera and approximately 2,200 species, currently comprising 18 families (NICKRENT et al., 2010). Among these families, Loranthaceae presents worldwide importance due to its representativeness with cosmopolitan distribution (TAINTER, 2002).

The “ervas-de-passarinho” [literally, bird’s plants] are so called because of the significant number of species, whose dispersal is mainly done by birds, with a close relationship between the plant group and birds (REID, 1991). When this relationship is upset by environmental changes, serious consequences occur, such as a sharp decrease in parasitic plants due to the loss of dispersers (ROBERTSON et al., 1999).

The family Loranthaceae comprises 700 species in 60 genera (KUIJT, 2007) and is abundant in the tropics, inhabiting a wide variety of hosts (TAINTER, 2002; LEAL et al., 2006). Although the first taxonomic analysis of the family was published in *Die natürlichen Pflanzenfamilien* by Adolf Engler (1897a, b and c), many divisions within the order have been added, where for a long time the Viscaceae had been included (NICKRENT et al., 2010).

Loranthaceae has been the target of several changes in its nomenclature. At first, Van Tieghem (1894) tallied 118 genera which Engler (1897a) synonymised under the genus *Loranthus* Jacq. Later, Danser (1929) proposed the basic framework for the current classification, dividing the family into three tribes: Nuytsieae, Elytrantheae and Loranthaeae. Molecular studies carried out by Nickrent and Duff (1996), Nickrent et al. (1998) and more recently by Vidal-Russell and Nickrent (2008) and Nickrent et al. (2010) upheld the monophyly of Loranthaceae, with the Schoepfiaceae and Misodendraceae families as sister groups. The study by Nickrent et al. (2010) did not merely support the monophyly of Loranthaceae but also divided the family into tribes and sub-tribes.

In Brazil, the principal contributions to the taxonomy of Loranthaceae were the studies by Rizzini (1956, 1975, 1978, 1980 and 1995). However, other works by Krause (1922), Sugiyama (1992), Moreira and Rizzini (1997) and more recently Reif and Andreato (2011) increased information on the family within the Brazilian flora.

Caires and Dettke (2014) reported eight species of Loranthaceae for the State of Paraíba, although the lack of publications on the taxonomy of the family for its flora constitutes a gap in the knowledge on the representativeness of mistletoes.

Current research presents a taxonomic survey of Loranthaceae for the state of Paraíba, Brazil, and aims to contribute towards in-depth knowledge on the richness and distribution of its genera and species in the region and on the flora of northeastern Brazil.

Material and methods

Study area

The state of Paraíba, Brazil, mainly lies on the Borborema Plateau (Planalto da Borborema), with the drought polygon constituting 98% of its territory. Geographic relief is in general quite different (AESAs, 2006), featuring two large regions: the littoral, with predominant sandy coastal plains (restingas) on narrow beaches and fixed dunes (CARVALHO; OLIVEIRA-FILHO, 1993), and the interior, dominated by “caatinga” vegetation, characterized by thorny, deciduous, woody and herbaceous species of low height (SAMPAIO et al., 1995).

Field studies

Field work was carried out on different vegetation formations in the state of Paraíba, between August 2010 and August 2011, covering the municipalities of Alcantil (07°44'38"S; 36°03'21"W), Areia (06°57'46"S; 35°41'31"W), Bananeiras (06°45'00"S; 35°37'58"W), Barra de Santana (07°31'12"S; 36°00'00"W), Campina Grande (07°13'50"S; 35°52'52"W), Monteiro (07°53'20"S; 37°07'12"W), São Domingos do Cariri (07°38'09"S; 36°25'58"W), São João do Tigre (08°04'44"S; 36°50'52"W), Serra Branca (07°28'58"S; 36°39'54"W) and Riacho de Santo Antônio (07°41'34"S; 36°09'25"W), totalling 17 excursions. Fertile specimens were obtained (flowers and/or fruits) from all the species of Loranthaceae found and the field information about habit, colour of

reproductive structures, habitats and other relevant data for the group's morphological analyses were noted. Further, digital images of the environments and the species were obtained, including the structures of the flowers and fruits, which were later stored in a liquid medium (70% alcohol).

Taxonomic treatment

The morphologic analyses were based on specimens obtained in Paraíba during the study, complemented by examination of exsiccates deposited in the Herbarium Jaime Coelho de Moraes (EAN) and Herbarium Lauro Pires Xavier (JPB), both in the State of Paraíba, and by consulting types and original descriptions. The herbaria acronyms followed Thiers (2014) and taxonomic identifications for genus and species levels were based on specialised literature (ENGLER, 1897a; KUIJT, 1978, 1986, 2007, 2009; REIF; ANDREATA, 2011) or by analysis of specimens deposited in the previously mentioned herbaria.

The descriptions were given following the model of the “Flora Fanerogâmica do Estado de São Paulo” (FFESP). The works of Hickey et al. (1973) and Weberling (1989) were adopted to standardize the morphological terms. An identification key was prepared for the species and also a set of data on the geographical distribution, flowering and/or fructification was provided.

Results and discussion

Taxonomy

Loranthaceae Juss., Ann. Mus. Natl. Hist. Nat. 12: 292. 1808.

Type: *Loranthus* Jacq., Enum. Stirp. Vindob. 55: 230. 1762.

Plants shrubs, sub-shrubs, and lianaceous or erect. Haustorial hemiparasites which insert themselves into the host's vascular system. Stem cylindrical to angular. Leaves simple, cross-opposite or distichously, rarely alternate or verticillate, eucamptodromous or acrodromous. Inflorescences composed of dyads, triads or monads grouped in spikes or racemes, found in the leaf axils or solitary. Flowers unisexual or bisexual, 4-5-6-merous, bracteates or not; epicalyx entirely in the form of a sheath; androecium isomerous, stamens epipetalous, stigma and style undivided. Berries monospermic.

The family presents approximately 700 species in 60 genera distributed in the tropics and subtropics around the globe (KUIJT, 2007). Four genera and 10 species were recorded for the State of Paraíba (Figure 1).

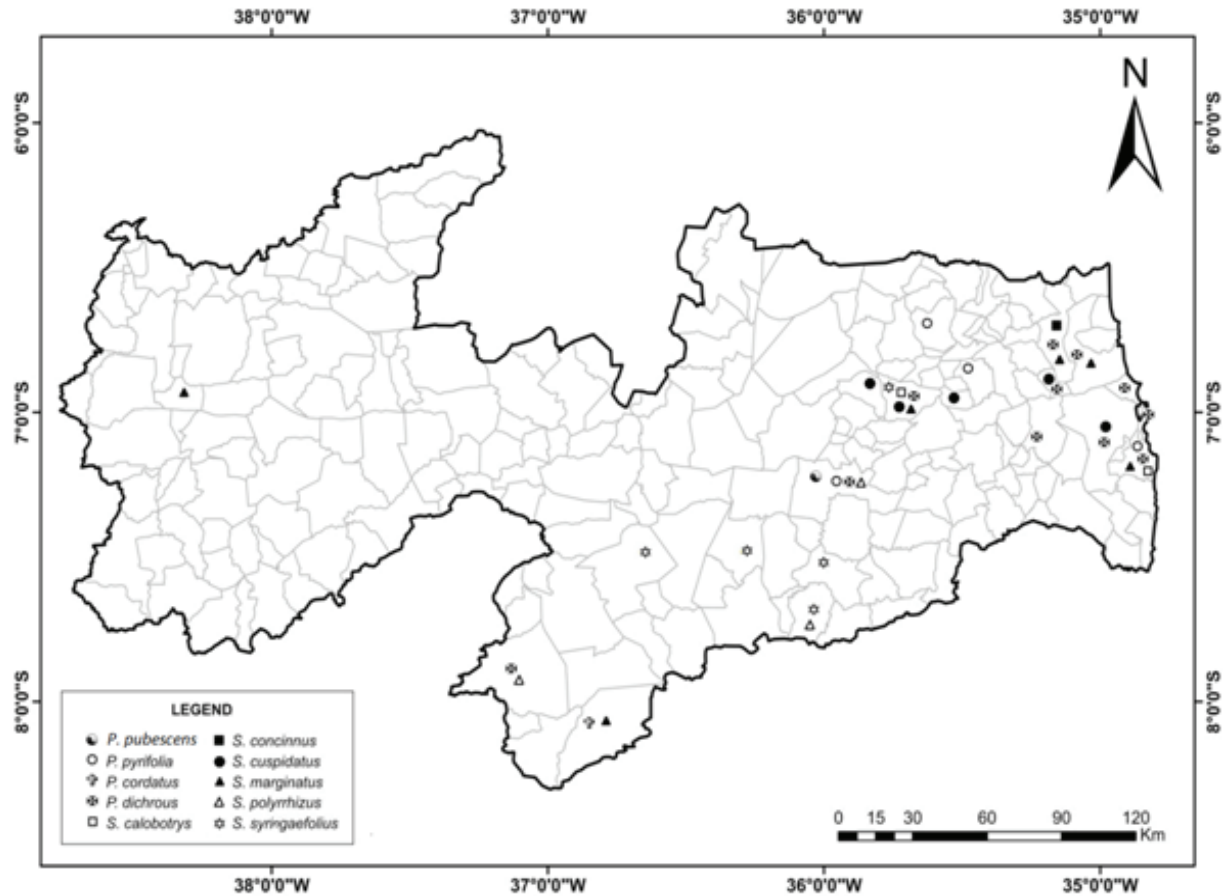


Figure 1. Distribution map of the Loranthaceae species in the State of Paraíba, Brazil.

Key to the Loranthaceae species of state of Paraíba, Brazil:

- 1. Plants with epicortical roots..... 2
- 2. Filaments with depressions accommodating basifixed anthers..... 1. *Passovia pyrifolia*
- 2.' Filaments without depressions accommodating anthers, which are dorsifixed..... 3
- 3. Stem slightly to moderately lenticellate; inflorescences in racemes..... 4
- 4. Leaf apex acute; bracts acute-dentate, the middle larger than the lateral..... 10. *Struthanthus syringifolius*
- 4.' Leaves of varying apexes; ovate bracts, the middle similar to the laterals..... 5
- 5. Inflorescences 2(-3) per axil..... 8. *Struthanthus marginatus*
- 5.' Inflorescences 1 per axil..... 6
- 6. Petiole 1.5-2 cm long; axis of inflorescences cylindrical..... 5. *Struthanthus calobotrys*
- 6.' Petiole 0.8-1 cm long; axis of inflorescences compressed..... 7. *Struthanthus cuspidatus*
- 3'. Stem densely lenticellate; inflorescences never in racemes..... 7
- 7. Leaves lanceolate to ovate, apex acuminate; inflorescences in spikes..... 6. *Struthanthus concinnus*

- 7.' Leaves obovate, apex emarginated and acute; inflorescences in corymbs... 9. *Struthanthus polymrhizus*
- 1'. Plants devoid of epicortical roots..... 8
- 8. Stem papillose; flowers smaller than 4 cm in length, 4-merous..... 4. *Pusillanthus pubescens*
- 8.' Stem not papillose; flowers larger than 4 cm in length, 6-merous..... 9
- 9. Leaves sessile, crassous, base cordate; inflorescences in racemes of triads; flower with corolla intense orange..... 2. *Psittacanthus cordatus*
- 9.' Leaves, petiolate, semi-crassous, base cuneate; inflorescences in pseudo-raceme of dyads or triads; flower with corolla reddish..... 3. *Psittacanthus dichroos*

Passovia H. Karst., Bot. Zeitung. (Berlin) 4(7): 107. 1846.

Basionim: *Passovia stelis* (L.) Kuijt, Pl. Div. Evol. 129(2): 205-206. 2011.

Plants glabrous or farinose when young, with epicortical roots. Stem erect or not, cylindrical or angular, usually brown, lenticellate or not. Leaves opposite, alternate or crossed, petiolate or sessile, usually coriaceous, never crassous. Inflorescences in racemes or spikes of triads or dyads, bracteates, axillary or terminal. Flowers 1-1.5 cm long, sessile,

bisexual or unisexual, corolla 4-6-merous; stamens wider than their length, filament with depression accommodating anthers which are basifixed. Fruits ovoid to oblong, endosperm present.

1. *Passovia pyrifolia* (Kunth) Tiegh., Bull. Soc. Bot. Franc. 42: 172. 1895. Figure 2.

Basionim: *Loranthus pyrifolius* Willd. ex Schult.f., Syst. Veg., ed. 15 bis [Roemer and Schultes] 7(2): 1647. 1830.

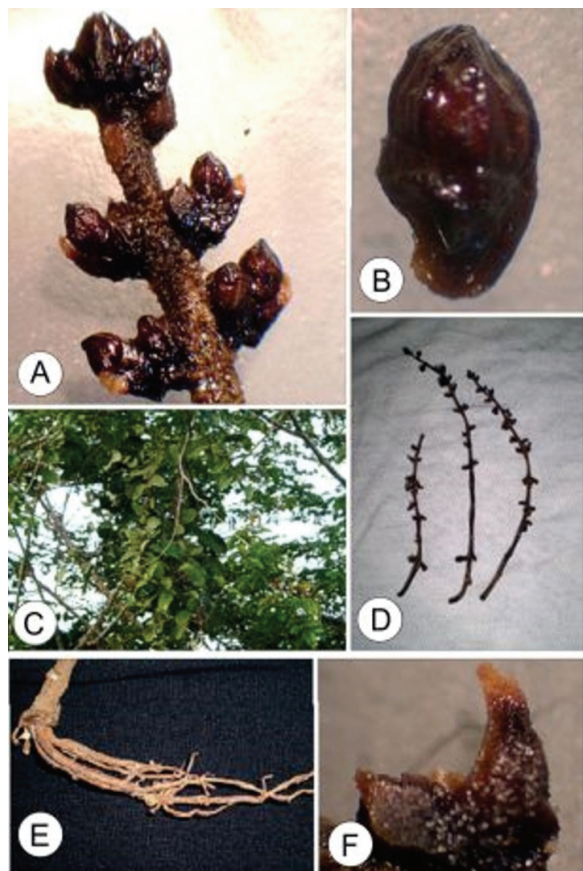


Figure 2. *Passovia pyrifolia*. A. Detail of inflorescence. B. Bud. C. Habitat. D. Inflorescences. E. Epicortical roots. F. Bracts

Plants decumbent, covered with rufous-furfuraceous scales, slightly branched, densely leaved. Epicortical roots present only at the base. Stems angular when young, adults cylindrical, greyish-brown, lenticels sparse; internodes 3.5-4.5 cm long. Leaves opposite, petiolate; petiole 0.5-1 cm in length; blade ovate, 4-7(-9) × 3-5(-6) cm, apex acute, base round, perfectly eucamptodromous, dark green, glabrous, lustrous. Inflorescences in axillary raceme of triads, 1 per axil, 6-7 cm in length, 12-16(-18) triads per inflorescence, branches of inflorescence cylindrical, acute bracts at the base of the branches of the inflorescence, middle bract similar to the laterals. Flowers sessile, bisexual, buds

cylindrical; epicalyx green; corolla 6-merous, 0.2-0.3 cm long, dark red, valvate; stamens-6, dimorphic, 3 major and 3 minor alternating with each other, majors 0.8-1 × 0.1 cm, minors 0.5-0.6 × 0.1 cm, included. Fruit ovoid, 0.4 cm in length, purplish when mature.

Material examined

BRAZIL. Paraíba: Bananeiras, on *Mimosa caesalpinifolia* Benth., 07-IX-2011, fl. fr., Vasconcelos 14 (ACAM). Campina Grande, on *Mimosa caesalpinifolia* Benth., 18-II-2011, fl. fr., Vasconcelos 05 (ACAM). Guarabira, 07-IX-1942, fl. fr., Espinola s/n (JPB 1229). João Pessoa, 30-IV-1980, fl. fr., Agra 271 (JPB).

Habitat and distribution

The plant densely infests the host, and more than one specimen may be found on the same host or on different hosts of the same species. The plants are characterised by epicortical roots, filaments with depressions accommodating anthers, which are basifixed, and also by the presence of rufous-furfuraceous scales. In the state of Paraíba, it was predominantly found in areas of the Atlantic Forest. It commonly occurs on fruit trees and ornamental plants, found mainly in urban spaces, especially on *Terminalia catappa* L. (Combretaceae).

Similar to some other species of Loranthaceae, *Passovia pyrifolia* has a wide distribution and may occur in Colombia, Costa Rica, Ecuador, Jamaica, Mexico, Panama, Venezuela and Brazil (REIF; ANDREATA, 2011) where it has been recorded in the States of Acre, Amazonas, Pará, Rondônia, Roraima, Tocantins, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Mato Grosso and Espírito Santo (CAIRES; DETTKE, 2014).

Phenology

Flowered and fructified in February, April and September.

Psittacanthus Mart., Flora 13(1): 106. 1830.

Plants glabrous or pilose, devoid of epicortical roots. Stems usually erect, cylindrical when adult, brown to greyish. Leaves opposite, petiolate or sessile, alternate or rarely verticillate, generally coriaceous, sometimes crassous. Inflorescences in racemes or umbels of dyads or triads, bracteates; axillary or terminal. Flowers larger than 4 cm in length, pedicellate, bisexual, corolla 6-merous; stamens longer than width, dimorphic, filaments slender, anthers dorsifixed. Fruits ovoid, with endosperm.

The genus has 119 species distributed from Mexico to Argentina (KUIJT, 2009), 42 of which reported for Brazil (CAIRES; DETTKE, 2014).

2. *Psittacanthus cordatus* (Hoffmanns. ex Schult. f.) Blume, Syst. Veg., ed. 15 bis [Roemer and Schultes] 7(2): 1730. 1830. Figure 3.

Basionym: *Loranthus cordatus* Hoffmanns., Syst. Veg. (ed. 15 bis) 6: 128. 1820.

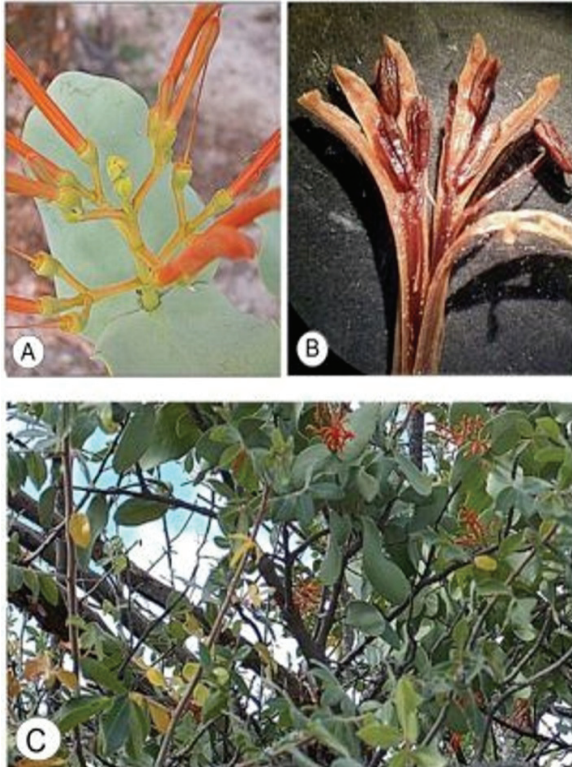


Figure 3. *Psittacanthus cordatus*. A. Inflorescence. B. Detail of flower. C. Habitat.

Plants erect, glabrous, heavily branched, densely leaved. Stems cylindrical, greyish, with few lenticels; internodes 4-4.5 cm in length. Leaves cross-opposite, sessile; blade oblong to ovate-cordate, 4-6 × 3 cm, apex obtuse to rounded, base cordate, perfectly basal actinodromous, pale green, glabrous, crassous. Inflorescences in racemes of triads in the terminal portion, 8-9 cm long, 3-7 pairs of triads per inflorescence, branches of inflorescence cylindrical, bracts at the base of the axis of the inflorescence. Flowers pedicellate, bisexual, buds cylindrical, pedicel 1-1.5 cm in length; epicalyx orange; corolla 6-merous, 5-5.5 cm in length, intense orange, valvate; stamens-6, dimorphic, 3 major and 3 minor, alternating with each other, majors 4.7 × 0.1 cm, minors 4.3 × 0.1 cm, included; ovary ca. 0.3 cm in length. Fruit not observed.

Material examined

BRAZIL. Paraíba: São João do Tigre, APA das Onças, Serra do Paulo, on *Spondias tuberosa* L., 16-VI-2011, fl., Lacchia s/n (ACAM 1240).

Habitat and distribution

Psittacanthus cordatus usually shows more than one specimen on a single host, but none in neighbouring plants. It is morphologically characterised as a plant devoid of epicortical roots, leaves sessile, crassous, base cordate, and by inflorescences in racemes of triads with the corolla intense orange. The species is common in “caatinga” areas and, in current research, it was found in the region called ‘Cariri Paraíba’, one of the driest areas of the state, with a predominance of the shrubby “caatinga”. In Brazil, it is found in the states of Amazonas, Pará, Rondônia, Tocantins, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Sergipe, Goiás, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Rio de Janeiro and São Paulo (CAIRES; DETTKE, 2014). The species was recently cited by Melo et al. (2011) for the state of Paraíba, Brazil.

Phenology

Flowered in May during a recognition visit to the area, and in June.

3. *Psittacanthus dichroos* (Mart.) Mart., Flora 13(7): 108. 1830.

Basionym: *Loranthus dichroos* Mart., Syst. Veg., ed. 15 bis [Roemer and Schultes] 7(1): 122 (-123). 1829.

Plants erect, glabrous, heavily branched, densely leaved. Stem cylindrical, brownish, presenting fissures, without lenticels; internodes 3.5-4 cm in length. Leaves opposite to sub-opposite, petiolate; petiole 0.8-1 cm in length; blade obovate, 3-5 × 2.5-3.5 cm, apex obtuse sometimes emarginated, base cuneate, hyphodromous, dark green, glabrous, semi-crassous. Inflorescences in pseudo-racemes of dyads or triads, axillary, 1 per axil, 2-3 × 0.2 cm, 3-4 pairs of triads or dyads per inflorescence, axis of inflorescence cylindrical, minute acute bract sometimes present. Flowers pedicellate, bisexual, buds clavate; epicalyx orange; corolla 6-merous, 5-6 × 0.3 cm, reddish, valvate; stamens-6, dimorphic, 3 major and 3 minor, alternating with each other, majors 0.7 × 0.1 cm, minors 0.5 × 0.1 cm, included; ovary ovoid, ca. 0.3 cm in length, with nectariferous disk. Fruit not observed.

Material examined

BRAZIL. Paraíba: Areia, 20-VIII-1946, fl., Vasconcelos s/n (EAN 544); Areia, Mata do Bujari, 02-X-1980, fl., Fevereiro et al. 450 (EAN); Areia, Campus da UFPB, CCA, 23-XI-1987, fl., Felix et al. 1784 (EAN); Areia, Sema II, 04-III-1989, fl., Felix and Santana 3630 (EAN); Areia, Sema II, Campo Grande, 19-XII-1989, fl., Felix and Santana 2530

(EAN); Arcia, Mata Redonda, 09-IV-2003, fl., Veloso 341 (JPB). Cabedelo, Praia do Jacaré, 04-XI-1982, fl., Moura s/n (JPB 1822). Campina Grande, 09-XII-1972, fl., Xavier s/n (JPB 3393). Capim, Mata da Usina Monte Alegre, 29-IV-2005, fl., Gadelha-Neto and Pontes 1365 (JPB). João Pessoa, Jacarapé, 14-VI-1987, fl., Moura 245 (JPB). Lucena, Ilha Bela, 15-I-1994, fl., Moura 1185 (JPB). Mamanguape, Cabeceira do Rio dos Patos, 01-IX-1989, fl., Felix and Santana 2255 (EAN). Monteiro, 21-III-2009, fl., Gadelha-Neto and Pessoa 2273 (JPB). Rio Tinto, Mata do Maracujá, 20-XII-1989, fl., Felix and Santana 2587 (EAN). Santa Rita, Usina São João, 05-II-1992, fl., Agra and Góis 1364 (JPB); Santa Rita, 14-II-1954, fl., Xavier s/n (JPB 1843). Sapé, Fazenda Pacatuba, 25-V-2001, fl., César 224 (JPB).

Habitat and distribution

The species is easily recognizable by its petiolate leaves, semi-crassous with base cuneate, and by inflorescences in pseudo-racemes of dyads or triads with reddish corollas. Another important character is the stem with longitudinal fissures. The species was the most extensively distributed in the state of Paraíba among the species encountered, and has been frequently found in the vegetation of coastal tablelands “tabuleiros litorâneos” or even in “caatinga” areas where it is associated with shrubby-tree physiognomies, affecting more than one specimen. According to Reif and Andreatta (2011), it is a common parasite on species of Myrtaceae and Melastomataceae. It occurs in Paraguay and Brazil (MOREIRA; RIZZINI, 1997); in Brazil, it is distributed in the States of Alagoas, Bahia, Paraíba, Pernambuco, Rio Grande do Norte, Sergipe, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo and Paraná (CAIRES; DETTKE, 2014).

Phenology

Flowered almost all the year, except in July.

Pusillanthus Kuijt, Novon 18(3): 372. 2008.

Plants papillose with inconspicuous indumentum, devoid of epicortical roots. Stem erect or not, cylindrical, brown. Leaves cross-opposite, petiolate. Inflorescences in capitules or umbels with flowers gathered at the apex of the peduncle conferring a glomerate appearance, bracteates, solitary or axillary. Flowers 0.4-1 cm in length, sessile, bisexual, corolla 4-merous; stamens with greater length than width, filaments isomorphic, anthers versatile cordate. Fruit ovoid to oblong, endosperm present.

The species occurs in Venezuela and Brazil (KUIJT, 2008), where it has been recorded in the

states of Alagoas, Bahia and Paraíba (CAIRES; DETTKE, 2014).

4. *Pusillanthus pubescens* (Rizzini) Caires, Acta Bot. Bras. 26(3): 669. 2012. Figure 4.

Basionym: *Struthanthus pubescens* Rizzini, Rev. Bras. Biol.: 404. 1950.



Figure 4. *Pusillanthus pubescens*. A. Habit. B. Inflorescence.

Plants heavily branched, densely leaved. Stem cylindrical, cinereous, indumentum conspicuous, with papillae trichotomous; internodes 2–4.5 cm in length. Leaves petiolate; petiole 0.2–0.3 cm in length; blade oblong lanceolate to elliptic, (3-)4-5(-6) × 1.5–2 cm, apex acute to slightly obtuse, base cuneate, actinodromous basal to supra-basal, 2-4 basal veins, dark green, papyraceous. Inflorescences

in racemes, internodes short or constricted, axillary, 1 per axil, 2-4 cm in length, 1 pair of terminal triads, axis of inflorescence cylindrical, contracted, bracts acute, the middle bract similar to the laterals. Flowers with clavate buds; epicalyx lacerated greenish; corolla 0.4-1 cm in length, greenish, valvate; stamens-6, 0.6×0.1 cm, exerted or not, anthers sub-sessile, locule ellipsoid. Fruit not observed.

Material examined

BRAZIL. Paraíba: São José da Mata, Fazenda Pedro Costa de Agra, on *Spondias* sp., 28-VI-1991, fl., Agra 1318 (JPB); São José da Mata, VII-1991, fl., Agra 1870 (JPB).

Habitat and distribution

The species is recognizable, particularly, due to the trichotomous papillae on the branches, which characterize the specific epithet as well as by the 4-merous flowers, smaller than 4 cm in length. Moreover, it presents inflorescences with contracted internodes, differentiating it from the other representatives of the family in Brazil. In the state of Paraíba, it was recorded only in more humid areas at altitudes above 500 m. This species was first treated in the genus *Struthanthus* as *S. pubescens* Rizzini (1980); recently Caires et al. (2012) included it in the genus *Pusillanthus*. In Brazil it has been found in the States of Bahia and Paraíba (CAIRES; DETTKE, 2014).

Phenology:

Flowered in June and July.

Struthanthus Mart., Flora 13(1): 102. 1830.

Plants glabrous or pilose; epicortical roots present or not along the stem, between the internodes or at the base of the branches. Stem erect or scandent, cylindrical or angular when young, when adult, generally with brown lenticels. Leaves opposite or sub-opposite, distichously, petiolate. Inflorescences in racemes, spikes, corymbs or glomerules of triads, bracteates, axillary to terminal. Flowers 0.5-1 cm in length, sessile pedicellate, unisexual or bisexual, corolla 4-6-merous; stamens longer than they are wide, male flowers bearing dimorphic stamens, 3 major and 3 minor alternating with each other, anthers versatile dorsifixed; female flowers with nectar glands encircling the atrophied gynoecium and androecium. Fruits elliptical, endosperm present.

The genus includes 60-70 species distributed from Mexico to Argentina (REIF; ANDREATA, 2011) of which 53 have been recorded in Brazil (CAIRES; DETTKE, 2014).

5. *Struthanthus calobotrys* Eichler, Fl. Bras. (Martius) 5(2): 1879.

Plants heavily branched, densely leaved. Devoid of epicortical roots along the internodes. Stem cylindrical, greyish brown, with few lenticels; internodes 3-4 cm in length. Leaves cross-opposite, petiolate; petiole 1.5-2 cm in length; blade elliptical to lanceolate, (3-)4-6 \times 2-3.5 cm, apex acuminate, base round to cuneate, eucamptodromous, green, semi-coriaceous. Inflorescences in racemes of axillary triads, 1 per axil, (3)-6-10 cm in length, 4-6 pairs of triads per inflorescence, axis of inflorescence cylindrical, bracts ovate. Flowers sessile, buds slender; epicalyx greenish; corolla 6-merous, ca. 0.6 cm in length, greenish, valvate; stamens-6, majors 0.5×0.1 cm, minors 0.4×0.1 cm, included; rudimentary pistil in male flowers. Fruit not observed.

Material examined

BRAZIL. Paraíba: Areia, on *Enterolobium contortisiliquum* (Vell.) Morong, 15-VII-1953, fl., Vasconcelos s/n (EAN 1006). João Pessoa, Jacarapé, on Urucum, 17-IV-1990, fl., Moura 422 (JPB).

Habitat and distribution

There are three reports on *Struthanthus calobotrys* in Brazil, including the type collected by Sellow in the state of Bahia. Morphologically, it is strongly characterised by epicortical roots, leaves with petioles of 1.5-2 cm in length, leaf blade strongly opaque, which often makes the stomata obvious to the naked eye, and a cylindrical axis of inflorescences. It is associated with areas of Atlantic Forest in the state of Paraíba, on the coast and in humid forest enclaves "brejos de altitude". The species is restricted to Brazil, only found in the states of Bahia and Paraíba (CAIRES; DETTKE, 2014).

Phenology

Flowered in April and July.

6. *Struthanthus concinnus* Mart., Flora 13(1): 105. 1830.

Plants heavily branched, densely leaved. Occasional epicortical roots in the internodes. Stem cylindrical to compressed, greyish-brown, densely lenticellate; internodes 4-5 cm in length. Leaves opposite, petiolate; petiole 0.5-1 cm in length; blade lanceolate to ovate, 6-7 \times 3-4 cm, apex acuminate, base round, eucamptodromous, green, semi-coriaceous. Inflorescences in sessile spikes of axillary triads, 1 per axil, 3-4 cm in length, 3-6 pairs of triads

per inflorescence, axis of inflorescence compressed, bracts acute, ovate-lanceolate. Flowers sessile, buds slender; epicalyx greenish; corolla 6-merous, 0.3-0.4 cm in length, greenish, valvate; stamens-6, majors 0.4×0.1 cm, minors 0.3×0.1 cm, included; ovary obovate, 0.2 cm in length; style cylindrical, 0.3-0.4 cm in length. Fruit ellipsoid, 0.8-0.5 cm in length, purplish when mature.

Material examined

BRAZIL. Paraíba: Mamanguape, Maripitanga Sema II, on Cupiubá, 13-VI-1991, fl. fr., Felix and Souza 3991 (EAN).

Habitat and distribution

Occasional parasite usually found associated with coastal tableland "tabuleiro" vegetation. According to Reif and Andreata (2011), it is commonly characterized by inflorescences in spikes, stems densely lenticellate and leaves lanceolate. However, in current study, the leaf blade ovate with acuminate apex was also observed. The main distinctiveness lies in inflorescences in spikes of compressed axis, since the other species of the family studied have inflorescences with cylindrical or angular axis.

During current study, it was exclusively recorded in the municipality of Mamanguape, associated with the Atlantic Forest vegetation. Guerra and Marini (2002) note that *S. concinnus* has *Hylophilus amaurocephalus* and *Ilicura militares* as its most frequent dispersers. According to Sugiyama (1992), the species is frequently found on cultivated plants showing self-parasitism. According to Reif and Andreata (2011), it is known as "erva-de-passarinho de folha miúda" (bird's plant with small leaves). In Brazil, it has been recorded in the states of Acre, Tocantins, Distrito Federal, Goiás, Mato Grosso, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo (CAIRES; DETTKE, 2014). Current paper gives the first notice and report on the species for the state of Paraíba.

Phenology

Flowered in June.

7. *Struthanthus cuspidatus* Mart., Flora 13(1): 105. 1830.

Plants heavily branched, scantily leaved. Epicortical roots present at the base of the plant. Stem cylindrical, greyish-brown, with few lenticels; internodes (3-)4.5-6.5(-7) cm in length. Leaves opposite to sub-opposite, petiolate; petiole 0.8-1 cm in length; blade elliptical, obovate to obcordate, $1.5-2.5 \times 1-2$ cm, apex rounded to slightly acuminate, base obtuse, eucamptodromous, olive green, semi-

coriaceous. Inflorescences in racemes of triads, axillary, 1 per axil, 2-4 cm in length, 4-6 pairs of triads per inflorescence, axis of the inflorescence compressed, bracts sub-acuminate. Flowers sessile, buds clavate; epicalyx greenish; corolla 6-merous, 0.3-0.4 cm in length, greenish, valvate; stamens-6, majors 0.4×0.1 cm, minors 0.3×0.1 cm, included; ovary obovate, 0.2 cm in length; style cylindrical, 0.3-0.4 cm in length, presenting filiform staminodes of compressed thecae. Fruit not observed.

Material examined

BRAZIL. Paraíba: Alagoinha, 26-XI-1942, fl., Xavier s/n (JPB 979). Areia, on *Mimosa* sp., 15-IX-1953, fl., Vasconcelos s/n (EAN 1004); Areia, on *Acacia* sp., 24-X-1953, fl., Vasconcelos s/n (EAN 1005). Capim, 02-IV-1988, fl., Agra and Ferreira s/n (JPB 18431). Remígio, 02-XII-1988, fl., Felix et al. 1462 (EAN). Santa Rita, Tibirizinho, III-1992, fl., Agra et al. 1802 (JPB).

Habitat and distribution

The plants usually show more than one specimen per host, less frequently found in other neighbouring specimens, commonly associated with shaded areas. It is characterised by petioles 0.8-1 cm in length, compressed axis of inflorescence, and also by staminodes with compressed thecae. In the state of Paraíba, it has been reported in areas of the Atlantic Forest mainly in humid forest enclaves "brejos de altitude", in urban space. In Brazil, *Struthanthus cuspidatus* may be found in the States of Bahia, Paraíba, Pernambuco, Piauí, Minas Gerais and Rio de Janeiro (CAIRES; DETTKE, 2014).

Phenology

Flowered in March, April and from September to December.

8. *Struthanthus marginatus* (Ders.) Blume, Syst. Veg., ed. 15 bis [Roemer and Schultes] 7(2): 1731. 1830. Figure 5.

Plants heavily branched, sparsely leaved. Epicortical roots found at the base of the plant and along the internodes. Stem cylindrical, greyish, with lenticels; internodes 6-7 cm in length. Leaves sub-opposite, petiolate; petiole 0.4-0.5 cm in length; blade elliptical, $3-3.5 \times 2$ cm, apex acuminate, base obtuse to cuneate, eucamptodromous, bright green, semi-coriaceous. Inflorescences in racemes of axillary triads, 2(-3) per axil, 2.5-3.5 cm in length, 3-4 pairs of triads per inflorescence, axis of inflorescence angular, bracts acute. Flowers pedicellate, buds clavate; epicalyx greenish; corolla

6-merous, 0.3-0.4 cm in length, greenish, valvate; stamens 6, majors 0.4×0.1 cm, minors 0.3×0.1 cm, included; ovary ovoid, 0.3 cm in length; style cylindrical, 0.3-0.4 cm in length, rudimentary pistil in male flowers. Fruit elliptical, 0.2-0.3 cm in length, reddish when mature.

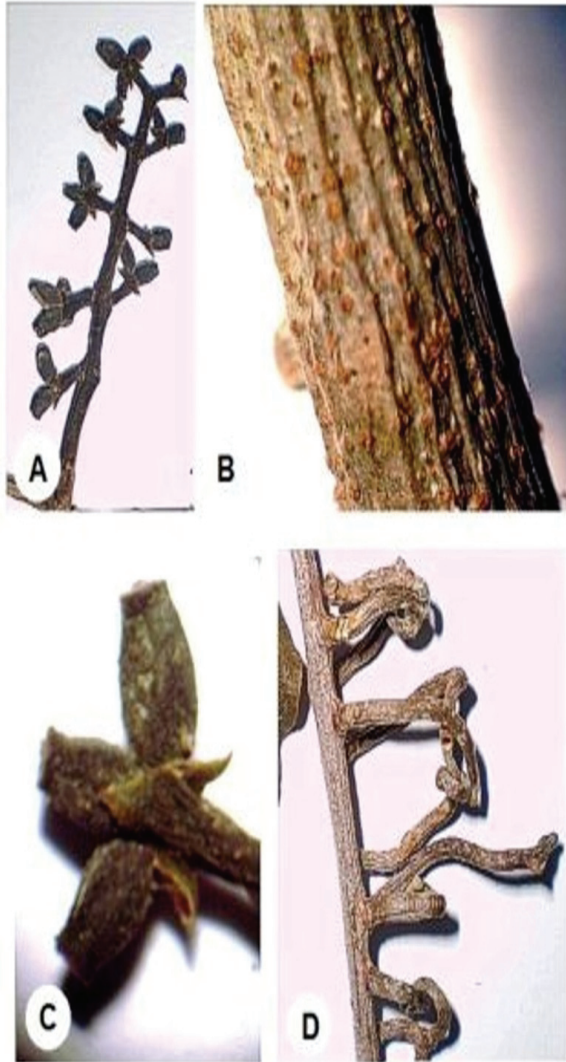


Figure 5. *Struthanthus marginatus*. A. Inflorescence. B. Detail of the lenticellate stem. C. Triad. D. Epicortical roots.

Material examined

BRAZIL. Paraíba: Areia, on Bamboo, 15-X-1953, fl., Vasconcelos s/n (EAN 994); Areia, Mata do Pau Ferro, 28-V-1980, fr., Andrade-Lima and Fevereiro 13-1980 (EAN); Areia, *Campus* II, UFPB, 08-IX-2011, fl., Vasconcelos 17 (ACAM). João Pessoa, *Campus* I, UFPB, 28-IX-1987, fr., Agra and Batista 632 (JPB); João Pessoa, 25-VIII-1971, fl., Xavier s/n (JPB 3004). Mamanguape, Sema II, 26-IV-1990, fl., Felix and Santana 2924 (EAN). Nazarezinho, 02-VIII-1982, fl., Souza et al. 1320 (JPB). Rio Tinto,

Estuário Ecológico, 19-VIII-1988, fl., Felix and Miranda s/n (JPB 8334). São João do Tigre, APA das Onças, Serra do Paulo, 29-V-2010, fr., Lima s/n (ACAM 1200).

Habitat and distribution

According to Reif and Andreata (2011), the trait which gives it its epithet is the cartilaginous margin of the leaf blade, representing its main feature by which it is recognized. Another important trait is the presence of 2-3 inflorescences per axil. Although the flowers were not analysed, examination of the fruits revealed that the flowers were sessile and bracteates. In the study area, it was found in more humid Atlantic Forest and in drier areas “caatingas”, commonly associated with sunny stretches. Reif and Andreata (2011) reported its use for the treatment of bronchitis. In Brazil, it may be found in the states of Amazonas, Pará, Tocantins, Bahia, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Sergipe, Distrito Federal, Goiás, Mato Grosso, Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo (CAIRES; DETTKE, 2014). This species is known in Brazil as “erva-de-passarinho-de-grandes-folhas” [bird’s plant with big leaves] (REIF; ANDREATA, 2011).

Phenology

Flowered in April and from August to October, and fructified in May and September.

9. *Struthanthus polyrhizus* (Mart.) Mart., Flora 13(1): 105. 1830. Figure 6.

Plants heavily branched, sparsely leaved. Abundant epicortical roots, present at the base of the plant and along the internodes. Stem angular when young, cylindrical when adults, greyish, densely lenticellate; internodes 5-9 cm in length. Leaves opposite to sub-opposite, petiolate; petiole 0.5-2 cm in length; blade cordate, $2.5-4 \times 1.5-3$ cm, apex emarginated, acuminate or acute, base attenuate to acute, eucamptodromous, dark green, semi-coriaceous. Inflorescences in sessile corymbs of axillary triads, 1 per axil, 4-5 cm in length, with 3-4 pairs of triads per inflorescence, axis of inflorescence angular, bracts ovate. Flowers sessile, buds cylindrical; epicalyx green; corolla 6-merous, 0.3-0.5 cm in length, reddish-cream, valvate; stamens-6, majors 0.5×0.1 cm, minors 0.3×0.1 cm, included; ovary obovate, 0.2 cm in length; style cylindrical, 0.3-0.4 cm in length, staminodes filiform with compressed thecae. Fruit elliptical, 0.8 cm in length, reddish when mature.

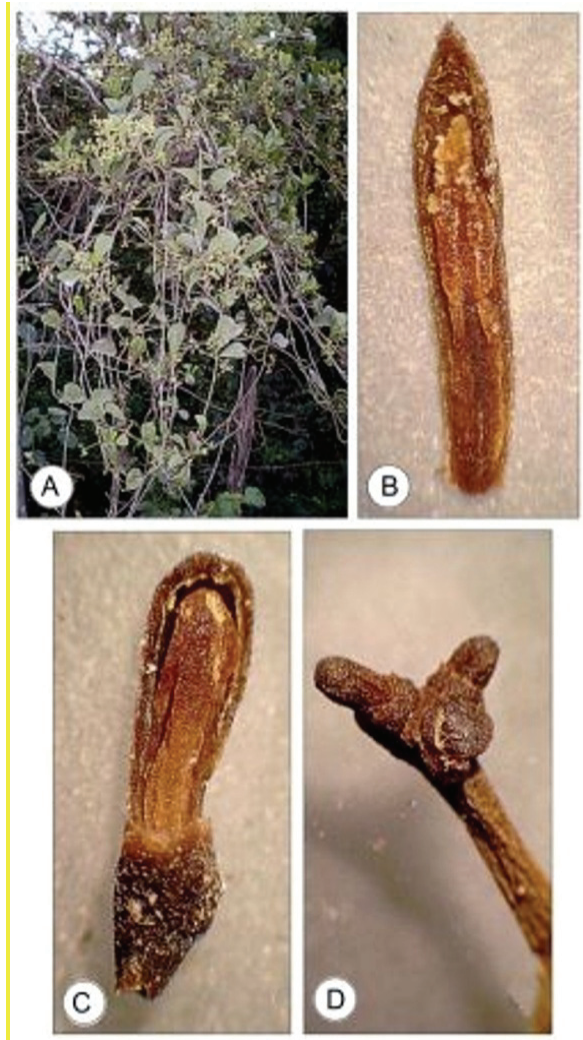


Figure 6. *Struthanthus polyrhizus*. A. Habit. B. Petal and its epipetalous stamen. C. Open bud. D. Arrangement of triads.

Material examined

BRAZIL. Paraíba: Alcantil, 16-VIII-2010, fl. fr., Vasconcelos 09 (ACAM). Campina Grande, on *Mimosa hostilis* Benth., 18-II-2011, fl. fr., Vasconcelos 12 (ACAM). Monteiro, on *Prosopis juliflora* (Sw.) DC., 12-V-2011, fl., Vasconcelos 21 (ACAM).

Habitat and distribution

The plants are heavily branched, with branches protruding from the host, occupying almost the entire crown. Species easily recognised by presentation of leaf blade obovate, emarginated and acute apex, as well as by inflorescences in corymbs of triads and an abundance of epicortical roots along the branches. In Paraíba, it was recorded exclusively in “caatinga” regions. According to Krause (1922), it is frequently found on specimens of *Rapanea* Aubl. (Primulaceae) and *Sebastiania* Spreng. (Euphorbiaceae). In Brazil, it

was recorded in the States of Alagoas, Bahia, Pernambuco, Piauí, Sergipe, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul (CAIRES; DETTKE, 2014).

Phenology

Flowered in February, May and August and fructified in February and August.

10. *Struthanthus syringifolius* Mart., Flora 13(1): 105. 1830. Figure 7.



Figure 7. *Struthanthus syringifolius*. A. Habitat. B. Reproductive branch. C. Arrangement of triads.

Plants semi-erect, sparsely branched and leaved. Epicortical roots found only at the base of the plant.

Stem flattened when young, cylindrical in adults, brown, with few lenticels; internodes 4.5-5 cm in length. Leaves cross-opposite to rarely sub-alternate, petiolate; petiole 1.5-2 cm in length; blade oblong-lanceolate, (4-)6.5-7 × 2.5-3 cm, apex acute to acuminate, base obtuse to cuneate, eucamptodromous, yellowish green, semi-coriaceous. Inflorescences in racemes of aggregate triads in the terminal portion of the branch, 6-7 cm in length, 4 pairs of triads per inflorescence, axis of inflorescence compressed to tetragonus, bracts acute-dentate with the middle bracts being larger than the lateral bracts. Flowers sessile, buds clavate; epicalyx green; corolla 6-merous, 0.4-0.5 cm in length, greenish, valvate; stamens-6, majors 0.6 × 0.1 cm, minors 0.4 × 0.1 cm, included; ovary inconspicuous with ca. 0.1 cm in length; style cylindrical, 0.3-0.4 cm in length. Fruit not observed.

Material examined

BRAZIL. Paraíba: Alcantil, on *Poincianella pyramidalis* (Tul.) L.P. Queiroz, 16-VIII-2011, fl., Vasconcelos 10 (ACAM). Areia, on *Mangifera indica* L. and *Bambusa* sp., 20-I-1944, fl., Vasconcelos s/n (EAN 123); Areia, on *Mangifera indica* L., 28 VIII-1956, fl., Vasconcelos s/n (EAN 1788). Barra de Santana, on *Spondias tuberosa* L., 16-X-2010, fl., Vasconcelos 01 (ACAM). Cabaceiras, Sítio Bravo, 30-IX-1991, fl., Nascimento and Martins 128 (JPB). Região do Curimataú, 10-XI-1954, fl., Vasconcelos s/n (EAN 1531). Serra Branca, 09-IX-2005, fl., Agra et al. 6654 (JPB). Unknown locality, 23-XI-1989, fl., Agra et al. 693 (JPB).

Habitat and distribution

Plants with branches protruding from the host, but sparsely branched, presenting small volume and never reaching neighbouring hosts. As noted by Reif and Andreato (2011), the species is easily recognisable by leaf blades with an acute apex and acute-dentate bracts, the middle bracts being bigger in size than the lateral ones. In the study area, it is commonly found on rocky outcrops, also occurring in areas of Atlantic Forest and "caatinga". In Brazil, it has been recorded in the States of Acre, Bahia, Ceará, Paraíba, Mato Grosso, Goiás, Minas Gerais and Rio de Janeiro (CAIRES; DETTKE, 2014).

Phenology

Flowered in January and from August to November.

Conclusion

Ten species and four genera were reported for the state of Paraíba, with *Struthanthus concinnus* representing

a new record for the state's flora. The main features used for the separation of the species comprised presence or absence of epicortical roots, distribution of the lenticels in the branches, leaf apex format, types of inflorescences, and number of inflorescences per axil and position of anthers. The number of representatives found and the vegetative and reproductive morphological features highlighted for species recognition of Loranthaceae evidence the importance of current study for the family and also on other mistletoe groups in the State of Paraíba.

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