



Flora of Paraíba State, Brazil: *Aechmea* Ruiz & Pav. (Bromeliaceae)

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Abstract: *Aechmea* is one of the largest genera of Bromeliaceae, having more than 250 species, and Brazil is its principal center of endemism. We taxonomically examined the species of *Aechmea* encountered in Paraíba State in northeastern Brazil. Our analyses were based on specimens collected during the present study, as well as examinations of local and regional herbaria collections. Eleven species were encountered to State: *Aechmea aquilega*, *A. chrysocoma*, *A. constantinii*, *A. emmerichiae*, *A. eurycorymbus*, *A. fulgens*, *A. leptantha*, *A. mertensii*, *A. nudicaulis*, *A. patentissima*, and *A. werdermannii*. Of those taxa, seven are endemic to northeastern Brazil and five are included within one of the threatened categories according to IUCN criteria, two of them being “endangered” and “critically endangered”. We include here a key to the identification of the species, a list of the materials examined, commentaries concerning the taxonomic affinities of the species based on morphological characters, data concerning their geographic distributions, flowering, fruiting, inferences concerning their conservation statuses, as well as images and drawings indicating their principal characteristics.

Keywords: *Bromelioideae*, *conservation*, *flora*, *northeastern Brazil*, *taxonomy*.

Flora da Paraíba, Brasil: *Aechmea* Ruiz & Pav. (Bromeliaceae)

Resumo: *Aechmea* é um dos maiores gêneros de Bromeliaceae, tendo mais que 250 espécies, e o Brasil é seu principal dentro de endemismo. Examinamos taxonomicamente as espécies de *Aechmea* encontradas no estado da Paraíba, Nordeste do Brasil. As análises foram baseadas em espécimes coletados durante a realização deste estudo, complementadas pelas coleções de herbários locais e regionais. Foram encontradas 11 espécies para o Estado: *Aechmea aquilega*, *A. chrysocoma*, *A. constantinii*, *A. emmerichiae*, *A. eurycorymbus*, *A. fulgens*, *A. leptantha*, *A. mertensii*, *A. nudicaulis*, *A. patentissima* e *A. werdermannii*. Dentre estas, sete são endêmicas do Nordeste brasileiro e cinco estão incluídas em uma das categorias de ameaça de acordo com os critérios da IUCN, com duas delas “em perigo” e “criticamente em perigo”. O tratamento inclui uma chave para a identificação das espécies, relação de material examinado, comentários sobre as afinidades taxonômicas baseados em caracteres morfológicos, dados de distribuição geográfica, floração, frutificação e inferências sobre o *status* de conservação para as espécies, bem como imagens e estampas em nanquim destacando os principais caracteres dos taxa.

Palavras-chave: *Bromelioideae*, *conservação*, *flora*, *nordeste brasileiro*, *taxonomia*.

Introduction

Bromeliaceae A. Juss. comprises approximately 3140 species distributed into 58 genera (Givnish et al. 2011), with predominately Neotropical distributions (Smith & Downs 1974). Brazil is one of the principal centers of diversity of the family, having representatives of more than 70% of the genera and 40% of the species (Wanderley et al. 2007, BFG 2015). Among the eight currently recognized subfamilies of Bromeliaceae (Givnish et al. 2007, Givnish et al. 2011), Bromelioideae demonstrates the greatest diversity, comprising more than 50% of the genera of the family (Smith & Downs 1979, Barros & Costa 2008).

Aechmea Ruiz & Pavón (1794) is recognized as the largest genus of Bromelioideae, with more than 250 species (Luther 2008) distributed throughout the tropical Americas (Smith & Downs 1979); 184 of its species occur in Brazil, with 159 being endemic to that country (BFG 2015) – although only 49 of those taxa have been evaluated in terms of their conservation statuses (Martinelli & Moraes 2013). *Aechmea* has been found to be problematic in terms of its infrageneric classification and poorly established conceptual limits, being considered an artificial group (Wendt 1997, Faria et al. 2004, Barros & Costa 2008) with controversial circumscriptions (Sousa & Wanderley 2015).

The high representivity of bromeliads in greatly threatened Brazilian ecosystems such as the Atlantic Forest and Caatinga (BFG 2015) and the extreme ecological importance of bromeliads in maintaining many biological processes (Benzing 2000), calls for more attention to be paid to studies of the morphologies and distributions of *Aechmea* species, as well as the family itself. Bromeliaceae is considered the second most numerous family in Brazil in terms of the numbers of threatened species, with the highest number of species considered “critically threatened” (Martinelli & Moraes 2013) - intensifying the necessity for more in - depth studies of its component taxa. There have been relatively few studies concentrating on this family (and genus) in Paraíba State, with only the studies of Pontes (2005) of the Atlantic Forest region a synopsis of the genus in three northeastern states by Maciel et al. (2015), and a study of the family on rocky outcrops (Silva et al. 2015).

As such, this work presents a taxonomic study of *Aechmea* (Bromeliaceae) for Paraíba State, northeastern Brazil providing up-to-date information concerning morphological, taxonomic, and phenological aspects of its species as well as their distributions, which can be used for preparing management and conservation plans for bromeliads in that region.

Materials and Methods

Paraíba State (-06°00'11" to -08°19'54" and -34°45'50" to -38°47'58") covers 56.440 km², corresponding to 3.3% of northeastern Brazil. The region receives high levels of solar radiation, has a hot climate with a mean annual temperature of 26 °C and a mean annual rainfall rate >1600 mm. The State have four principal natural ecosystems that have been impacted by different, but intense, anthropogenic modifications: Coastal Plains, Forests, Transition Zones, and *Caatinga*. The forest formations include *Caatinga*, those found on coastal plains, mangrove swamps, humid forests, semi-deciduous forests, Atlantic Forest, and near-ocean sandy *restinga* forest stands (AESA 2006).

Field collections were made on a monthly basis by way of random walks through the greatest possible number of municipalities in the state during the period between May/2015 and May/2016. During these

excursions we obtained fertile specimens (with flowers and/or fruits) and recorded field data such as habitat and the colors of the reproductive structures - among other aspects important for identifying the species and characterizing their environments. The collection points were recorded using a hand-held GPS. Reproductive structures (flowers and fruits) were preserved in 70% alcohol in the field for posterior examination in the laboratory. The collections were appropriately processed and incorporated into the Manuel de Arruda Câmara Herbarium (ACAM).

Comparative analyses were made with preserved herbarium specimens in different herbaria (EAN, IPA, JPB, PEUFR, and RB) and also with images from virtual herbaria (B, HVASF, NY, UFP) (acronyms Thiers 2016) available on the JSTOR and Species Link platforms. The description of the genus was based on the species encountered in Paraíba State, and the flowering and fruiting data considered both our field records and herbaria labels. The terminology utilized follows Smith & Downs (1979), Sousa & Wanderley (2000) and Gonçalves & Lorenzi (2011). Inferences concerning the degrees of conservation of the species were based on available information on the Species Link and JSTOR databases as well as on information gathered in the various herbaria visited, and were used to characterize the conservation status of the species according to IUCN (2001) criteria.

Results and Discussion

The genus *Aechmea* was represented in the Paraíba State by 11 species, of which nine are endemic to Brazil, and seven restricted to northeastern Brazil. Most of the species were restricted to the eastern region of Paraíba State.

The conservation statuses of all species encountered, according to IUCN (2001) criteria, included eight in the “Vulnerable”, “Endangered”, or “Critically Endangered” categories; one was considered “Almost Threatened” and two “Least Concern”.

Aechmea Ruiz & Páv., Fl. Peruv.: 47. 1794. Type: *Aechmea paniculata* Ruiz & Pav.

Terrestrial herbs, epiphytes or rupicolous. Leaves in rosette open or tubular. Leaf chartaceous or coriaceous; sheath wide; blade linear, linear-lanceolate to oblong, margin serrate or saw-edged, to strongly aculeate. Scape well-developed, erect, suberect, covered by bracts; bracts at base of scape imbricate or not, lax to congested. Inflorescences simple or composite, spiciform or paniculate, lax or congested, included or exserted within the leaf rosette; floral bracts conspicuous or inconspicuous. Flowers showy, sessile, subsessile or pedicellate; sepals strongly asymmetrical, connate at base; petals free, yellow, orange or lilac colored, frequently spatulate; petal appendices present; callosities generally present; stamens enclosed, free, or adnate to the petals; ovary inferior, epigynous tube present, small to well-developed, stigma erect-simple or spiral-conduplicate; fruit a berry.

Identification key to the species of *Aechmea* native to Paraíba State

1. Abaxial surface of leaf blade with cinereous transversal stripes formed by dense concentrations of trichomes, aculeus less than 0.1 cm long; inflorescences glabrous; flowers with corolla lilac-colored; petals cuculiform 6. *A. fulgens*

1'. Abaxial surface of the leaf blade scaly or glabrescent, without cinereous transversal stripes, aculeus more than 0.1 cm long; inflorescences scaly, tomentose or pulvinate; flowers with corolla white, yellow, orange or yellowish-orange; petals spatulate

2. Inflorescences simple, spiciform; scape bracts imbricate at base of inflorescence 9. *A. nudicaulis* var. *nordestina*

2'. Inflorescences composite, paniculate; scape bracts not imbricate at base of the inflorescence

3. Inflorescences cylindrical; peduncle of the primary branches up to 0.4 cm long; primary bracts with aculeate margins

..... 8. *A. mertensii*

3'. Inflorescences pyramidal or subcylindrical; peduncle of the primary branches more than 0.4 cm long; primary bracts with entire margins

4. Sets of ramification of the inflorescence globose, congested towards the apex by the shortening of the internodes and the branch peduncles; inferior primary bracts extending beyond the branches; floral bracts equal in size to the sepals

5. Inflorescences 11–18 cm long; peduncle of the primary branches 1–2 cm long; floral bracts greenish-yellow; basal petal appendices with apices fimbriate ..

..... 2. *A. chrysocoma*

5'. Inflorescences 15–31.5 cm long; peduncle of the primary branches 1.3–11 cm long; floral bracts pinkish-red; basal petal appendices with apices erose

..... 1. *A. aquilega*

4'. Sets of ramification of the inflorescences not globose, lax towards the apex by the distancing of the internodes and of the peduncles of the branches; inferior primary bracts not extending beyond the branches; floral bracts shorter than the sepals

6. Flowers 1.2–1.3 cm long, verticillate; corolla white, callosities absent; ovary ca. 0.4 cm long; fruits bluish-white

..... 10. *A. patentissima*

6'. Flowers 3–4.5 cm long, not verticillate; corolla yellow or orange, callosities present; ovary longer than 0.6 cm; fruits greenish–yellow or green

7. Floral bracts inconspicuous, not extending beyond the ovary

8. Primary bracts ligulate; floral bracts strongly tomentose, with star-shaped trichomes; flowers sessile; sepals carinate, tomentose, green

..... 3. *A. costantinii*

8'. Primary bracts linear-lanceolate; floral bracts slightly scaly, trichomes scaly; flowers conspicuously pedicellate; sepals carinate, glabrous, yellow

..... 7. *A. leptantha*

7'. Floral bracts conspicuous, extending beyond ovary

9. Upper branches congested; primary bracts the same size as the branches

..... 4. *A. emmerichiae*

9'. Upper branches sparse; primary bracts distinctly smaller than the branches

10. Floral bracts 1.5–1.7 cm long; flowers subsessile

..... 5. *A. eurycorymbus*

10'. Floral bracts 0.5–1 cm long; flowers sessile

..... 11. *A. werdermannii*

1. *Aechmea aquilega* (Salisb.) Griseb., Fl. Brit. W. I.: 592. 1864. *Bromelia aquilega* Salisb., Parad. Lond. 2: 40. 1806. Lectotype (designated by Smith & Downs, 1979): Brazil, without location, *D. Hurlock s.n.* (illustration published by Salisbury, 1806)

Figure 1a-b

Terrestrial, epiphyte or rupicolous, ca. 1.3 m tall. Leaves 57.5–75 cm long; sheath ca. 16.5 × 10.5 cm, elliptic, coriaceous, reddish-brown, sparsely scaly; blade 50–100 × 3–5 cm, linear-lanceolate, coriaceous, slightly scaly, abaxial surface scaly, without cinereous transversal stripes, apex apiculate, margins aculeate, aculeus 0.1–0.3 cm long, longer nearer the base, brown, spaced 0.5–1 cm. Scape 26.5–60 cm long, erect, white-tomentose, vinaceous, totally covered by amplexi-scape bracts; scape bracts 14.5–16 × 2–2.5 cm, not imbricate at base of the inflorescence, ligulate, papyraceous, lower ones green-vinaceous, upper ones pinkish red to orangish, scaly, apex rounded, mucronate, margins entire. Inflorescence 15–31.5 long, yellow-vinaceous to orangish, scaly, composite, panicle pyramid-shaped or subcylindrical, with ca. 13 branches, ramifications to the third order, from the base to the apex of the inflorescence, sets of ramification globose; inflorescence branches distributed sparsely at base, gradually more congested towards the apex due to the shortening of the internodes and of the peduncles of the branches; peduncles of the primary branches 1.3–11 cm long, longer at base, very sharp to almost sessile at apex; primary bracts 3.5–15.5 × 1.5 cm, basal bracts longer, extending beyond or equal in length to the branch, upper bracts equal in length to the branch or slightly smaller, ligulate, reflexed to evident, yellow-vinaceous, sparsely scaly, apex acuminate, margins entire; peduncles of the secondary and tertiary branches very short, 0.5–0.3 cm long, congested; secondary and tertiary bracts 3–3.5 cm long, similar to the floral bracts, shorter than those of the branches, oval-lanceolate, orangish, carinate. Floral bracts 1.5–2.5 × 0.8–1 cm, completely covering the ovary, same size as those of the sepals, widely oval, chartaceous, pinkish-red, sparsely scaly, apex long-mucronate. Flowers 3–4 cm long, subsessile; sepals 1–1.5 × 0.8–1 cm, connate, strongly asymmetrical, carinate, greenish-yellow, slightly scaly, apex mucronate, mucron ca. 0.1 cm long; petals ca. 3 × 0.3 cm, spatulate, yellow, apex mucronate; callosities ca. 2 cm long; basal petal appendices ca. 0.3 cm long, apex erose; stamens ca. 2.7 cm long, external ones with filaments free, internal ones with filaments almost completely adnate to the petals; filaments ca. 2 cm long, complanate; anthers ca. 0.5 cm long; ovary with epigynous tube ca. 1 cm long, elliptic, glabrous, copious nectar at base; styles ca. 2.8 cm long; stigma ca. 0.2 cm long, spiral-conduplicate. Berry ca. 1 cm long, elliptic, yellowish-orange or white when young.

Material examined: BRAZIL, PARAÍBA: Arara, 06°88'23" S and 35°75'83" W, 11.XII.1958, fl., J.C. Moraes s.n. (EAN 1996); Dona Inês, 06°60'33" S and 35°29'17" W, 13.VII.1998, fr., E.A. Rocha 4610 (IPA); Picuí, 06°51'05" S and 36°34'69" W, 20.XI.2008, fl., P.C. Gadelha-Neto et al. 1961 (JPB).

Additional material examined: BRAZIL, PERNAMBUCO: Petrolina, 09°38'35" S and 40° 50'79" W, 376m, 13.V.1974, fl., D. Andrade-Lima et al. 2600 (RB). SERGIPE: Pirambu, 14°42'43" S and 36°50'48" W, 60m, 6.IV.1999, fl., G. Martinelli et al. 15342 (JPB).

Phenology: Flowering recorded in November and December and fruiting in July.

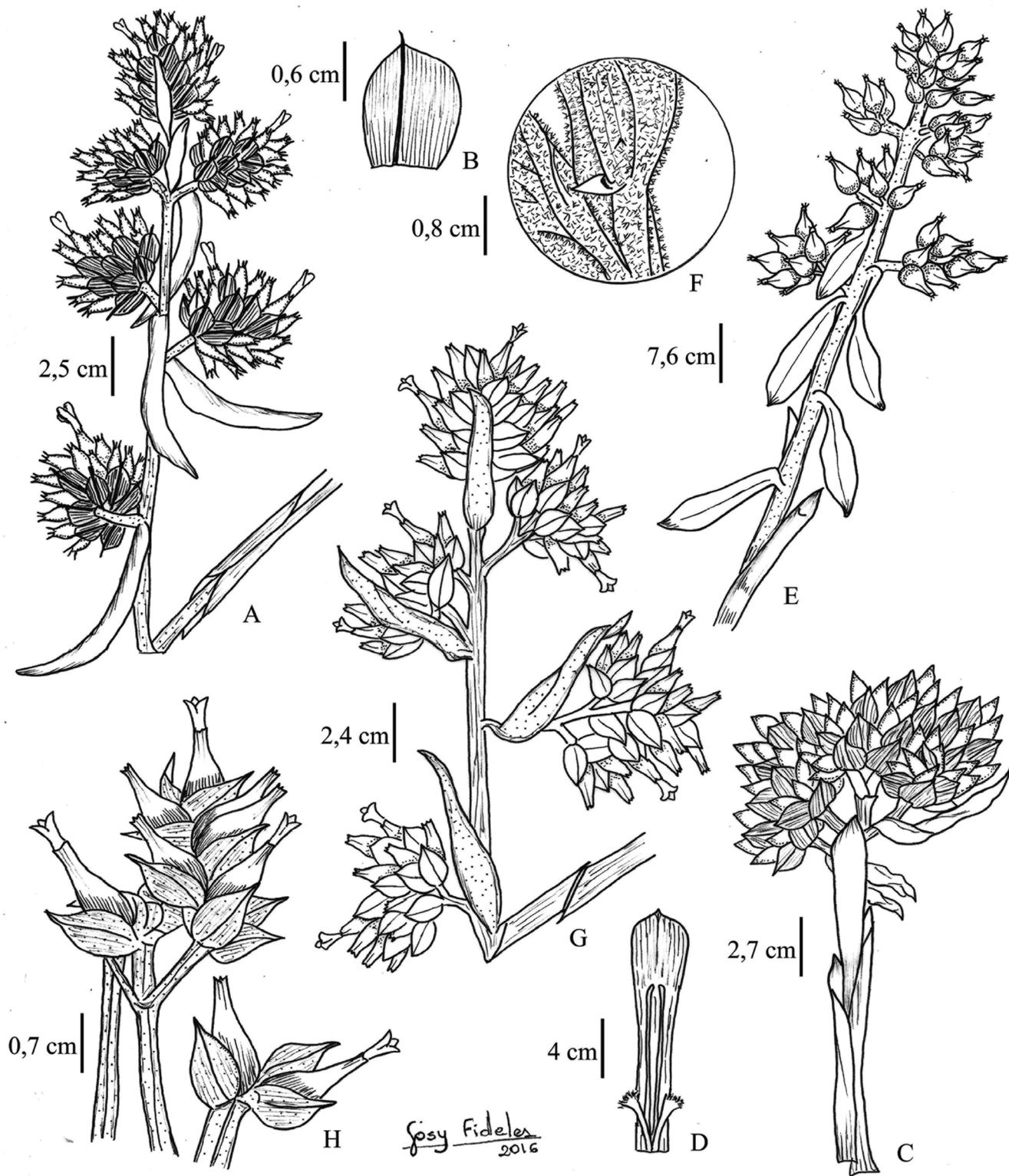


Figure 1. a-b) *Aechmea aquilega*: a) inflorescence; b) sepal. c-d) *A. chrysocoma*: c) inflorescence; d) petal with petal appendix and callosities. e-f) *A. costantini*: e) inflorescence; f) detail of the indument. g-h) *A. emmerichiae*: g) inflorescence; h) detail of the inflorescence. a-b from E.A. Rocha 461; c-d from R.A. Pontes et al. 131; e-f from T.S. Silva et al. 41; g-h from R.A. Pontes et al. 150.

Distribution and habitat: Endemic to Brazil, occurring in the northern, northeastern, and southeastern regions of that country. Distributed in the eastern region of the country from Ceará State to Espírito Santo State, and in the extreme west in Amazonas State, being found in the Amazonian, Caatinga, Cerrado and Atlantic Forest domains (BFG 2015). In Paraíba State, was recorded in the present study in Brejos de Altitude, in the municipalities of Arara, Dona Inês, and Picuí (Figure 2a), and reported by Pontes et al. (2010) for the municipalities of Bayeux, Caaporã, and Mamanguape.

Conservation status: Pontes et al. (2010) considered this species to be “Vulnerable”. However, as it is well-represented in the herbaria collections visited, widely distributed within Brazil, and occurs in several phytogeographical domains (BFG 2015), according to the criteria proposed by the IUCN (2001), its conservation status can be considered of “Least Concern” (LC).

Commentaries: *Aechmea aquilega* can be distinguished from the congeneric species recorded in the present study by its inflorescence pyramid-shaped to subcylindrical, elongated, with primary branches forming congested fascicles and internodes gradually decreasing in size from the base to the apex, also with floral bracts pinkish-red, of the same size as the sepals.

2. *Aechmea chrysocoma* Baker, Handb. Bromel. 44: 272. 1889. Type: Brazil, Pernambuco, Igarassu, XI/1887, *Ramage s. n.* (BM 885911, web!)

Figure 1c-d

Epiphyte or terrestrial, ca. 90 cm tall. Leaves 119.5–180 cm long; sheath ca. 16 × 8 cm, wide-elliptic, coriaceous, light-brown, scaly; blade ca. 103.5 × 5.5 cm, linear-lanceolate, coriaceous, slightly scaly, abaxial face scaly, without cinereous transversal stripes, apex acute, dark-brown, apiculate, margins aculeate, aculeus 0.1–0.25 cm long, longer nearer the base, brown, spaced 0.3–0.8 cm. Scape ca. 70.5 cm long, erect, strongly tomentose, vinaceous, totally covered by the amplexi-scape bracts; scape bracts 7.5–19.5 × 2.5–3.5 cm, not imbricate at base of inflorescence, oval-elliptic, papyraceous, inferior ones green-vinaceous and upper ones pinkish-red, scaly, apex acuminate, margins entire. Inflorescence 11–18 cm long, reddish-green, dense-tomentose, composite, panicle pyramid-shaped, with ca. 2–4 branches, ramifications to the third order, from the base to the apex of the inflorescence, sets of ramifications globose, all branches short, congested due to the shortening of the internodes as well as the peduncles of the branches; peduncles of primary branches 1–2 cm long, longer at base, almost sessile at apex; primary bracts 3–12.5 × 0.8–2.3 cm, elliptic-lanceolate, reflexed to evident, lower ones extending beyond the branch, upper ones equal in length to the branches, apiculate, margins entire; peduncles of the secondary and tertiary branches very short, congested; secondary and tertiary bracts similar to the floral bracts, shorter than those of the branches, oval-lanceolate, carinate. Floral bracts 2–2.4 × 1–1.3 cm, completely covering the ovary, the same size as the sepals, oval, greenish-yellow, glabrous, apex long-mucronate. Flowers ca. 2.5 cm long, sessile; sepals 1.5 × 1 cm, connate at base and at the epigynous tube, strongly asymmetrical, carinate, yellowish-orange, glabrous, apex mucronate, mucron ca. 0.1 cm long; petals ca. 2.5 × 0.4 cm, spatulate, orange, apex acuminate; callosities 1.5–2 cm long; basal petal appendices, ca. 0.4 cm long, apex fimbriate; stamens ca. 2.4 cm

long, those of the external ring free, those of the internal ring adnate to the petals for ca. 2 cm; ovary with epigynous tube ca. 1 cm long, elliptic, glabrous, nectar copious at base. Berry not seen.

Material examined: BRAZIL. PARAÍBA: Caaporã, 07°42'63" S and 34°96'22" W, 94 m, 16.XI.2004, fl., R.A. Pontes et al. 131 (RB). 16.XI.2004, fl., R.A. Pontes et al. 149 (RB).

Additional material examined: BRAZIL. PERNAMBUCO: São Lourenço da Mata, Engenho Mamucaia, 08°00'22" S and 35°01'83" W, 6.I.2008, fl., E.P. Queiroz et al. 2600 (RB).

Phenology: In Paraíba State, was recorded flowering in November.

Distribution and habitat: Endemic to northeastern Brazil, occurring in the Atlantic Forest domain in the states of Paraíba, Pernambuco, and Alagoas (BFG 2015). Records exist for Igarassu (PE), Penedo (AL) (Leme & Siqueira-Filho 2006) and, in Paraíba State, only for the municipality of Caaporã (Figure 2a), along the BR-101 Highway (*Pontes 131* (RB) and *Pontes 149* (RB)). In spite of substantial efforts, it was not possible to find new specimens at that latter locality.

Conservation status: Due to its restricted distribution, insufficient records from conservation areas, and endemism associated with one of the three most globally threatened ecosystems, this taxon is considered here as “Vulnerable”, with an occupied area estimated to be less than 2000 km² and fragmented into at least 10 areas, with accentuated fluctuations in its extent of occurrence (B2a, ci).

Commentaries: *Aechmea chrysocoma*, originally described by Baker (1889), was later recognized as a variety of *A. aquilega* (Smith & Downs 1979, Read & Luther 1991). Leme & Siqueira-Filho (2006), however, revalidated it what is considered until today including BFG (2015), and has likewise been recognized in the present work. *Aechmea chrysocoma* and *A. aquilega* can be confused, principally in relation to the inflorescences formed by congested branches, primary bracts red and flowers sessile, yellowish-orange. They can be distinguished by the shorter inflorescence (11–18 cm vs. 15–31.5 cm long), composed of from 2 to 4 globose branches, with the peduncles of the primary branches distinctly shorter (1–2 cm long vs. 1.3–11 cm long).

3. *Aechmea costantinii* (Mez) L. B. Smith, Phytologia 19: 281. 1970. *Gravisia costantinii* Mez, Repert. Spec. Nov. Regni Veg. 14: 245. 1916. Type: Brazil, Distrito Federal, Brasília, s.d., *Mez s.n.* (B100186965, web!)

Figures 1e-f; 3a-b

Epiphyte or terrestrial, 80–100 cm tall. Leaves 84.5–138.5 cm long; sheath 12–24.5 × 10.5–12.7 cm, oval-elliptic, coriaceous, dark-brown, scaly; blade 57.5–81.5 × 4.5–6.2 cm, wide-lanceolate, coriaceous, glabrescent, without cinereous transversal stripes, apex rounded, apiculate, margins aculeate, aculeus 0.1–0.3 cm, inconspicuous as they near the apex, brown, spaced 0.2–0.6 cm. Scape 40–50 cm long, erect, red, white-tomentose, totally covered by amplexi-scape bracts; scape bracts 11.8–15 × 3–5.5, not imbricate at base of the inflorescence, oval-elliptic, papyraceous, pale, scaly, apex acuminate, margins entire. Inflorescence 30–60 cm long, green-vinaceous, tomentose, composite, panicle pyramid-shaped, with ca. 8 branches, ramifications to the third order, from the base to the apex of the inflorescence, sets of ramifications not globose, lax; peduncles of the primary branches 0.8–6.5 cm long, longer at base, sessile at apex; primary bracts 2.5–13 × 0.5–5 cm, not

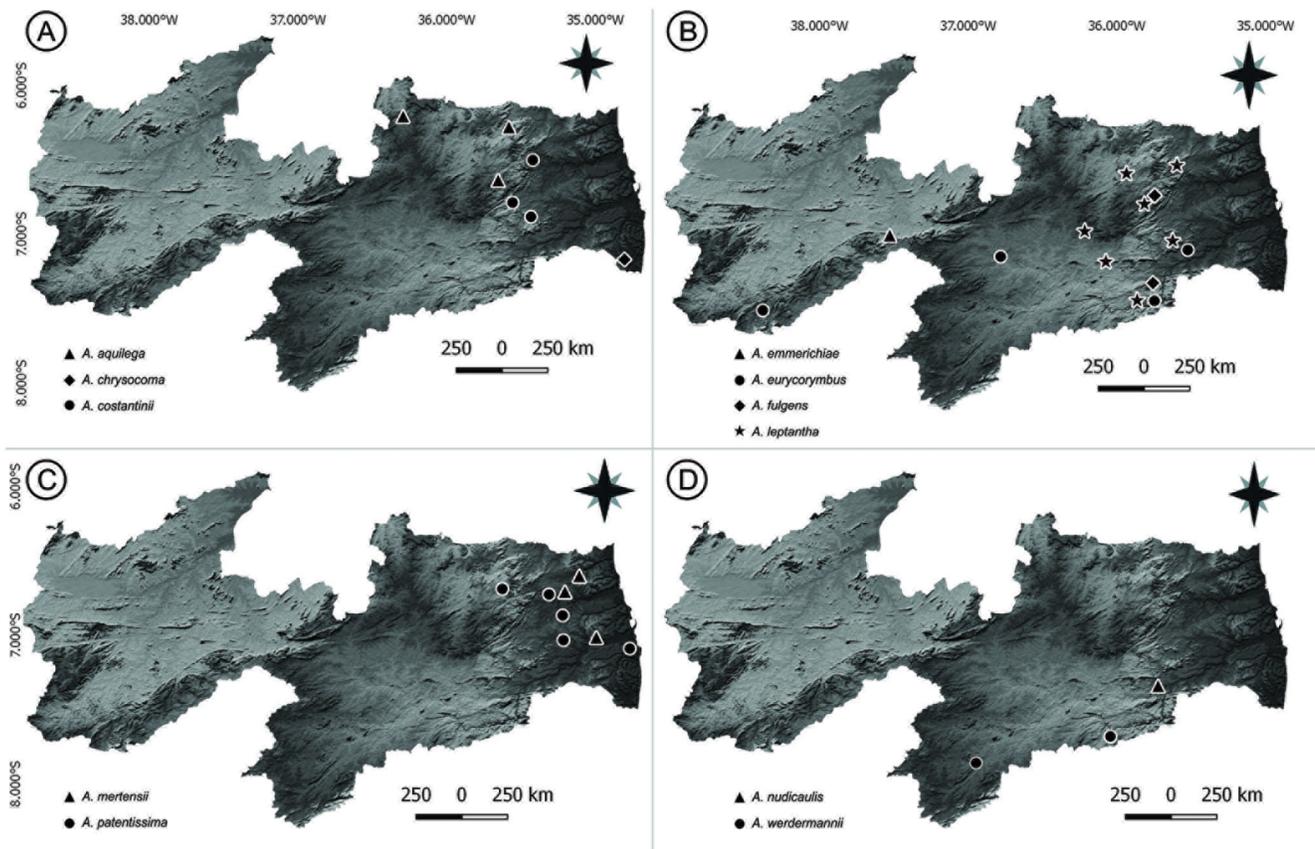


Figure 2. a) *Aechmea eurycorymbus*: inflorescence. b-c) *A. patentissima*: b) inflorescence; c) corolla lobe. d) *A. leptantha*: d) inflorescence; e) *A. werdermannii*, inflorescence. a from T.S. Silva et al. 85; b-c from L.P. Félix et al. 5549; d from T.S. Silva et al. 55; e from R.A. Pontes 430.

extend beyond the branch, ligulate, papyraceous, red or pale, generally reflexed, scaly, apex mucronate, margins entire; peduncles of the secondary and tertiary branches 0.6–0.8 cm long, lax; secondary and tertiary bracts ca. 0.3 cm long, similar to the floral bracts, but shorter than those of the branches, triangular, white-tomentose, carinate. Floral bracts 0.2–0.3 × 0.1 cm, inconspicuous, not extending beyond the ovary, distinctly smaller than the sepals, triangular, membranaceous, vinaceous, strongly tomentose, trichomes star-shaped, apex long-mucronate. Flowers 3–4 cm long, sessile; sepals 1.3–1.5 × 0.5–0.6 cm, connate, strongly asymmetrical, carinate, green, tomentose, apex mucronate, mucron ca. 0.05 cm long; petals ca. 2.5 × 0.3 cm, spatulate, yellow, apex shortly mucronate; callosities 1.5–1.8 cm long; basal appendixes ca. 0.2 cm long, apex crenate; stamens ca. 3 cm long, free or adnate to the petals for ca. 1.5 cm; filaments ca. 2.5 cm long, complanate; anthers ca. 0.5 cm long; ovary with epigynous tube 0.6–1 cm long, clavate, green, tomentose; styles ca. 2 cm long, stigma spiral-conduplicate. Berry ca. 1 cm long, ovoid, dark green.

Material examined: BRAZIL, PARAÍBA: Alagoa Grande, 18.I.1994, fr., L.P. Felix 6371 (EAN); Areia, Mata do Pau Ferro, 69°63'33" S and 35°69'17" W, 20.III.2015, fr., T.S. Silva et al. 41 (ACAM); 15.IX.1944, fl., J.C. Moraes s.n. (EAN 68); 23.VIII.1998, fl., G. Martinelli 15087 (PEUFR); 3.X.2004, fr., R.A. Pontes 107 (RB); 20.VI.2005, fr., R.A. Pontes et al. 318 (RB); 2.VI.2010, fl., R.G. Dias-Terviro 43 (EAN); Bananeiras, 06° 75' S and 35°63'33" W, 19.I.1993, fr., L.P. Felix et al. 5540 (EAN).

Additional material examined: BRAZIL, PERNAMBUCO: Bonito, 08°47.028' S and 35°72'86" W, 30.VI.1996, fl., M.C. Tschá 842 (PEUFR); Quipapá, Engenho Brejinho, 88°27'778" S and 36°01'17", 15.XI.1972, fl., I. Pontual 72 (PEUFR); 02.IX.1980, fl., Z. Brito 18 (IPA); Vicência, Mata do Engenho Jundiá, 07°65.694' S and 35°32.67', 28.IX.1968, I. Pontual 861 (PEUFR); 06.IX.1986, fl., M.F. Sales 60 (PEUFR).

Phenology: Flowering in June, August, and September and fruiting in January, June, and October.

Distribution and habitat: Species endemic to northeastern Brazil, occurring in the states of Alagoas, Paraíba, and Pernambuco (BFG 2015). Found as an epiphyte in an area of humid forest, municipality of Areia (Figure 2a), “brejo paraibano” region and, according to herbarium consultations, it can also be found as a terrestrial plant.

Conservation status: Although this taxon is well-represented in the herbaria visited, its occurrence can be considered restricted as it is associated with the highly fragmented Atlantic Forest domain, and is only encountered in three Brazilian states. As such, and according to IUCN (2001) criteria, this taxon is considered here as “Vulnerable” (NT), in light of its restricted area of occupation and the accentuated fluctuations of its extension of occurrence, as well as the low numbers of recorded sightings (criterion B2cI, III).

Commentaries: According to observations made in different herbaria, photographic records of the type materials, and observations by Sousa & Wanderley (2000), *Aechmea costantinii* is morphologically



Figure 3. a-b) *Aechmea costantinii*: a) epiphytic habit; b) inflorescence. c-d) *A. eurycorymbus*. c) terrestrial habit; d) inflorescence. e-f) *A. fulgens*: e) terrestrial habit; f) inflorescence. Photos by T.S.Silva.

similar to *A. tomentose*, which is endemic to the Brazilian states of Pernambuco and Alagoas. It differs from the latter species by having longer branch peduncles (up to 6.7 cm long vs. up to 2 cm long in *A. tomentose*), inflorescence lax (vs. inflorescence strongly congested in *A. tomentose*), inflorescence apex triangular (vs. widely rounded), and size of the flowers (up to 4 cm long vs. ≥ 5 cm long). It can be distinguished from the other congeneric species by having inflorescence lax, flowers sessile with floral bracts inconspicuous, and indument strongly tomentose, with star-shaped trichomes. Specimens of *A. costantini* in most of the herbaria visited were still identified as *A. stelligera*, although since Leme & Siqueira-Filho (2006) this name is recognized as a synonym of *A. costantini*.

4. *Aechmea emmerichiae* Leme, Bradea 4: 309. 1987. Type: Brazil, Bahia, s.d., *A. Seidel 1048* (HB, web!)

Figure 1g-h

Terrestrial or rupicolous, ca. 105 cm tall. Leaves 72–95 cm long; sheath 12.5–28 × 8–10.5 cm, elliptic, coriaceous, light-brown, scaly; blade 60–67 × 3.5–5 cm, lanceolate, coriaceous, scaly, abaxial face scaly, without cinereous transversal stripes, apex acuminate, apiculate, margin aculeate, aculeus 0.1–0.2 cm long, dark-brown, spaced 0.5–0.6 cm. Scape 75–85 cm long, erect, inconspicuously white-tomentose, pink, never totally covered by bracts; scape bracts 4.7–23 × 1.5–4 cm, not imbricate at base of the inflorescence, lanceolate, paleaceous, green to pink, scaly, apex acuminate, mucronate, upper ones with margins aculeate and lower ones with margins entire. Inflorescence 20–35.5 cm long, pink-yellowish, slightly tomentose, composite, panicle pyramid-shaped, with ca 5–8 branches, branches of the inflorescence sparsely distributed at base, upper ones strongly congested, ramifications to the third order, sets of ramifications not globose, lax; peduncles of the primary branches 0.6–6.5 cm long, longer at base, almost sessile at apex; primary bracts 2.3–11.5 × 0.6–2.5 cm, the same size as the branches, lower ones not longer than the branches, linear-lanceolate, papyraceous, evident, pink-yellowish, strongly scaly, apex acuminate, margins entire; secondary and tertiary bracts ca. 1 cm long, similar to the floral bracts, shorter than the branches. Floral bracts 1.1–2 × 0.6–0.8 cm, conspicuous, extending past the ovary, smaller than the sepals, elliptic-lanceolate, pink-yellowish, slightly tomentose, apex long-mucronate. flowers 3.5–4 cm long, subsessile; sepals ca. 2 × 1.1 cm, connate, asymmetrical, carinate, yellow, median portion tomentose, apex mucronate, mucron ca. 0.2 cm long; petals ca. 3.5 × 0.5 cm, spatulate, yellow, apex apiculate; 2 callosities ca. 2.5 cm long, parallel until mid-length; Basil appendix ca. 0.2 cm long, apex erose; stamens ca. 3.6 cm long, adnate for ca. 1.5 cm; filaments ca. 3 cm long, complanate; anthers ca. 0.6 cm long; ovary with epigynous tube 0.6–0.7 cm long, clavate, greenish-yellow, tomentose; styles ca. 3.2 cm long, stigma spiral-conduplicate, tomentose. Berry 2.5–3 cm long, ovoid, greenish-yellow.

Material examined: BRAZIL, PARAÍBA: Maturéia, Parque Estadual do Pico do Jabre, 07°26'694" S and 37°35'14" W, 8.XII.2004, fr., R.A. Pontes et al. 145 (RB); 8.XII.2004, fl., R.A. Pontes et al. 150 (JPB); 15/IV/2005, fr., R.A. Pontes et al. 194 (JPB).

Phenology: Flowering recorded in December and fruiting in December and April.

Distribution and habitat: *Aechmea emmerichiae* is endemic to Brazil, occurring only in the states of Bahia and Paraíba (BFG 2015). Pontes (2005) reported it for the first time to Paraíba, municipality of Maturéia (Figure 2b), on rock outcrops fully exposed to the sun or as a facultative epiphyte.

Conservation status: According to IUCN (2001) criteria, its restricted distribution to only two states in Brazil (Read & Luther 1991, Leme & Siqueira-Filho 2006, Maciel et al. 2015, BFG 2015). Combined with the accentuated declines of the Caatinga and Atlantic Forest domains, we consider this species “Endangered” in light of its small area of occurrence (500 km²), and accentuated decreases in its distribution and habitat quality (B2bIII).

Commentaries: In the study area, *Aechmea emmerichiae* differed from the most closely related taxa (*A. aquilega*, *A. eurycorymbus*, *A. leptantha*, *A. werdermannii*) by the peduncle of the upper branches being distinctly shorter and congested, primary bracts smaller or of the same size as the branches, floral bracts tomentose, smaller than the sepals, but covering the ovary.

5. *Aechmea eurycorymbus* Harms, Notizl. Bot. Gart. Berlin-Dahlem 12: 528. 1935. Type: Brazil, Pernambuco, Serra Negra, III/1932. *Werdermann 2931* (B100244721. web!)

Figures 3c-d; 4a

Terrestrial or rupicolous, 76.5–88.5 cm tall. Leaves 60–80 cm long; sheath 20–22 × 10–20 cm, oblong, chartaceous, brown, scaly; blade 40–50 × 3.5–4 cm, linear-lanceolate, coriaceous, slightly scaly, abaxial face scaly, without cinereous transversal stripes, apex acuminate, apiculate, margin aculeate, aculeus 0.1–0.4 cm long, dark-brown, spaced 0.3–1.1 cm. Scape 43–51 cm long, erect, reddish, slightly tomentose, totally covered by bracts; scape bracts 9.5–12 × 1.5–2.5 cm, not imbricate at base of the inflorescence, lanceolate, chartaceous, reddish-yellow, apex acuminate, margins entire. Inflorescence 33–38 cm long, reddish, tomentose, composite, panicle pyramid-shaped, with ca. 6–8 branches, branches of the inflorescence sparse from base to apex, by the spacing of the internodes, ramifications to the third order, sets of ramifications not globose, erect, lax; peduncle of the primary branches 0.5–3 cm long, lax; primary bracts 2.7–7 × 0.4–1.8 cm, distinctly shorter than the branches, not extending past the branches, oblong-lanceolate, chartaceous, reflexed to evident, reddish, slightly scaly, apex acuminate, margins entire; peduncle of the secondary and tertiary branches 0.5–1 cm long, lax; secondary and tertiary bracts 1.1–1.5 cm long, shorter than the branches, triangular-lanceolate, reddish-yellow, carinate. Floral bracts 1.5–1.7 × 0.6–0.8 cm, conspicuous, extending past the ovary, smaller than the sepals, oval-lanceolate, greenish-yellow, slightly tomentose, apex acuminate. Flowers 3.5–4.1 cm long, subsessile; sepals 1.1–1.6 × 0.5–0.9 cm, connate, strongly asymmetrical, carinate, slightly tomentose, yellow, apex mucronate, mucron ca. 0.15–0.2 cm long; petals ca. 3–3.4 × 0.3–0.4 cm, linear-lanceolate, orange, apex acute; callosities present, ca. 1.7–2.1 cm long; basal petal appendices ca. 0.2 cm long, apex crenate; stamens ca. 3 cm long, free or adnate to the petals for ca. 1.5 cm; filaments ca. 2.7 cm long, complanate; anthers 0.7–0.8 cm long; ovary with epigynous tube ca. 1.0 cm long, clavate, slightly tomentose; styles ca. 2.3 cm long; stigma ca. 0.2 cm long, spiral-conduplicate. Berry ca. 1.2 cm long, with sepals persistent, ovoid, green.

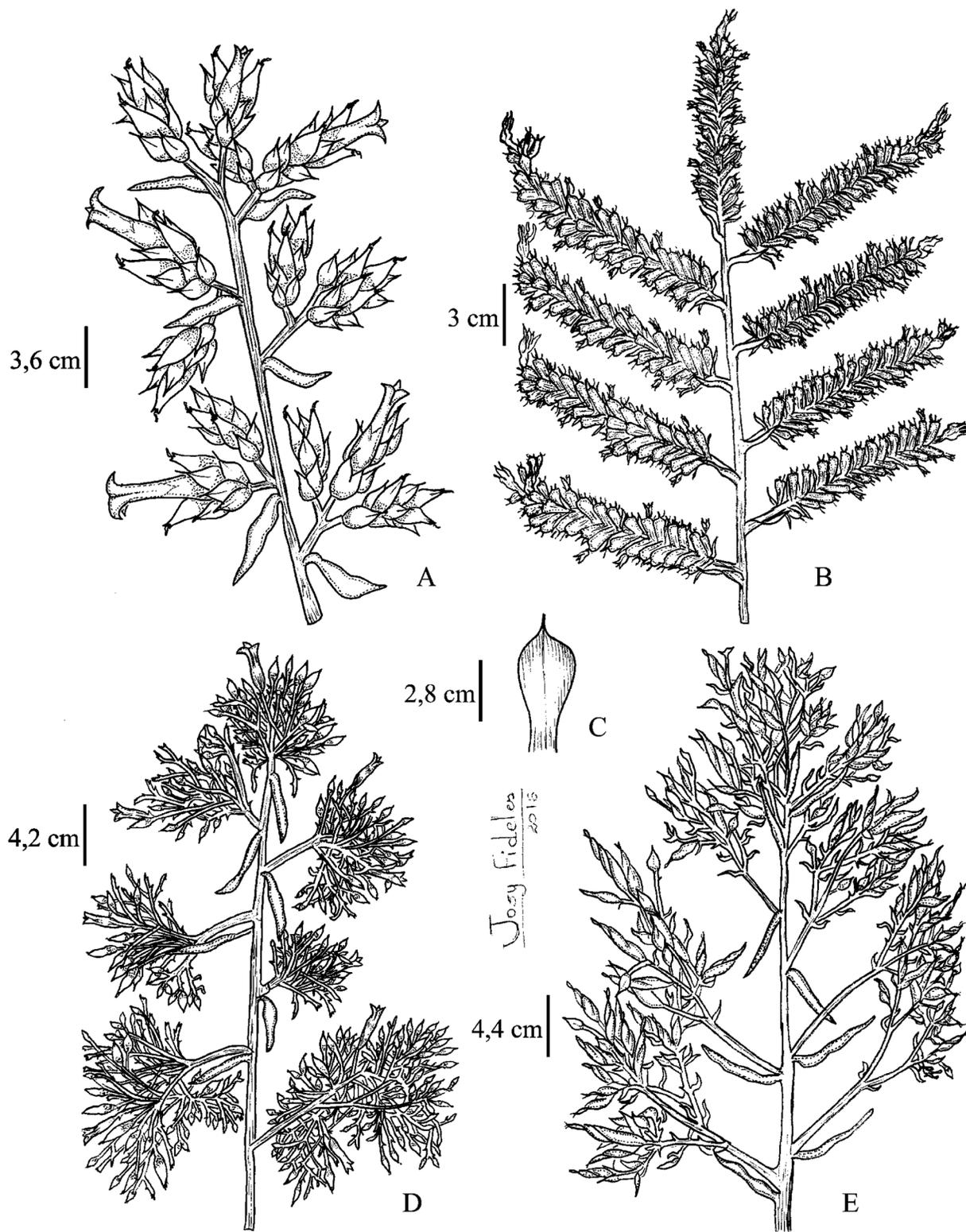


Figure 4. a) *Aechmea eurycorymbus*: inflorescence. b-c) *A. patentissima*: b) inflorescence; c) corolla lobe. d) *A. leptantha*: d) inflorescence; e) *A. werdermannii*, inflorescence. a from T.S. Silva et al. 85; b-c from L.P. Félix et al. 5549; d from T.S. Silva et al. 55; e from R.A. Pontes 430.

Material examined: BRAZIL, PARAÍBA: Natuba, 07°64'151" S and 35°55'220" W, 338 m, 14.V.2005, fr., R.A. Pontes 230 (RB); Salgado de São Félix, Sítio Campina Seca, 07°35'694" S and 35°44'06" W, 14.V.2005, fr., R.A. Pontes 345 (JPB); São João do Cariri, Serra da Arara, 07°44'766" S and 36°47'971" W, 15.IV.2016, fl., G.R. Almeida 01 (ACAM); 22.V.2016, fl., T.S. Silva 85 (ACAM); São José de Princesa, Sítio Machado, 07°44'12" S and 38°05'38" W, 17.X.2008, fl., R.A. Pontes 415 (JPB).

Phenology: Flowering in April and May and fruiting in October.

Distribution and habitat: This species is endemic to the states of Alagoas, Paraíba, and Pernambuco in northeastern Brazil, especially in the Caatinga and Atlantic Forest domains. In the present study, populations found in Caatinga and Atlantic Forest environments, even at relatively high elevations (652 m) in the Serra da Arara Range, in the municipality of São João do Cariri (Figure 2b).

Conservation status: *Aechmea eurycorymbus* is included in the list of Species of the Brazilian Flora Threatened with Extinction, published by the Ministry of the Environment (MMA 2014). According to the criteria established by the IUCN (2001), *A. eurycorymbus* can be considered "Endangered" due to its limited area of occurrence (estimated to be less than 5000 km²) with continuous decreases in its area of occupation and/or habitat quality (criterion B1bii), as well as the fact that its populations are associated with Caatinga and Atlantic Forest vegetation, which are both threatened by anthropogenic pressure through tourist and agricultural activities.

Commentaries: Morphologically, *A. eurycorymbus* is very similar to *A. leptantha* and *A. werdermannii*, but can be distinguished from them by its primary bracts distinctly smaller than the branches, floral bracts 1.5–1.7 cm long, extending past the ovary, and flowers 3.5–4 cm long, subsessile, and inconspicuous pedicel.

6. *Aechmea fulgens* Brongn., Ann. Sci. Nat. Bot. 15: 571. 1841. Type: Brazil, without locality, without data, *A. Questel s.n.* (P00077231. web!). Figures 3e-f; 5a-d

Epiphyte or terrestrial, 28.5–50 cm tall. Leaves 24–60 cm long; sheath 8–14 × 4–6 cm, ovate, chartaceous, light-brown, scaly; blade 16–49.5 × 4–5.4 cm, oblong-lanceolate, chartaceous, glabrescent, abaxial surface with cinereous transversal stripes formed by a dense layer of trichomes, apex rounded, apiculate, margins aculeate, aculeus less than 0.1 cm long, light-brown, spaced 0.5–0.8 cm. Scape 10–20.5 cm long, erect, glabrescent, red, never totally covered by the bracts; scape bracts 4–6.8 × 0.5–1 cm, not imbricate at base of the inflorescence, elliptic-lanceolate, pale, glabrescent, apex mucronate, margins entire. Inflorescence 7.4–13.5 cm long, red, glabrous, simple or with ramifications only at base, lax; peduncles of the basal branches 0.6–1 cm long. Secondary bracts absent. Primary bracts 2–4 × 0.5 cm, similar to those of the scape. Floral bracts ca. 0.1 × 0.1 cm, never completely covering the ovary, triangular, membranaceous, glabrous, apex mucronate. Flowers ca. 1.5 cm long, sessile; sepals 0.4–0.5 × 0.4–0.5 cm, connate, asymmetrical, carinate, purple, glabrous, margins white, apex retuse; petals 1–1.2 × 0.5 cm, rounded, cuculliform, lilac colored, margins white, apex emarginate; callosities absent; appendixes basal ca. 0.5 cm long, apex erose; stamens ca. 1 cm long, adnate to the petals to the apex; filaments ca. 0.6 cm long, complanate; anthers ca. 0.4 cm long; ovary with epigynous tube 0.6–0.9 cm long, oval-elliptic,

red, glabrous, nectar copious at base; styles ca. 0.8 cm long; stigma ca. 0.1 cm long, spiral-conducculate. Berry 1–1.5 cm long, ovoid, red.

Material examined: BRAZIL, PARAÍBA: Areia, Campus II da UFPB, 06°96'33" S and 35°69'17" W, 20.VII.2005, fl., R. A. Pontes 332 (JPB); Natuba, Mata da Antena, 07°64'15" S and 35°55'22" W, 14.IV.2015, fl., T. S. Silva et al. 49 (ACAM); 15.V.2005, fr., R. A. Pontes 244 (JPB); 14.IV.2015, fr., T. S. Silva et al. 50 (ACAM).

Additional material examined: BRAZIL, ALAGOAS: Murici, Serra do Ouro, 09°14'56" S and 35°50'4" W, 3.V.1999, fr., G. Martinelli 15331 (JPB); Quebrangulo, Reserva Biológica Federal da Pedra Talhada, 09°39'777" S and 36°72'472" W, 11.V.2014, fr., L. Nusbaumer et al. 4013 (RB). PERNAMBUCO: Palmeirina, 09°00'444" S and 36°62'58" W, 10.X.1985, fl., L. P. Felix et al. 1785 (UFP); Taperoá, 07°21'01" S and 36°82'43" W, 532 m, 27.I.1955, fl., J. C. Moraes s.n. (EAN 1236).

Phenology: Flowering in April and July and fruiting in April and May.

Distribution and habitat: According to Sousa & Wanderley (2000), *Aechmea fulgens* can be found in the Brazilian states of Pernambuco, Bahia, and Rio de Janeiro. In the Species List of the Brazilian Flora (BFG 2015), however, it was cited only for the states of Paraíba, Pernambuco, and Alagoas; the latter circumscription is adopted here.

Conservation status: *Aechmea fulgens* was only encountered in a fragment of Atlantic Forest in the municipality of Natuba, Paraíba State (Figure 2b), where it constituted large populations and demonstrated terrestrial and epiphytic habits, being considered a rare species in the study area. In agreement with Pontes et al. (2010), the conservation status of *A. fulgens* in the present study is considered "Vulnerable" (IUCN 2001), due to its limited area of occurrence, high fragmentation, and being known from less than 10 localities (criterion B2a).

Commentaries: *Aechmea fulgens* can be easily distinguished from the other species in the present study by having leaves with their abaxial surfaces with cinereous transversal stripes, inflorescence glabrous, with ramifications only at the base, and flowers lilac-colored, with cuculliform petals with white margins.

7. *Aechmea leptantha* (Harms) Leme & J.A. Siqueira-Filho, Fragm. Atlantic Forest N. E. Brazil: 213. 2006. *Portea leptantha* Harms, Notizbl. Bot. Gart. Berlin-Dahlem, 10: 786. 1929. Type: Brazil, Pernambuco, Tapera, II/1929. *Pickel 1919* (B100390478. web!) Figures 4d; 6a-d

Epiphyte or rupicolous, ca. 1.2 m tall. Leaves 61–130.5 cm long; sheath ca. 12 × 9 cm, oblong, coriaceous, brown, sparsely scaly; blade 37–60 × 3–3.5 cm, lanceolate, coriaceous, slightly scaly, abaxial surface scaly, without cinereous transversal stripes, apex obtuse to acuminate, apiculate, margins aculeate, aculeus 0.1–0.3 cm long, dark-brown, spaced 0.6–1.7 cm. Scape 60–70 cm long, erect or recurved during fruiting, sparsely tomentose when rupicolous to pulvinate when an epiphyte, red, totally covered by amplexi-scape bracts; scape bracts 12–24.5 × 1.5–5 cm, not imbricate at base of the inflorescence, lanceolate, chartaceous, greenish-yellow, scaly, apex mucronate, margins entire. Inflorescence 30–40 cm long, reddish, slightly tomentose when rupicolous to pulvinate when epiphytic, composite, panicle pyramid-shaped, with ca. 10 branches from the base to the apex of the inflorescence, ramifications to the fourth order, sets of ramifications not globose, lax; peduncle of the primary branches 1–7 cm long,

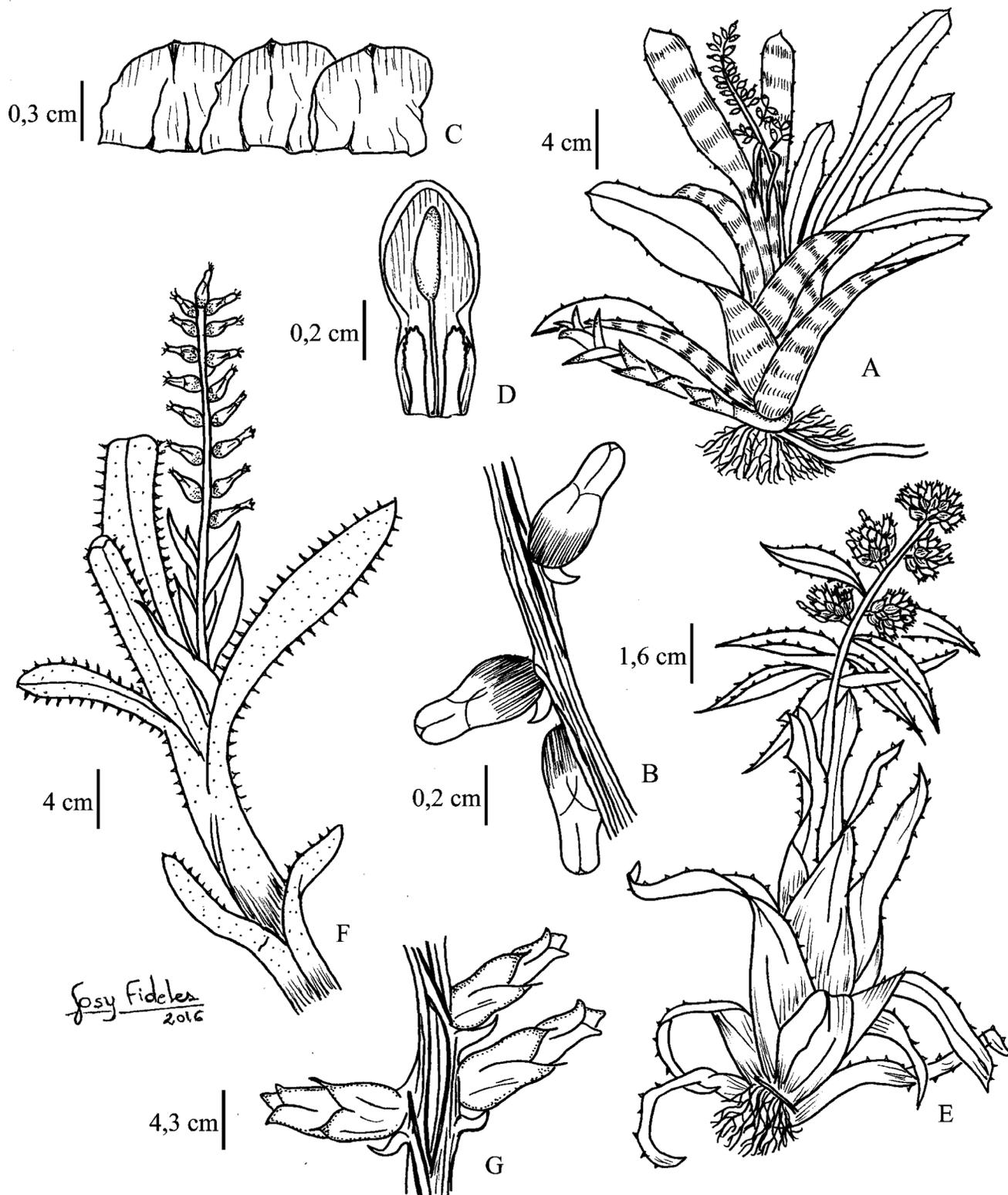


Figure 5. a-d) *Aechmea fulgens*: a) habit; b) detail of the flowers with floral bracts; c) sepals; d) petal and petal appendix. e) *A. mertensii*: habit. f-g) *A. nudicaulis* var. *nordestina*: f) habit; g) detail of the inflorescence. a-d from T.S. Silva et al. 50; e from M.F. Agra s.n.; f-g from T.S. Silva et al. 53.

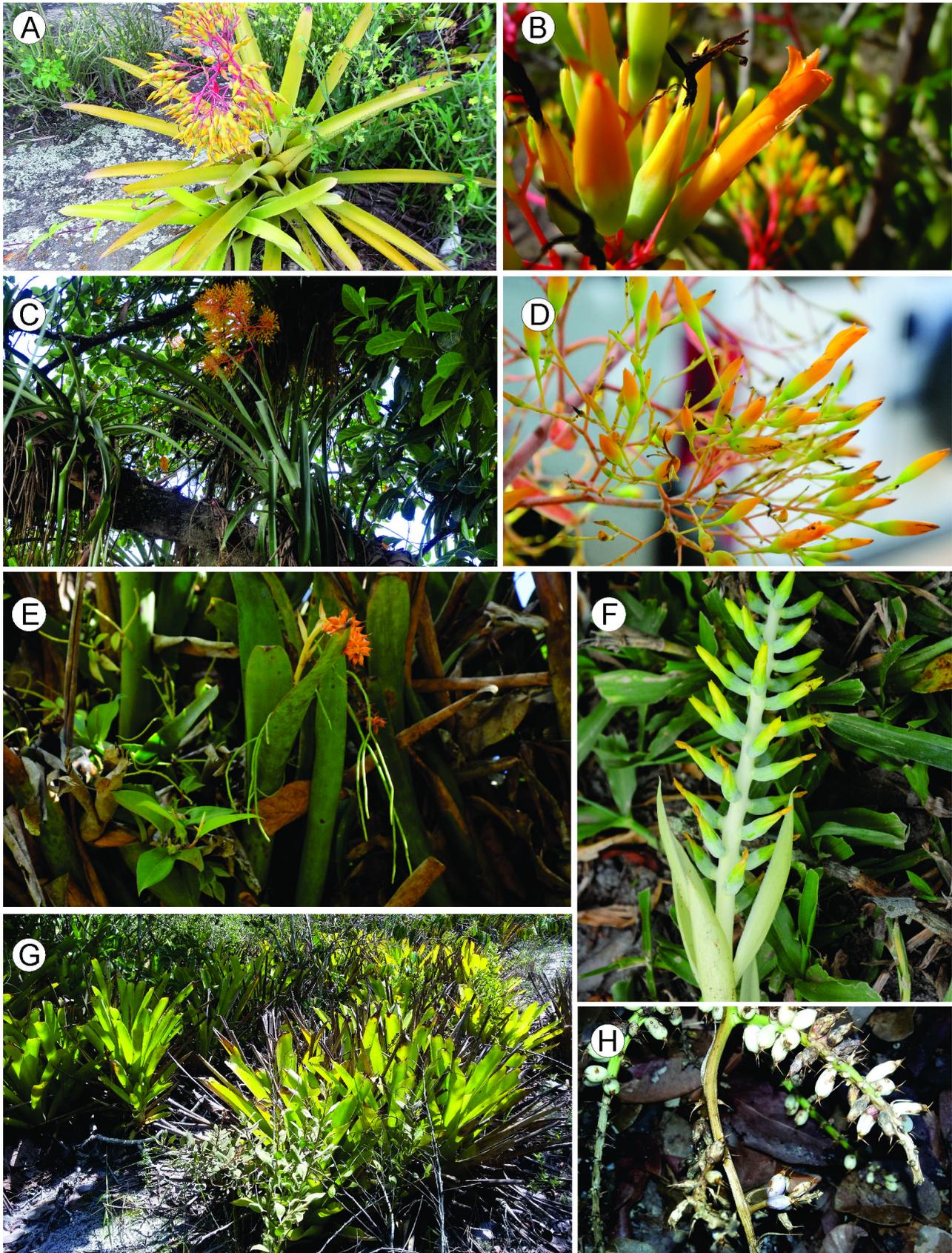


Figure 6. a-d) *Aechmea leptantha*: a) rupicolous habit; b) detail of the inflorescence; c) epiphytic habit; d) detail of the inflorescence. e-f) *A. nudicaulis* var. *nordestina*: e) epiphytic habit and fruits; f) inflorescence. g-h) *Aechmea patentissima*: g) Terrestrial habit; h) Habit with fruits. Photos by T.S.Silva.

ramifications lax; primary bracts 2–13.5 × 0.2–2 cm, distinctly smaller than the branches, lower ones not extending past the branches, linear-lanceolate, reflexed, reddish, slightly scaly, apex mucronate, margins entire. Secondary and tertiary bracts 0.6–1 × 0.1–0.2 cm, lanceolate, greenish-yellow, apex long-acuminate. Floral bracts 0.5–0.8 × 0.1–0.3 cm, inconspicuous, smaller than the sepals, not extending beyond the ovary, triangular, reddish-green, slightly scaly, trichomes scaly, apex long-acuminate. Flowers 3–4.5 cm long, conspicuously pedicellate; sepals 1.4–1.7 × 0.5–0.9 cm, connate, strongly asymmetrical, carinate, yellow, glabrous, apex mucronate, mucron ca. 0.1 cm long; petals 2.3–2.7 × 0.2–0.4 cm, lanceolate, orange, apex obtuse, mucronate; callosities ca. 1.2 cm long; basal petal appendices ca. 0.15 cm long, apex crenate; stamens ca. 2 cm long, outer ones with filaments free, inner ones with filaments adnate to the petals for ca. 1 cm; filaments ca. 1.5 cm long, complanate; anthers ca. 0.8 cm long; ovary with epigynous tube 0.7–1.3 cm long, clavate, slightly tomentose; styles 2–3 cm long; stigma ca. 0.2 cm long, spiral-conduplicate. Berry 2–3 cm long, with persistent sepals, ovoid, light-green.

Material examined: BRAZIL, PARAÍBA: Areia, 69°63'33" S and 35°69'17" W, 20.III.2015, fl.fr., T.S. Silva et al. 42 (ACAM); Campina Grande, distrito Fagundes, Pedra de Santo Antônio, 07°38'83" S and 35°76'25" W, 22.III.2015, fl.fr., T.S. Silva et al. 43 (ACAM); Guarabira, 06°85'12" S and 35°49'22" W, 98 m, 21.V.2015, fr., T.S. Silva et al. 56 (ACAM); Itapororoca, Fazenda Santíssimo, 06°50'245" S and 35°12'25" W, 30.IV.2005, fr., R.A. Pontes et al. 208 (JPB); Lagoa Seca, Cachoeira do Pinga, 07°08'109" S and 35°47'325" W, 14.V.2015, fr., T.S. Silva et al. 55 (ACAM); 06.VI.2015, fr., T.S. Silva et al. 63 (ACAM); Natuba, 07°64'151" S and 35°55'220" W, 338 m, 14.IV.2015, fl.fr., T.S. Silva et al. 45 (ACAM); Salgado de São Félix, Sítio Pau-D'arco, 07°28'34" S and 35°28'33" W, 16.IV.2005, 16/IV/2005, fr., R.A. Pontes 162 (JPB).

Additional material examined: BRAZIL, ALAGOAS: Ibataguara, Usina Serra Grande, 08°97'25" S and 35°93'94" W, 16.III.2003, fl., A. Viana et al. 268 (IPA); Quebrangulo, Reserva Biológica de Pedra Talhada, 09°26'358" S and 36°42'204" W, 26.IV.2014, fl., L. Nusbaumer et al. 3967 (PEUFR); São José da Laje, Usina Serra Grande, 09°00'972" S and 36°05'83" W, 27.II.2002, fl., M. Oliveira et al. 780 (IPA). PERNAMBUCO: Bonito, 08°48'93" S and 35°71'88", 698 m, 09.II.1996, fl., A.B. Marcon 123 (PEUFR); Buíque, Vale do Catimbau, 08°62'306" S and 37°15'58" W, 01.XI.1961, fl., D. Andrade-Lima (IPA 12902); Caruaru, Estação Experimental do IPA, 08°28'333" S and 35°97'61", 21.V.1992, fr., F. Guedes 108 (IPA); 04.I.1996, fl., L.F. Silva et al. 113 (PEUFR).

Phenology: Flowering from January to April, with fruiting extending from February to December.

Distribution and habitat: Restricted to the states of Alagoas, Paraíba (Figure 2b), and Pernambuco, in northeastern Brazil. Growing on rock outcrops or as facultative epiphytes, forming large populations in trees such as *Artocarpus heterophyllus* Lamarck (Moraceae), a naturalized species popularly known as "jaqueira" (BFG 2015).

Conservation status: In light of its restricted area of occurrence, and continuous declines and growing fragmentation of the Caatinga and Atlantic Forest environments where its populations occurs, this taxon is considered here as "Vulnerable" (IUCN 2001), criterion B1bIII.

Commentaries: This species was treated as *Portea* Brongn. & K.Koch until recently, a genus morphologically very similar to *Aechmea*. Forms a group closely related to *A. costantinii*, *A. eurycorymbus*, *A. leptantha*, and *A. werdermannii* based on the type of inflorescence, being most closely related to *A. eurycorymbus* because of the orangish flowers and fruits with persistent sepals. However, *A. leptantha* can be distinguished from *A. eurycorymbus* by having flowers that are conspicuously pedicellate (vs. sessile) and inconspicuous floral bracts 0.5–0.8 cm long (vs. 1.5–1.7 cm long).

8. *Aechmea mertensii* (G. Mey.) Schult. & Schult. f., Syst. Veg. 7(2): 1272. 1830. *Bromelia mertensii* G. G. Mey., Prim. Fl. Esseq. 144. 1818. Type: Suriname, próximo ao Rio Essequibo, sem data, E. K. Rodschied 292 (holotype: GOET, web!)

Figure 5e

Epiphyte, 18.5–35.5 cm tall. Leaves 18–33 cm long; sheath 7–11 × 3–4.2 cm, oval–elliptic, chartaceous, light–brown, scaly; blade 8.5–24 × 1.1–1.8 cm, linear-lanceolate, coriaceous, white–scaly, abaxial surface scaly, without cinereous transversal stripes, margin aculeate, aculeus 0.2–0.3 cm long, light–brown, spaced 0.3–0.5 cm, apex foliar acuminate, serrate, vinaceous. Scape 18.5–24.5 cm long, erect, light–green, inconspicuously white–tomentose, never covered totally by the bracts; scape bracts 2.6–5.2 × 0.6–1.1 cm, not imbricate at the base of the inflorescence, lanceolate, paleaceous to membranaceous, red, abaxial surface white–tomentose, apex mucronate, margin aculeate. Inflorescence 6–10.5 cm long, greenish, slightly tomentose, composite, panicle cylindrical, with ca. 11–14 branches, ramifications from base to apex, ramifications to the first order; branches erect, congested, uniformly spaced from the base to the apex of the inflorescence; peduncle of the primary branches to 0.4 cm long; basal primary bracts distinctly extended beyond the branches, upper ones ca. 0.1 cm long, triangular, reflexed to evident, margins aculeate, apex acuminate. Secondary bracts absent. Floral bracts ca. 0.4 × 0.3 cm, almost totally covering the ovary, oval, membranaceous, greenish–orange, scaly, apex mucronate. flowers ca. 1 cm long, sessile; sepals ca. 0.4 × 0.3 cm, connate, slightly asymmetrical, carinate, glabrescent, apex mucronate, mucron 0.1–0.15 cm long; petals 0.7 × 0.15 cm, spatulate, yellowish–orange, apex acuminate; callosities up to 0.4 cm long; appendixes basal ca. 0.3 cm long, apex erose; stamens ca. 0.5 cm long, external ones with filaments free, internal ones with filaments adnate to the petals to the anthers; filaments ca. 0.4 cm long, complanate; anthers ca. 0.1 cm long; styles ca. 0.6 cm long; stigma spiral–conduplicate. Berry not seen.

Material examined: BRAZIL, PARAÍBA: Mamanguape, Cabeça de Boi, 06°83'888" S and 35°12'583" W, 35m, 24.V.1990. L.P. Felix & E.S. Santana 3065 (EAN); Mata do Peru, 06°561' S and 35°05'56" W, 1.V.2005, fl., R.A. Pontes & P. Gadelha-Neto 219 (RB); Rio Tinto, 06°80'306" S and 35°08'06" W, 19.VIII.1998, fl., L.P. Felix & A.M. Miranda s.n. (EAN 15658); Santa Rita, 07°11'389" S and 34°97'81" W, 14.IV.1980, fl., M.F. Agra s.n. (RB 207583).

Phenology: Flowering in April, May, and August.

Distribution and habitat: Frequently epiphytic, occurring in Trinidad, Colombia, Ecuador, Peru, Venezuela, Guiana, and Brazil (Smith & Downs 1979, Aguirre-Santoro & Betancur 2008), where it is found in the Amazon region (North), reaching Mato Grosso

State in the central-western region, and the states of Alagoas, Bahia, Maranhão, Paraíba (Figure 2c), and Pernambuco in the northeastern region (BFG 2015).

Conservation status: Due to its wide distribution, *Aechmea mertensii* is considered here of “Least Concern” (LC), a category which comprises the most abundant taxa, according to IUCN criteria (2001). This species is, however, included in the Red List of the Phanerogam Flora of Columbia (Betancur & García 2006) and, as it occurs in highly threatened domains (the Amazon and Atlantic Forests), it is important to draw attention to its populations in those environments.

Commentaries: *A. mertensii* can easily be identified by its leaf margins with well-developed aculeus (ca. 0.3 cm long) all the way to the leaf apex, conspicuously spaced (0.3–0.5 cm), inflorescence cylindrical with peduncles of the branches distinctly shorter (ca. 0.4 cm long), primary bracts aculeate and floral bracts extending past the sepals. *A. mertensii* also is distinct by its association with ants (Koch et al. 2013) that nest in it and protect it from predators; the ants are sheltered in the clumps of its roots (Leme & Siqueira-Filho 2006).

9. *Aechmea nudicaulis* var. *nordestina* J.A. Siqueira-Filho & Leme, *Fragm. Atlantic Forest N. E. Brazil* 243, 2006. Type: Brazil, Pernambuco, Distrito de Pirauá, Macaparana, II/2004. *J. A. Siqueira-Filho et al. 1454* (UFP 51556. web!) Figures 5f-g; 6e-f

Epiphyte, ca. 50 cm tall. Leaves 22.5–94.5 cm long; sheath 14–24.5 × 5.5–7.3 cm, elliptic-linear, chartaceous, brown, scaly; blade 12.5–73 × 2.5–5.8 cm, oblong, chartaceous, glabrescent, abaxial surface scaly, without cinereous transversal stripes, apex rounded, revolute, apiculate, margins aculeate, aculeus ca. 0.2 cm long, dark-brown, spaced 0.1–0.3 cm. Scape 25.5–43 cm, sub-erect, white-tomentose, light-green, not totally covered by the bracts; scape bracts 4.5–6.5 × 1–1.6 cm, imbricate at base of inflorescence, oval-elliptic, membranaceous, pale, abaxial surface slightly tomentose, apex mucronate, light-brown, margins entire. Inflorescence 8.5–9.5 cm long, simple, spiciform, greenish yellow, white-tomentose. Primary bracts absent. Floral bracts ca. 0.15 × 0.15 cm, never completely covering the ovary, triangular, membranaceous, white-tomentose, apex mucronate. Flowers 1.4–2 cm long, sessile; sepals 0.7–0.9 × 0.3–0.4 cm, connate, strongly asymmetrical, carinate, greenish-yellow, median portion tomentose, apex mucronate, mucron ca. 0.05 cm long; petals 1–1.2 × 0.2 cm, spatulate, yellow, apex acute, mucronate; callosities ca. 0.5 cm long; basal appendixes 0.3–0.4 cm long, apex fimbriate; stamens ca. 1 cm long, external ones with filaments free, internal ones with filaments adnate to the petals for ca. 0.5 cm; filaments ca. 0.6 cm long, complanate; anthers ca. 0.4 cm long; ovary with epigynous tube 0.4–0.8 cm long, elliptic, tomentose; styles ca. 1 cm long, stigma erect-simple. Berry ca. 0.7 cm long, ovoid, yellow.

Material examined: BRAZIL, PARAÍBA: Salgado de São Félix, Sítio Pau d’Arco, 07°28’34” S and 35°28’33” W, 16.IV.2005, fr., R.A. Pontes 165 (RB); fl., R.A. Pontes 167 (RB); 14.IV.2015, fl., T. S. Silva et al. 53 (ACAM); 14.IV.2015, fr., T.S. Silva et al. 54 (ACAM).

Phenology: Flowering and fruiting in April.

Distribution and habitat: Obligatory epiphyte, endemic to northeastern Brazil; occurs in the states of Bahia, Paraíba, and Pernambuco. It has only been recorded in the municipality of Salgado de São Félix in Paraíba (Figure 2d).

Conservation status: Considering that this species is endemic to the Atlantic Forest, restricted to three states in northeastern Brazil, and represented by few records in the herbaria collections, it is considered here as “Vulnerable” (IUCN 2001), as its distribution is restricted, it has high potential for harvesting/collecting, and therefore at high risk for extinction in nature.

Commentaries: *Aechmea nudicaulis* var. *nordestina* differs from the type-species by its pale (vs. red) scapes and scape bracts, and its greenish-yellow sepals (vs. yellow or spotted with red), this being the morphological pattern found in northeastern Brazil (Leme & Siqueira-Filho 2006). It can be distinguished from the other taxa of *Aechmea* of this study area by having imbricate scape bracts at the base of the inflorescence, a simple inflorescence with a white-tomentose indument, and all of the flowers sessile.

10. *Aechmea patentissima* (Mart. ex Schult. f.) Baker, *J. Bot.* 17: 227. 1879. *Billbergia patentissima* Mart. ex Schult. & Schult.f., *Syst. Veg.*, 7(2): 1270. 1830. Type: Brazil, Bahia, Almada, s.d., *Martius s.n.* (M) Figures 4b-c; 6g-h

Terrestrial, ca. 1 m tall. Leaves 84–90.5 cm long; sheath 7.5–28 × 7–11.5 cm, oblong, chartaceous, brown, scaly; blade 14–55 × 6–8 cm, linear-lanceolate, coriaceous, abaxial surface scaly, without cinereous transversal stripes, apex rounded or slightly acuminate, apiculate, margins aculeate, light-brown, aculeus 0.1–0.2 cm long, dark-brown, spaced 0.5–0.7 cm. Scape 24–45 cm long, erect, slightly tomentose, green, partially covered by the amplexi-scape bracts; scape bracts 4.5–6 × 0.7–1.2 cm, not imbricate at base of the inflorescence, lanceolate, membranaceous, paleaceous, apex acuminate, margins entire. Inflorescence 20–36.5 cm long, greenish, glabrescent, composite, panicle pyramid-shaped or subcylindrical, 10–13 branches, ramifications to the first order, from the base to the apex, sets of ramifications not globose, lax towards the apex due to the lengthening of the internodes; peduncles of the branches ca. 1 cm long; primary bracts 1–3 × 0.5 cm, not extending beyond the branches, lanceolate, evident, membranaceous, greenish, apex acuminate, margins entire. Secondary bracts absent. Floral bracts 0.4–0.7 × 0.1–0.15 cm, smaller than the sepals, triangular-lanceolate, greenish, glabrescent. Flowers 1.2–1.3 cm, sessile, verticillate; sepals 0.4–0.5 × 0.3–0.4 cm, connate, asymmetrical, carinate, green, glabrous, apex mucronate, mucron 0.1–0.2 cm long; petals ca. 1 × 0.2 cm, oblongs, whites, apex extremely acute; callosities absent; basal petal appendixes ca. 0.5 cm long, apex fimbriate; stamens 0.7–0.8 cm long, external ones with filaments free, internal ones adnate to the petals for ca. 0.5 cm; filaments ca. 0.7 cm long, complanate; anthers ca. 0.2 cm long; ovary with epigynous tube ca. 0.4 cm long, oblong, glabrous; styles ca. 0.8 cm long; stigma ca. 0.1 cm long, spiral-conduplicate. Berry ca. 0.5 cm long, globose, white when immature, blue when mature.

Material examined: BRAZIL, PARAÍBA: Capim, 06°53’34” S and 35°103’ W, 29.IV.2005, fr., R.A. Pontes 223 (JPB); João Pessoa, 07°115’ S and 34°86’31” W, 17.II.2004, fr., R.A. Pontes 51 (JPB); Mamanguape, Reserva Biológica Guaribas, Cabeça de Boi, 06°07’22” S and 35°182’ W, 11.IX.2004, fl., R.A. Pontes et al. 97 (RB); 03.V.2016, fr., T.S. Silva 87 (ACAM); Sapé, 07°09’63” S and 35°23’25” W, 17.I.2001, fl., E.A. César 89 (JPB); Serraria, 06°82’ S and 35°633’ W, 19.I.1993, fl., L.P. Félix et al. 5549 (EAN).

Phenology: Recorded flowering in January, February, and September and fruiting in February, April, and May.

Distribution and habitat: *Aechmea patentissima* is found in Atlantic Forest areas in northeastern Brazil as well as in the states of Rio de Janeiro and Espírito Santo in the southeastern region of that country (BFG 2015). In the present study, we encountered records only for municipalities along the coast of Paraíba State (Figure 2c).

Conservation status: In spite of nomenclatural and taxonomic changes that have resulted in imprecise and indications of *A. patentissima* for a considerable period of time, and its confusion with other closely related species (with resulting imprecision concerning its areas of occurrence), and considering its distribution and the materials examined in the present study, we consider it here as “Almost Threatened”, although it will probably be placed in another category in the near future.

Commentaries: *Aechmea patentissima* was long considered to be a variety of *A. lingulata*, and considerable numbers of herbarium specimens are still labeled as *A. lingulata*. The concept of *A. lingulata* became restricted after Leme & Siqueira-Filho (2006), with the establishment of the *A. lingulata* complex, when taxa previously considered varieties were awarded the status of species, including *A. patentissima*. The taxonomic limits between them are still somewhat inconsistent, but according to the mentioned authors, *A. lingulata* s.str. is characterized by having floral bracts 7–13 mm long, fruits dark-red to blackish, and its distribution restricted to the Amazon region. *A. patentissima*, in turn, has sepals with a mucron 0.1–0.2 cm long (vs. 0.2–0.3), petal apex widely acute, ovary ca. 0.4 cm long, and fruits blue when mature, being restricted to the Atlantic Forest.

11. *Aechmea werdermannii* Harms, Notizbl. Bot. Gart. Berlin–Dahlem 12: 528. 1935. Type: Brazil, Pernambuco, Serra Negra, III/1932. *Wedermann 2911* (B100186964. web!)

Figure 4e

Terrestrial, epiphyte or rupicolous, ca. 1.2 m tall. Leaves 60–80 cm long; sheath ca. 21 × 14 cm, oblong, chartaceous, sparsely scaly; blade 40–60 × 4–6 cm, lanceolate, coriaceous, scaly, abaxial surface scaly, without cinereous transversal stripes, apex acuminate, apiculate, margins aculeate, aculeus 0.2–0.5 cm long, dark-brown, spaced 0.4–1 cm. Scape ca. 50 cm long, erect, red, sparsely tomentose, totally covered by amplexi-scape bracts; scape bracts 11–12 × 2.5 cm, not imbricate at base of the inflorescence, ligulate, reddish, scaly, apex acuminate, margins entire. Inflorescence 25–42 cm long, reddish, slightly tomentose, composite, panicle pyramid-shaped, with ca. de 13 branches, inflorescence branches sparsely distributed from the base to the apex, ramifications of the fourth order, sets of ramifications not globose, lax towards the apex due to the increasing spacing of the internodes and peduncles; peduncle of the primary branches 2–8 cm long; primary bracts 1.5–6.8 × 0.5–1 cm, distinctly smaller than the branches, inferior ones not extending beyond the branches, lanceolate, reflexed to evident, reddish, scaly, apex acuminate, margins entire; secondary and tertiary bracts ca. 1 cm long, triangular, apex long-acuminate. Floral bracts 0.5–1 × 0.3 cm, conspicuous, extending beyond the ovary, smaller than the sepals, triangular, reddish, slightly tomentose, apex long-acuminate. Flowers 3–4 cm long, sessile; sepals 1.6 × 0.7 cm, connate, strongly asymmetrical, carinate, yellow, slightly scaly, apex mucronate, mucron 0.1–0.2 cm long; petals ca. 2.5 × 0.3 cm, lanceolate, orange, apex obtuse,

shortly mucronate; callosities present, ca. 1.2 cm long; basal appendixes ca. 0.15 cm long; apex crenate; stamens ca. 2 cm long, external ones with filaments free, internal ones with filaments adnate to the petals; filaments ca. 1.2 cm long, complanate; anthers ca. 0.7 cm long; ovary with epigynous tube ca. 0.7 cm long, clavate, slightly tomentose; styles ca. 2.5 cm long; stigma ca. 0.2 cm long, spiral-conduplicate. Berry 2–3 cm long, with persistent sepals, ovoid, light green.

Material examined: BRAZIL, PARAÍBA: Natuba, Distrito de Pirauá, 07°383' S and 35°32'59" W, 13.XI.2007, fr., R.A. Pontes 430 (JPB); 06.X.2010, fr., R.A. Pontes 577 (JPB); São João do Tigre, APA das Onças, 08°07'91" S and 36°84'78", 24.V.2006, fl.fr., R.A. Pontes 355 (JPB).

Additional material examined: BRAZIL, PERNAMBUCO: Floresta, 08°625' S and 37°15'41" W, 26.VI.1996, fr., D.S. Pimentel et al. 113 (PEUFR); Inajá, 08°71'66" S and 38°01'305", 08.III.1995, fl., G.M. Sousa 69 (PEUFR); 08.VIII.1998, G. Martinelli et al. 15043 (PEUFR).

Phenology: Collected with flower in March and April and fruiting from July to November.

Distribution and habitat: *A. werdermannii* is encountered in Caatinga and Atlantic Forest environments, being restricted to the Brazilian states of Paraíba (Figure 2d), Pernambuco, and Alagoas (BFG 2015).

Conservation status: Included in the Species List of the Brazilian Flora Threatened with Extinction and, according to IUCN criteria (2001) and Leme & Siqueira-Filho (2006), it is placed in the “Critically Endangered” category in light of its small area of occurrence (less than 10 km²) and the high fragmentation of the habitats in which it occurs (2BbIII).

Commentaries: According to Sousa & Wanderley (2000), Leme & Siqueira-Filho (2006) and Maciel et al. (2015), the morphological limits between *A. werdermannii* and *A. eurycorymbus* are still poorly defined. *Aechmea werdermannii*, *A. leptantha*, and *A. eurycorymbus* are very closely related, belonging to the “*Gravisia complex*”, which comprises of the all species of the genus *Gravisia* Mez, those having been relocated to the genus *Aechmea* (Leme & Siqueira-Filho 2006). *Aechmea werdermannii* can be fundamentally distinguished from *A. leptantha* by having sessile flowers (vs. conspicuously pedicellate flowers) and well-developed floral bracts covering the ovary (0.5–1 × 0.3 cm vs. 0.5–0.8 × 0.1–0.3 at the base of the pedicels); it can be distinguished from *A. eurycorymbus* by having smaller floral bracts (0.5–1 cm long vs. 1.5–1.7 cm) and sessile flowers (vs. subsessile).

Conflicts of Interest

The authors declare that they have no conflict of interest related to the publication of this manuscript.

Author Contributions

Thaynara de Sousa Silva: Substantial contribution in the concept and design of the study. Contribution to data analysis and interpretation.

José Iranildo Miranda de Melo: Substantial contribution in the concept and design of the study, adding intellectual content and to critical revision. Contribution to data analysis and interpretation.

Maria das Graças Lapa Wanderley: Contribution to critical revision, adding intellectual content.

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